TerreSculptor 2

HMES · Heightmap Editing Software
Reference Manual

Documentation for TerreSculptor HMES version 2.0.

Document Revision 2024-03-23

Preface

TerreSculptor HMES is the Heightmap Editor Software developed by Demenzun Media Inc.
TerreSculptor HMES and its forerunner HMCS, Heightmap Conversion Software, contain a number of years of software development in the field of computer generated and manipulated heightmaps.

TerreSculptor 2.0 is free for all uses including academic, commercial, and personal.
No payment is required to use this software or any of the files that it creates.

Contents

Preface ... **8**
About the Tutorials ... 8
Reference Manual Conventions ... **9**
Notification Icons ... 9
Mouse Icons ... 9
Features ... **11**
General Features ... 11
World Editor ... 11
System Requirements ... **12**
Installation ... **13**
Uninstall ... 13
Overview ... **14**
World Space and Object Space ... 14
Working with Objects ... 15
Basic Object Properties ... 15
Transforming Objects ... 16
Heightmaps ... 16
Weightmaps ... 17
Masks ... 17
Launching TerreSculptor ... **18**
The Welcome Dialog ... **19**
The About Dialog ... **20**
The TerreSculptor Interface ... **21**
The Menu bar ... **24**
File Menu ... 25
Edit Menu ... 26
Generate Menu ... 27
Noisemap Menu ... 28
Weightmap Menu ... 29
Adjust Menu ... 30
Modify Menu ... 31
Transform Menu ... 33
Erosion Menu ... 35
Create Menu ... 36
View Menu ... 37
Tools Menu ... 38
Help Menu ... 40
The Main Toolbar ... **42**
The Toolbox ... **44**
The Main Viewport ... **45**
Viewport Cameras ... **46**
Orbit Camera ... 47
Free Camera ... 48
WASD Camera ... 49
The Function Panels ... **50**
Camera: Camera ... 51
Camera Properties ... 53
Lights: Ambient ... 54
Lights: Directional ... 55
Grids: Home Grid ... 56
Grids: User Grids ... 58
Layout: Designer ... 60

Creating Designer Textures 62
Terrain: Properties 63
Terrain Material 65
Scene: Objects 70
Scene: Backdrop 71
Scene: Backdrop: Cube 72
Scene: Backdrop: Cube Gradient 73
Scene: Backdrop: Cube Textured 74
Creating Cube Textures 76
Scene: Backdrop: Skydome 77
Creating Skydome Textures 78
Scene: Backdrop: Skyplane 79
Creating Skyplane Textures 81
Scene: Fog 82
Scene: Water 85
Creating Water Textures 87

The Main Statusbar 88

Initial Application Settings 89

Colorsets 90
Auto-Range Colorsets 90
Colorset Material and Menu 91

Shortcut Accelerator Keys 94

Terrain LOD Modes 95
Terrain LOD Settings 96

Undoing Changes 97
Setting the Undo Settings 97
Undoing changes to the Base Heightmap 97
Undoing changes to the Input Controls 98

Scene Objects and Helpers 99

Viewport Concepts 105
Active Viewport 105
Orthographic Views 105
Perspective View 107

Starting a New Project 108

Devices 109
Dialog Context Help 110
Dialog Command Buttons 110
Dialog Preview Window 111
Preview Window Control 111
Dialog Preview Crop 112
Preview Window Options Toolbar 113
Preview Window Statusbar 114
Device Progress 115

Devices Generator 116
Generate: Constant Value 117
Generate: Filled Circle 118
Generate: Filled Quadrilateral 119
Generate: Filled Rectangle 120
Generate: Filled Square 121
Generate: Filled Triangle 122
Generate: Diagonal Gradient 124
Generate: Gaussian Gradient 125
Generate: Horizontal Gradient 126
Generate: Linear Gradient 127
Generate: Radial Gradient 128
Generate: Vertical Gradient 129

Devices Noisemap **130**
Noisemap Common Properties 131
Noisemap: Billow 132
Noisemap: BoxMuller 133
Noisemap: Gaussian 134
Noisemap: Gradient 135
Noisemap: Perlin 136
Noisemap: Random 137
Noisemap: Ridged 138
Noisemap: Simplex 139
Noisemap: Value 140
Noisemap: Voronoi 141

Devices Weightmap **142**
Weightmap Overview 143
Weightmap Common Properties 143
Weightmap: Altitude 144
Weightmap: Concavity 145
Weightmap: Convexity 146
Weightmap: Curve Max 147
Weightmap: Curve Min 148
Weightmap: Direction 149
Weightmap: Flowline 150
Weightmap: Flowmap 151
Weightmap: High Frequency 152
Weightmap: Low Frequency 153
Weightmap: Slope 154
Weightmap: Steep 155
Weightmap: Uphill 156
Weightmap: Composite 157

Devices Adjust **158**
Adjust: Flip Horizontally 159
Adjust: Flip Vertically 160
Adjust: Rotate 90° Clockwise 161
Adjust: Rotate 90° Counterclockwise 162
Adjust: Rotate 180° 163
Adjust: Rotate Custom 164

Devices Modify **165**
Modify: Altitude 166
Modify: Altitude Top 167
Modify: Altitude Top-Center 168
Modify: Altitude Center 169
Modify: Altitude Bottom-Center 170
Modify: Altitude Bottom 171
Modify: Bias Gain Level 172
Modify: Blur 173
Modify: Brightness 174
Modify: Clamp 175
Modify: Contrast 176
Modify: Convolution Filter 177
Modify: Crop 178
Modify: Downsample 179
Modify: Exponent 180
Modify: Exposure 181
Modify: Gamma 182
Modify: Intensity 183
Modify: Interpolate 184
Modify: Invert 185
Modify: Normalize 186
Modify: Resample 187
Modify: Size 188
Modify: Smooth 190

Devices Transform ... **191**
Transform: Add Noise ... 192
Transform: Beach ... 193
Transform: Bit Level ... 194
Transform: Blend ... 195
Transform: Brush ... 196
Transform: Combine ... 198
Transform: De-spike ... 199
Transform: Displace ... 202
Transform: Equalize ... 204
Transform: Fill Region ... 205
Transform: Flatten Edges ... 206
Transform: Flood Level ... 207
Transform: Lens Warp ... 208
Transform: Mirror ... 209
Transform: Offset ... 210
Transform: Pather ... 211
Transform: Peak Compressor ... 213
Transform: Pixelate ... 214
Transform: Planetize ... 215
Transform: Replace ... 216
Transform: Shaper ... 217
Transform: Terrace ... 218
Transform: Threshold ... 219
Transform: Tileable ... 220
Transform: Tilt ... 221
Transform: Void Fill ... 222

Devices Erosion ... **223**
Erosion: Hydraulic ... 224
Erosion: Rain ... 225
Erosion: Slope ... 226
Erosion: Thermal ... 227

Create Menu ... **228**
Bitplane Creator ... 229
Colorset Creator ... 230
Contour Creator ... 231
Normalmap Creator ... 232
Splatmap Creator ... 233
Tile Creator ... 234
Mask Editor ... 235

View Menu ... **236**

Tools Menu ... **237**
Tools: View Datamap Statistics ... 238
Tools: Save Colorset Bitmap ... 241
Tools: Save Vertex Color Bitmap ... 243
Tools: Save Screenshot ... 245
Save Custom Screenshot ... 247
Tools: Benchmark ... 249
Tools: Event Log ... 251
Tools: DEM Sites ... 254
Tools: Unreal Engine Landscape Sizes ... 255
Tools: Settings ... 257
Settings: General ... 259
Settings: Colors ... 261
Settings: DEM ... 263
Settings: Dimensions ... 264
Settings: Formats ... 266
Settings: Grid and Snap ... 267
Settings: Heightmap ... 269
Settings: Image ... 271

Settings: Interface ... 273
Settings: Mesh ... 274
Settings: Modifiers ... 276
Settings: Preferences ... 277
Settings: Scene ... 279
Settings: Scene Objects ... 281
Settings: Shortcuts ... 283
Settings: System ... 284
Settings: Units ... 286
Settings: Viewports ... 287

Help Menu ... 288
Help: License Agreement ... 290
Help: System Information ... 291
Help: Software Update ... 292

Cartesian Coordinate Systems ... 294

Display Performance ... 296
Editor Performance Settings ... 296

File Backup ... 297

Last Folder Memory ... 298

Texture Support ... 299
Texture Resize Dialog ... 300

Viewport Stats ... 301

Terrain Design ... 302
Terrain Use ... 302
Terrain Size ... 302
Power-of-Two ... 302
Heightmap Bit-depth ... 303
Units Vertex Spacing ... 303
Terrain Quad Size ... 304
Terrain Area Size ... 305

Creating Heightmaps for Unreal Engine 2 ... 306
Performance ... 306
X and Y Dimensions ... 306
Altitude and TerrainScale.Z ... 306

Exporting a Heightmap for Unreal Engine 2 ... 307

Creating Heightmaps for Unreal Engine 3 UDK ... 308
Performance ... 308
X and Y Dimensions ... 308
Altitude and DrawScale3D.Z ... 308

Exporting a Heightmap for UDK Landscape ... 309
Notes ... 310

Exporting a Heightmap for UDK Terrain ... 311
Notes ... 312

Creating Weightmaps for Unreal Engine 3 UDK ... 313

Exporting a Weightmap for UDK Landscape ... 314
Notes ... 315

Tutorial: How to Convert a Heightmap file format ... 317
Using the 3D Editor ... 317
Using the 2D Converter ... 317

Tutorial: How to Open, Edit, and Save a Heightmap file ... 318
Using the 3D Editor ... 318
Using the 2D Converter ... 318

Tutorial: How to create Weightmaps from an existing Heightmap file ... 319

Appendix A: File Format Export and Import Options **320**

Appendix B: Export and Import Type Conversion **323**
Export Type Conversion 323
Import Type Conversion 324

Appendix C: File Formats **326**
.3ds – Autodesk 3DS Max mesh 327
.ase – Autodesk ASCII Scene Export 328
.bil – Band Interleaved by Line DEM 329
.bmp – Windows Bitmap 331
.bt – Binary Terrain 332
.csv .tab .tsv .txt – Delimited ASCII Text and Vista Pro 4 ASCII DEM 333
.dem – VistaPro 4 binary DEM 334
.flt – GridFloat DEM 335
.gif – Graphics Interchange Format 336
.hgt – SRTM DEM Heightmap 337
.obj – Alias Object ASCII Mesh 338
.pam – Portable AnyMap Binary Image or Heightmap 339
.pgm – Portable GrayMap ASCII and Binary Image or Heightmap 340
.png – Portable Network Graphics 341
.r8, .r16, .r32, .raw – RAW Heightmap 342
.stl – StereoLitho ASCII and Binary Mesh 344
.t3d – Epic 3D Text 345
.tab – TAB Delimited ASCII Text 346
.ter – Terragen Terrain 347
.tga – Truevision TARGA 348
.tif – Tagged Image Format 349
.tsv – TAB Delimited ASCII Text 350
.txt – Space Delimited ASCII Text and Vista Pro 4 ASCII DEM 351

Appendix D: Obtaining DEM Data **352**
DEM Sample Spacing 352
DEM Spacing to Engine Units 352
DEM Properties Files 352
DEM Dataset Links 353

Appendix D: Keyboard Shortcuts **354**

Preface

Welcome to the *TerreSculptor 2.0 Reference Manual*.
This reference manual is part of the documentation set accompanying the TerreSculptor 2.0 software.

This reference manual covers a complete set of topics for learning and using the software. Topics include installing the software, fundamental concepts, user interface controls, managing the 3D scene including cameras and lights, how to use all of the included tools, as well as many step-by-step tutorials.

For the Adobe PDF version of the reference manual, it is beneficial to open the Bookmarks tab in order to have the Table of Contents always available for quickly navigating the chapters. The Bookmarks tab can be activated through the Adobe Reader's View menu or the Bookmarks icon on the left pane, depending on the Reader version.

About the Tutorials

The tutorials in this document assume that you are familiar with the terrain systems in the specified target video game engine. This document is a reference for the TerreSculptor software, it is not a reference for any of the mentioned video game engines. Refer to the documentation supplied by the engine developer/publisher for information on how to import and export files, perform basic level design skills, etc.

Reference Manual Conventions

This manual provides a significant amount of in-depth material accompanied by a large amount of graphical material and examples.

Notification Icons

This reference manual uses graphical icons to inform the reader of various actions.

 Signifies important information

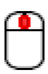
Mouse Icons

This reference manual uses graphical icons to depict the various possible mouse button and movement actions and combinations.

 press the left mouse button

 press the right mouse button

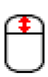
 press the left and right mouse buttons

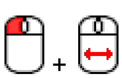
 press the middle mouse button

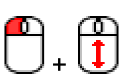
 move the mouse on its X axis

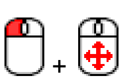
 move the mouse on its Y axis

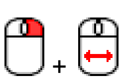
 move the mouse on its X and Y axes

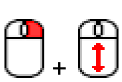
 scroll the mouse wheel

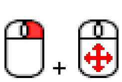
 press the left mouse button and move the mouse on its X axis

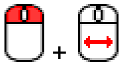
 press the left mouse button and move the mouse on its Y axis

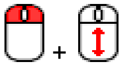
 press the left mouse button and move the mouse on its X and Y axes

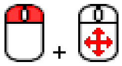
 press the right mouse button and move the mouse on its X axis

 press the right mouse button and move the mouse on its Y axis

 press the right mouse button and move the mouse on its X and Y axes

 press the left and right mouse buttons and move the mouse on its X axis

 press the left and right mouse buttons and move the mouse on its Y axis

 press the left and right mouse buttons and move the mouse on its X and Y axes

Features

General Features

- Single executable file for both 32-bit and 64-bit Windows operating systems.
- Multi-threaded performance for multi-core processors.
- Internal processing and algorithmic functions in 32-bit, 64-bit, and floating-point format for greater accuracy.
- Terrain altitude coloring displayed in 48-bit simulated color on standard 24-bit color monitors.
- Edit heightmaps and weightmaps using a wide number of tools.
- Digital Elevation Model (DEM) editing functions.
- Undo system.
- Context-aware help on every edit and property dialog.
- Open and save image, heightmap, digital elevation model, and mesh file formats.
- BMP/JPG/PNG/TIF Images 8-bit Color Indexed, 2GB max, 46340 × 46340
- BMP/JPG/PNG/TIF Images 8-bit Grayscale, 2GB max, 46340 × 46340
- PNG/TIF Images 16-bit Grayscale, 2GB max, 32767 × 32767
- BMP/JPG/PNG/TIF Images 24-bit RGB Color, 2GB max, 26754 × 26754
- PNG/TIF Images 32-bit RGBA Color, 2GB max, 23170 × 23170
- PNG/TIF Images 48-bit RGB Color, 2GB max, 18918 × 18918
- PNG/TIF Images 64-bit RGBA Color, 2GB max, 16383 × 16383.

World Editor

- World Editor 3D interface utilizing hardware-accelerated OpenGL.
- Create heightmap-based terrains up to 65536 × 32751 or 32751 × 65536 or 46329 × 46329 maximum.
- Create weightmap alpha masks based on heightmap properties for layering and scattering.
- Perspective and Orthogonal viewport modes.
- Aggressive terrain level-of-detail mode for sharing video memory with other software applications.
- Multiple camera types, multiple camera navigation systems, camera bookmarks.
- Master Home grid and User grids.
- Configurable lighting system.
- Designer overhead.
- Scene Backdrop, Fog, Water, and other visualization effects.

System Requirements

Minimum system requirements:

- PC Compatible Computer
- 2.0GHz Dual-Core Processor
- 3GB system RAM memory
- ATI 2000 series or Nvidia 8000 series video adapter with 512MB video memory
- 17-inch or 19-inch Monitor at 1280x1024 resolution
- Keyboard and Mouse
- Windows 7, 32-bit or 64-bit version
- Microsoft dot.NET 4.7.2
- OpenGL 1.5 or greater
- 10GB or more of free hard drive space for creating worlds

Recommended system requirements:

- PC Compatible Computer
- 3.0GHz Dual-Core or Quad-Core Processor, or faster, or more cores, or hyper-threading
- 8GB system RAM memory or more, 16GB or more for large worlds
- ATI 4000 series or Nvidia GeForce 200 series or newer video adapter with 1GB video memory or more
- 24-inch Monitor at 1920x1080 resolution, or larger
- Keyboard and Mouse
- Microsoft Windows 7, 8, 8.1, 10 or 11 64-bit
- Microsoft dot.NET 4.7.2
- OpenGL 3.0 or greater
- 10GB or more of free hard drive space for creating worlds

TerreSculptor performs best with a 3.4GHz or faster Quad-Core processor, 8GB or more system RAM, the latest high-end ATI or Nvidia video adapter with 2GB video memory, a 27-inch or 30-inch Monitor, and Windows 10 64-bit.

Note: The current builds of TerreSculptor do not have international support.
The software is built and tested only on English US and English Canada localizations.
TerreSculptor may not successfully run on other localizations.

Installation

The TerreSculptor application consists of a single executable file for both 32-bit and 64-bit operating systems, a set of DLL files, configuration settings ini file, an events log file, this owner's manual reference guide pdf, and the release notes file.

TerreSculptor makes no changes to the host computer or its operating system or system registry, other than the automatic creation of its configuration settings ini file, and its event log file.

Automatic Install

To automatically install the TerreSculptor software, use the installation Setup.exe.

Manual Install

To manually install the TerreSculptor software executable, create a new folder called *TerreSculptor 2.0* in the *C:\Program Files* folder and copy the TerreSculptor.exe and DLL files to this folder.
Right-click on the .exe file and choose "Pin to Start menu" to create a program shortcut on the Start menu.

If you receive a Windows Security pop-up dialog when you run the software, right-click on the .exe file, choose Properties on the context menu, and on the Properties dialog click on the *Unblock* button.

Configuration Settings Ini File

The TerreSculptor.ini configuration ini file will be automatically created by TerreSculptor the first time that the executable file is ran.
The configuration settings ini file will be created in the current user account's *Application Data* folder.
For Windows 7, 8, 8.1, and 10 this is located at:

C:\Users\<user>\AppData\Local\TerreSculptor 2.0

Each Windows user account will have their own independent ini file with unique settings for that user.

Event Log File

The TerreSculptor.log event log file will be automatically created by TerreSculptor every time that the executable file is ran. The log file is located in the same user account folder as the .ini file.

Uninstall

Automatic Uninstall

Use this method if you used the automatic install.

To automatically remove TerreSculptor from a computer, launch the Windows Control Panel, choose the Uninstall a program option, locate and choose TerreSculptor 2.0 in the program listing and select Uninstall.

Manual Uninstall

Use this method if you used the manual install.

To manually remove TerreSculptor from a computer:
1. Delete the *C:\Program files\TerreSculptor 2.0* folder which contains the application .exe and other files.
2. Delete the *C:\Users\<user>\AppData\Local\TerreSculptor 2.0* folder which contains the .ini and .log files.
3. Delete the TerreSculptor 2.0 icon from the Start menu.

Overview

TerreSculptor is a three-dimensional terrain creation and editing software application designed for Windows-based PCs. You use TerreSculptor to create, edit and view professional quality heightmaps and weightmaps for use in video games, film, and geographic systems.

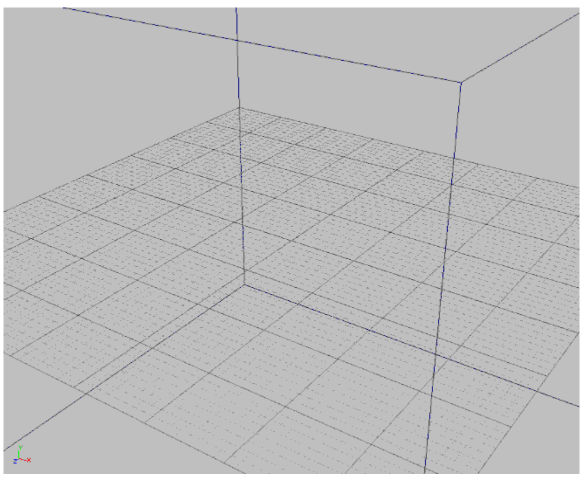
The TerreSculptor application presents all of the functions that you require in a single unified interface workspace. The standard Windows design and layout of menus and toolbars provides quick access to the commands and functions that you will use the most. The tab-based function area contains a rich interface to the tools for manipulating objects in your world scene.

World Space and Object Space

TerreSculptor uses two specific coordinate systems called *World Space* and *Object Space*.

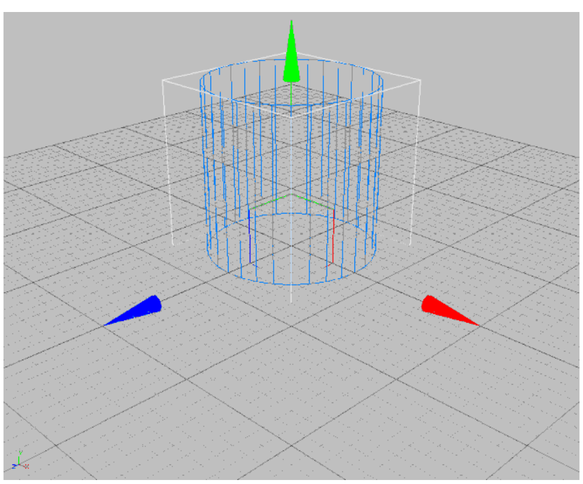
World Space

World Space is the global coordinate system that defines the location of all objects in the scene. The World Extents bounding cube and Home Grid show the world space coordinate system and its extents. World Space is always constant and never moves.
TerreSculptor defines the world space extents as a cube that is an equal number of world units in width, length, and height. Enabling the Scene World Extents helper will display the world bounding cube.

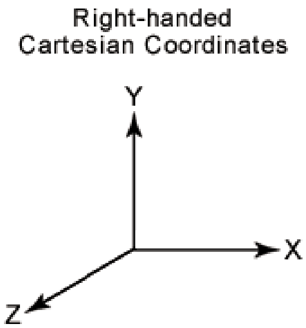


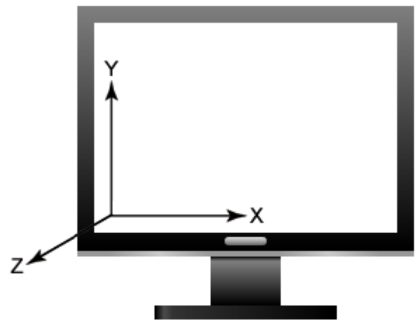
Object Space

Object Space is the coordinate system that is unique or *local* to each object in the scene. Object Space defines the local rotation and scale of each object. After any rotation and scale is applied, objects are then translated (moved) to the World Space to their final viewed location.



TerreSculptor uses the default OpenGL world coordinate system, which is commonly known as *Y-Up Right-handed Cartesian Coordinates*. The Y axis is positive upward, the X axis is positive to the right, and the Z axis is positive out of the screen.





This is similar to a flat 2D paper on the computer screen where X is the paper width left-to-right, and Y is the paper height up-and-down. Z would be moving the paper closer towards you or further away from you.

See the chapter on Coordinate Systems for additional information.

Working with Objects

In TerreSculptor, the term *object* refers to an item in the world scene. There are a wide variety of objects available including the terrain, cameras, lights, grids, backdrop and water. Each object has a variety of properties including its world location, color, size, etc.

Cameras: Provide a view into the scene. Multiple camera types and navigation styles are supported in addition to camera bookmarks.

Lights: Provide realistic scene lighting including brightness and color. There is one fixed ambient light and one moveable directional light available.

Grids: A fixed-position Home Grid and multiple user-configurable User Grids provide visual delineation of the world dimensions and locations.

Terrain: Provides a fixed-position 3D representation of the underlying heightmap data.

Backdrop: Provides a fixed-position background to the world scene for a more realistic scene view.

Water: A fixed-position sizeable translucent water plane located at the mid-altitude point in the world scene.

Basic Object Properties

All objects have a set of common basic properties, such as their local pivot point and their world location. Some objects include additional properties such as color, rotation and scale.

Parameters

The object parameters describe the size and shape of the object. For some of the objects the number of editable parameters vary, for example one object may only allow setting its color, whereas another object may allow setting its color, size, rotation, and location.

Each set of object parameter values can be specified in the edit dialog for that object.

Pivot Point

Every object in the scene has a pivot point that identifies the local center and orientation of the object. The pivot point is the origin of the object's *local coordinate system*; it is the center of the object's rotation and scaling; and it is the center of the object's location in *world space*. Some objects have a fixed pivot point origin in world space while others can be modified.

Bounding Box

The bounding box is the cubic volume that completely encloses an object. Some of the object bounding boxes can be displayed in the scene while others are always invisible.

Transforming Objects

A transform is a 3D manipulation of an object's local coordinate system. The local coordinate system of an object is contained in a matrix of values that specify: the rotation of the object about its pivot point; the scale of the object along its local axes; and the position of the object's center in world space.

The object matrix is called the transformation matrix and its information relates directly to the transforms of Rotate, Scale, and Translate (move to location).

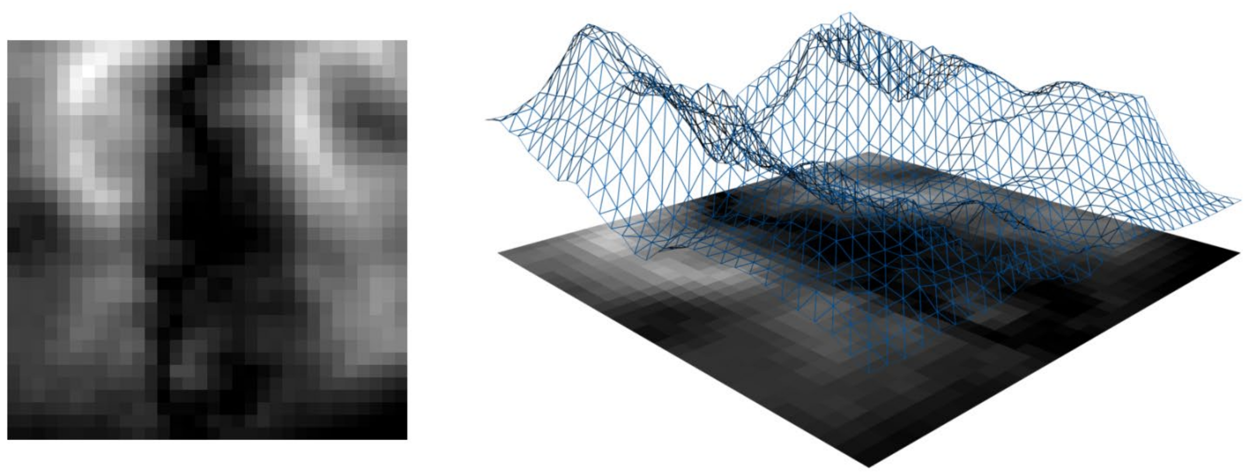
Some objects have one or more fixed transformations in the scene, preventing them from being moved or rotated.

Note: Object transform is not to be confused with the Heightmap Transform functions which perform geographic transformations on the heightmap data.

Heightmaps

A heightmap is a rectangular array of numeric data representing the altitudes for a terrain mesh. Heightmaps can appear to be similar to a grayscale image, however, each of their sample points contain altitude information instead of grayscale pixel information. Darker color values are lower altitude while lighter color values are higher altitude. Heightmaps are typically 16-bit sample data representing 65536 possible discrete altitudes. Under normal circumstances 8-bit data will not be used for heightmaps since that is only 256 discrete altitude values. Standard paint software cannot properly edit 16-bit grayscale files. TerreSculptor manages heightmap data internally as 32-bit floating point values for high accuracy.

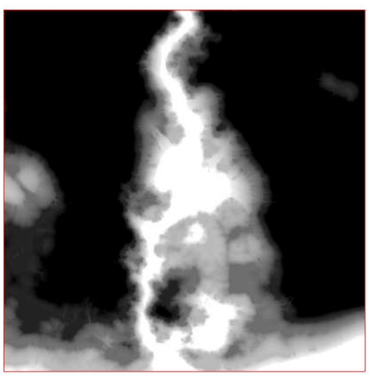
Example: A simple low resolution heightmap and its resulting equivalent mesh. Each heightmap value corresponds to a mesh vertex. Larger numerical heightmap values (lighter gray colors) are higher mesh altitudes.

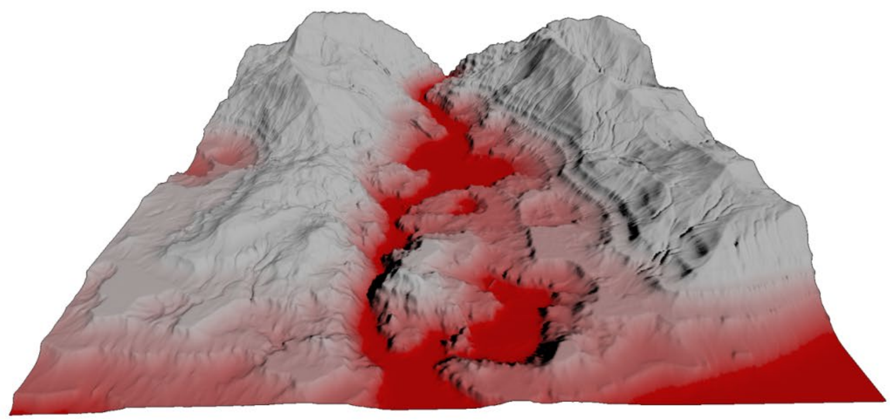


Weightmaps

A weightmap is an 8-bit grayscale *mask* or *alpha* image that represents the layout of some type of object that is overlaid on a heightmap. The overlaid object may be a texture or material shader, the area placement information for grass meshes, or other meaningful data as required by the game engine. Weightmap information can be algorithmically extracted from heightmap data for such features as by-altitude, by-slope, by-direction, by-flow, etc. A weightmap is typically the same rectangular dimensions of width and length as its source heightmap. Weightmaps, like masks, are typically 8-bit data and can be created and/or edited as a standard 8-bit grayscale image in paint software.
A weightmap is essentially the same as a mask, but by a different name in order to differentiate it functionality, and to prevent confusion as to its purpose. For example, a mask can be used within a shader to mix two textures together, which is then overlaid on a heightmap according to the content of a weightmap.

Example left: An algorithmically generated weightmap from the lower altitude range of a heightmap. Like a standard alpha mask, the pixels of black are typically treated as 0%, the pixels of white are typically treated as 100%, and the pixel values in between are the alpha gradient translucency.
Example right: The source heightmap with the weightmap used for the red color layer control. Areas of weightmap black (0) are not changed, areas of weightmap white (255) are tinted solid red, and weightmap values in between are a gradient red based on the pixel strength. In this example, this weightmap could be used for applying a river bed texture.

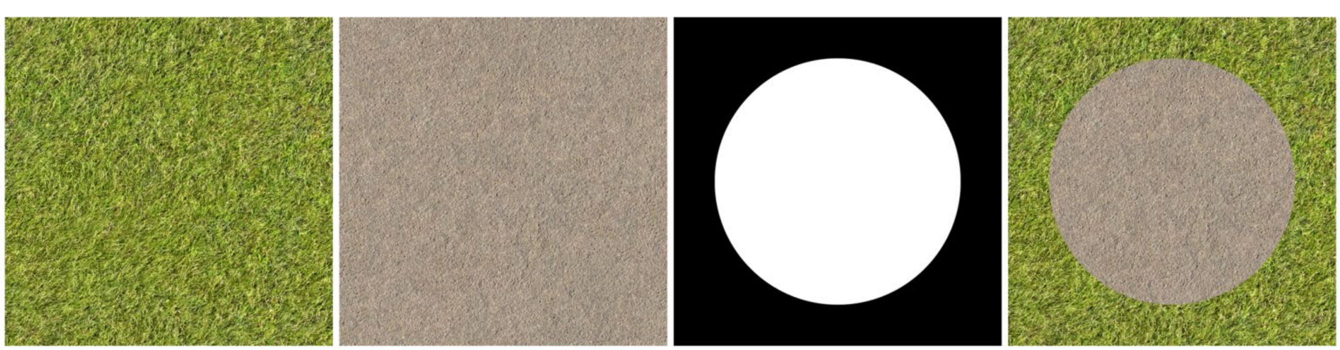




Masks

A mask is an 8-bit grayscale *alpha* image that is typically used to blend between two other images or sets of data. Masks are typically 8-bit data and can be created and/or edited as a standard 8-bit grayscale image in paint software.

Example: A grass texture and dirt texture are blended using a mask. Where the mask value is 0, grass is shown; where the mask value is 255, dirt is shown; for all values in between, the two textures are blended based on the mask value weight.

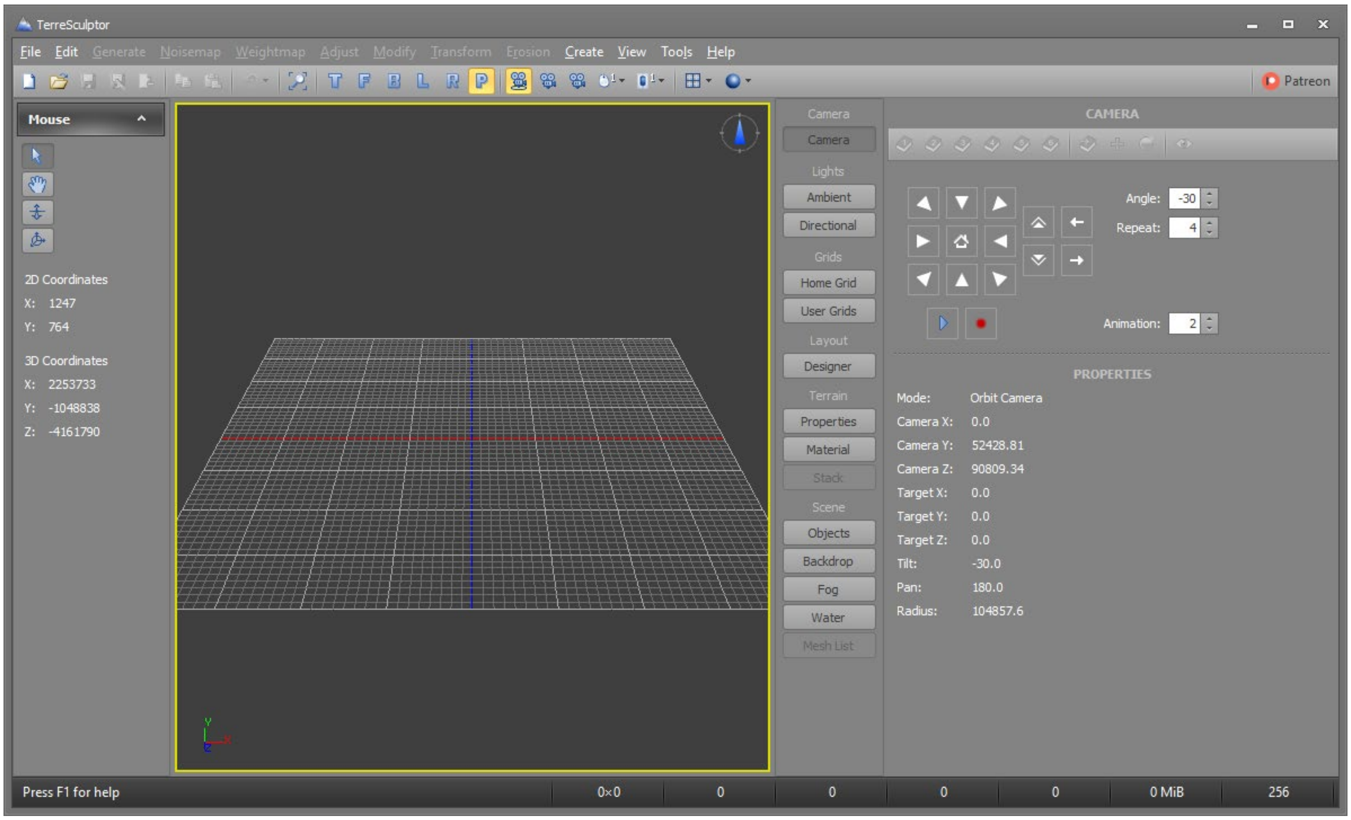


Launching TerreSculptor

After you have installed TerreSculptor on your computer, you launch it by double-clicking the TerreSculptor icon created during installation, typically found on the Windows Start menu. You can also use other standard Windows methods to launch TerreSculptor such as double-clicking the .exe executable file in Windows Explorer.

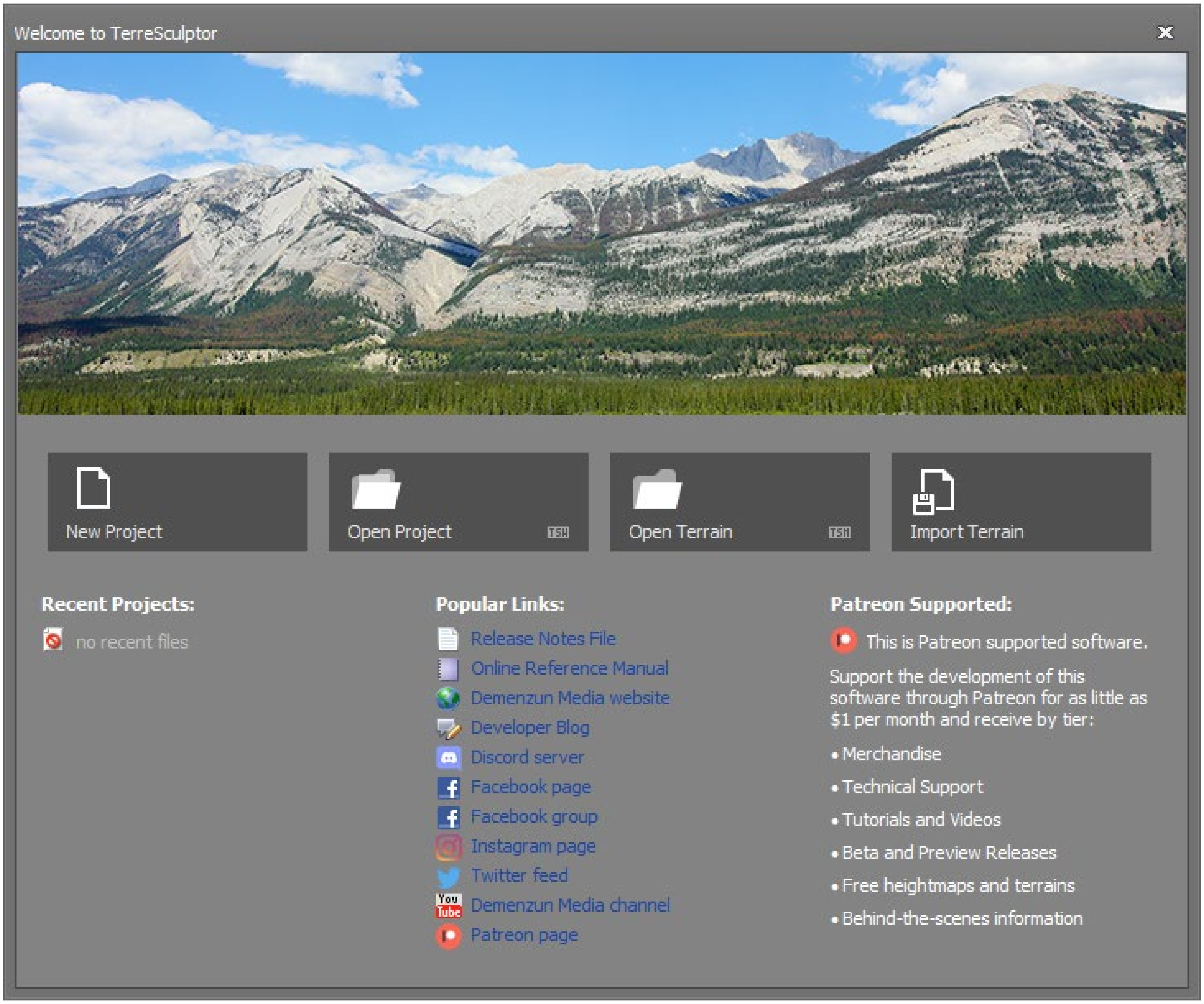
When TerreSculptor launches, the main application window appears on your desktop as shown below. The main interface design uses standard Windows controls and design conventions.

TerreSculptor is a single document application and therefore only one scene can be open at any time. Multiple copies of the software can run simultaneously on the same computer, although this is not recommended as the software requires a large amount of system resources.



The Welcome Dialog

The Welcome dialog is optionally displayed on application startup and contains a number of quick links to common application functions. These links include starting a new project, opening an existing project, opening an existing terrain file, importing an existing file, all of the recent project files, and links to documentation and popular internet sites related to the software.

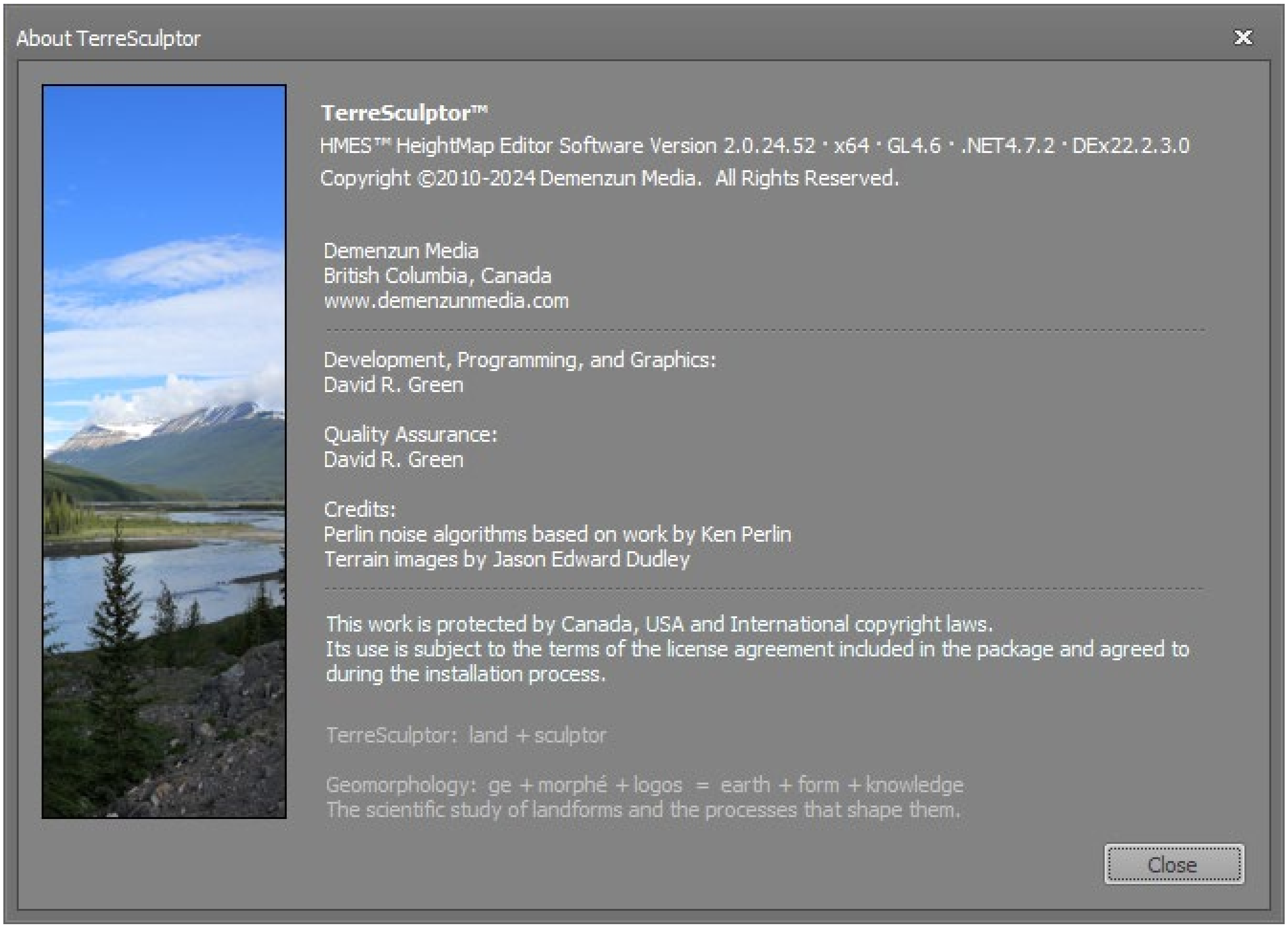


Click on a link to choose that action.
Click on the close button on the top-right corner of the dialog to cancel or close it.

The Welcome dialog is displayed on application startup by default.
This behavior can be changed through the application Settings on the General tab Startup group.

The About Dialog

The About dialog, located on the Help menu, contains the general information about the software including the Version number, Development credits, and Copyright information.



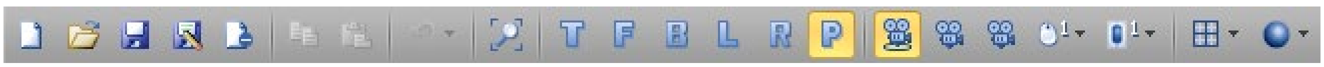
The TerreSculptor Interface

When TerreSculptor is launched you are presented with the main World Editor 3D interface. The world editor interface is similar to other 3D modeling software applications and is used to create and edit terrain systems targeted for video game development. The user-interface follows Windows guidelines for layout and functionality to provide a more intuitive experience.

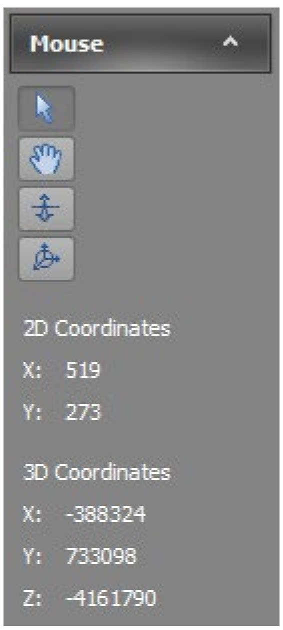
The software window has six main areas: the Menu bar, the Toolbar, the Toolbox, the Viewport, the Function tab panels, and the Status bar.

Menu bar – Contains functions for opening, saving and editing files, in addition to setting application options.

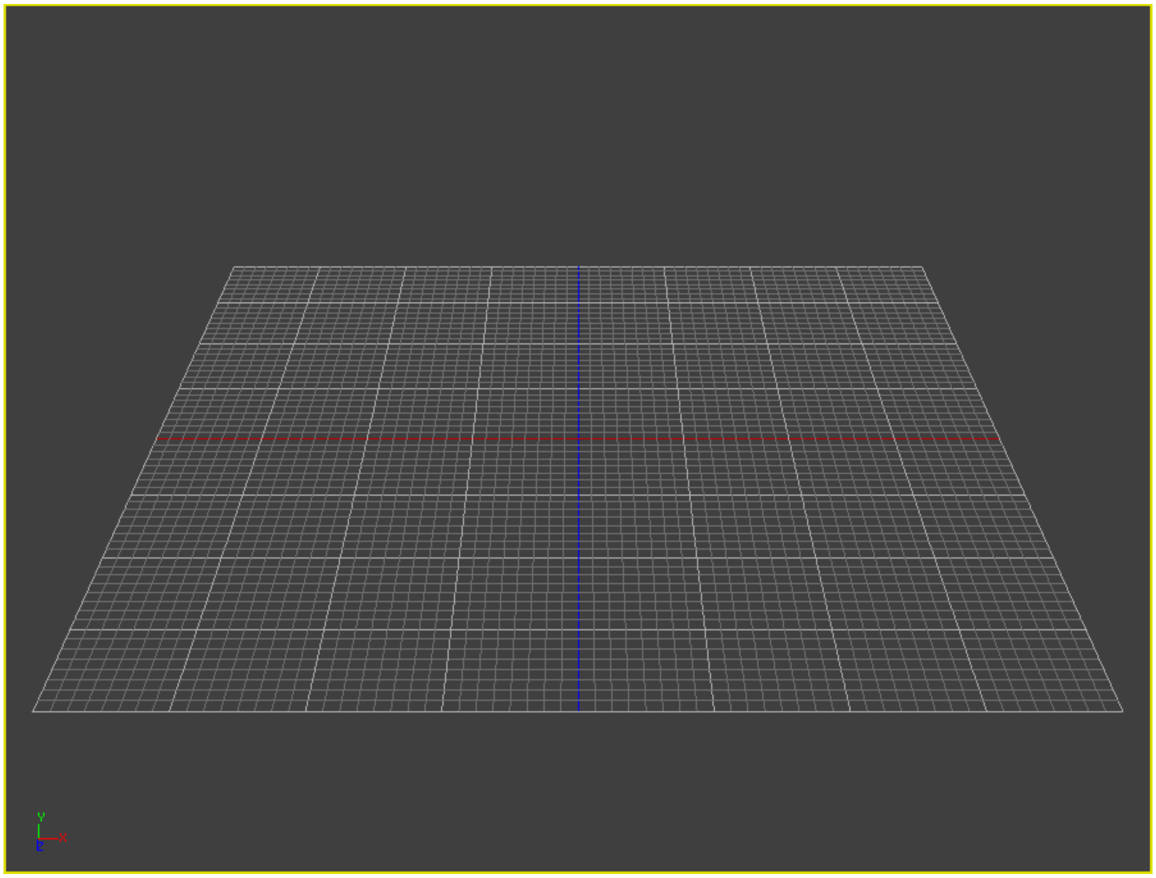
Toolbar – Contains functions that mirror many of the Menu functions, plus tools for viewport control and editing.



Toolbox – Contains functions for viewport camera control.



Viewport – Allows viewing and editing the objects in the world.



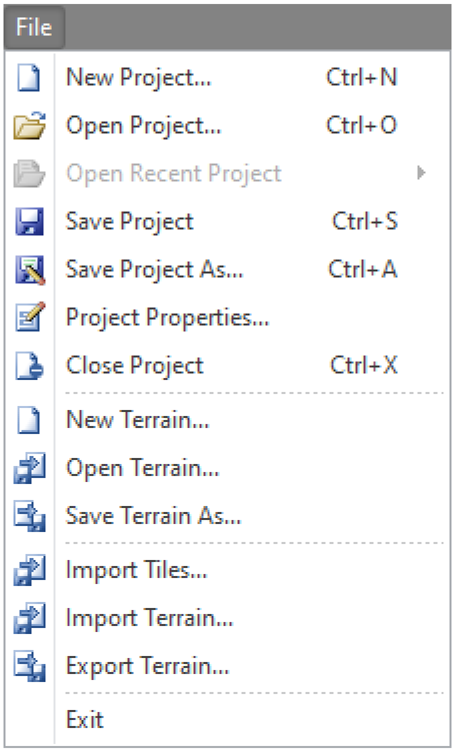
Function Panels – Provide access to the world scene objects and tools.

Status bar – Display current application status.

The Menu bar

The menu bar contains several categories of commands including standard Windows application operations.

File Menu



New Project – closes any current project and starts a new project, resets most project properties to default.

Open Project – open an existing project file.

Open Recent Project – re-open a recently opened project file from the menu list.

Save Project – save the current project to a project file.

Save Project As – save the current project with a specified project file name.

Project Properties – display the current project file properties dialog.

Close Project – close the current project.

New Terrain – creates a new terrain, replaces any current terrain, retains any current project properties.

Open Terrain – open a TSmap floating-point terrain file into the current project terrain.

Save Terrain As – save the project terrain to a TSmap floating-point terrain file.

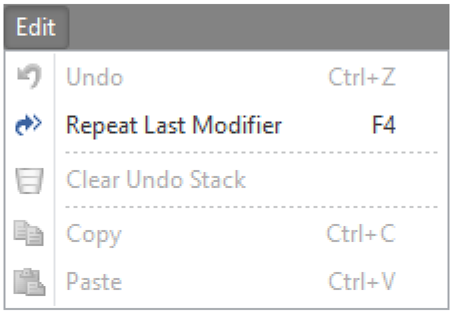
Import Tiles – import a tiled digital elevation model file.

Import Terrain – import a wide variety of digital elevation model, heightmap, image, and mesh files.

Export Terrain – export a wide variety of digital elevation model, heightmap, image, and mesh files.

Exit – exit the application.

Edit Menu



Undo – undo the last operation.

Undo currently only undoes a specific set of actions. Not all application actions or changes can be undone by this menu item. See the chapter on Undoing Changes.

Repeat Last Modifier – the last Modifier that was accessed will be opened with its last settings.

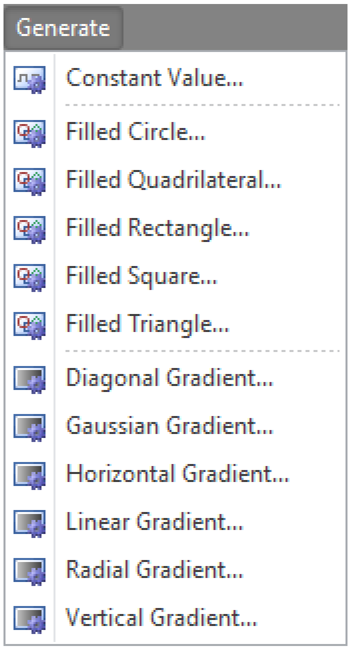
Clear Undo Stack – clear the undo list and delete all undo temporary files.

Copy – copy the current object to the Windows clipboard.

Paste – paste the contents of the Windows clipboard to the current object.

Generate Menu

Contains the fill, gradient, and shape generators.
See the *Devices* chapter for information on each device.



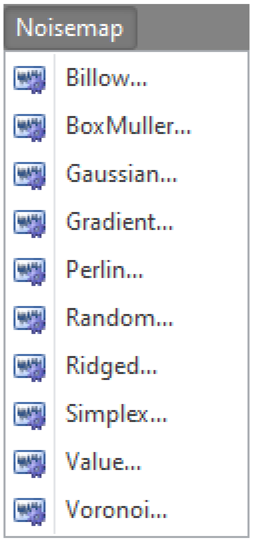
Constant Value – Generate a constant value.

Filled Circle – Generate a filled circle.
Filled Quadrilateral – Generate a filled quadrilateral.
Filled Rectangle – Generate a filled rectangle.
Filled Square – Generate a filled square.
Filled Triangle – Generate a filled triangle.

Diagonal Gradient – Generate a diagonal gradient.
Gaussian Gradient – Generate a gaussian circle gradient.
Horizontal Gradient – Generate a horizontal gradient.
Linear Gradient – Generate a linear gradient.
Radial Gradient – Generate a radial circle gradient.
Vertical Gradient – Generate a vertical gradient.

Noisemap Menu

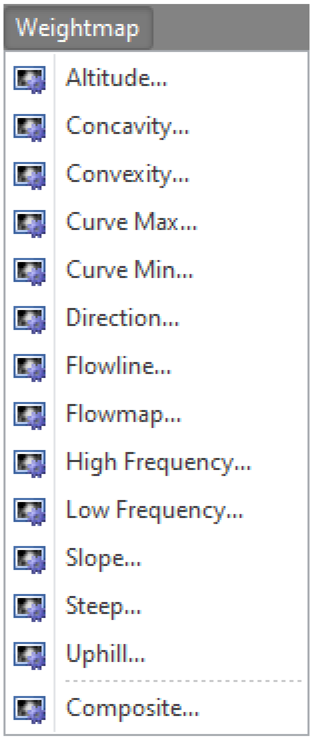
Contains the procedural noise generators.
See the *Devices* chapter for information on each device.



Billow – Generate billow perlin type noise.
BoxMuller – Generate boxmuller random noise.
Gaussian – Generate gaussian random noise.
Gradient – Generate gradient perlin type noise.
Perlin – Generate standard perlin noise.
Random – Generate standard random noise.
Ridged – Generate ridged perlin type noise.
Simplex – Generate simplex perlin type noise.
Value – Generate value perlin type noise.
Voronoi – Generate Voronoi noise.

Weightmap Menu

Contains the Weightmap mask extractors.
See the *Devices* chapter for information on each device.

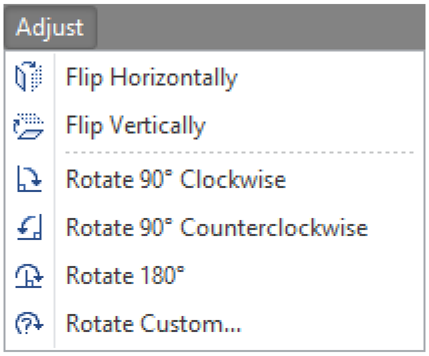


Altitude – Extract a weightmap mask based on altitude.
Concavity – Extract a weightmap mask based on concavity.
Convexity – Extract a weightmap mask based on convexity.
Curve Max – Extract a weightmap mask based on maximum curvature.
Curve Min – Extract a weightmap mask based on minimum curvature.
Direction – Extract a weightmap mask based on direction.
Flowline – Extract a weightmap mask based on water flow lines.
Flowmap – Extract a weightmap mask based on a water flow map.
High Frequency – Extract a weightmap mask of high frequency.
Low Frequency – Extract a weightmap mask of low frequency.
Slope – Extract a weightmap mask based on slope.
Steep – Extract a weightmap mask based on steepness.
Uphill – Extract a weightmap mask of uphill flow lines.

Composite – Extract a composite multiple weightmap mask.

Adjust Menu

This menu contains a number of editing functions that change the terrain heightmap.
See the *Devices* chapter for information on each device.



Flip Horizontally – flip the terrain heightmap horizontally.

Flip Vertically – flip the terrain heightmap vertically.

Rotate 90º Clockwise – rotate the terrain heightmap 90 degrees clockwise.

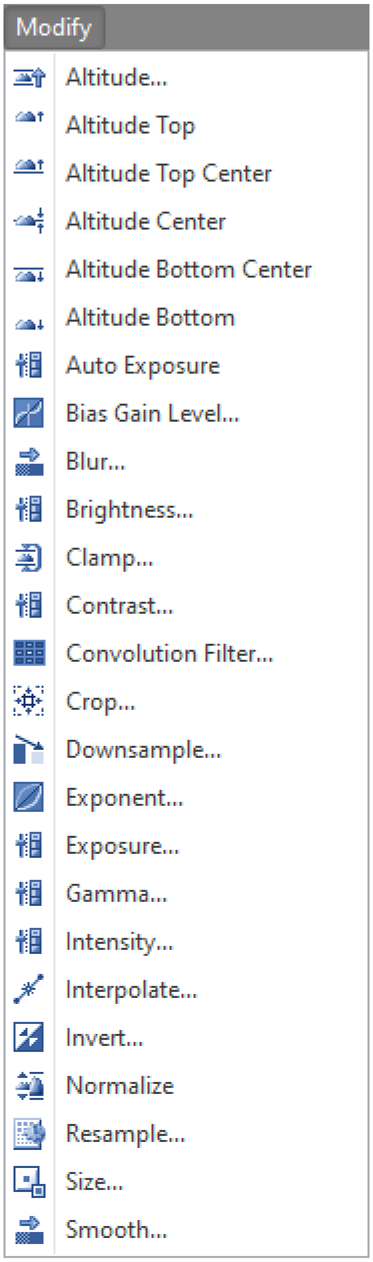
Rotate 90º Counterclockwise – rotate the terrain heightmap 90 degrees counter-clockwise.

Rotate 180º – rotate the terrain heightmap 180 degrees.

Rotate Custom – rotate the terrain heightmap by a specified degrees amount.

Modify Menu

This menu contains a number of editing functions that change the terrain heightmap.
See the *Devices* chapter for information on each device.



Altitude – adjust the altitude of the terrain heightmap.

Altitude Top – Adjust the heightmap to the top altitude location.

Altitude Top-Center – move the terrain heightmap to the top-center altitude.
The heightmap will be positioned with its lowest altitude value at the center Y coordinate.

Altitude Center – move the terrain heightmap to the center altitude.
The heightmap will be positioned with its median value at the center Y coordinate.

Altitude Bottom-Center – move the terrain heightmap to the bottom center altitude.
The heightmap will be positioned with its highest altitude value at the center Y coordinate.

Auto Exposure – Automatically adjust the mask exposure.

Bias Gain Level – adjust the altitude of the terrain heightmap.
Bias = modify gain above and below the specified center point.
Gain = modify overall gain.
Level = move the terrain heightmap up and down the Y value.

Blur – Gaussian blur the mask.

Brightness – Adjust the mask brightness.

Clamp – clamp the altitude limits of the terrain heightmap.

Contrast – Adjust the mask contrast.

Convolution Filter – apply a variety of spatial filters to the terrain heightmap.

Crop – crop the terrain heightmap to a smaller size.

Downsample – Reduce the dimensions of the heightmap.

Exponent – apply an exponent and multiplier to the terrain heightmap.

Exposure – Adjust the mask brightness, contrast, intensity, and gamma.

Gamma – Adjust the mask gamma.

Intensity – Adjust the mask intensity.

Interpolate – interpolate the terrain heightmap to a larger resolution.

Invert – invert the terrain heightmap altitudes.

Normalize – adjust the terrain heightmap to its maximum altitude limits.

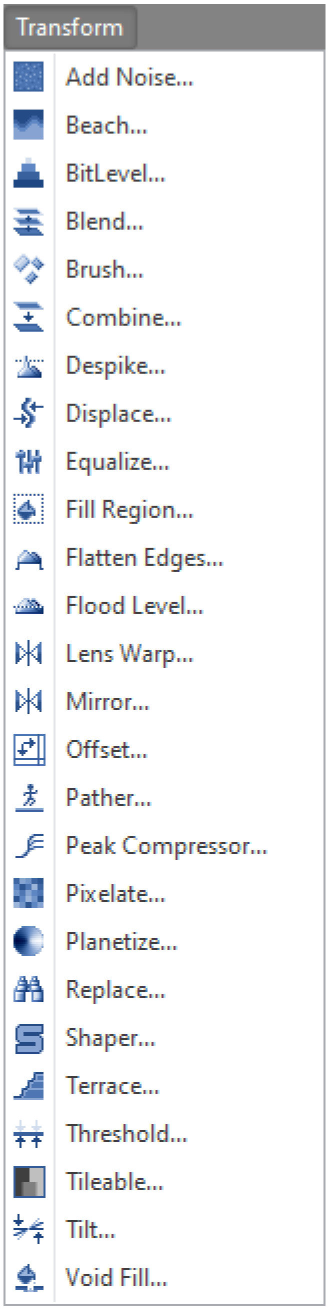
Resample – change the resolution of the terrain heightmap.

Size – change the total size of the terrain heightmap while retaining the original heightmap dimensions. This adds additional space around the perimeter of the current terrain heightmap.

Smooth – apply smoothing to the terrain heightmap.

Transform Menu

Contains the Transform type Devices.
See the *Devices* chapter for information on each device.



Add Noise – Add noise to the heightmap.

Beach – Smooth the beach elevation range of the heightmap.

BitLevel – Convert the heightmap into bit levels.

Blend – Blend two heightmaps together.

Brush – Place an alpha brush on the heightmap.

Combine – Combine two heightmaps together.

De-spike – remove single vertex spikes on the terrain heightmap.

Displace – Displace the heightmap using files or noise.

Equalize – adjust the equalization of the terrain heightmap.

Fill Region – fill the specified XZ region with the specific Y altitude value.

Flatten Edges – flatten the outer edges of the terrain heightmap.

Flood Level – simulated flooding of the terrain heightmap.

Mirror – mirror the terrain heightmap to one of the four sides, typically for symmetrical map designs.

Offset – offset the terrain heightmap along the width and length.

Pather – Flatten a path along the heightmap edge.

Peak Compressor – compress the upper altitude peaks of the terrain heightmap.

Pixelate – pixelate the XY on the terrain heightmap.

Planetize – curve the surface of the terrain heightmap.

Replace – Replace any value in the heightmap.

Shaper – Shape the heightmap based on the specified mask.

Terrace – Create geological terracing in the heightmap.

Threshold – Adjust the heightmap elevation up or down based on a specified elecation.

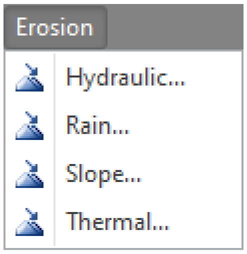
Tileable – make the terrain heightmap tileable by blending its edges.

Tilt – Tilt the heightmap.

Void Fill – Fill void values in the heightmap.

Erosion Menu

Contains the Erosion type Devices.
See the *Devices* chapter for information on each device.



Hydraulic – Perform hydraulic water erosion on the heightmap.

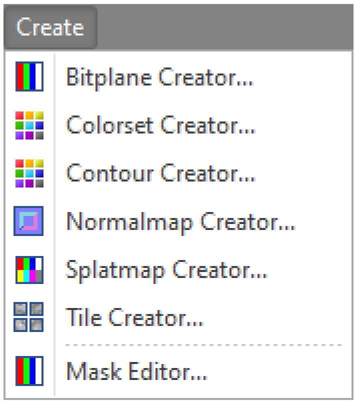
Rain – Perform rain particle erosion on the heightmap.

Slope – Perform slope-based erosion on the heightmap.

Thermal – Perform thermal erosion on the heightmap.

Create Menu

Contains custom asset creation items.
See the *Create* chapters for information on each individual tool.



Bitplane Creator – Pack up to four masks into an RGBA texture.

Colorset Creator – Create 48-bit gradient colorsets for the terrain material rendering.

Contour Creator – Convert the heightmap into a contour line image.

Normalmap Creator – Convert a texture into a normalmap.

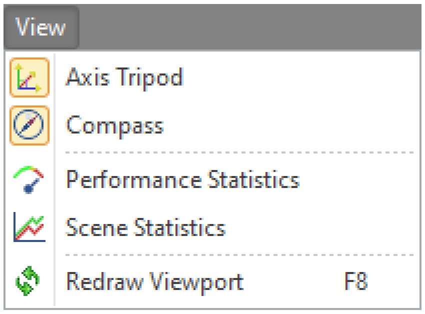
Splatmap Creator – Pack up to four weightmaps into an RGBA texture.

Tile Creator – Split a texture into tiles.

Mask Editor – Display the mask editor dialog.

View Menu

The view menu toggles various widget icons and displays on the main editor viewport.



Axis Tripod – Toggle the editor viewport axis tripod visibility.
The axis tripod can be disabled in the Settings Scene settings.

Compass – Toggle the editor viewport compass icon visibility.

Performance Statistics – Display the viewport rendering performance statistics.
The performance statistics include the frame render time.
See the chapter on *Viewport Statistics*.

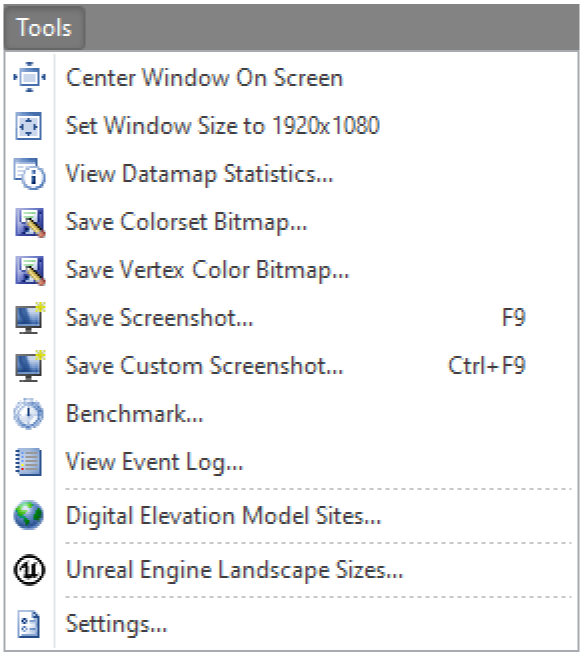
Scene Statistics – Display the viewport rendering scene statistics.
See the chapter on *Viewport Statistics*.

Redraw Viewport – Redraw the viewport scene.

The statistics display font can be changed in the Settings Viewport settings.
The performance statistics and scene statistics can be enabled in the Settings Scene settings.
The performance statistics units can be changed in the Settings Scene settings.

Tools Menu

Contains special tools items.



Center Window on Screen – Center the application window on the screen.
This properly handles multi-monitor setups.

Set Window Size to 1920x1080 – Set the main window size to 1920x1080.

View Datamap Statistics – View the statistics for the selected terrain stack datamap.
See the chapter on *Statistics*.

Save Colorset Bitmap – Save the heightmap colorset material as an image file.
See the chapter on *Saving Colorset Bitmaps*.

Save Vertex Color Bitmap – Save the terrain mesh colorset material as an image file.
See the chapter on *Saving Colorset Bitmaps*.

Save Screenshot – Save the current contents of the viewport as an image file.
This function is valid for all orthogonal and perspective views.
See the chapter on *Saving Screenshots*.

Save Custom Screenshot – Save the current contents of the viewport as an image file of the specified resolution.
This function is valid for all orthogonal and perspective views.
See the chapter on *Saving Screenshots*.

Benchmark – Run a computer system performance benchmark.
See the chapter on *Benchmarking System Performance*.

View Event Log – View the application event log file contents.
See the chapter on *Application Event Logging*.

Digital Elevation Model Sites – Display a dialog with links to common DEM sites.
See the chapter on *Digital Elevation Model Sites*.

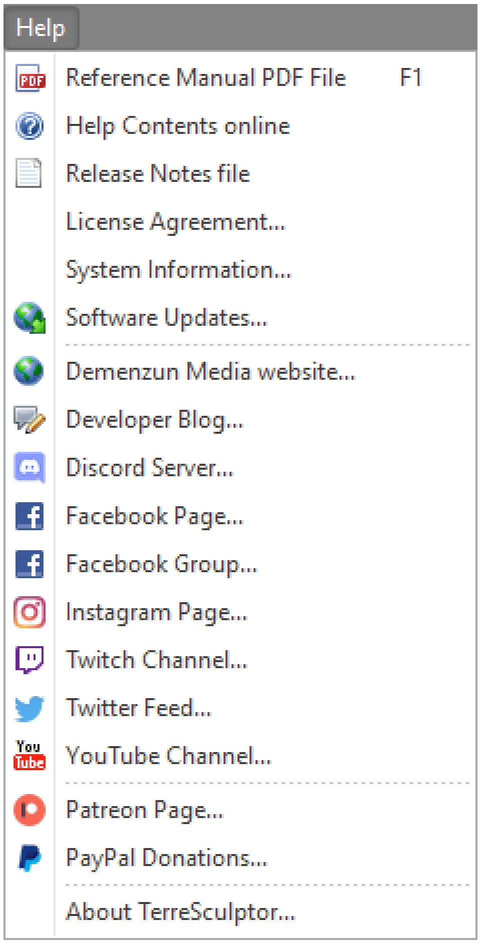
Unreal Engine Landscape Sizes – Launch the Unreal Engine 3/4/5 Landscape Sizes dialog.

See the chapter on the *Unreal Engine Landscape*.

Settings – Display the application settings dialog.
Information on the *Settings* is provided in another chapter in this document.

Help Menu

Contains help and social media links.



Reference Manual PDF file – Launch the reference manual PDF file.

Help Contents Online – Display the application online reference manual file.

Release Notes – Display the application release notes file.

License Agreement – Display the software license agreement.

System Information – Display the system information dialog.

Software Updates – Check the Internet for application updates and new versions.

Demenzun Media website – Connect to the software main website.

Developer blog – Connect to the developer blog site.

Discord Server – Connect to the Discord server.

Facebook Page – Connect to the software Facebook web page.

Facebook Group – Connect to the software Facebook group.

Google Asset Drive – Connect to the Google Drive that contains free asset files.

Instagram Page – Connect to the company Instagram web page.

Twitch Channel – Connect to the company Twitch channel.

Twitter Feed – Connect to the company Twitter feed.

YouTube channel – Connect to the software YouTube channel for video tutorials.

Patreon Page – Connect to the Patreon support web page.

PayPal Donations – Connect to PayPal for donations.

About TerreSculptor – Display the about and copyright dialog.

The Main Toolbar

The toolbar provides quick *one-click* access to many of the common functions found on the menus. The toolbar also contain additional application functions that are not available on the menus.

New Project – closes any current project and starts a new project.

Open Project – open an existing project file.

Save Project – save the current project.

Save Project As – save the current project with a specified file name.

Close Project – close the current project.

Copy – copy the current object to the Windows clipboard.

Paste – paste the contents of the Windows clipboard to the current object.

Undo – undo the last operation.
This is a drop-down menu that lists the ordered undo actions.

Undo currently only undoes a specific set of actions.
Not all actions or changes can be undone by this button item.
See the chapter on Undoing Changes.

Zoom Extents – zoom the viewport to the extents of the current terrain.
This will zoom only to the extents of the current terrain. If no terrain is loaded then this will have no effect.
If any scene objects lie outside of the current terrain area, this will not zoom to encompass them.

Top – select the viewport top orthogonal view.

Front – select the viewport front orthogonal view.

Back – select the viewport back orthogonal view.

Left – select the viewport left orthogonal view.

Right – select the viewport right orthogonal view.

Perspective – select the viewport perspective view.

Orbit Camera – select the orbit camera.
See the Viewport Cameras chapter for camera movement information.
The camera selection can also be assigned to one of the mouse X-buttons in the application Options.

Free Camera – select the free movement camera.
See the Viewport Cameras chapter for camera movement information.

The camera selection can also be assigned to one of the mouse X-buttons in the application Options.

WASD Camera – select the WASD keyboard camera (currently experimental).
See the Viewport Cameras chapter for camera movement information.
The camera selection can also be assigned to one of the mouse X-buttons in the application Options.

Mouse Speed – camera mouse speed multiplier.
This is a drop-down menu that contains the available mouse speed multipliers.
The mouse speed can also be assigned to one of the mouse X-buttons in the application Options.

Mouse Wheel Speed – camera mouse wheel speed multiplier.
This is a drop-down menu that contains the available mouse wheel speed multipliers.
The mouse wheel speed can also be assigned to one of the mouse X-buttons in the application Options.

LOD – render the terrain mesh using multiple level-of-detail modes.
This is a drop-down menu that contains the available LOD modes.
See the Terrain LOD Modes chapter.

Render Mode – render specific scene objects as wireframe, facetted, or smoothed triangles.
This is a drop-down menu that contains the available render modes.
The scene objects that support multiple render modes include the backdrop, terrain, and water.

The Toolbox

The Toolbox, always located on the left side of the main viewport, contains toolbox buttons and properties for controlling and manipulating a variety of viewport functions. These functions include camera control.

Pointer – default camera mode.
Available for all cameras.

Truck / Pedestal – truck (move left-to-right) and pedestal (move up-and-down) the camera.
Often incorrectly called Pan.
Available for the Free camera only.

Dolly – dolly the camera (move in-and-out or towards-and-away).
Available for all cameras.

Orbit – spin (orbit) and pitch the Orbit camera; free-look the Free and WASD cameras.
Available for all cameras.

2D Coordinates

The 2D coordinates of the mouse on the main viewport.

3D Coordinates

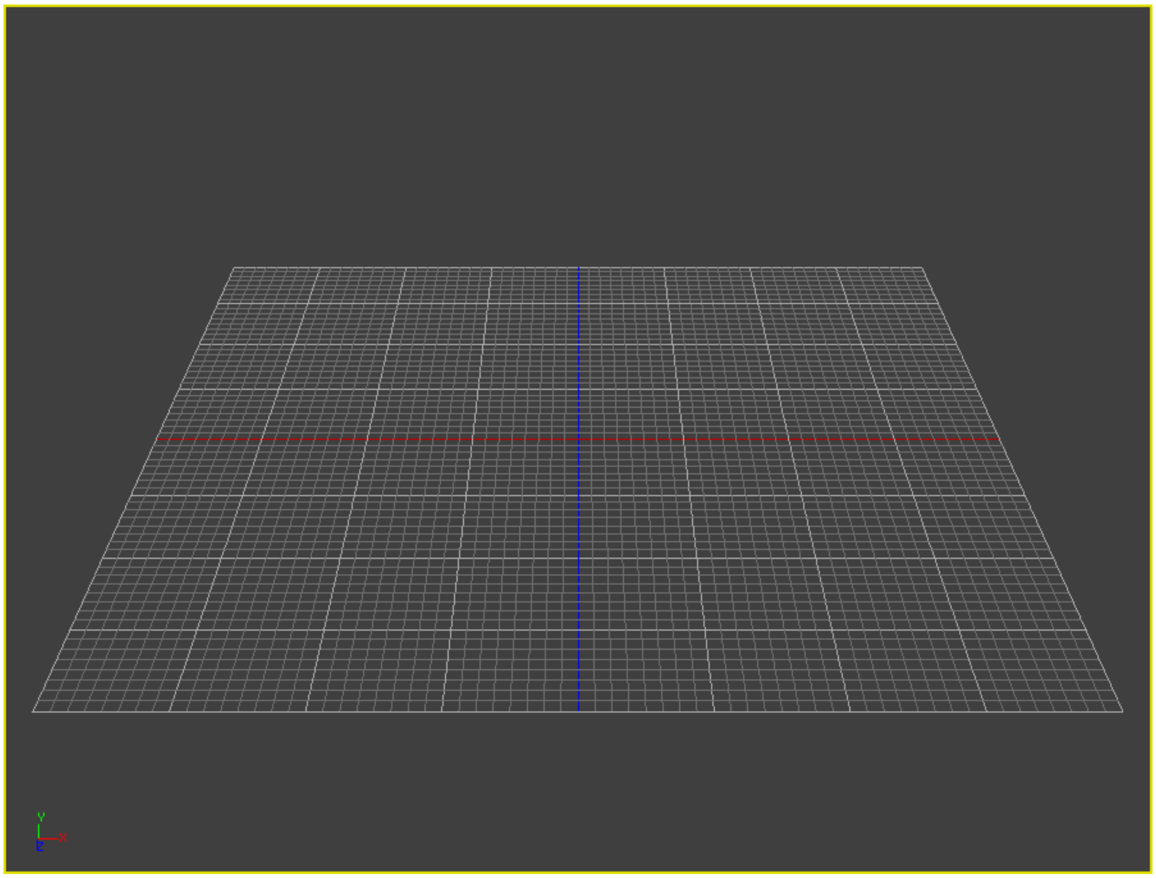
The 3D coordinates of the mouse on the main viewport.

The Main Viewport

The main viewport is a view into the three-dimensional space of the world scene. While creating a world scene, the viewport provides a dynamic view of the world construction data and scene objects.

The viewport view is always through a default camera. With this viewport camera, the scene can be moved, panned, and zoomed. The viewport camera supports two different movement modes, orbit and free. The camera is moved around the scene using a variety of mouse movements, mouse button combinations, and the mouse wheel, as listed in the shortcut options.

The viewport is active when its focus border is highlighted. The default highlight color is light yellow. The viewport must be active for camera movement to occur. To make the viewport active, click on it anywhere.



Viewport Cameras

Navigating the scene through the main viewport is accomplished by moving the camera. Two different camera movement modes are supported, orbit and free, which use a combination of mouse movements, mouse buttons, the mouse wheel, and camera toolbar buttons.

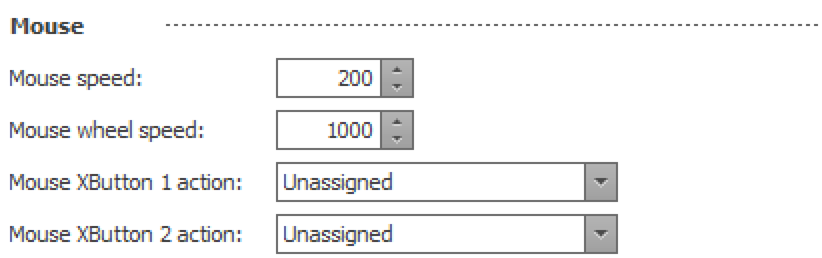
Each camera movement mode is fully independent, with each retaining its last world location when switching between the modes.

Two camera speed multiplier drop-down menus are provided on the toolbar to modify the speed of the mouse movement and mouse wheel. The wheel speed can also be changed by clicking the mouse wheel button.

 Changes the mouse movement speed by ¼×, ½×, 1×, 2×, 4× and 8×

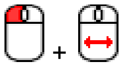
 Changes the mouse wheel speed by ¼×, ½×, 1×, 2×, 4× and 8×

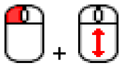
The mouse speed base setting is located in the Settings on the Viewports tab in the Mouse group.
The speed range is from 1 (slow) to 1000 (fast) with a default value of 200.

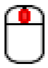


Orbit Camera

The orbit camera moves in a circle around the scene with its camera target always fixed looking at the scene world origin at 0,0,0.

 Orbit

 Pitch

 Cycle through the mouse wheel speeds 1×, 2×, 4×, 8×

 Dolly

Additional fixed-function *left mouse button* + *mouse movement* camera modes are available on the toolbox as:

 Pointer – default orbit mode

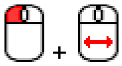
 Truck and Pedestal – not used

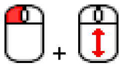
 Dolly – dolly the camera in-out

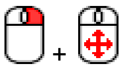
 Orbit – orbit and pitch the camera

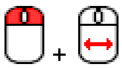
Free Camera

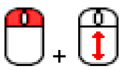
The free camera provides complete freedom of movement on any scene axis to any location and position in the scene.

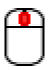
 Pan

 Dolly

 Free-look

 Truck

 Pedestal

 Cycle through the mouse wheel speeds 1×, 2×, 4×, 8×

 Dolly

Additional fixed-function *left mouse button* + *mouse movement* camera modes are available on the toolbox as:

 Pointer – default free mode

 Truck and Pedestal – truck and pedestal

 Dolly - dolly

 Orbit – free-look

WASD Camera

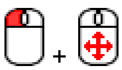
The WASD camera simulates walking on the surface of the terrain in the viewport.

W — walk forward

S — walk backward

A — walk left

D — walk right

 Free-look

Additional fixed-function *left mouse button* + *mouse movement* camera modes are available on the toolbox as:

Pointer – Default WASD mode

Truck and Pedestal – Truck and pedestal

Dolly - Dolly

Orbit – Free-look

The Function Panels

To the right of the main viewport are the Function panel selection buttons and panels.
The Function panels provide access to the scene objects including the camera, lights, grids, layout objects, terrain object, and scene objects.
Only one panel is visible at a time. The other panels are displayed by clicking on their selection button.

Camera – Provides controls for managing the camera position in the scene.

Lights – Provides controls for managing the lighting in the scene.

Grids – Provides controls for managing the home grid and user grids in the scene.

Layout – Provides controls for managing the optional designer plane features in the scene.

Terrain – Provides controls for managing the terrain.

Scene – Provides controls for managing the optional backdrop, fog, and water features in the scene.

Camera: Camera

The Cam-Nav, or Camera Navigation, area of the Camera tab provides quick access to common camera locations and positions in the scene.

Bookmarks

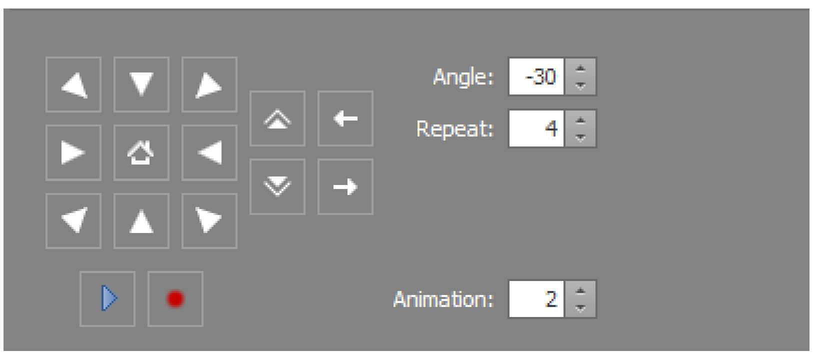
To be completed.

Orbit Camera

The Cam-Nav area for the Orbit Camera consists of the Navigation Pad and Angle/Repeat settings controls.
The Navigation Pad has pads for positioning the camera at the Home location, 8 position fixed rotation pads at 45 degree angles, dolly in and dolly out pads, and two rotation clockwise and counter-clockwise direction pads.

The Angle numeric control sets the angle in degrees for the fixed rotation pads.
The Repeat numeric control sets the repeat speed for the dolly and rotation pads.

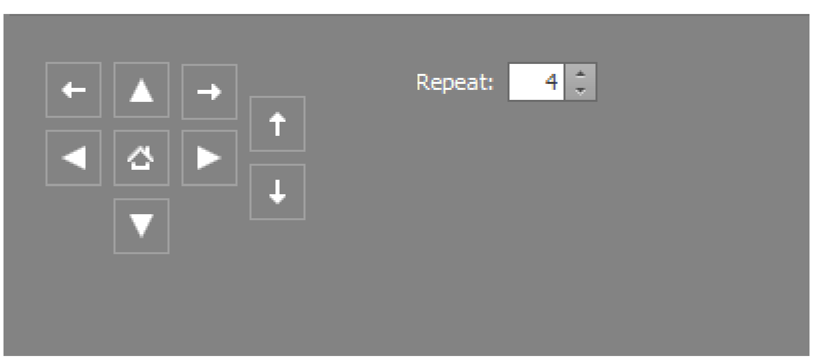
The Play Button animates the orbit camera and spins it around at the Animation Speed.
The Record Button records the viewport rotation animation to an image file list.



Free Camera

The Cam-Nav area for the Free Camera consists of the Navigation Pad and Repeat settings controls.
The Navigation Pad has pads for positioning the camera at the Home location, 4 direction pads for truck left/right and forward/backward, truck up/down pads, and two rotation clockwise and counter-clockwise direction pads.

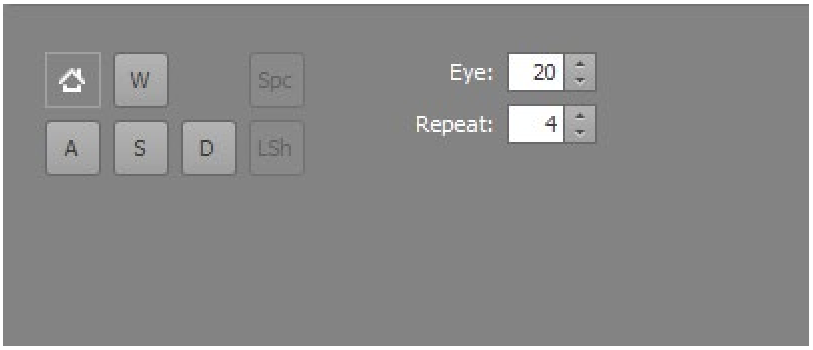
The Repeat numeric control sets the repeat speed for the truck, dolly, and rotation pads.



WASD Camera

The Cam-Nav area for the WASD Camera consists of the Navigation Pad and Eye and Repeat settings controls.
The Navigation Pad has pads for positioning the camera at the Home location, plus the four WASD direction pads.
The WASD Camera is unique in that if it is placed above the main viewport terrain mesh, it will drop down and float along the terrain surface at the Eye height distance above the terrain, simulating walking on the terrain.

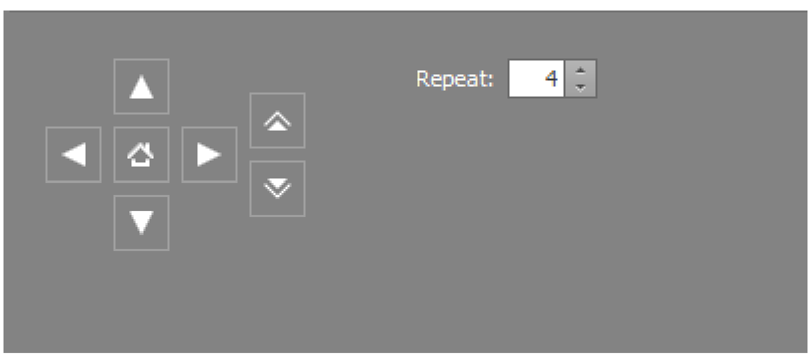
The Eye numeric control sets the height at which the camera is above the terrain mesh surface.
The Repeat numeric control sets the repeat speed for the WASD pads.



Ortho Cameras

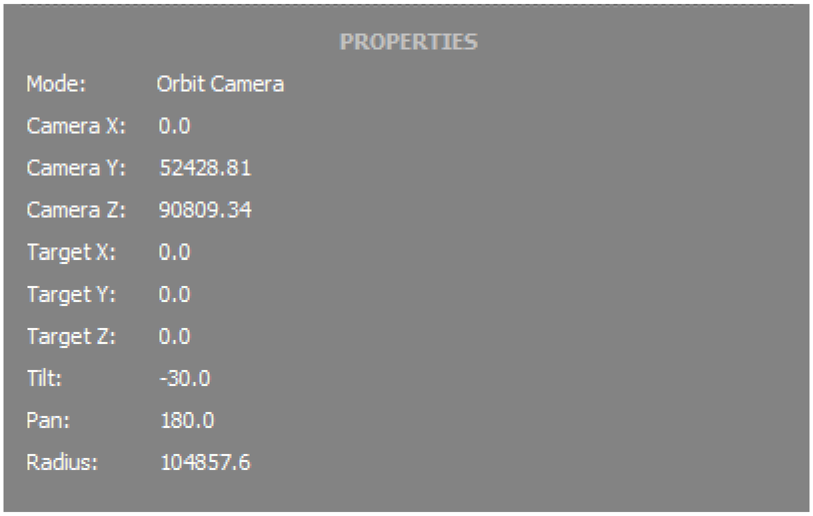
The Cam-Nav area for the Ortho Camera consists of the Navigation Pad and Repeat settings controls.
The Navigation Pad has pads for positioning the camera at the Home location, 4 direction pads for truck left/right and forward/backward, and dolly in/out pads.

The Repeat numeric control sets the repeat speed for the truck and dolly pads.



Camera Properties

The Camera Properties area of the Camera tab provides the current camera positional information.

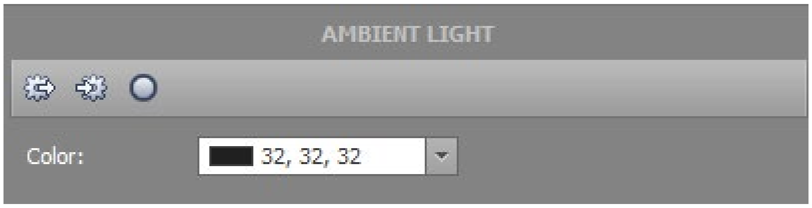


Lights: Ambient

The world scene includes two light sources: an ambient light, and a directional light that simulates the sun or moon.

The Lights are toggled on and off with the Function panel Scene settings.

Ambient Light



Load the original lighting settings from the application settings file.

Save the current lighting settings to the application settings file.

Reset the lighting to the default settings.

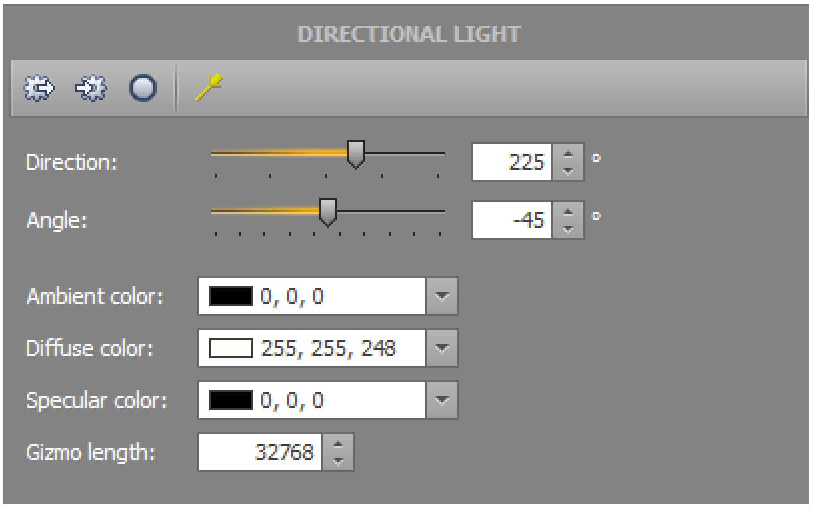
Color – specify the color of the ambient light.

Lights: Directional

The world scene includes two light sources: an ambient light, and a directional light that simulates the sun or moon.

The Lights are toggled on and off with the Function panel Scene settings.

Directional Light



Load the original lighting settings from the application settings file.

Save the current lighting settings to the application settings file.

Reset the lighting to the default settings.

Show the directional light indicator gizmo in the viewport.

Direction – the world direction that the directional light is facing, in degrees from 0 to 359.

Angle – the pitch angle that the directional light is facing, in degrees from -90 (straight down) to 0 (horizontal).

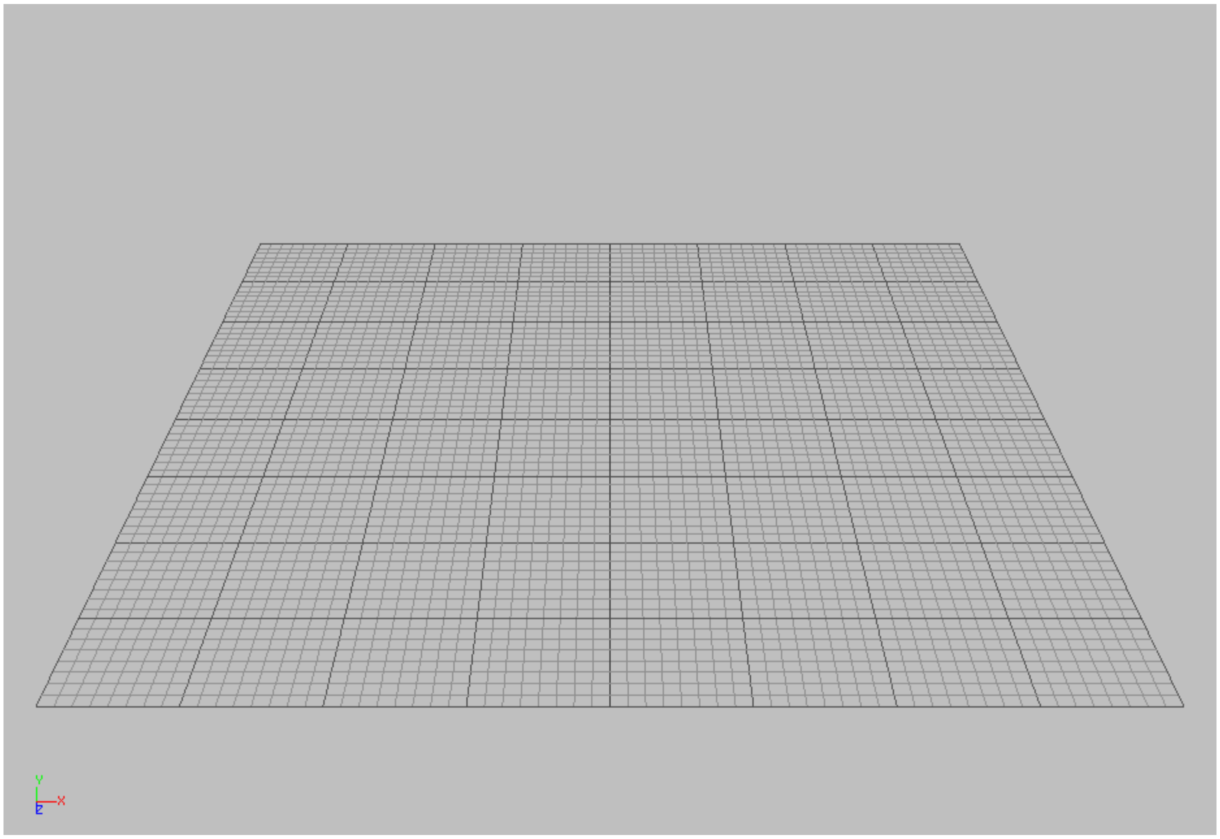
Ambient Color – specify the ambient color of the directional light. Use this to set a base shadow color.

Diffuse Color – specify the diffuse color of the directional light. Use yellows for sunlight and white-violet for moonlight.

Specular Color – specify the specular color of the directional light. Use this for flat or shiny lighting.

Gizmo length – specify the length of the directional light indicator from the world origin.

Grids: Home Grid



The home grid that you see in the viewport represents one of three planes that intersect at right angles to one another at a common point called the *origin*. Intersection occurs along three lines which are the world coordinate X, Y, and Z axes in the geometric Cartesian coordinate system.

The plane based on the world coordinate XZ axis is called the *home grid plane*, which is the base reference system of the 3D world.

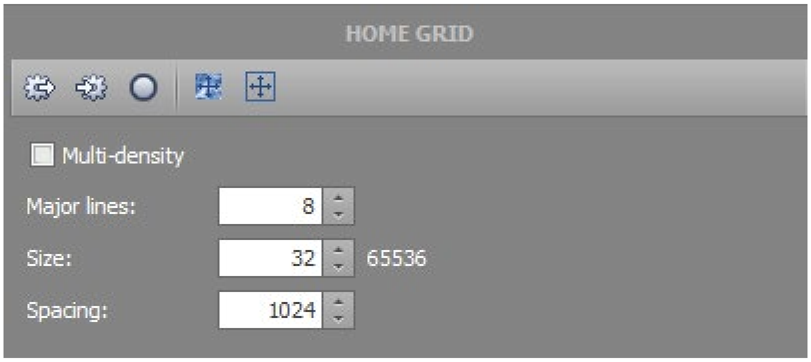
Two axes define the plane of the home grid. In the perspective viewport, you are looking across the XZ plane, with the X axis running left-to-right, and the Z axis running front-to-back. The third axis, Y, runs vertically through this plane up-and-down.

The home grid is always aligned with the world XZ coordinate axes. It can be turned on and off in each viewport view, but its orientation cannot be changed. The center of the home grid plane is always located at the world origin X,Y,Z of 0,0,0.

The home grid is not used for object snapping since all objects in the scene are always aligned on integer digit values on all three world axes.

Choose the Home Grid item on the Function panel Scene settings to toggle the visibility of the home grid.

The home grid properties are set on the Grids panel of the Function Panel area.



 Load the original home grid settings from the application settings file.

 Save the current home grid settings to the application settings file, making them the startup settings.

 Reset the home grid to the default settings.

 Set the home grid spacing*size to the current terrain dimensions.

 Set the home grid spacing*size to the world extents.

Multi-density – toggle the home grid between standard constant-spaced lines and a multiple density grid.

Multi-density is useful for reducing “grid line aliasing clutter” that occurs when viewing the scene from oblique or shallow angles, as the further out the grid is from the center origin, fewer lines are rendered.

Major lines – sets every *n*th line to be a bolder line color.

Size – specifies the number of grid lines in each of the axis directions – and + from the center origin.

The numeric value to the right of the Size control is the current home grid full extents along the X and Z axes. For example, a Size value of 32 grid lines on each side of the origin multiplied by a Spacing of 1024 world units equals: (32 × 2) × 1024 = a 65536 world units home grid size.

Spacing – specifies the world units spacing between each grid line.

The size and spacing of the home grid can be set larger than the world extents, however, the size will be clamped back to the world extents on either a home grid re-creation or when a world file is loaded.

Options

The home grid startup and line coloring settings are located on the Settings dialog’s Grid and Snap tab.
See the Settings dialog chapter for information on these settings.

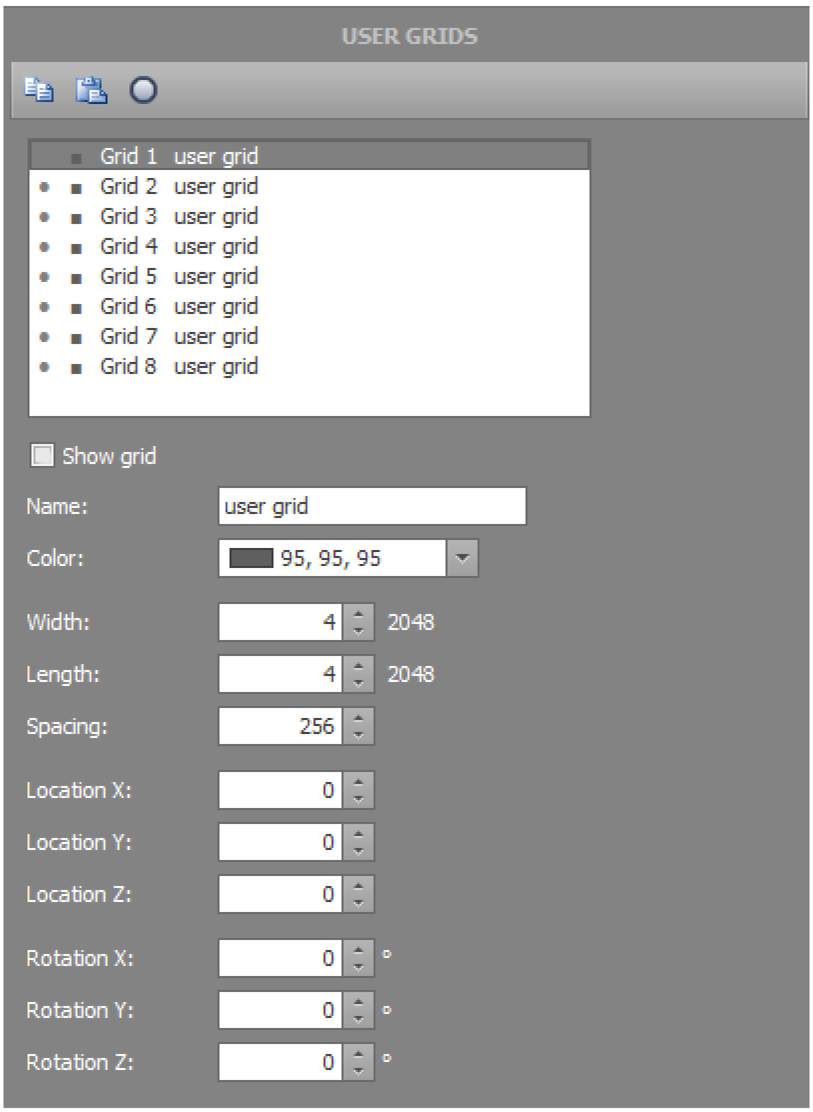
Grids: User Grids

The home grid is supplemented with eight user grids. User grids are independent grids that can be placed anywhere in the scene and rotated to any angle. User grids cannot be snapped to directly but provide a visual grid system only.

User grids can also be used to provide visual grids in the main viewport orthographic views for front, back, left and right, which only see the home grid on its flat edge axis.

To display a user grid in the scene, select one of the eight grids in the list, and check its *Show grid* option.
You can then:

- Assign a custom name to the grid by typing in the Name textbox.
- Change its grid line color by clicking on the Color button and choosing another color.
- Change its size by modifying the values of its width and length and the spacing between each grid line.
- Change its location on the X, Y, and Z axes.
- Change its rotation on the X, Y, and Z axes.



Copy the current grid settings to the clipboard.

Paste the clipboard settings to the current grid.

Reset the grid to the default settings.

displays a grey or green light depending on whether the grid is currently invisible or visible.

reflects the current color of the grid.

Name – specify the name of the grid.

Color – specify the color of the grid lines.
The grid origin lines will always be colored using the default origin line color specified in the Options.

Width – specify the width in world unit of the grid.

Length – specify the length in world units of the grid.

Spacing – specify the spacing in world units between grid lines.

Location X – specify the grid world location on the X axis plane.

Location Y – specify the grid world location on the Y axis plane.

Location Z – specify the grid world location on the Z axis plane.

Rotation X – specify the grid rotation in degrees around the X axis.

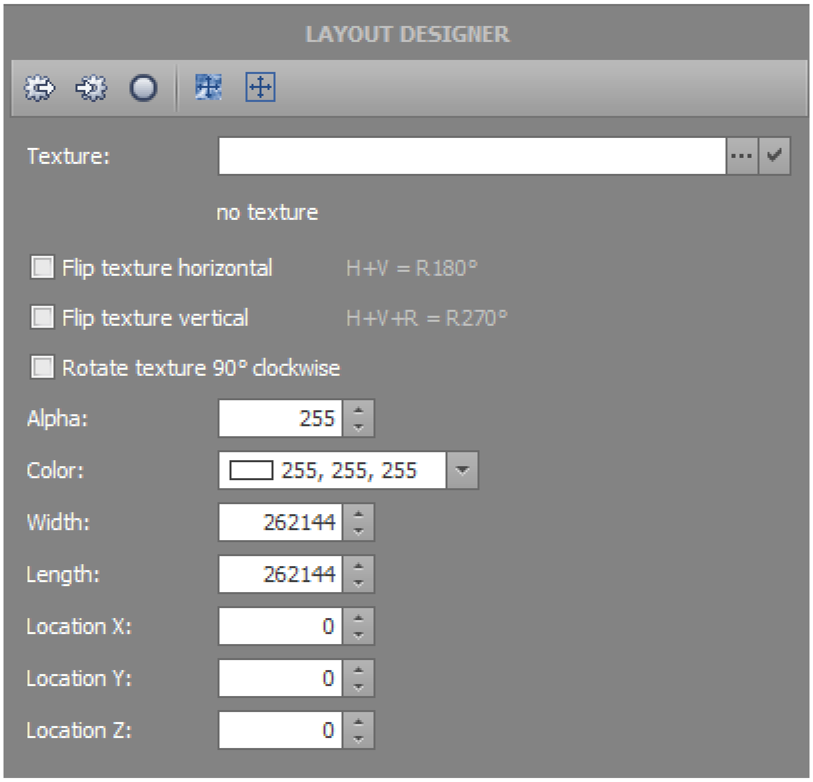
Rotation Y – specify the grid rotation in degrees around the Y axis.

Rotation Z – specify the grid rotation in degrees around the Z axis.

Layout: Designer

The scene designer provides a textured plane mesh that is used for displaying an overhead design map of the terrain layout. Overheads are commonly used in video game level design to depict the layout of map objects and storyboard scene events. The Designer can be used with Planner primitives and shapes to create a complete proxy layout of the final level design.

The Designer is toggled on and off with the Function panel Scene settings.



Load the original designer settings from the application settings file.

Save the current designer settings to the application settings file.

Reset the designer to the default settings.

Set the designer spacing*size to the current terrain dimensions.

Set the designer spacing*size to the world extents.

Texture – specify the texture file to display on the designer plane mesh.
The designer supports square-aspect, 2:1 and 1:2 width:height ratio textures only.
32-bit textures with alpha are supported.
See the chapter on Texture Support for a list of supported texture formats and sizes.

browse for a texture file.

load or re-load the specified texture file.

Flip texture horizontal – flip the texture horizontally.

Flip texture vertical – flip the texture vertically

Rotate texture 90º clockwise – rotate the texture 90 degrees clockwise.

Alpha – specify the alpha transparency of the design plane mesh. This is additive with any texture alpha.

Color – specify the designer plane mesh color. Typically this will be white but other colors will tint the texture.

Width – specify the designer plane mesh width in world units.

Length – specify the designer plane mesh length in world units.

Location X – specify the designer plane mesh location along the x axis in world units.

Location Y – specify the designer plane mesh location along the y axis in world units.

Location Z – specify the designer plane mesh location along the z axis in world units.

Creating Designer Textures

Designer textures are a square or rectangular aspect image that is typically the same dimensions or aspect as the heightmap. The texture is applied using planar UV mapping coordinates that are configured as full planar 1:1 with edge clamping. The designer Width and Length properties should be set to match the texture aspect ratio.

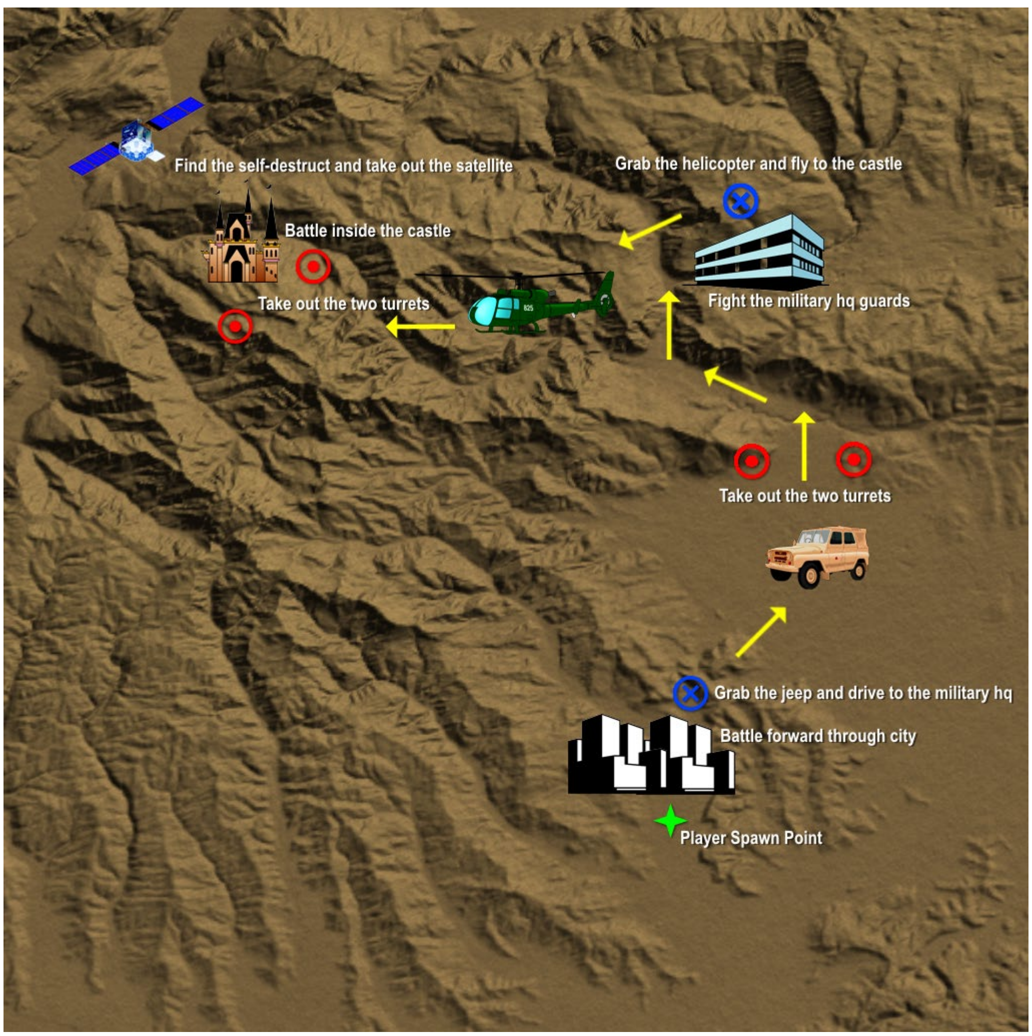
The texture is applied to both the top and the bottom of the designer plane mesh, with the bottom UV mapping set to mirror the top so that it appears like looking through the plane mesh.

The texture may contain alpha channel information to provide areas of translucency or transparency.

Designer textures are typically used for level designer storyboard overheads and map layout guidelines. The information contained on the texture can be used to determine heightmap design layout, such as where mountains or rivers are located, or to depict the storyboard events and their locations on the terrain.

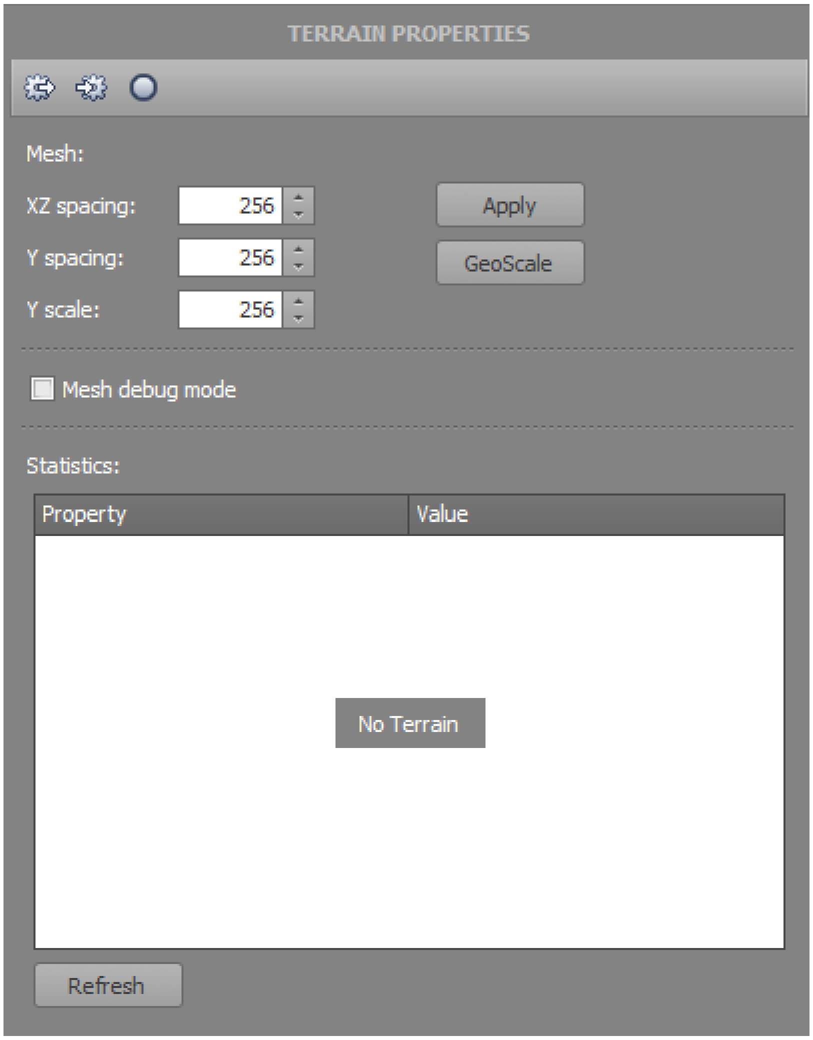
A top view screenshot of the terrain can be saved to use as a reference guide for placing the various storyboard elements. The completed designer texture can be checked against the final heightmap, and all terrain assets passed to the level design department.

An example designer storyboard texture.



Terrain: Properties

The terrain properties panel contains terrain mesh rendering properties and terrain statistics.



 Load the original spacing and scale settings from the application settings file.

 Save the current spacing and scale settings to the application settings file.

 Reset the properties to the default settings.

XZ spacing – The terrain mesh X and Z axis vertex spacing, in world units.
For example, if Settings Units is centimeters, then XZ Spacing of 100 is 1 meter per pixel.

Y spacing – The terrain mesh Y axis vertex spacing, in world units.
This value is Heightmap Range / Y Scale set to Settings Units.

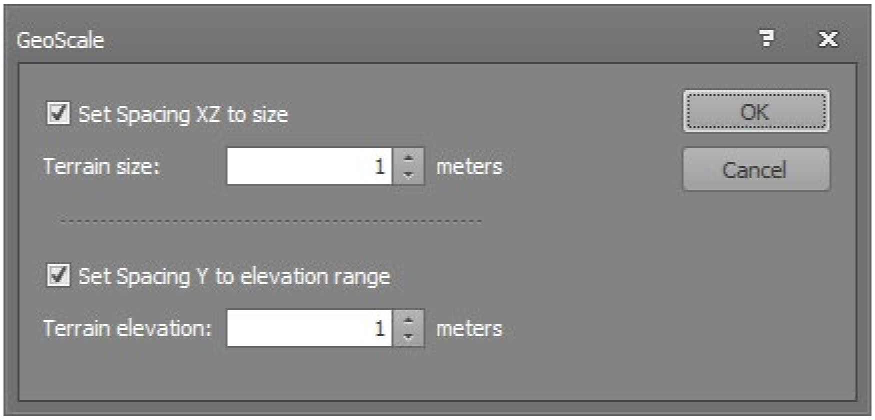
Y scale – The terrain mesh Y axis vertex scale, this is fixed to the value in the Settings, Ruler and Units, Units.
This value is normally just preset in the Settings Units and never changed here.
If XYZ Spacing and Y Scale are all 256, then a Normalized 256x256 heightmap will be a cube.

Mesh debug mode – Renders each terrain mesh section in a different tinted color.

Statistics – Displays the terrain mesh statistics.
Click on the Refresh button to update the statistics information.

GeoScale

The GeoScale dialog allows for setting the Terrain Mesh XZ Spacing and Y Spacing values to real-world values such as meters. Currently this dialog assumes that the editor Settings Units are centimeters, which is the most common units.



Enable the checkbox for the Spacing XZ and/or Y value that you would like to set and enter in the number of meters. For example, if you want the Spacing XZ to be 5 meters, enter 5 into the Terrain size numeric control.

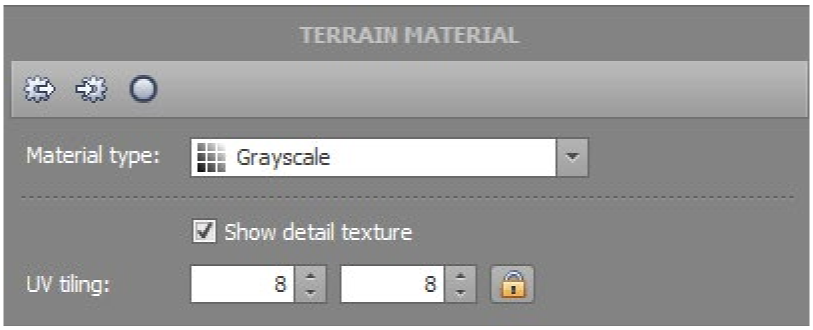
Terrain Material

The terrain material panel contains settings for setting the main viewport terrain mesh render material. The material determines the coloring of the main viewport terrain mesh.

There are currently four Material Types.

Material Type Grayscale

Render the viewport terrain mesh using a grayscale black-to-white color ramp.



 Load the original settings from the application settings file.

 Save the current settings to the application settings file.

 Reset the properties to the default settings.

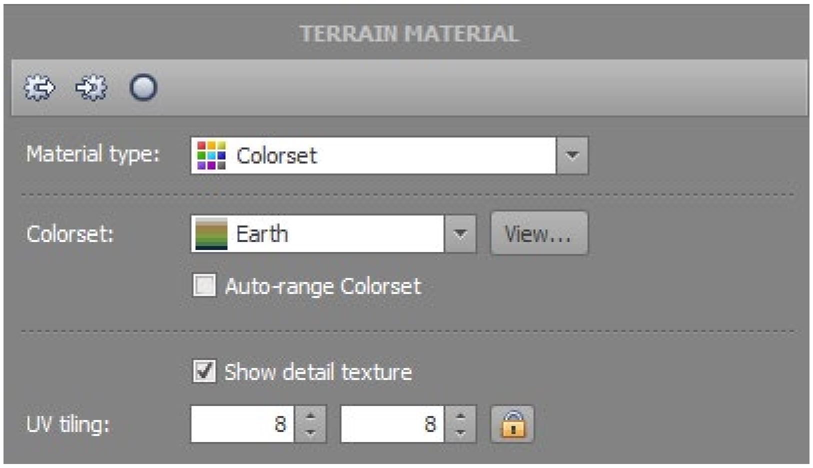
Material Type: Grayscale – Choose the material type.

Show detail texture – Whether the detail texture is rendered on the terrain mesh.

UV tiling – The UV tiling of the detail texture. Use the lock button to lock the U and V values.

Material Type Colorset

Render the viewport terrain mesh using a 48-bit gradient color ramp.
The colorset gradients simulate many real-world color schemes such as arctic and desert.



Load the original settings from the application settings file.

Save the current settings to the application settings file.

Reset the properties to the default settings.

Material Type: Colorset – Choose the material type.

Colorset – Choose the colorset gradient from the drop-down list.

View – View the colorset gradient in the Colorset Viewer dialog.

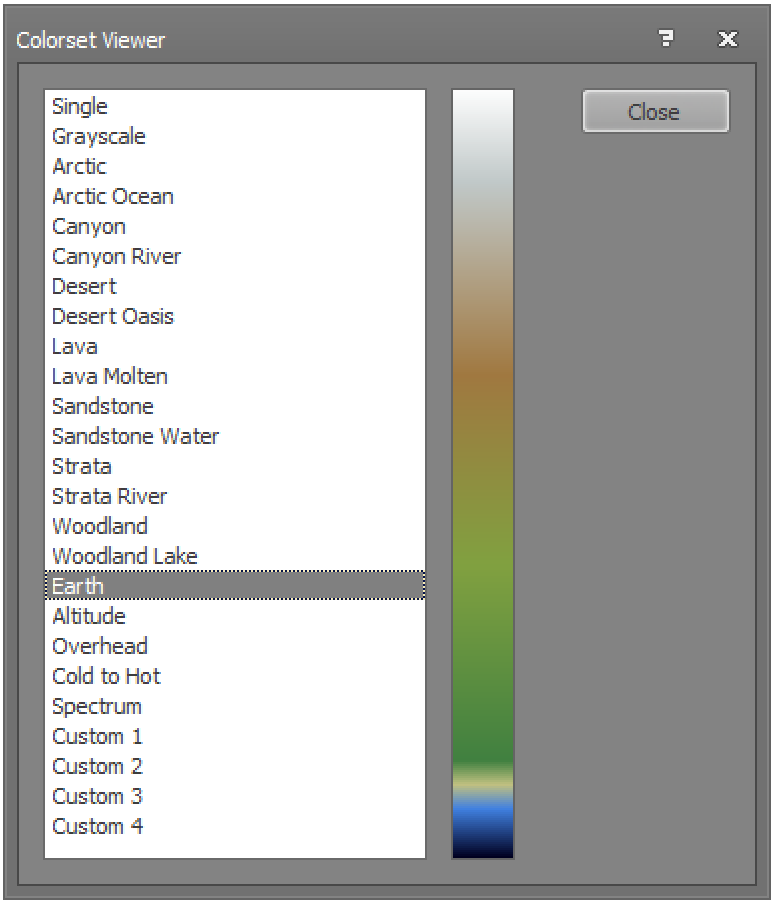
Auto-range Colorset – Whether the colorset gradient automatically scales its range to the terrain mesh range.

Show detail texture – Whether the detail texture is rendered on the terrain mesh.

UV tiling – The UV tiling of the detail texture. Use the lock button to lock the U and V values.

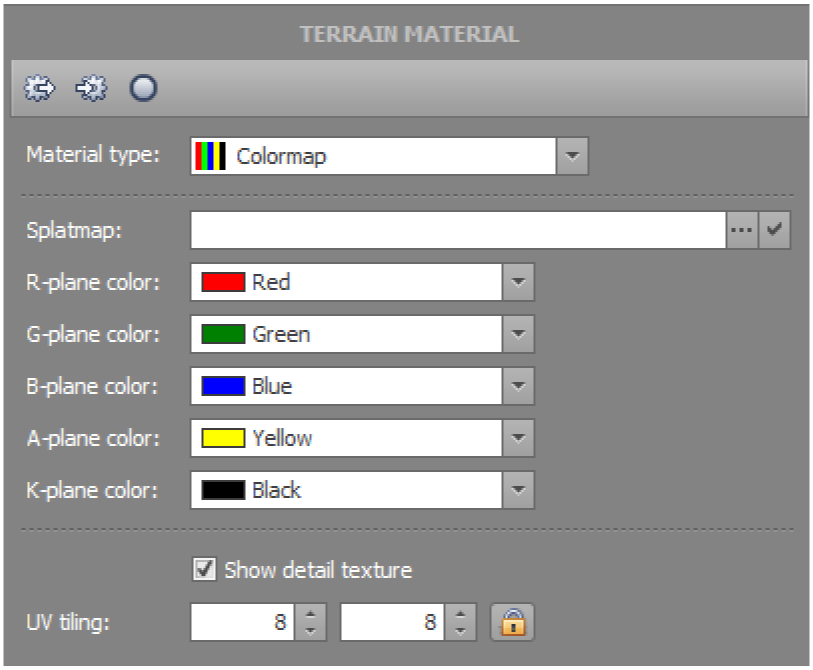
See the Colorset Creator for the ability to create custom colorsets.

The Colorset Material Colorset Viewer (click on the View button to display this dialog).



Material Type Colormap

Render the viewport terrain mesh using an RGB, RGBA, or RGBAK Splatmap texture material.



 Load the original settings from the application settings file.

 Save the current settings to the application settings file.

 Reset the properties to the default settings.

Material Type: Colormap – Choose the material type.

Splatmap – The splatmap texture. Supports RGB, RGBA, RGBAK splatmap texture.
The texture will be resampled to the size of the viewport terrain mesh.

R-plane color – The terrain color for the splatmap texture red plane.

G-plane color – The terrain color for the splatmap texture green plane.

B plane color – The terrain color for the splatmap texture blue plane.

A-plane color – The terrain color for the splatmap texture alpha plane.

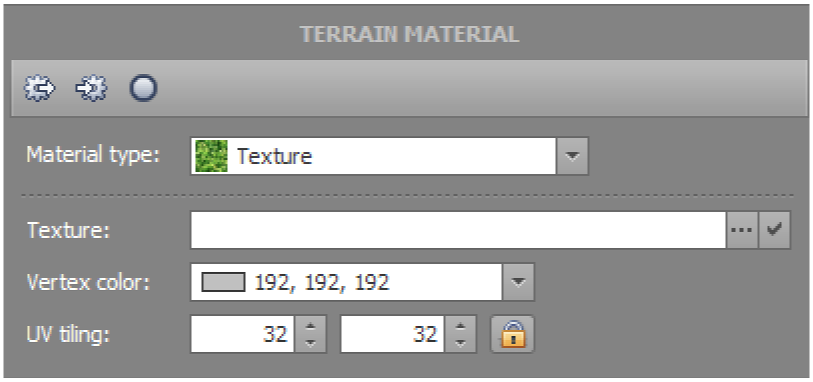
K-plane color – The terrain color for the splatmap black plane.

Show detail texture – Whether the detail texture is rendered on the terrain mesh.

UV tiling – The UV tiling of the detail texture. Use the lock button to lock the U and V values.

Material Type Texture

Render the viewport terrain mesh using a single UV Planar mapped texture.



Load the original settings from the application settings file.

Save the current settings to the application settings file.

Reset the properties to the default settings.

Material Type: Texture – Choose the material type.

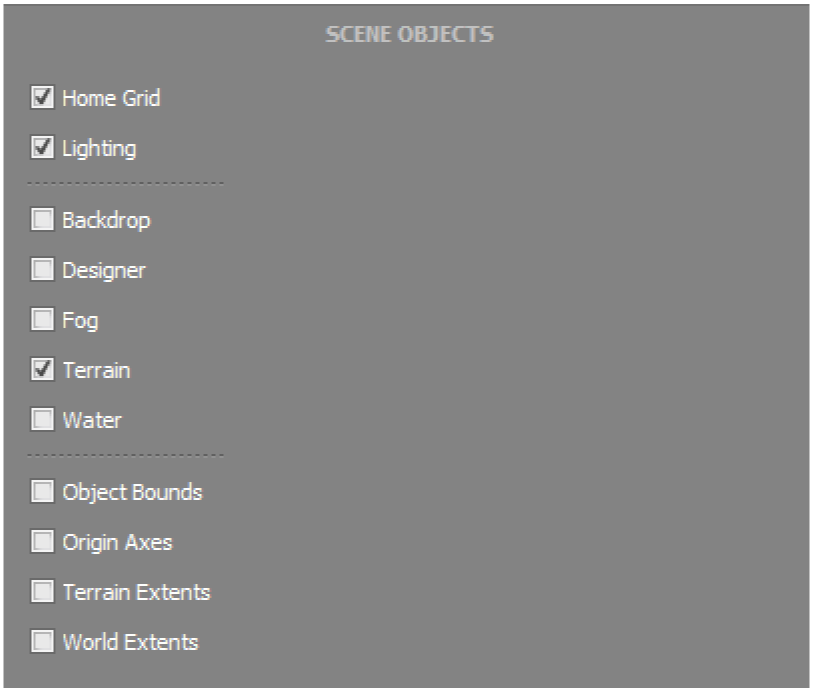
Texture – The texture file. Textures should normally be power-of-two resolutions from 256x256 to 16384x16384.

Vertex color – The terrain mesh vertex color. This can be changed to tint the texture. The default color is white.

UV tiling – The UV tiling of the texture. Use the lock button to lock the U and V values.

Scene: Objects

The function panel scene objects allows for showing and hiding a variety of main viewport scene objects.
All of these scene objects are available at all times, including when a terrain is not loaded.
See the *Scene Objects and Helpers* chapter for information on each tool.



Home Grid – Toggle the visibility of the home grid.

Lighting – Toggle the scene lighting.

Backdrop – Toggle the visibility of the scene backdrop.

Designer – Toggle the visibility of the scene designer plane.

Fog – Toggle the visibility of the scene fog effect.

Terrain – Toggle the visibility of the scene terrain.

Water – Toggle the visibility of the scene water.

Object Bounds – Toggle the visibility of the object bounding boxes.

Origin Axes – Toggle the visibility of the colored origin axes lines.

Terrain Extents – Toggle the visibility of the terrain extents bounding box.

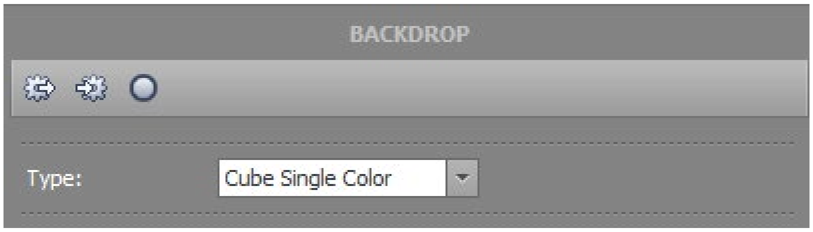
World Extents – Toggle the visibility of the world extents bounding box.

Scene: Backdrop

The scene backdrop is an optional visualization mesh that is used to simulate a sky surrounding the terrain mesh.

The Backdrop is toggled on and off with the Function panel Scene objects.

The following are the properties common to all Backdrop types:



Load the original backdrop settings from the application settings file.

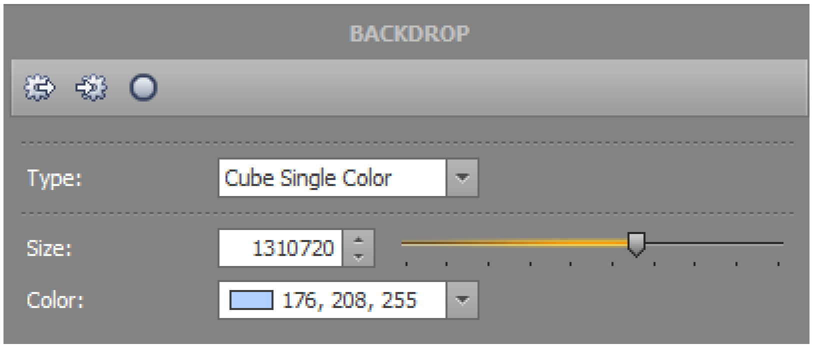
Save the current backdrop settings to the application settings file.

Reset the backdrop to the default settings.

Type – specify the scene backdrop type.
There are five different backdrop types.

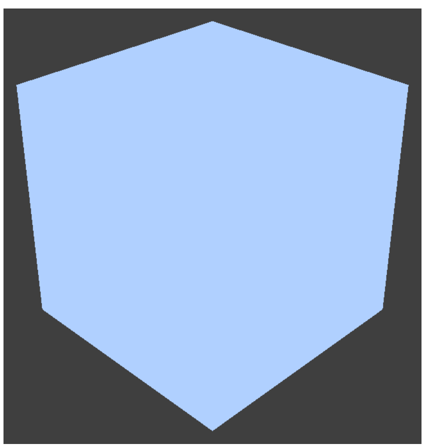
Scene: Backdrop: Cube

The Cube Single Color backdrop is a single color six-sided cube.



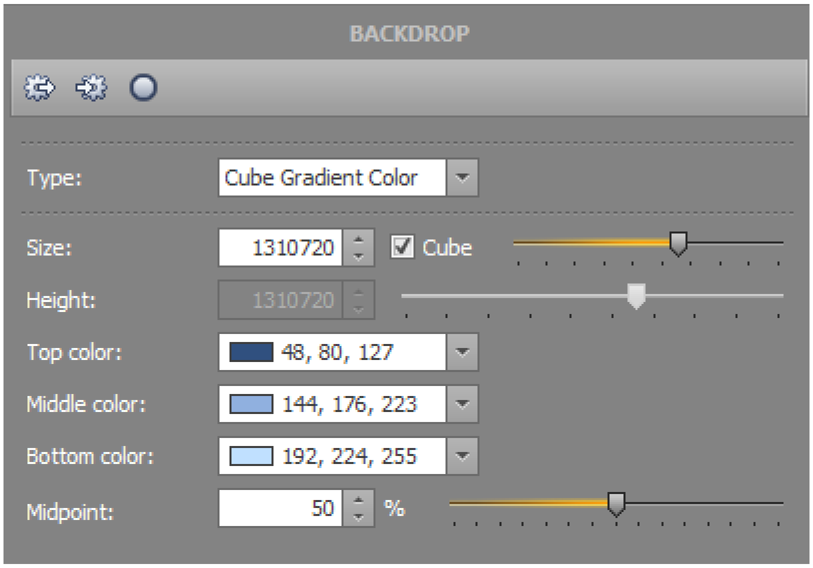
Size – specify the size of the cube in world units.

Color – specify the color of the cube.
The pop-up Color Dialog also includes 16 common sky color presets.



Scene: Backdrop: Cube Gradient

The Cube Gradient Color backdrop is a three color six-sided cube with the color gradient along the Y axis.



Size – specify the size or width/length size of the cube in world units.

Cube – maintains a cubic height-to-width/length size shape when checked.

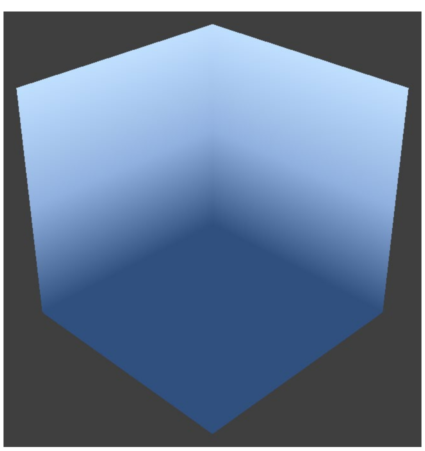
Height – specify the height of the cube when the Cube checkbox is not checked.

Top Color – specify the top color of the cube.
The pop-up Color Dialog also includes 16 common sky color presets.

Middle Color – specify the middle color of the cube.
The pop-up Color Dialog also includes 16 common sky color presets.

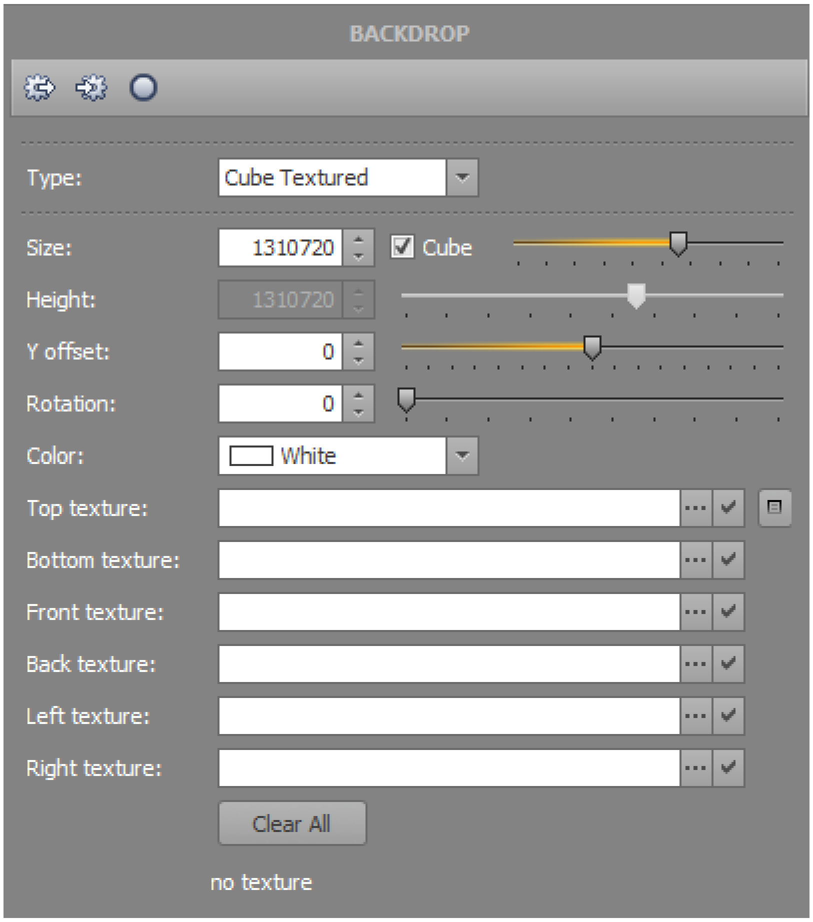
Bottom Color – specify the bottom color of the cube.
The pop-up Color Dialog also includes 16 common sky color presets.

Midpoint – specify the midpoint percent where the middle color is located along the cube height.
A midpoint of 0 is the bottom of the cube, a midpoint of 100 is the top of the cube.



Scene: Backdrop: Cube Textured

The Cube Textured backdrop is a six texture six-sided cube.



Size – specify the size or width/length size of the cube in world units.

Cube – maintains a cubic height-to-width/length size shape when checked.

Height – specify the height of the cube when the Cube checkbox is not checked.

Y offset – specify the world Y-axis offset for the center of the cube.

Rotation – specify the world Y-axis rotation around the center of the cube.

Textures

The textured cube backdrop supports square-aspect or 2:1 width:height textures only.
See the chapter on Texture Support for a list of supported texture formats and sizes.

 browse for a texture file.

 load or re-load the specified texture file.

Top texture – specify the texture file to display on the cube top surface.

Auto-Fill button – Auto-fill the remainder of the texture files, supports only certain file names.

Bottom texture – specify the texture file to display on the cube bottom surface.

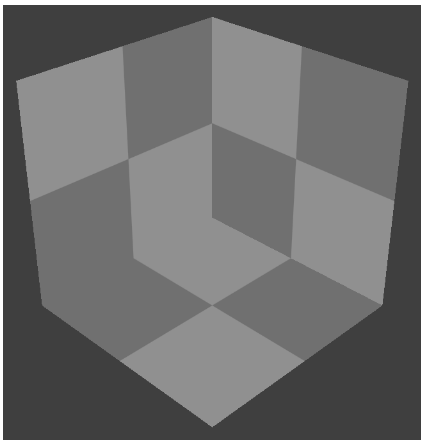
Front texture – specify the texture file to display on the cube front surface.

Back texture – specify the texture file to display on the cube back surface.

Left texture – specify the texture file to display on the cube left surface.

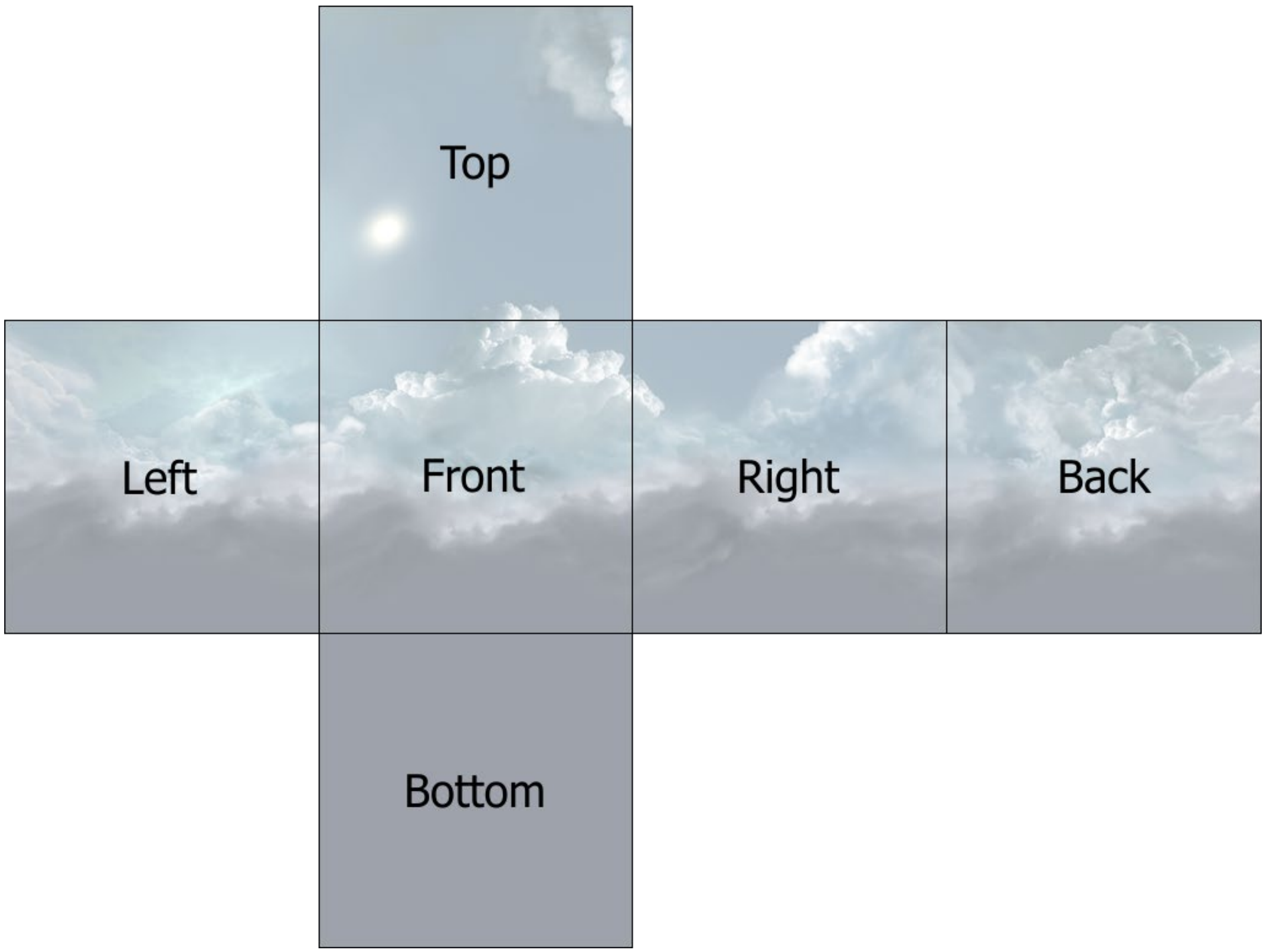
Right texture – specify the texture file to display on the cube right surface.

Clear All – Clear all texture file name text boxes.



Creating Cube Textures

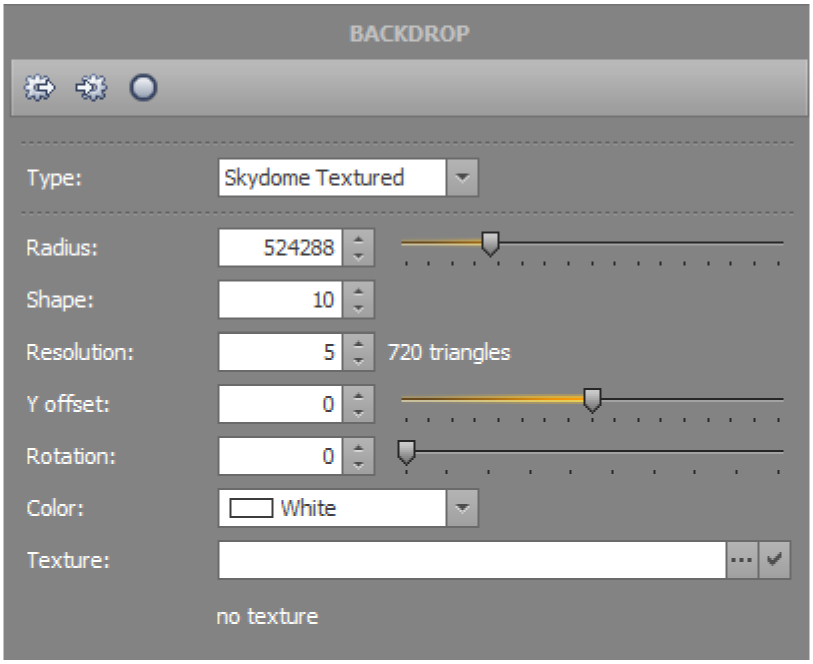
Cube textures are a set of six square-aspect images that are applied to each side of the backdrop cube using planar UV mapping coordinates.
The mapping coordinates are configured for 1:1, 1:2 or 2:1 aspect support.
The 1:2 aspect requires setting the Height property to 2× the Size property.
The 2:1 aspect requires setting the Height property to ½ of the Size property.
The textures must be seamless on all edges.
The six texture images are laid out as a cube that has been folded out and flattened.
The textures should not include any alpha channel information.



Note: the black lines are to visually depict the texture borders and would not be included in the actual textures.

Scene: Backdrop: Skydome

The Skydome backdrop is a textured variable shape hemisphere.



Radius – specify the radius of the dome in world units.

Shape – specify the shape of the dome. The shape range determines the flatness of the hemisphere.

Resolution – specify the dome mesh resolution.

Y offset – specify the world Y-axis offset for the base-center of the dome.

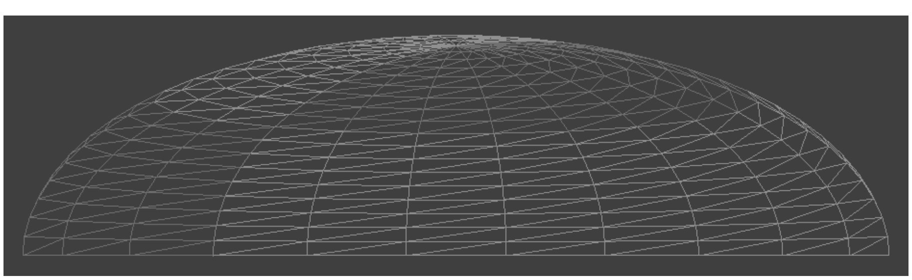
Rotation – specify the world Y-axis rotation around the center of the dome.

Color – The mesh vertex color, this is to tint the texture. Default color is white.

Texture – specify the texture file to display on the dome surface.
The skydome backdrop supports 4:1 ratio width:height textures only.
See the chapter on Texture Support for a list of supported texture formats and sizes.

 browse for a texture file.

 load or re-load the specified texture file.



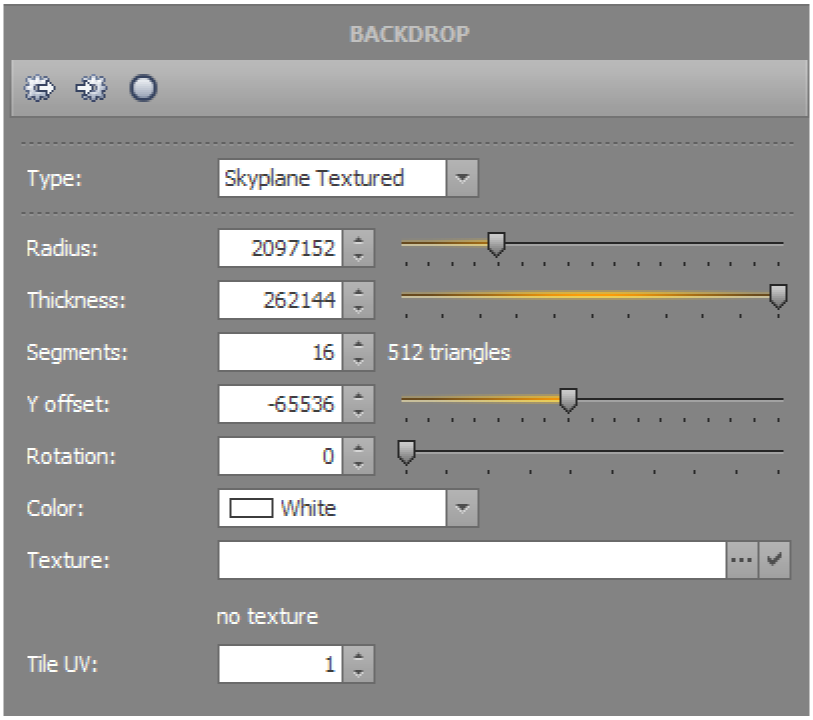
Creating Skydome Textures

Skydome textures are panorama images that are applied using spherical UV mapping coordinates.
The mapping coordinates are configured for 4:1 aspect support. 2:1 and 1:1 aspect textures will be stretch-distorted along the texture U (width).
The texture must be seamless on all edges.
The texture top 50 to 100 pixels should be blurred to a single color to prevent visible UV coordinate compression at the dome top.
The texture should not include any alpha channel information.

Note: the black lines are to visually depict the texture border and would not be included in the actual texture.

Scene: Backdrop: Skyplane

The Skyplane backdrop is a textured variable shape draped plane.
The plane is effectively the sheared top section of an imaginary bounding sphere.



Radius – specify the equivalent radius of the imaginary bounding sphere in world units.

Thickness – specify the thickness of the plane slice from the top of the imaginary bounding sphere.

Segments – specify the plane width and length segments resolution.

Y offset – specify the world Y-axis offset for the base-center of the plane.

Rotation – specify the world Y-axis rotation around the center of the plane.

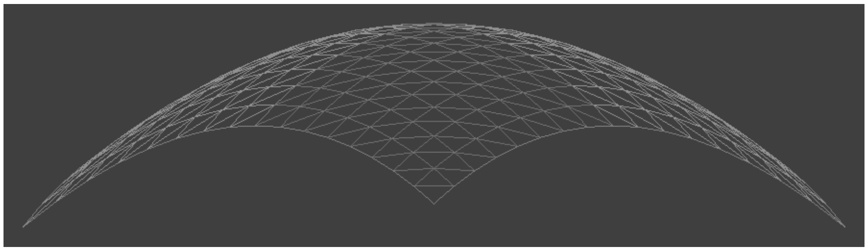
Color – The mesh vertex color, this is to tint the texture. Default color is white.

Texture – specify the texture file to display on the plane surface.
The skyplane backdrop supports square-aspect textures only.
See the chapter on Texture Support for a list of supported texture formats and sizes.

 browse for a texture file.

 load or re-load the specified texture file.

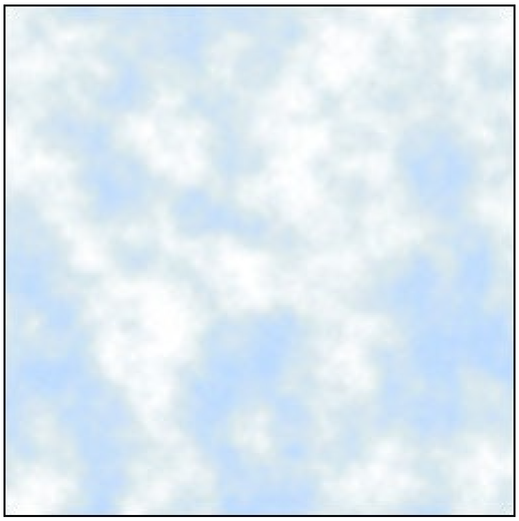
Tile UV – specify the texture tiling along the width and length of the plane.



Creating Skyplane Textures

Skyplane textures are square aspect images, optionally seamlessly tileable, that are applied using planar UV mapping coordinates.
The mapping coordinates are configured for 1:1 aspect (square) texture support.
The texture must be seamlessly tileable on all edges if the Tile XY property is set to any value other than 1.
The texture should not include any alpha channel information.
The texture can be either planar or spherical content design.

Planar texture:



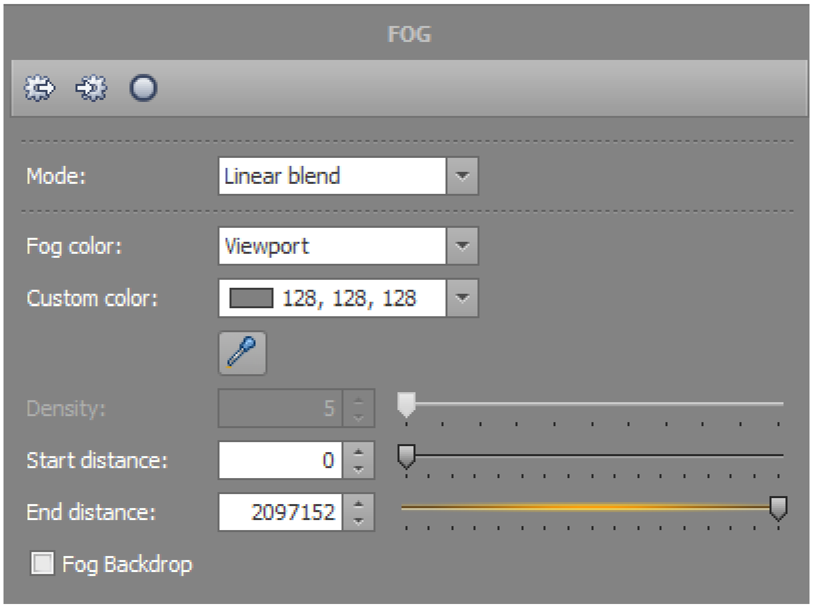
Note: the black lines are to visually depict the texture border and would not be included in the actual texture.

Spherical texture:

Scene: Fog

Scene fog adds a distance fogging effect to the 3D editor scene, which provides a pleasing real-world effect of haze or fog.

Fog is toggled on and off with the Function panel Scene objects.



Load the original fog settings from the application settings file.

Save the current fog settings to the application settings file.

Reset the fog to the default settings.

Mode – specifies the fog blending factor mode.

Linear: performs a linear blend from the Start distance to the End distance.
Exponential: performs an exponential distance blend of Density fog thickness.
Exponential 2: performs an exponential-squared distance blend of Density fog thickness.

Fog Color – specifies the color of the fog. The fog color is typically set to the color of the scene background.

Viewport: the fog is the color of the viewport background.
Custom: the fog is the specified custom color. See the Custom Color property.

Custom Color – specifies the custom fog color. This is relevant for Fog Color Custom only.

Custom Color Picker – Pick a color from the current active viewport. Click this button then click on the viewport.

Density – specifies the fog density. This is relevant for Exponential and Exponential 2 modes only.

Start distance – specifies the fog start distance in world units. This is relevant for Linear mode only.
Lower values pull the fog start closer to the camera.
The Start distance value should always be less than the End distance value.

End distance – specifies the fog end distance in world units. This is relevant for Linear mode only.
Any objects in the scene that are End distance from the camera will be solid fog color.

Lower values pull the fog end closer to the camera.
The End distance value should always be greater than the Start distance value.

Fog Backdrop – specifies whether the scene Backdrop is affected by Fog.
When this property is false, the scene backdrop will not be included in the scene fog. The chosen Fog Color should match with the backdrop color to provide proper visual blending. Backdrop textures may include a solid color band along their bottom edge in order to facilitate better scene blending with the terrain.
When this property is true, the scene backdrop will be included in the scene fog. The backdrop will be fogged according to the fog properties, which may cause the backdrop to fade or to be hidden by the fog.

Fog Mode Equations

The fog mode and its fog equation determine the fog *factor* at specific distances from the scene camera.
In simple terms, the fog factor is each rendered pixel's original color to fog color ratio. Typically, pixels on scene objects that are close to the camera are rendered at their original color, while pixels on scene objects that are far from the camera are rendered with the fog color.
In technical terms, fogging is accomplished by blending the fog color $Cfog$ with the scene fragments' color $Cfrag$ using a fog blending factor f using the formula $C = f * Cfrag + (1 - f) * Cfog$

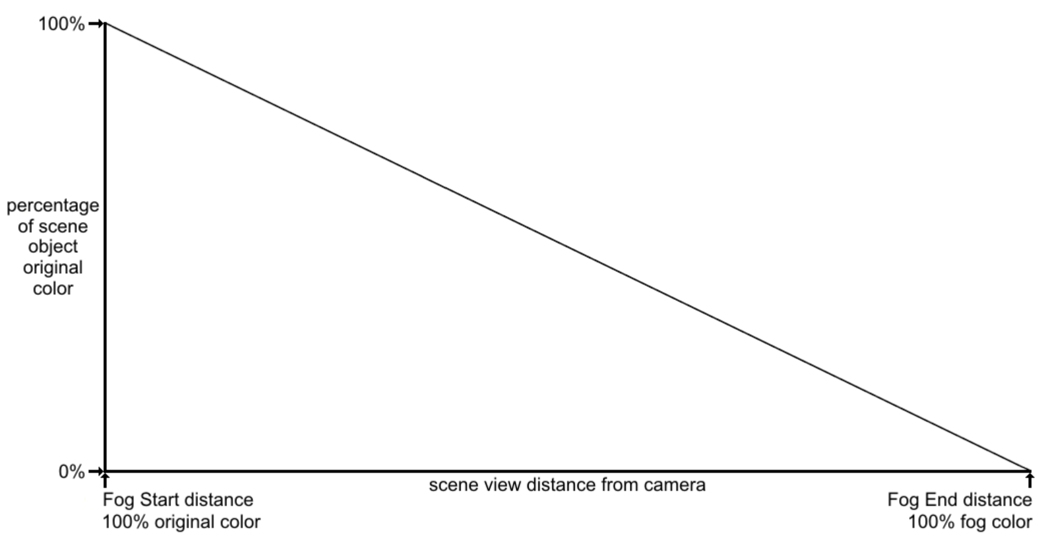
Linear Fog Mode

Linear fog mode uses the Fog Start Distance and Fog End Distance properties to determine the two distances from the camera where the fog begins and ends. Linear fog mode will color with 100% solid fog color any scene object pixels that are at or beyond the fog end distance value. The Fog Density property value is ignored.

The blending factor for linear fog mode is calculated using the equation $f = (end - z) / (end - start)$, where:

f = fog blending factor
$start$ = fog start distance value
end = fog end distance value
z = the distance between the camera and the fragment center

When plotted as a graph, linear fog mode appears as follows.



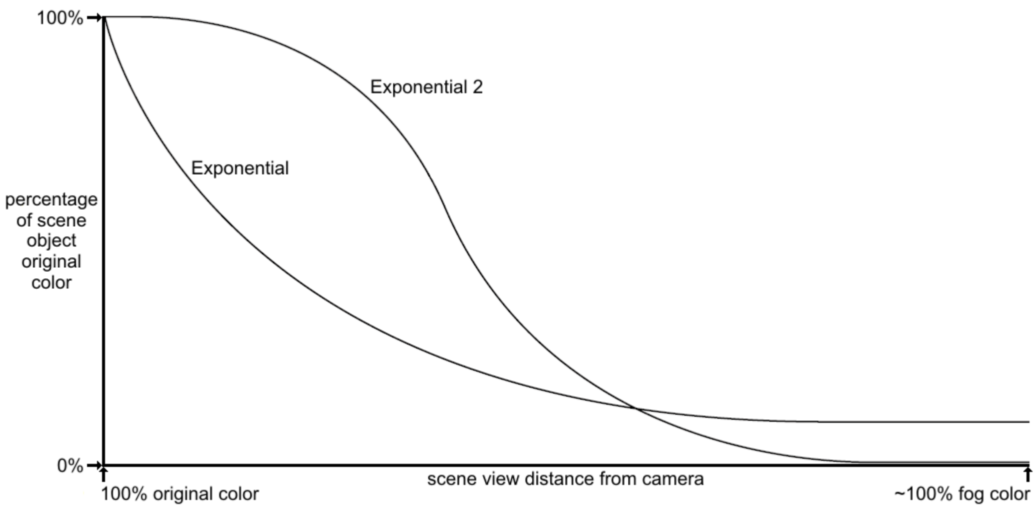
Exponential Fog Modes

Exponential fog modes use the Fog Density property to determine the fog density over distance from the camera. Exponential fog modes do not color the most distant pixels at 100% solid fog color. The Fog Start Distance and Fog End Distance property values are ignored.

The blending factors for the exponential fog modes are calculated using the equations *f = exponent(-d * z)*, and *f = exponent(-d * z)^2* where:

f	= fog blending factor
d	= fog density value
z	= the distance between the camera and the fragment center

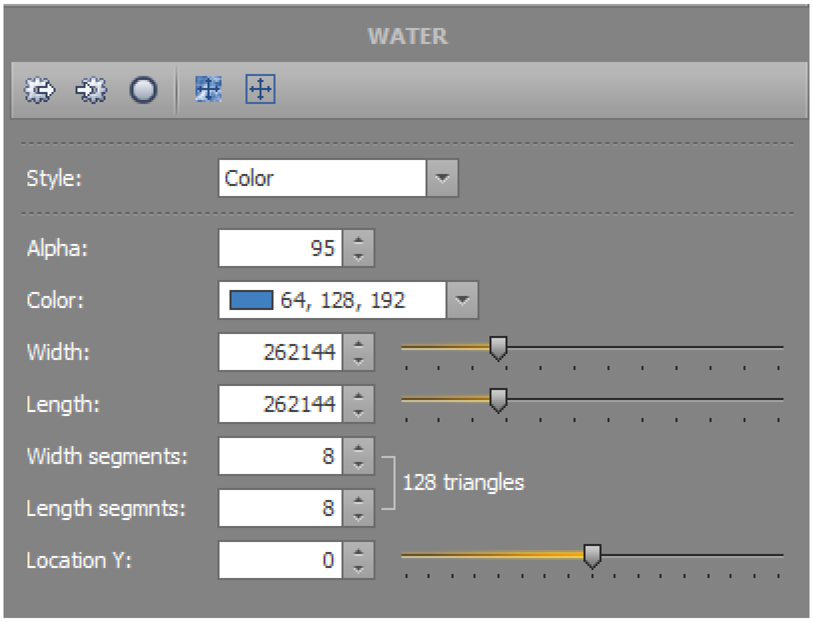
When plotted as a graph, the exponential fog modes appear as follows when Fog Density is at 50% of its value range.



Scene: Water

Scene water is a flat plane mesh that is used to simulate sea-level and is typically located at the center of the world Y axis, which in world units is a Y of 0. The center of the world Y axis is also the heightmap altitude value 50.0.

Water is toggled on and off with the Function panel Scene objects.



Load the original water settings from the application settings file.

Save the current water settings to the application settings file.

Reset the water to the default settings.

Set the water spacing*size to the current terrain dimensions.

Set the water spacing*size to the world extents.

Style – specifies the water rendering style.
Color: a single specified color.
Texture: a specified texture.

Alpha – specifies the water plane mesh transparency alpha color. 0 is transparent, 255 is opaque.

Color – specifies the water plane mesh color. This will tint the texture color for a texture style water.

Width – specifies the water plane mesh width along the world X axis in world units.

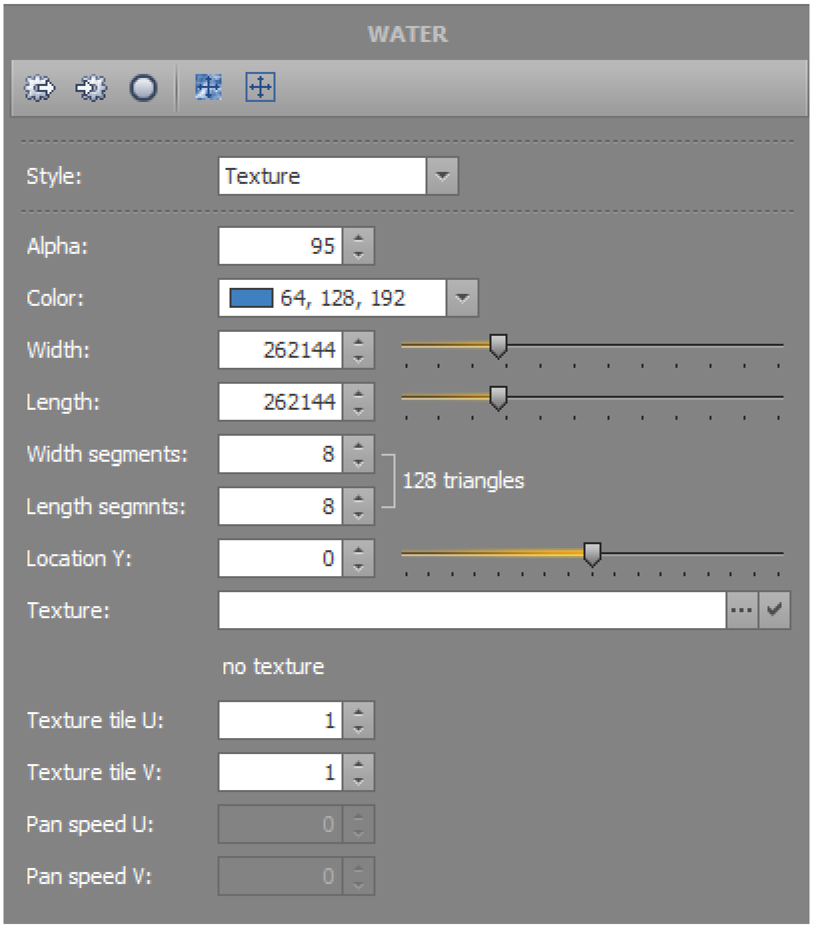
Length – specifies the water plane mesh length along the world Z axis in world units.

Width segments – specifies the number of water plane mesh quad segments along the plane width.

Length segments – specifies the number of water plane mesh quad segments along the plane length.

Faces – displays the total number of water plane mesh triangles, the plane (width × length) × 2.

Location Y – specify the water plane mesh location along the y axis in world units.



Texture – specify the texture file to display on the water plane mesh.
The water supports square-aspect textures only.
32-bit textures with alpha are supported.
See the chapter on Texture Support for a list of supported texture formats and sizes.

 browse for a texture file.

 load or re-load the specified texture file.

Tile U – specify the number of times to tile the texture along the texture x axis.

Tile V – specify the number of times to tile the texture along the texture y axis.

Pan speed U – Under development.

Pan speed V – Under development.

Creating Water Textures

Water textures are a square or rectangular aspect image that is applied using planar UV mapping coordinates. The mapping coordinates are configured for any aspect support. The Tile U and Tile V properties should be set to match the texture aspect.

The texture must be seamlessly tileable on all edges if the Tile U / Tile V properties are set to any value other than 1.

The texture may support alpha channel information for translucency.

The Main Statusbar

Located at the bottom of the application window is the main Statusbar.
The statusbar displays a variety of relevant information for the current scene and terrain.

Press F1 for help – The current application information and status line.

0 × 0 – The current terrain datamap dimensions, width × length.

0 – The current terrain datamap low value.

0 – The current terrain datamap middle value.

0 – The current terrain datamap high value.

0 – The current terrain datamap range value.

0 MB – The current terrain datamap memory requirement.

256 – The current home grid spacing.

Initial Application Settings

After installing the software onto a computer, the initial application settings should be set to the desired defaults.
Choose the *Settings* item on the *Tools* menu to display the Settings dialog.
Only the most common settings are covered here.

General tab:

- Choose whether to create a backup file on every save.
- Choose whether to display the Welcome dialog whenever the application is started.
- Choose whether to disable the Undo system, and specify the default Undo temporary file folder.

Dimensions tab:

- Choose the desired terrain heightmap range to show in the New dialog etc.
- Choose which of the dimensions sizes sets to display.

Formats tab:

- Select the default heightmap, image, mask and weightmap file formats.

Preferences tab:

- Choose whether to enable or disable the Center altitude, Zoom extents, Design and Water auto-size options.

Units tab:

- Specify the default heightmap sample point (vertex) spacing according to the target rendering engine.
  Unreal Engine 3 has a default terrain DrawScale3D XYZ of 256,256,256 and Scale of 512.
  Unreal Engine 4/5 have a default terrain DrawScale3D XYZ of 100,100,100 and Scale of 512.
- Specify the world-units to real-world-units ratio.
  Most Unreal Engine 4/5 games use a default measurement system of 1 unreal unit = 1 centimeter.

The other Settings dialog tabs can be adjusted as required, however they contain more advanced settings.
See the Settings chapter of this document for additional information on all of the settings.

Colorsets

Standard computer monitors are capable of displaying 24-bit color, which is comprised of 8-bits of red, 8-bits of green, and 8-bits of blue. When summed together as a grayscale, standard monitors can display 8-bits or 256 levels of gray starting from black and continuing up to white.

The heightmaps created and edited by TerreSculptor use a floating-point altitude range from 0.0 to 100.0, which literally has millions of values. For terrain vertex color rendering purposes the floating point altitude values are converted to a 16-bit value from 0 to 65535. This 16-bit value cannot be displayed as a 1:1 color or grayscale match on a standard 8-bit grayscale capable monitor.

Colorsets provide a method for displaying 48-bit simulated color on standard 24-bit color computer displays. This is equivalent to displaying 16-bits per pixel on 8-bits per pixel displays. Colorsets are created by deriving linear-interpolated gradient ranges of color starting at color value 0 and ending at color value 65535.

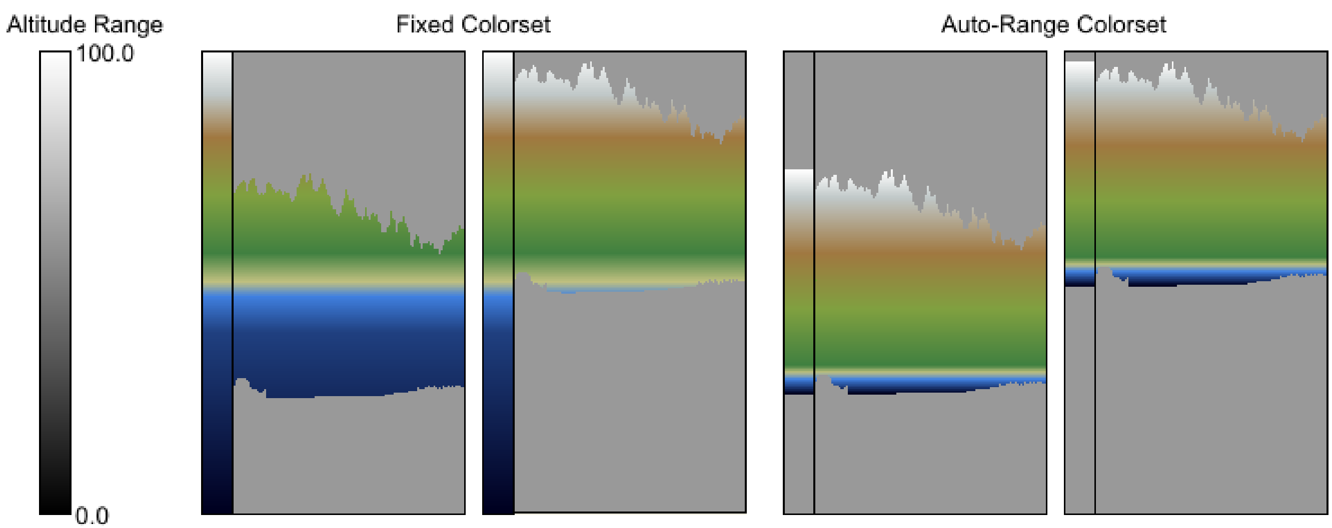
A wide variety of Colorsets are included in TerreSculptor. Many of the Colorsets are designed to simulate real-world terrain coloring such as sandy deserts and green lush forests.

Auto-Range Colorsets

The Auto-Range Colorsets differ from standard fixed Colorsets in that they are always rendered following the current altitude range of the heightmap. If the heightmap altitude range is changed, the auto-range colorset will automatically map itself correctly to the new heightmap range.

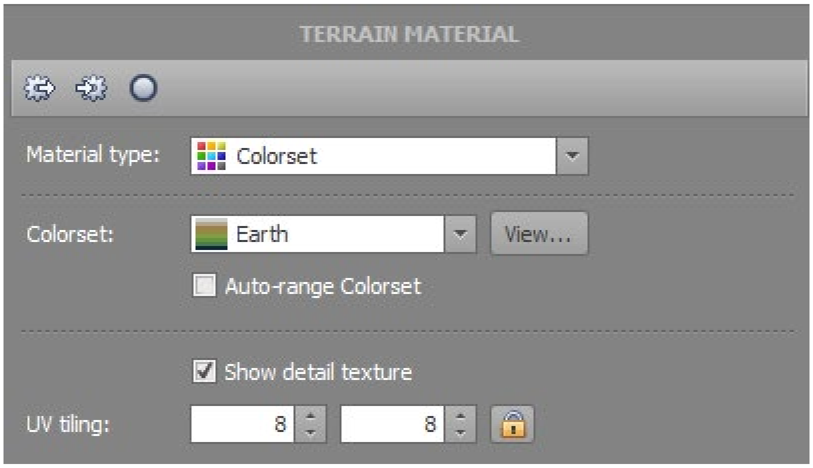
The Auto-Range Colorsets provide a closer simulation of real-world terrain coloring, while the fixed Colorsets provide a better visual representation of the heightmap range's position in the overall available 16-bit range.

In this diagram of a heightmap front view, notice that for the fixed Colorset, the heightmap coloring follows the Colorset colors. While for the Auto-Range Colorset, the Colorset colors follow the heightmap.

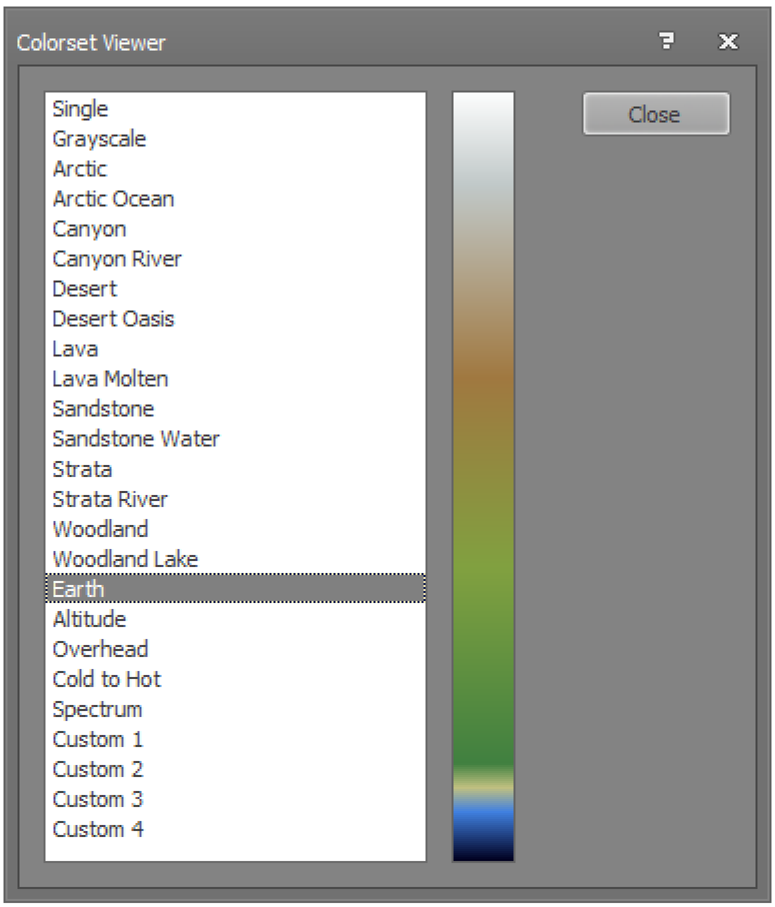


Colorset Material and Menu

The colorset material contains the available render color sets.
Most of the color sets are designed to simulate various earth or planetary geological region colorings.



Use the View button to view the colorset in the Colorset Viewer.



Custom colorsets can be created with the Colorset Creator.

Many Devices that support 2D and 3D Previews include a Colorset drop-down menu to allow choosing the colorset for preview rendering.

The colorsets include:

Single – A single color as defined in the Options. Typically used when painting the terrain.

Grayscale – Grayscale from black to white. This colorset is unaffected by the Auto-Range Colorset setting.

Arctic – Blue arctic winter.

Arctic Ocean – Blue arctic winter with water.

Canyon – Red striped canyon.

Canyon River – Red striped canyon with water.

Desert – Sandy desert.

Desert Oasis – Sandy desert with water.

Lava – Black earth with red hot lava.

Lava Molten – Black earth with red hot lava.

Sandstone – Red sandstone.

Sandstone Water – Red sandstone with water.

Strata – Striped sandstone.

Strata River – Striped sandstone with water.

Woodland – Green trees.

Woodland Lake – Green trees with water.

Earth – Multi-colored from water to sandy beaches to white snowcaps.

Altitude – Multi-colored water to snow with evenly spaced ranges.

Overhead – Multi-colored to simulate contour maps.

Cold to Hot – Blue to red.

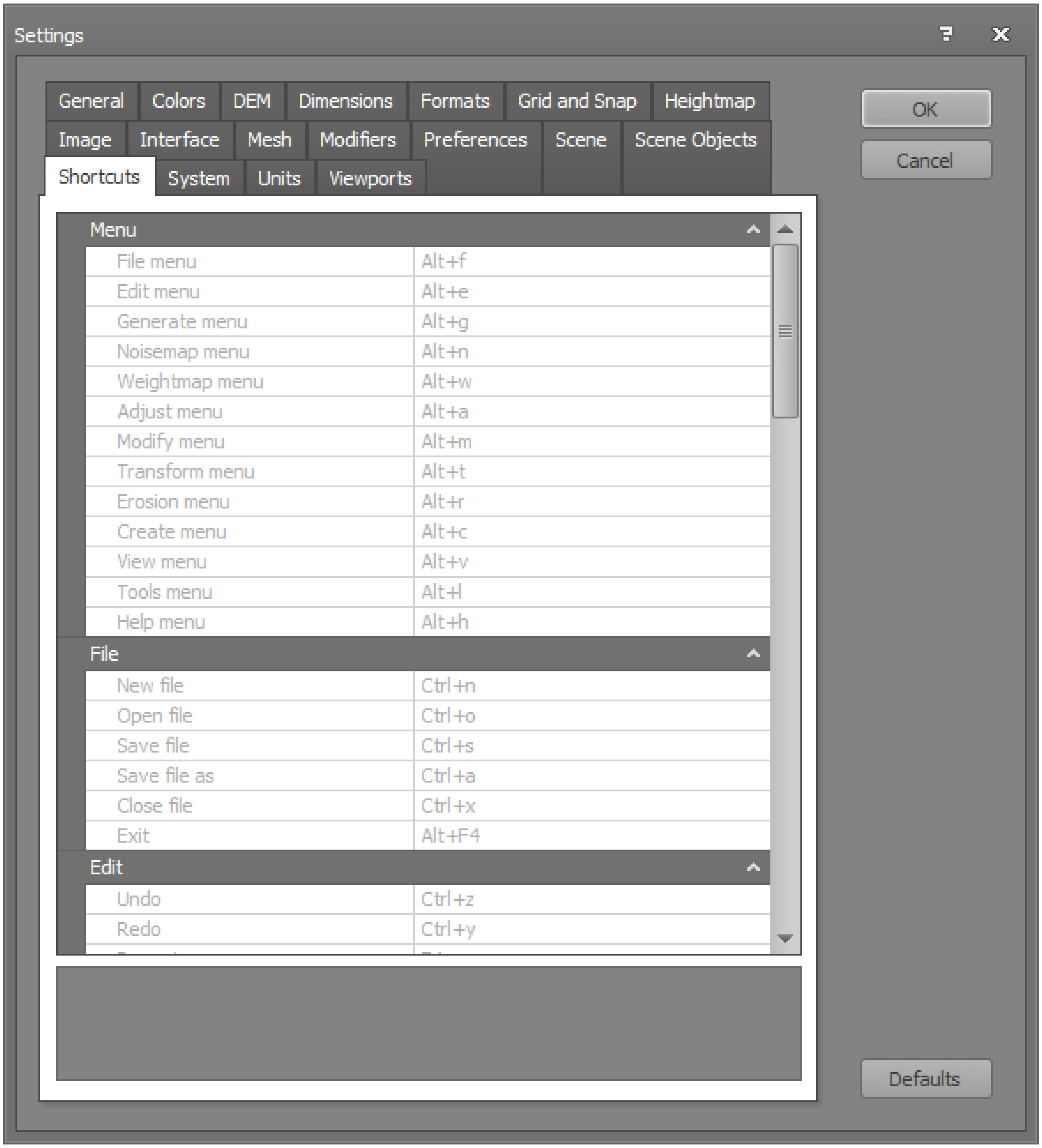
Spectrum – Multi-colored.

Custom 1 to 4 – Four custom colorsets that can be created with the Colorset Creator.

Shortcut Accelerator Keys

TerreSculptor provides a number of keyboard shortcut accelerator keys for single-key access to a number of the application features.
The shortcut accelerators are a combination of standard Windows shortcuts such as *Ctrl+n = New* and *Ctrl+o = Open*, plus a number of shortcuts that are similar in functionality to Autodesk 3DS Max such as *g = toggle grid* and *p = perspective view*, along with custom shortcuts specific to TerreSculptor.

See the Settings dialog Shortcuts tab for a complete list of shortcuts, or the Shortcuts Appendix in this document.



Terrain LOD Modes

The 3D Editor terrain mesh renderer supports multiple Level of Detail (LOD) modes to enhance render performance and system CPU and GPU memory requirements.

The LOD modes can lower render cost and memory requirements by reducing the number of terrain mesh sections and triangles that are rendered in the viewport.

TerreSculptor's terrain rendering system splits the heightmap into square chunks called sections. These sections are used for enhancing performance through frustum culling.
Additional performance enhancing is performed by LOD'ing the heightmap data used for the sections.

The Aggressive and Normal LOD modes effectively specify a fast low resolution and a slower maximum resolution terrain mesh.

Aggressive LOD

This is the default terrain rendering LOD mode.
This mode is well suited for general terrain visualization, and to conserve on GPU memory.

Aggressive LOD reduces the heightmap resolution to the *Aggressive LOD resolution* (ALODR) value specified in the application Settings. Heightmap resolutions below the ALODR value will be rendered normally; heightmap resolutions above the ALODR value will be reduced to the ALODR value prior to rendering. The ALODR resolution reduction respects the original heightmap aspect ratio.

For example, with an ALODR value of 1024 and a heightmap of 2048 × 2048:
- The rendered heightmap resolution will be 1024 × 1024 with 2× vertex spacing to maintain the same area.
- The GPU memory requirements for the LOD mesh data will be 48.26MB versus the non-LOD of 193.08MB.

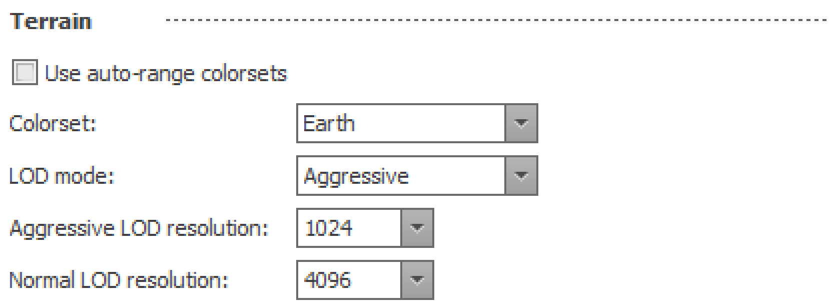
Normal LOD

The Normal LOD mode renders the full heightmap terrain mesh with no level of detail reduction, up to the maximum resolution specified in the settings.
This mode should only be used when necessary and only if the system GPU has sufficient video memory.

For large heightmaps the amount of required GPU memory can be high. A 4096 × 4096 terrain will require 772.42 MB of video memory to render the 33 million triangles. This is approximately three-quarters of a GB. Additional GPU memory will be required on top of the terrain for the other scene objects. For a Normal LOD of 4096, a GPU with 2GB of memory would be a minimum system requirement.

Terrain LOD Settings

The Terrain Settings for the LOD modes can be found on the Settings dialog, Scene Objects tab, Terrain group.



LOD mode:	The default terrain LOD mode. The current LOD mode can be changed at any time on the toolbar.
Aggressive LOD resolution:	The maximum dimensions of the terrain heightmap in aggressive LOD mode.
Normal LOD resolution:	The maximum dimensions of the terrain heightmap in normal LOD mode.

Undoing Changes

You can easily undo changes that you have made to your scene or terrain heightmap. TerreSculptor manages individual undo buffers for the Base Heightmap modification tools, and for the various textbox and numeric input controls on the dialogs and Function tabs.

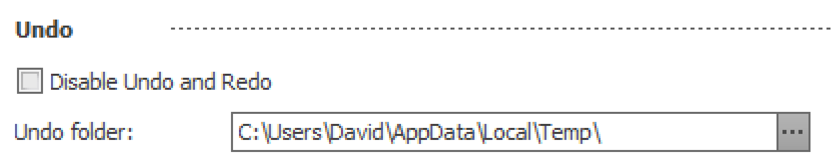
Setting the Undo Settings

The Settings dialog contains Undo preferences that can be set by the user. These Undo preferences relate to the Undo menu and toolbar items only, which are for the Base Heightmap modification tools' Undo system.

To set the Undo preferences:

1. Choose the Settings item on the Tools menu.
2. Click on the General tab.
3. Change the Undo options as preferred.

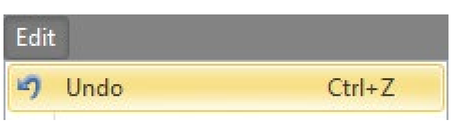
You can:
- Disable the Undo.
- Specify the Undo folder.
  The undo folder drive should have at least 1GB or more of free space.
  A fast hard drive or SSD will make the Undo system perform quicker.

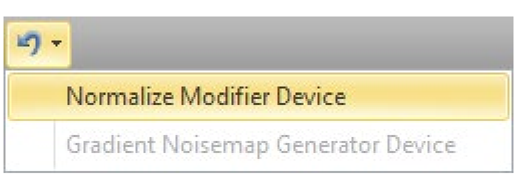


Undoing changes to the Base Heightmap

Use the Undo toolbar buttons or Undo commands in the Edit menu to reverse the effect of any of the Base Heightmap modification devices. The Base Heightmap modification undo system has 10 levels of undo.

The Undo toolbar buttons include a drop-down menu that displays the current modification devices that are on the Undo buffer stack. These are for reference only, choosing the Undo will always undo the top-most item on the undo stack list.

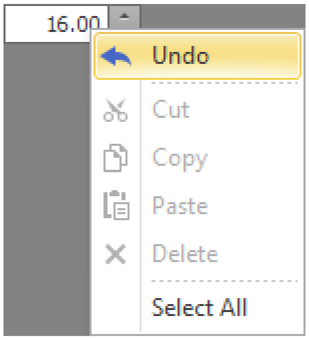


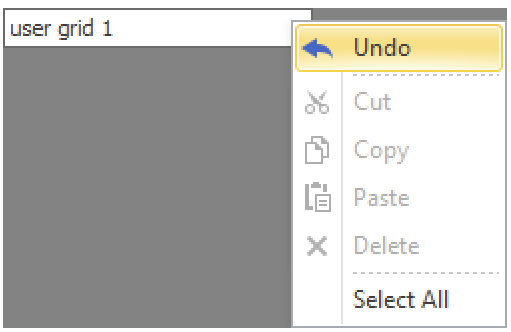


Undoing changes to the Input Controls

Most of the input controls found throughout the application include a single-level Undo. These input controls include text boxes and numeric entry controls.

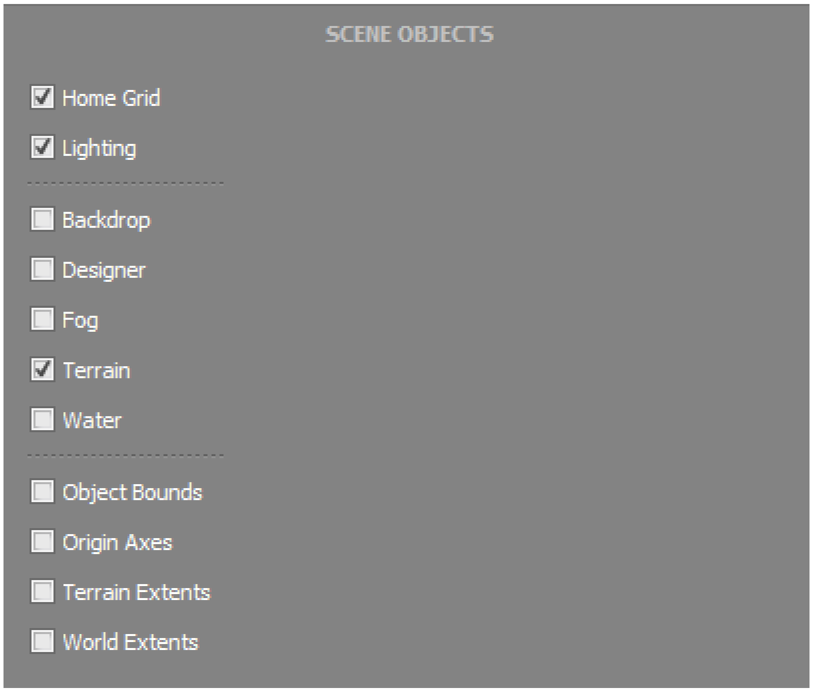
Right-click the mouse on any supported input control to display its pop-up menu. Choose Undo on the pop-up menu to reverse the last change to the input control. Choosing Undo again will redo the change (undoing the undo).





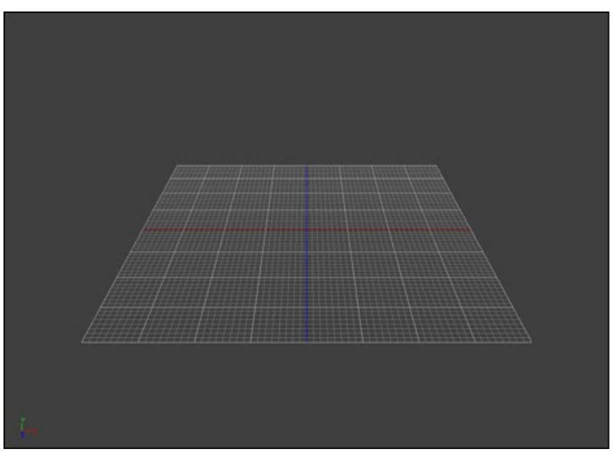
Scene Objects and Helpers

A variety of objects and helpers are available in the Editor Scene.
These objects and helpers can be turned on and off, or hidden and shown, using the Function panel Scene objects.
The Scene Objects typically have editable properties, whereas the Scene Helpers are typically fixed in their function.



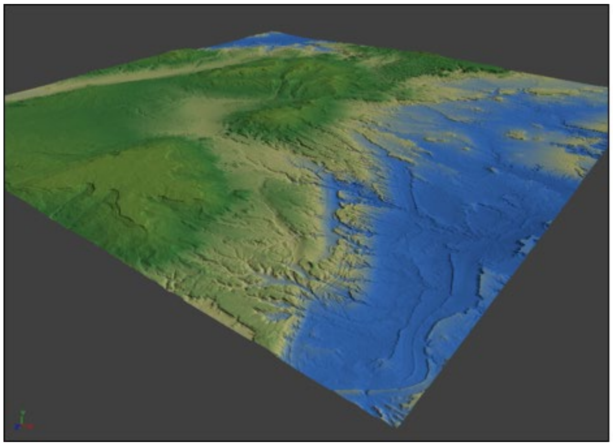
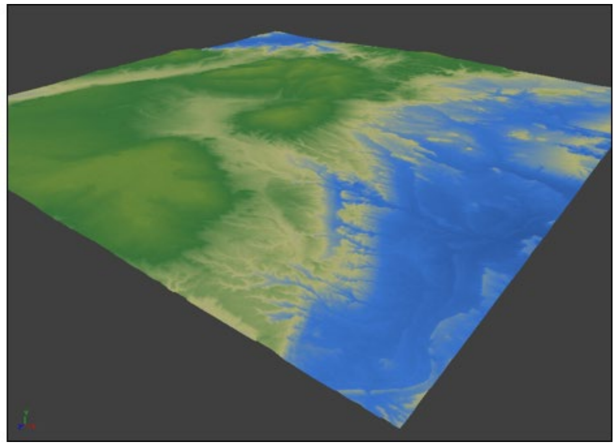
Home Grid

The scene Home Grid visible and hidden.
The Home Grid properties are available on the Function tabs.



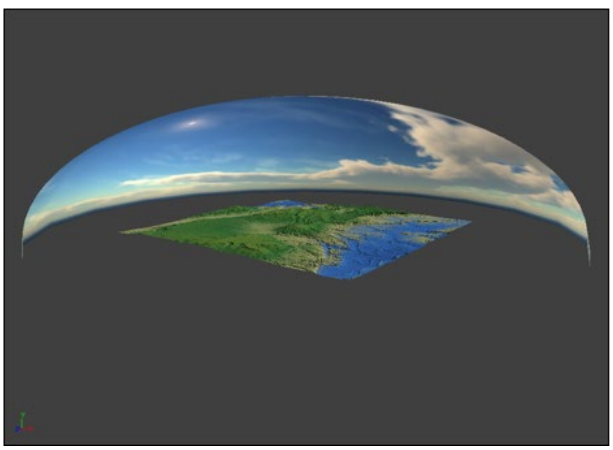
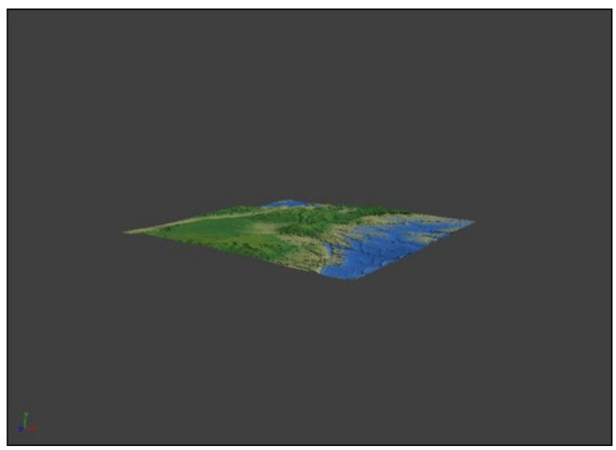
Lighting

The scene Lighting on and off.
The Lights properties are available on the Function tabs.

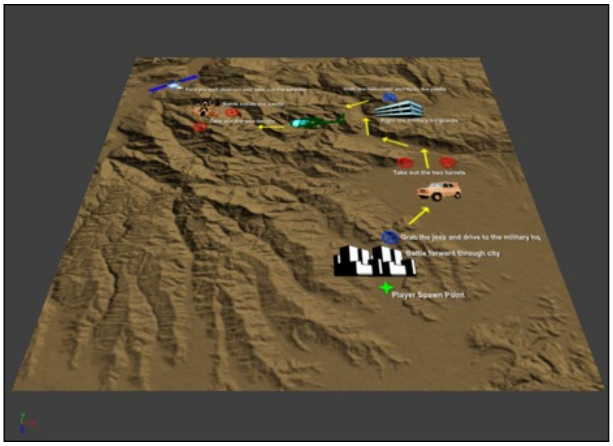
Backdrop

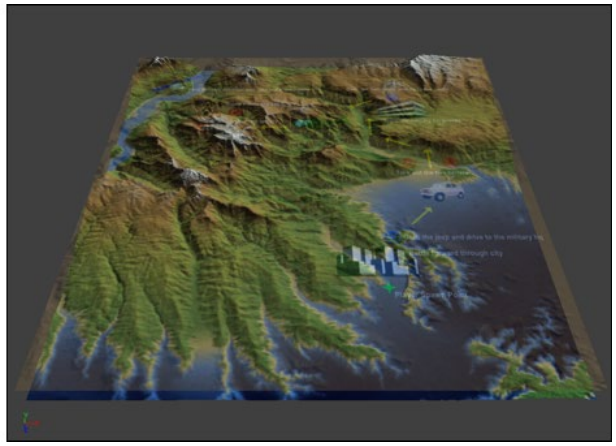
The scene Backdrop visible and hidden.
The Backdrop properties are available on the Function tabs.
The skydome backdrop shown in the image below is available in the *Professional Edition* only.

Designer

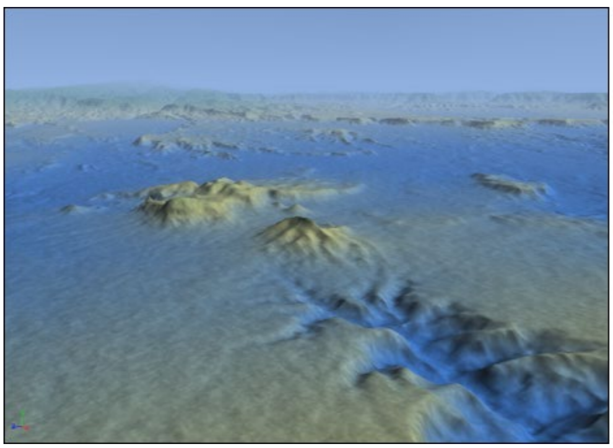
The scene Designer with an example storyboard, and placed at 40% transparency over the terrain.
The Designer properties are available on the Function tabs.

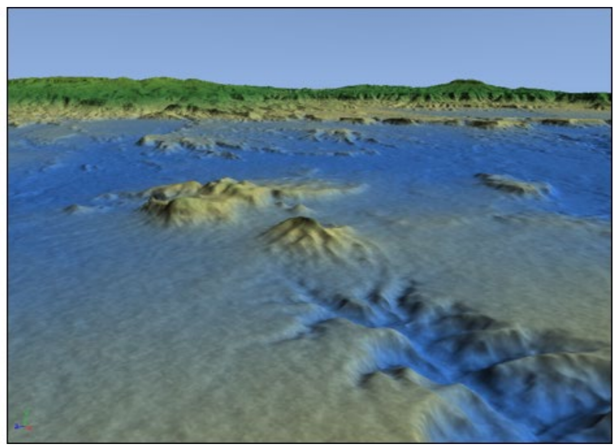




Fog

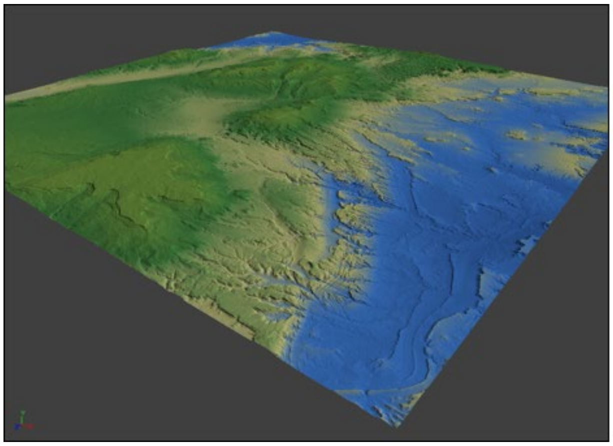
The scene Fog on and off.
The Fog properties are available on the Function tabs.





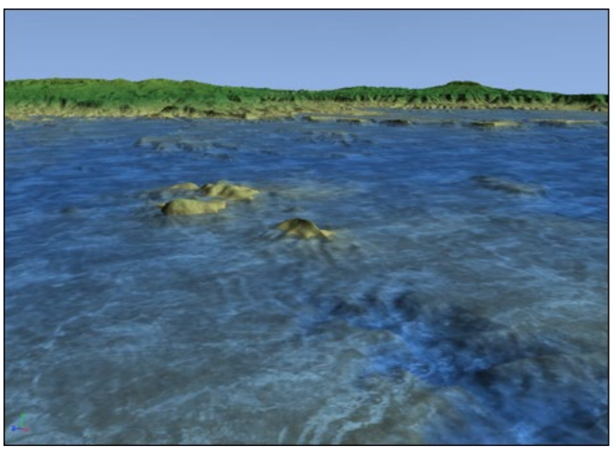
Terrain

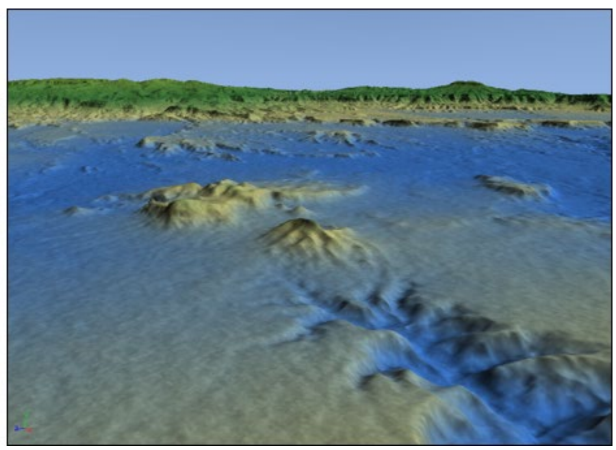
The scene Terrain visible and hidden.
The Terrain properties are available on the Function tabs.



Water

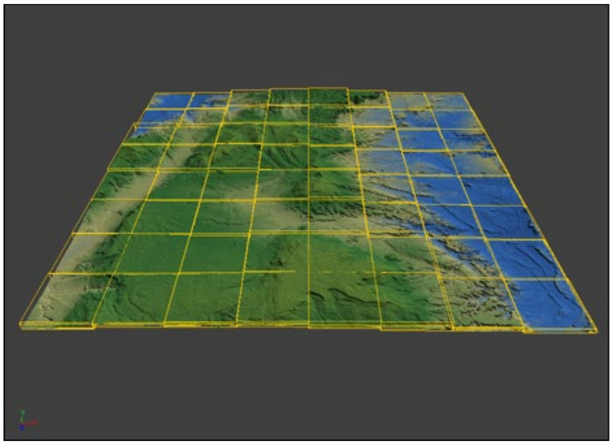
The scene Water visible and hidden.
The Water properties are available on the Function tabs.
The textured water shown in the image below is available in the *Professional Edition* only.

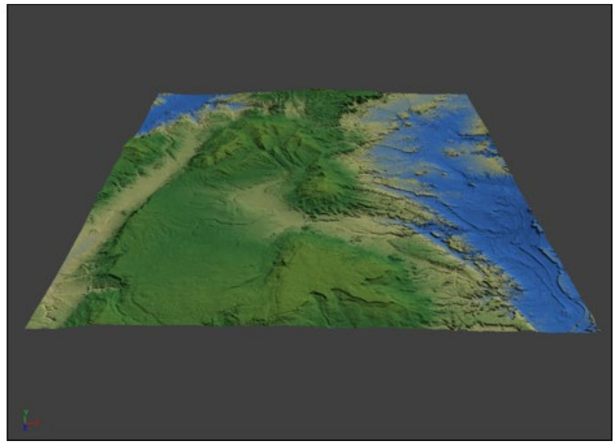




Object Bounds

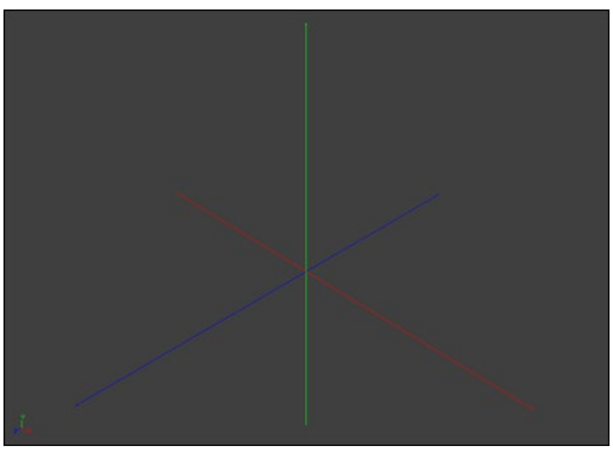
The scene Object Bounds visible and hidden.
The Object Bounds do not have any editable properties.
The Object Bounds depict the cubic or spherical volume that totally encompasses a single specific scene object.





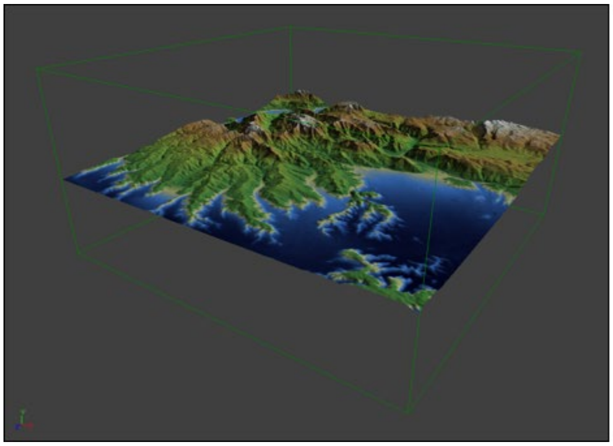
Origin Axes

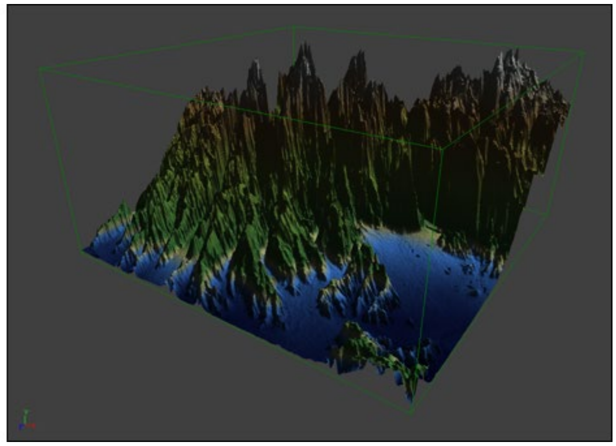
The scene Origin Axes.
The Origin Axes do not have any editable properties.
The Origin Axes extend from the world origin along each axis plane.
The Origin Axes lines are colored for each of the XYZ planes and include an arrow depicting the axis positive direction.



Terrain Extents

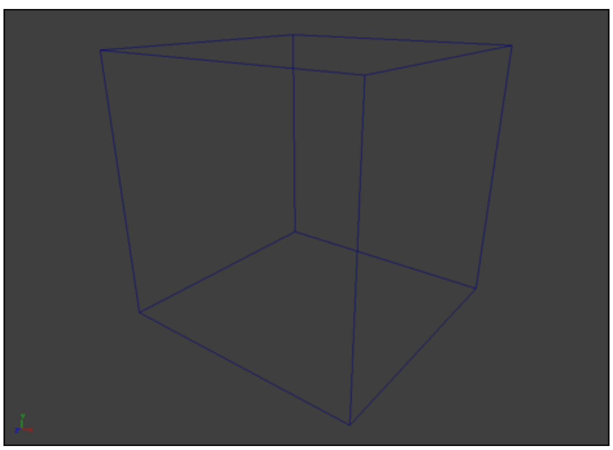
The scene Terrain Extents, with a terrain at default design and then normalized to fill the entire extents volume.
The Terrain Extents do not have any editable properties.
The Terrain Extents depict the maximum volume that the terrain can fill, which is the current width and length of the terrain and the maximum altitude height available for the terrain if it utilized the entire 0.0 to 100.0 value range.
The terrain width and length extents are calculated from the heightmap dimensions × the Units XZ Spacing value.
The maximum terrain altitude height extents are calculated from the maximum 100.0 value range × the Y Scaling factor value × the Units Y Spacing value.





World Extents

The scene World Extents.
The World Extents has only one editable property, Segments, located in the Settings.
The World Extents depict the maximum world volume width, length, and height.
The Backdrop is the only object that should ever extend beyond the world extents.



Viewport Concepts

The viewport is a framed two dimensional window that is used to project the three dimensional scene from the position of the virtual camera. The viewport is a dynamic control with flexible tools for camera and object movement and selection during scene viewing and editing.

Multiple independent cameras are available, each with the ability to move to virtually any scene location, and to move using pan, truck, pedestal, and dolly. Using a few mouse movements and clicks, any level of scene detail can be reached.

Active Viewport

When TerreSculptor is started, the Editor is shown with its main viewport. This is the active viewport, where commands and other scene actions occur. Only one viewport can be in the active state at any time. When a dialog that contains a preview viewport is displayed, its viewport becomes the active viewport.

Orthographic Views

The orthographic views are two-dimensional flat views, each defined by two world coordinate axes with a fixed movement camera. Six different orthographic views are available. Each orthographic view is a combination pair of the three available axes producing the views for top, front, back, left, and right.

The orthographic views and their axes:

Top	XZ
Front	XY
Back	XY
Left	YZ
Right	YZ

To select an orthographic view:

1. Select the viewport orthographic view using the toolbar buttons:

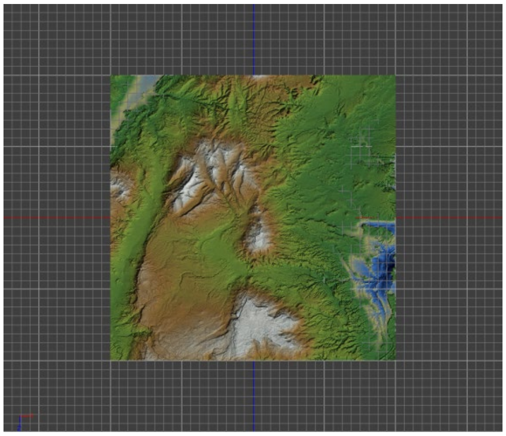
T	Top
F	Front
B	Back
L	Left
R	Right

2. Select the viewport orthographic view using the keyboard shortcuts:

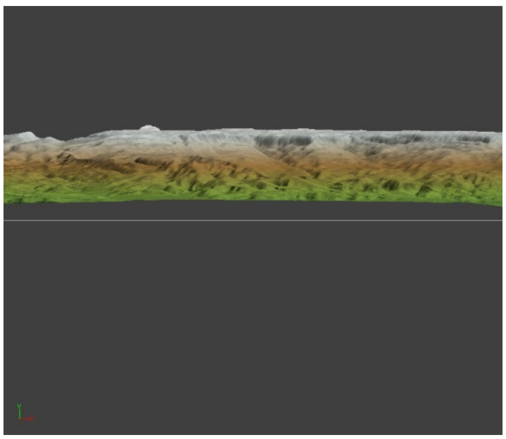
t	Top
f	Front
b	Back
l	Left
r	Right

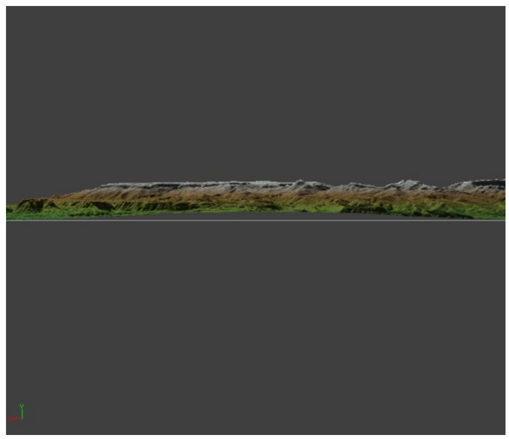
What you see:

In top view, the camera is looking straight down the Y axis at the XZ plane.

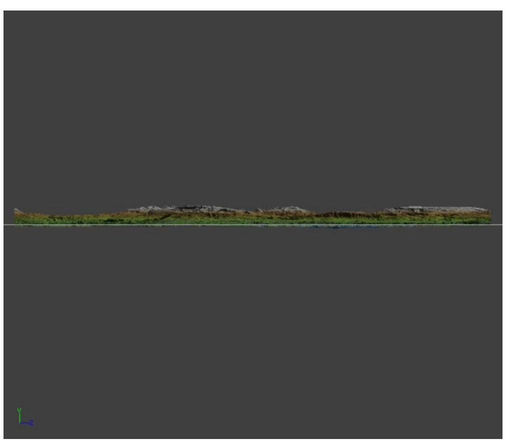


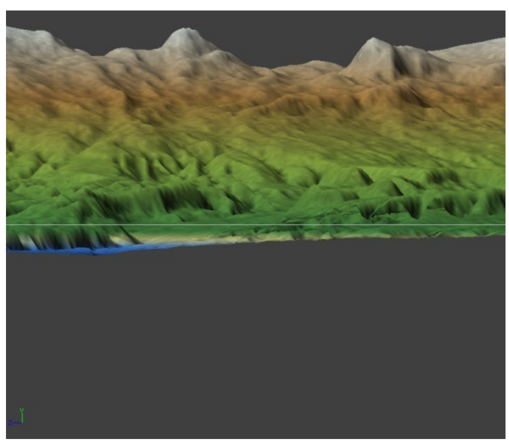
In front and back view, the camera is looking down the Z axis, the X axis runs left and right, the Y axis is vertical.





In left and right view, the camera is looking down the X axis, the Z axis runs left and right, the Y axis is vertical.





Perspective View

Perspective view resembles how humans see the world around them. The scene appears three dimensional, and objects recede into the distance, creating a sense of depth. Perspective view is the typical view used when working in the TerreSculptor Editor.

The cameras in perspective view are capable of virtually any movement, position, and location within the world on the three axes.

The perspective camera's field of view (FOV) can be changed in the application settings, allowing for narrow-angle and wide-angle lens types.

To select perspective view:

1. Select the viewport perspective view using the toolbar button:

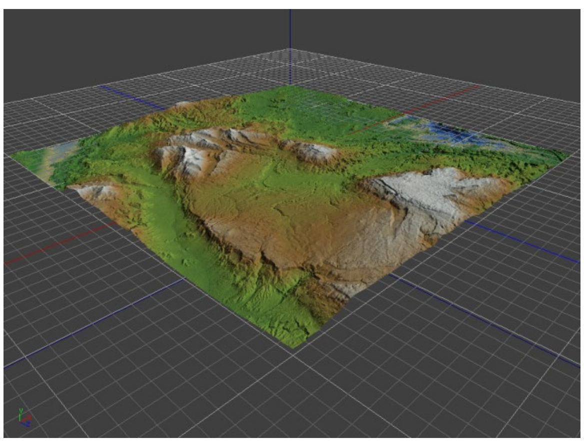
 Perspective

2. Select the viewport perspective view using the keyboard shortcut:

p Perspective

What you see:

In perspective view, the camera can move to virtually any world position and location.



Starting a New Project

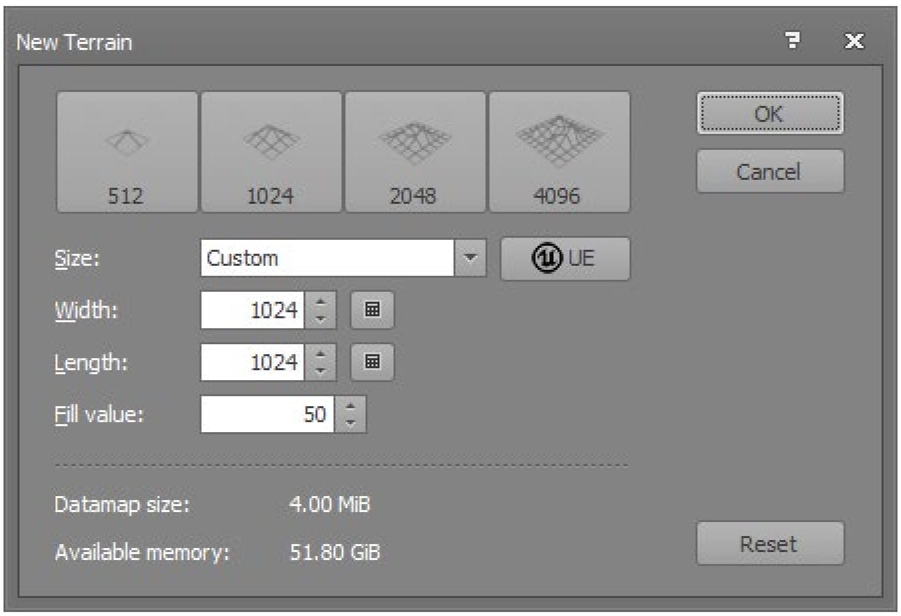
To start a new project and create a new flat heightmap, choose the New Project item on the File menu or the New Project button on the main toolbar. Choosing New Project also resets many of the application settings to defaults.

New Project.

When the New Project item is selected, you will be prompted to save the current project data if it has changed, and then the New Terrain dialog will appear.

Choose the desired heightmap resolution from the preset buttons or drop-down combobox of common resolutions, or specify a custom size in the Width and Length numeric controls.
The Fill value numeric control allows you to specify the initial altitude level of the heightmap, which is typically the center altitude 50.0.

Once the new heightmap is created, the various tools can be used on it to create a custom terrain system.



OK	Accept the settings and create a new heightmap.
Cancel	Cancel the dialog.
Reset	Reset the dialog to the default settings.
Preset buttons:	Common square-aspect heightmap sizes.
Size:	Choose a custom size or a common preset resolution.
UE button:	Choosing this button will display the Unreal Engine Landscape Sizes dialog. This button is available only when Unreal Engine is enabled in Settings, Dimensions.
Width:	The heightmap custom width value.
Length:	The heightmap custom length value.
Fill:	The heightmap altitude level.
Datamap size:	The amount of memory required to create the new heightmap.
Available memory:	The total amount of available system memory.

Devices

A *Device* is a module that performs a basic or complex function in TerreSculptor.
Devices include Generators, Extractors, Modifiers, and Control and File objects.

Device Menus

A variety of generators and modification Devices are available that modify the datamap data in a wide number of ways. The Devices are found on the Generate, Noisemap, Weightmap, Adjust, Modify, Transform, and Erosion menus.

The main Datamap data can be modified directly and immediately by using the Devices on the menus.

Dialog Context Help

All of the Device dialogs include instant context-sensitive help for every dialog control.
To access the context help, click on the help button on the dialog window title bar, then move the help cursor over to the control you wish to get help for, and click again. A context help tooltip will temporarily pop up. Click anywhere on the screen to remove the help tooltip.

1. Click on this button: 
2. Move the help cursor over a control and click: 

Dialog Command Buttons

All of the Device dialogs include these command buttons.

OK

Accept the current settings and close the dialog.

Cancel

Cancel and close the dialog.

Copy

Copy the current Device properties to the clipboard.

Paste

Paste the clipboard to the Device properties.

Reset

Reset the dialog controls to their original settings when the dialog was initially opened.

Default

Set the dialog controls to their default settings.

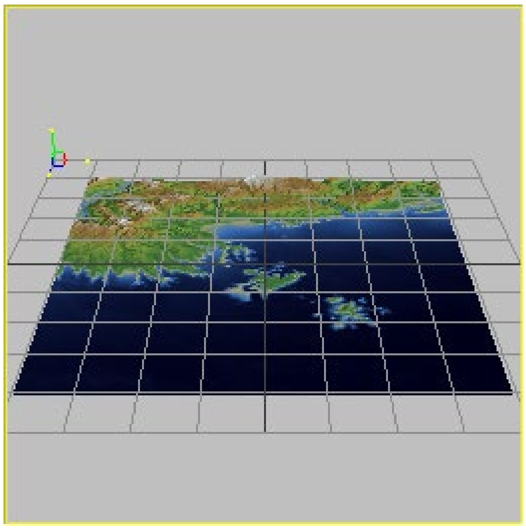
Preview

Preview the device results.

Dialog Preview Window

Many of the Device dialogs include a real-time preview of their function. This real-time preview window displays a thumbnail version of the current object being adjusted. Depending on the Device dialog, the preview window supports one or more views and a number of display options available on the Preview Window Options Menu.

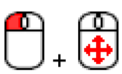
The preview window is often fully interactive with rendering settings and mouse control for panning or camera and light movement.



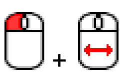
Preview Window Control

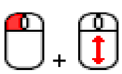
The preview window includes interactive viewing controls for each view mode.

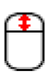
2D 100% Zoom Virtual View, if available:

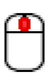
 Pan the heightmap in the preview window in Virtual 100% 1:1 Pan View.

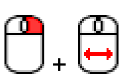
3D Perspective View, if available:

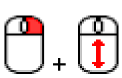
 Camera orbit.

 Camera pitch.

 Camera dolly.

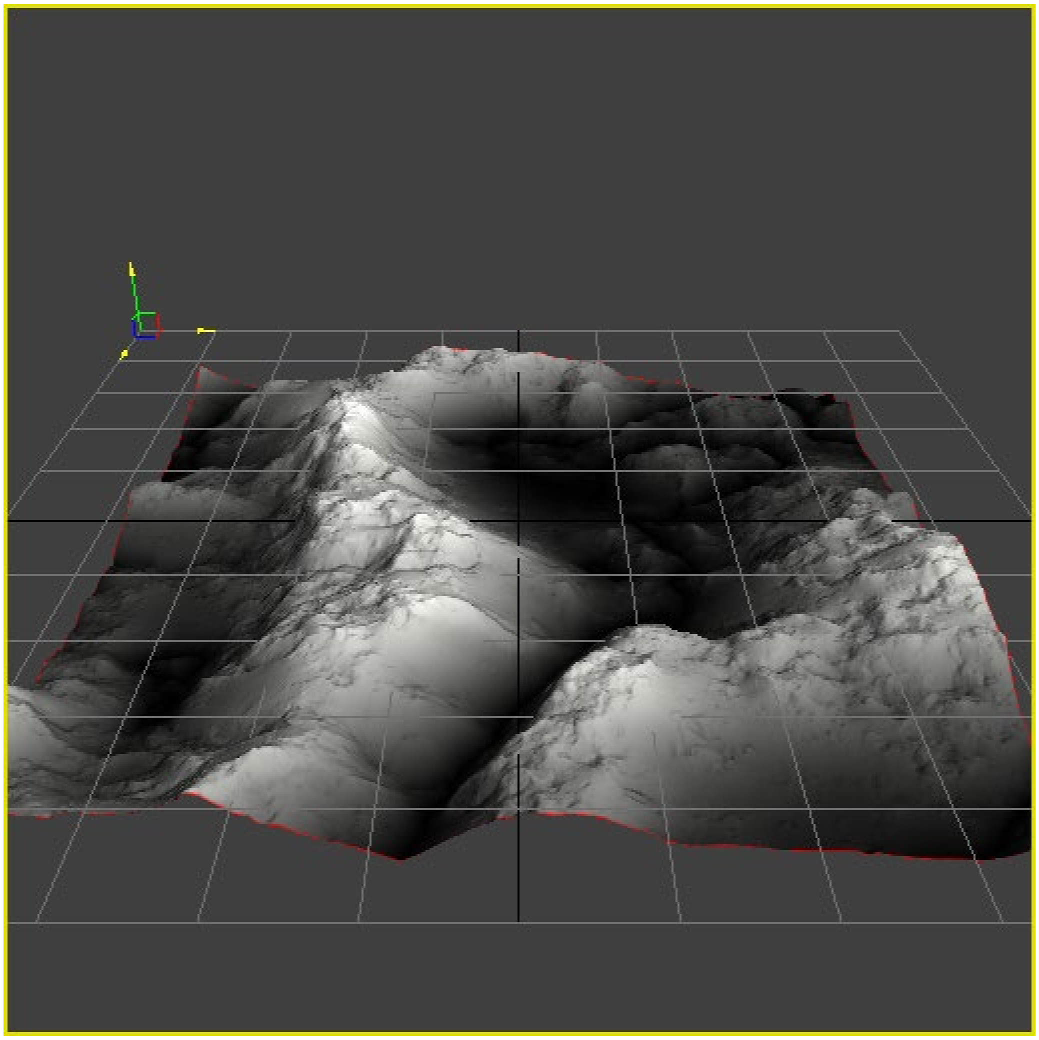
 Cycle between the two camera dolly speeds (1× and 4×).

 Directional Light orbit.

 Directional Light pitch.

Dialog Preview Crop

Some of the devices use a cropped 1-to-1 preview of the datamap for better previewing of the device effect. Previews that are cropped will have a red line border around the preview mesh as seen in this screenshot:



The dialog will also have a cropped note notice text.

Note: the preview shows a crop section of the datamap.

Use the Numpad Numlock 2,4,6,8 keys to pan the preview around to find the best datamap region for the device effect preview.

Preview Window Options Toolbar

Many of the Device dialogs include a real-time preview of their function. This real-time preview includes a toolbar that can be used to set many of the preview options such as the view mode, render colorsets, and more. The specific toolbar buttons that are available may vary by the Modifier chosen.

Top view – Select the preview top 2D or 3D view.

Front view – Select the preview front 2D or 3D view.

Side view – Select the preview left side 2D or 3D view.

Perspective view – Select the preview 3D perspective view.

100% 1:1 pan view – Select the preview top 2D 1:1 panning view.

Reset pan to origin – Reset the 1:1 pan view to the top-left edge of the preview.

Reset pan to center – Reset the 1:1 pan view to the center of the preview.

Show axis icon – Toggle the visibility of the XYZ tripod axis icon.

Show grid – Toggle the visibility of the grid.

Show water plane – Toggle the visibility of the water plane. The water plane is always at a world Y of 0.

Auto-range Colorset – Render the preview using the auto-range version of the specified colorset.
See the chapter on Colorsets.

Colorset – Render the preview using the specified colorset.
See the chapter on Colorsets.

Reset camera – Reset the orbit camera to its default position.

Reset lights – Reset the directional light to its default position.

Screenshot – Save a screenshot of the current preview viewport.

Modified/Original – Toggle the modified or original terrain heightmap view.

Preview Window Statusbar

Many of the Device dialogs include a real-time preview of their function. This real-time preview includes a statusbar that displays status information for the device preview. The specific statusbar content that is available may vary by the Device chosen.

Preview build time – The time in hours:minutes:seconds.milliseconds to build the preview noisemap.

Estimated build time – The estimated time in hours:minutes:seconds.milliseconds to build the full noisemap.

X coordinate – 2D Top view heightmap X coordinate located under the mouse cursor.

Y coordinate – 2D Top view heightmap Y coordinate located under the mouse cursor.

XY Value – 2D Top view heightmap altitude value at the XY coordinates.

Datamap XY value – The datamap altitude value at the XY coordinates.

Mask XY value – The weightmap mask altitude value at the XY coordinates.

Datamap size – The source heightmap dimensions.

Mouse wheel speed – the mouse wheel speed.

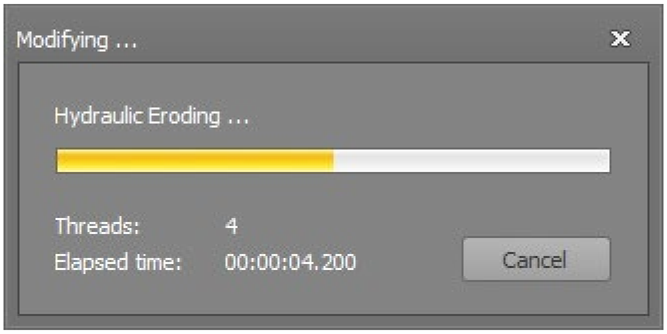
View mode – the preview window view mode.

Preview render performance – 3D scene frames per second.

Device thread count – the number of processor threads that the device supports.

Device Progress

While a Device is performing its function on the heightmap, the progress dialog will be displayed.



The progress dialog displays the following information:

- The Device function type that is executing.
- A progress meter bar that graphically depicts the current progress completion percentage.
- The number of processor threads used to perform the function, including the default interface thread.
- The elapsed execution time.

The Cancel button is available on some Devices during long execution times to allow cancelling of the function.

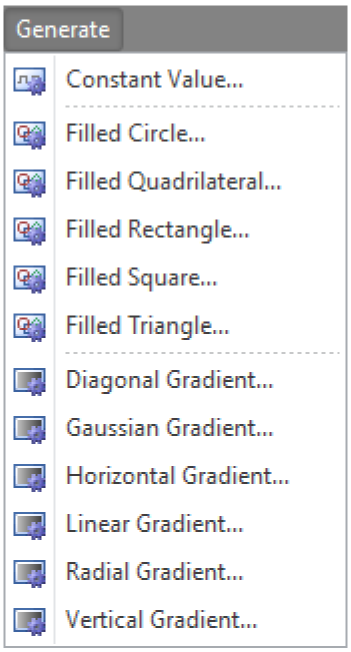
Devices Generator

The Generate menu contains devices that create fills and gradients.

The Generator devices are typically used for creating masks that can be used for masking the results of other devices.

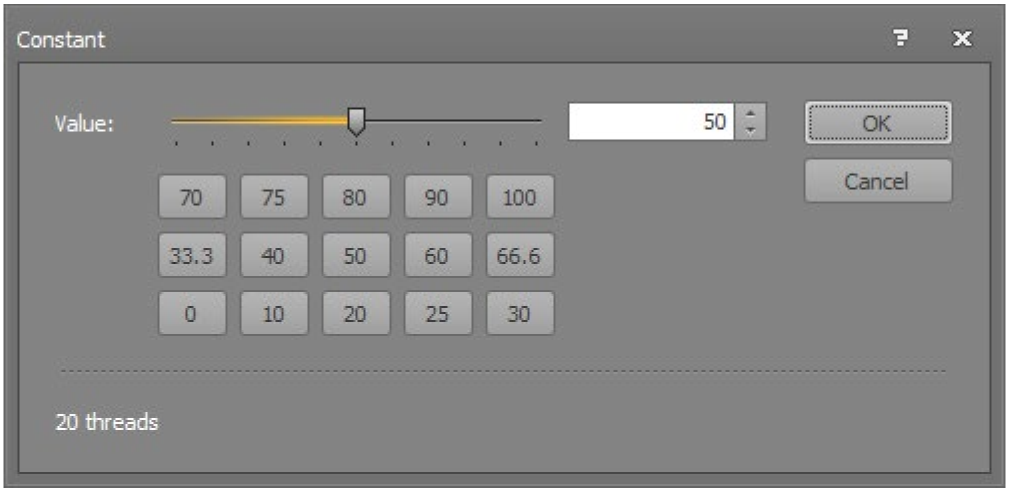
Most of the Generator devices can be cropped on their edges for masks such as the edge of a semi-circle.

The Generator devices can also be embedded onto the current datamap by not using the Fill Outside option. This allows for generating shapes onto the terrain for such things as bases and platforms.



Generate: Constant Value

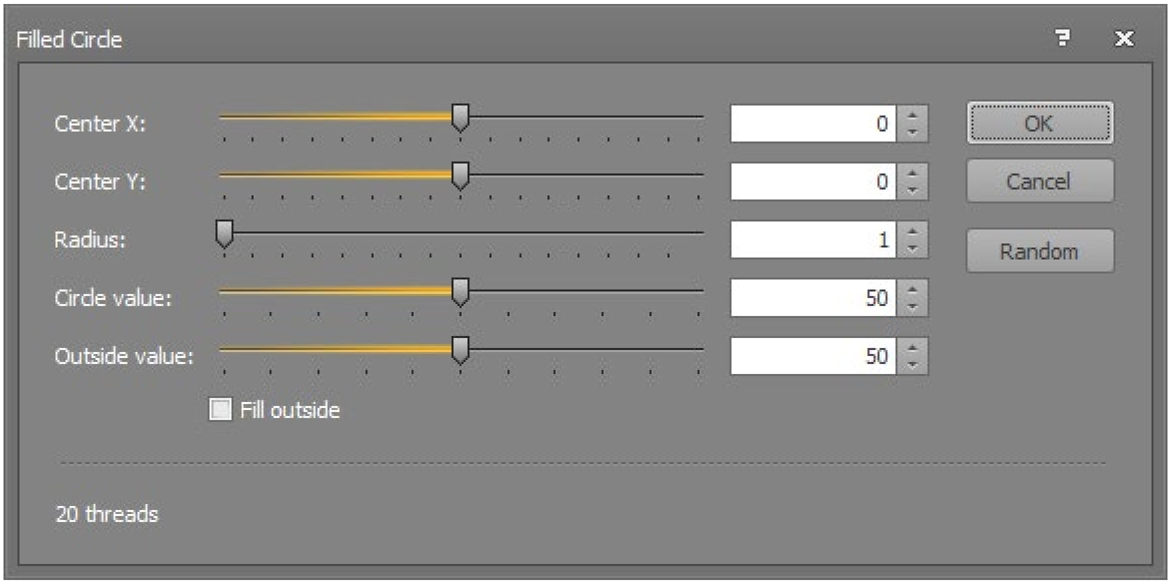
Generate a constant single value.



Value	The value to generate.
Value Preset Buttons	Common values.

Generate: Filled Circle

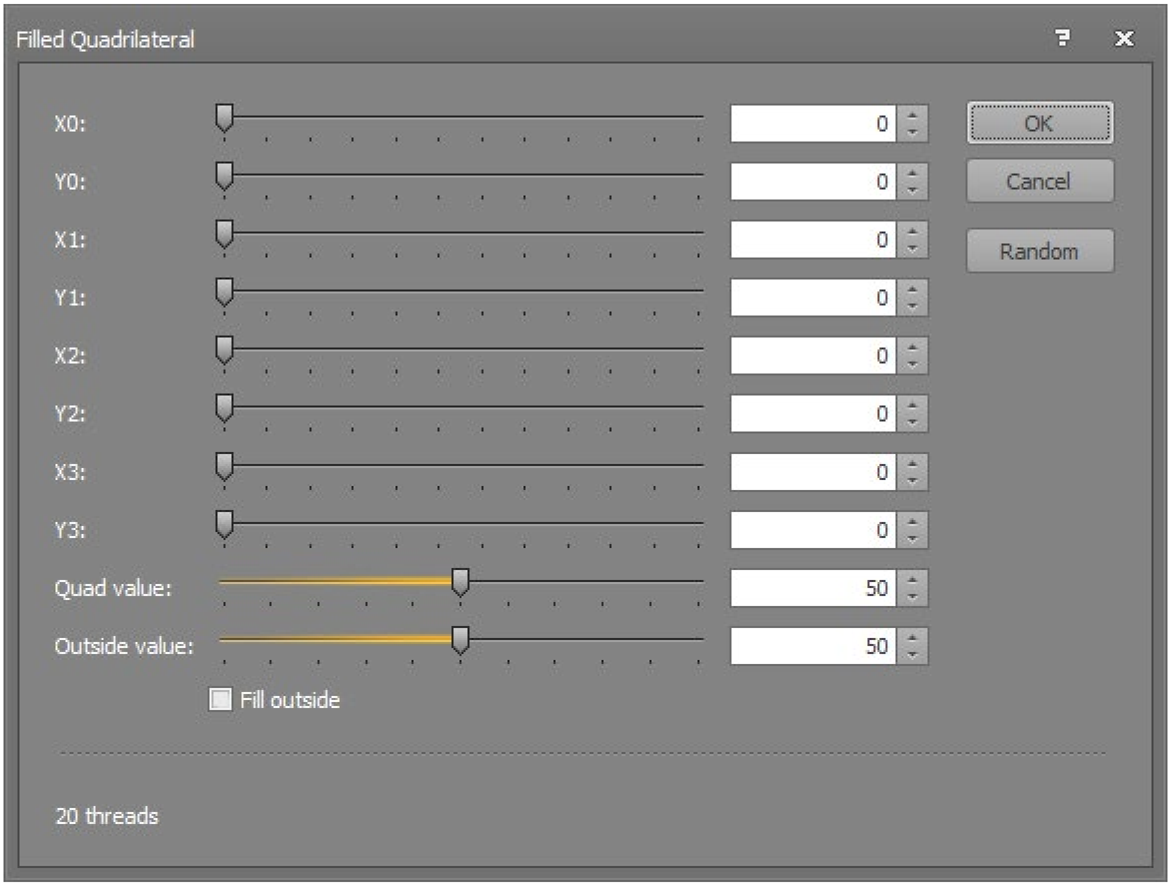
Generate a filled circle.



Center X	The center X coordinate.
Center Y	The center Y coordinate.
Radius	The circle radius.
Circle value	The circle fill value.
Outside value	The fill value outside of the circle.
Fill outside	Whether to fill the outside.

Generate: Filled Quadrilateral

Generate a four-coordinate filled quadrilateral.



X0	Coordinate X 0.
Y0	Coordinate Y 0.
X1	Coordinate X 1.
Y1	Coordinate Y 1.
X2	Coordinate X 2.
Y2	Coordinate Y 2.
X3	Coordinate X 3.
Y3	Coordinate Y 3.
Quad value	The quadrilateral fill value.
Outside value	The fill value outside of the quadrilateral.
Fill outside	Whether to fill the outside.

Notes:

The coordinates cannot be overlapping and must be a convex shape.

Generate: Filled Rectangle

Generate a filled rectangle.

X offset	The top-left X offset.
Y offset	The top-left Y offset.
Width	The rectangle width.
Length	The rectangle length.
Rect value	The rectangle fill value.
Outside value	The fill value outside of the rectangle.
Fill outside	Whether to fill the outside.

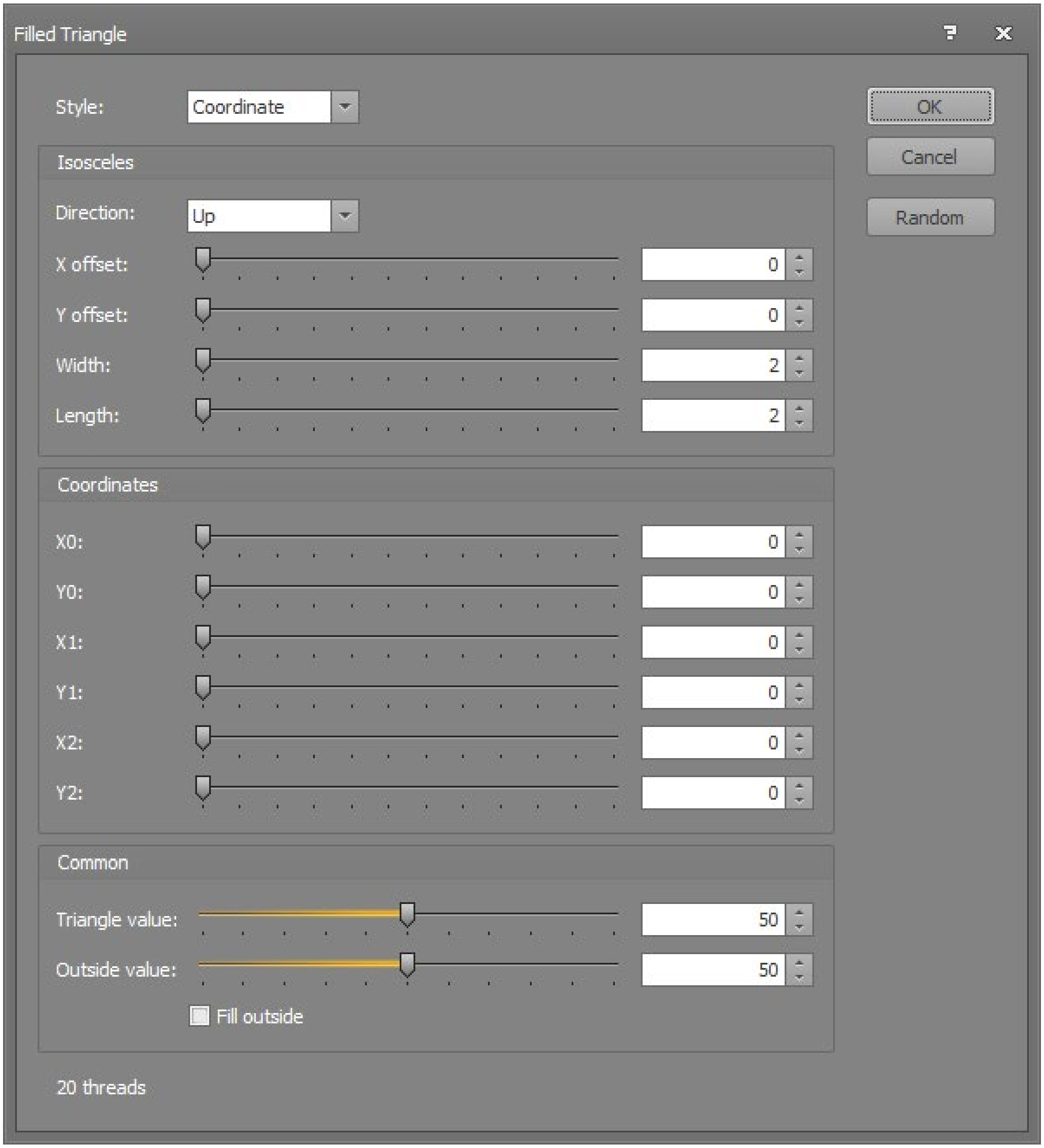
Generate: Filled Square

Generate a filled square.

X offset	The top-left X offset.
Y offset	The top-left Y offset.
Size	The square size. The width and length are the same value.
Square value	The square fill value.
Outside value	The fill value outside of the square.
Fill outside	Whether to fill the outside.

Generate: Filled Triangle

Generate a filled triangle.



Style	The triangle style. Coordinate: generate a triangle using three coordinates. Isosceles: generate a triangle within a rectangular bounds.

Isosceles

Direction	The triangle direction.
X offset	The top-left X offset.
Y offset	The top-left Y offset.

Width	The triangle width.
Length	The triangle length.

Coordinates

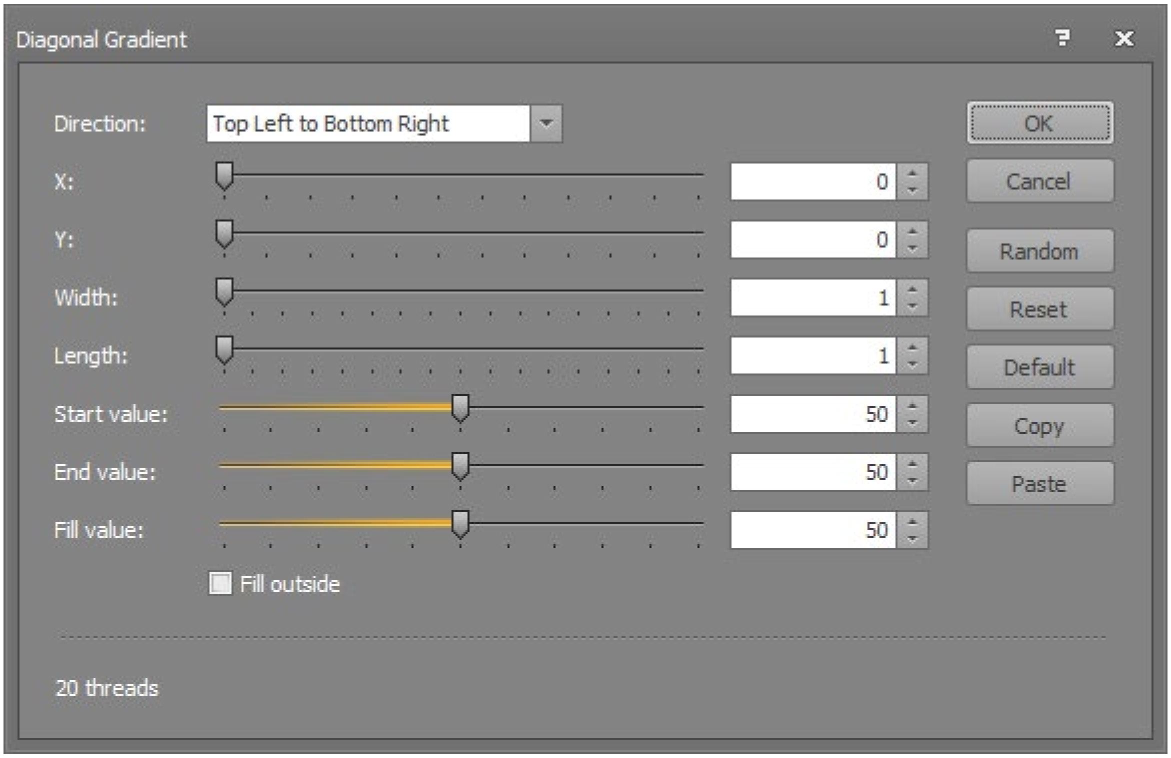
X0	Coordinate X 0.
Y0	Coordinate Y 0.
X1	Coordinate X 1.
Y1	Coordinate Y 1.
X2	Coordinate X 2.
Y2	Coordinate Y 2.
Triangle value	The triangle fill value.
Outside value	The fill value outside of the triangle.
Fill outside	Whether to fill the outside.

Notes:

The coordinates cannot be overlapping and must be a convex shape.

Generate: Diagonal Gradient

Generate a diagonal rectangular gradient from corner to corner.



Direction	The gradient direction. - Top Left to Bottom Right. - Top Right to Bottom Left. - Bottom Left to Top Right. - Bottom Right to Top Left.
X	The top-left X coordinate of the gradient rectangle.
Y	The top-left Y coordinate of the gradient rectangle.
Width	The width of the gradient rectangle.
Length	The length of the gradient rectangle.
Start value	The gradient start value.
End value	The gradient end value.
Fill value	The fill value outside of the rectangle.
Fill outside	Whether to fill the outside.

Generate: Gaussian Gradient

Generate a circular gaussian gradient.

X	The top-left X coordinate of the gradient circle.
Y	The top-left Y coordinate of the gradient circle.
Diameter	The diameter of the circle.
Sigma	The slope of the gaussian circle, larger values are a steeper circle.
Center value	The circle center value.
Edge value	The circle edge value.
Fill value	The fill value outside of the circle.
Fill outside	Whether to fill the outside.

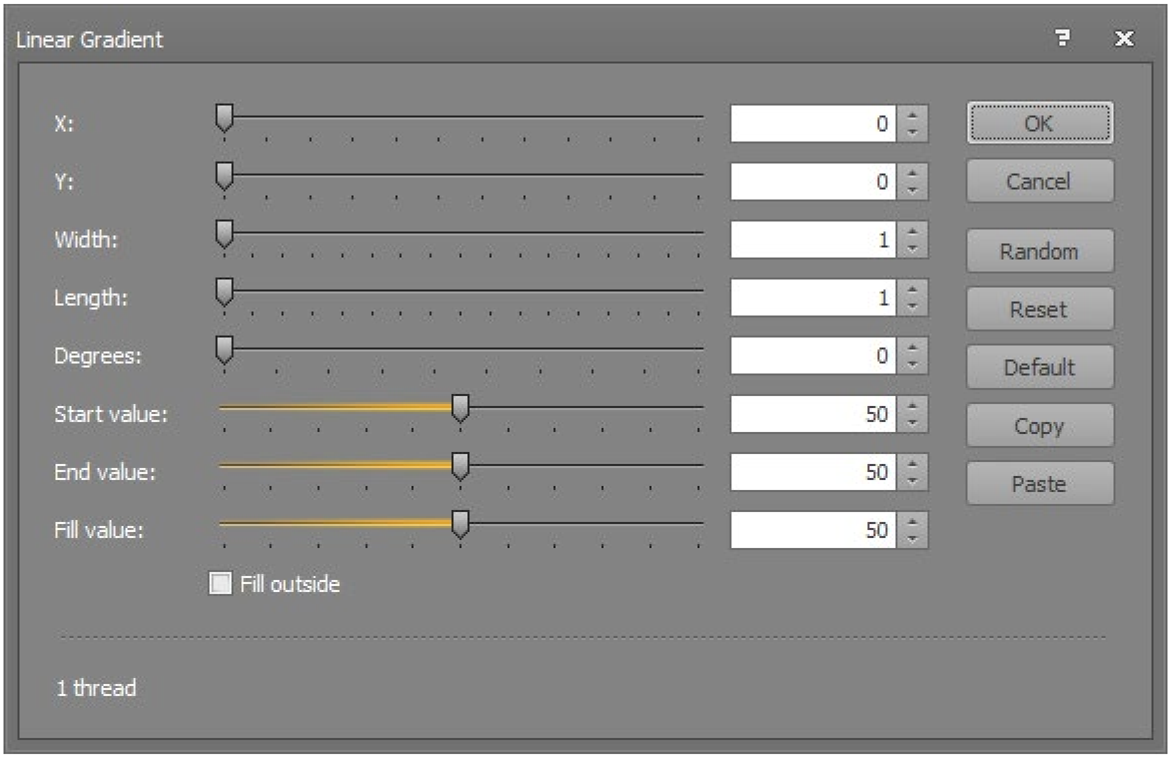
Generate: Horizontal Gradient

Generate a horizontal rectangular gradient.

X	The top-left X coordinate of the gradient rectangle.
Y	The top-left Y coordinate of the gradient rectangle.
Width	The width of the gradient rectangle.
Length	The length of the gradient rectangle.
Start value	The gradient start value.
End value	The gradient end value.
Fill value	The fill value outside of the rectangle.
Fill outside	Whether to fill the outside.

Generate: Linear Gradient

Generate a rotated linear rectangular gradient.



X	The top-left X coordinate of the gradient rectangle.
Y	The top-left Y coordinate of the gradient rectangle.
Width	The width of the gradient rectangle.
Length	The length of the gradient rectangle.
Degrees	The rotation degrees of the gradient.
Start value	The gradient start value.
End value	The gradient end value.
Fill value	The fill value outside of the rectangle.
Fill outside	Whether to fill the outside.

Generate: Radial Gradient

Generate a radial cone gradient circle.

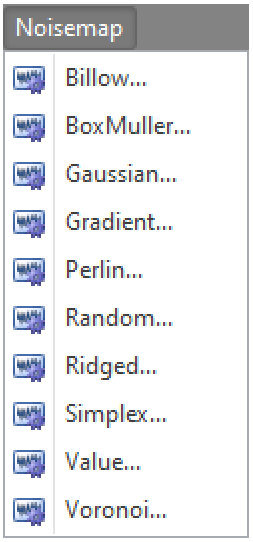
X	The top-left X coordinate of the gradient circle.
Y	The top-left Y coordinate of the gradient circle.
Diameter	The diameter of the gradient circle.
Center value	The gradient circle center value.
Edge value	The gradient circle edge value.
Fill value	The fill value outside of the rectangle.
Fill outside	Whether to fill the outside.

Generate: Vertical Gradient

Generate a vertical rectangular gradient.

X	The top-left X coordinate of the gradient rectangle.
Y	The top-left Y coordinate of the gradient rectangle.
Width	The width of the gradient rectangle.
Length	The length of the gradient rectangle.
Start value	The gradient rectangle start value.
End value	The gradient rectangle end value.
Fill value	The fill value outside of the rectangle.
Fill outside	Whether to fill the outside.

Devices Noisemap



The noisemap generator objects provide a wide variety of gradient and random noise patterns in both 2D and 3D fields. The typical uses for the noisemap generator objects are to create basic heightmap designs that can be modified with other tools, and to create random detailing effects that can be added to other heightmaps.

Each noisemap generator dialog provides a centralized area for controlling all of the noisemap parameters. The dialog includes a large 2D/3D preview window, a toolbar and information status bars, and a set of sliders and numeric controls to set the current noise type layout.

Most of the noisemap generators create Perlin-style procedurally generated noise, combining multiple octaves, or frequencies, of that noise to generate pseudo-realistic terrain heightmaps.

Some of the noisemap generation algorithms do not use fully stabilized noise in order to provide a wider range of noise effects. This can sometimes result in noise spikes or other irregularities with specific combinations of property settings.

Noisemap Common Properties

Noise Parameters Toolstrip

Randomize – Randomize the noisemap parameters.
This may generate a set of random numbers that creates unusable terrain.

Hold – Hold current parameters, save them to the swap buffer.

Swap – Swap the current parameters with the previous saved parameters.

Open – Open a noisemap parameters files.

Save – Save the noisemap parameters to a file.

Copy – Copy the noisemap parameters to the system clipboard.

Paste – Paste the noisemap parameters from the system clipboard.

Reset – Reset the noisemap parameters to the initial values.

Defaults – Set the noisemap parameters to the default values.

Noise Parameters Presets

Presets: Select the preset noisemap from the drop-down list.

Generator

Offset X:	The noisefield offset along the local X axis.
Offset Y:	The noisefield offset along the local Y axis.
x10	The noisefield offset X/Y values increment by 10's.
Zero	Zero (0) the noisefield offset X/Y values.
Seed:	The noise seed number. Different number generate different noisefields.
Randomize	Randomly generate a seed number.
Re-seed each detail level	Re-seed the noise generator on each successive detail level.
Type:	The noisefield generator type. Not all generators include this property.

Size

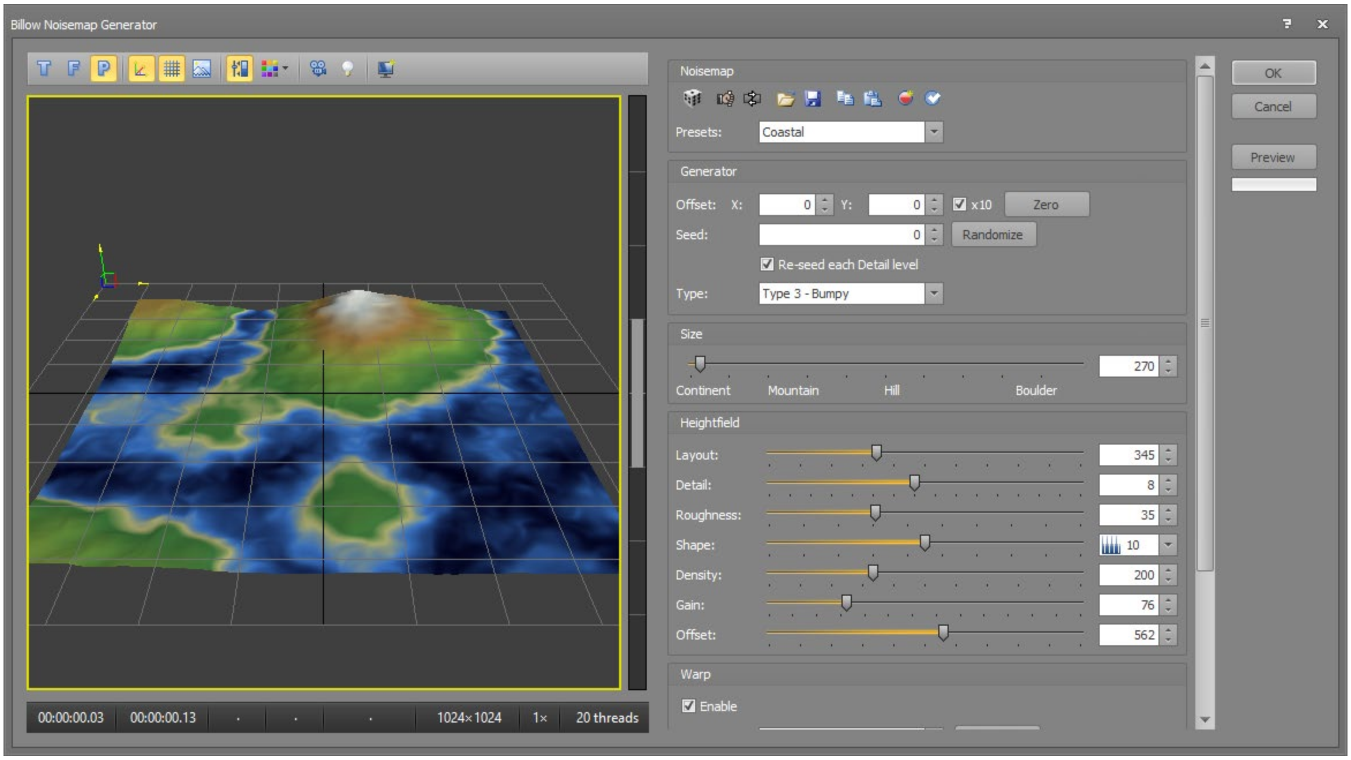
The Size slider and numeric control specify the size of the noisefield geological structures.

Statistics

High:	The noisefield high value.
Low:	The noisefield low value.
Range:	The noisefield value range.

Noisemap: Billow

Generate a procedural gradient noisemap that is mainly positive numbers and creates cloud like noisefields.



Heightfield

Layout: The noisefield layout. This is essentially moving the noisemap slices along the 3D Y.

Detail: The amount of noisefield detail. This is the number of noise octaves.

Roughness: The roughness of the noisefield surface. This is the amplitude of the noise octaves.

Shape: Adds a specific shape to the noisefield roughness by varying the noise octave levels.

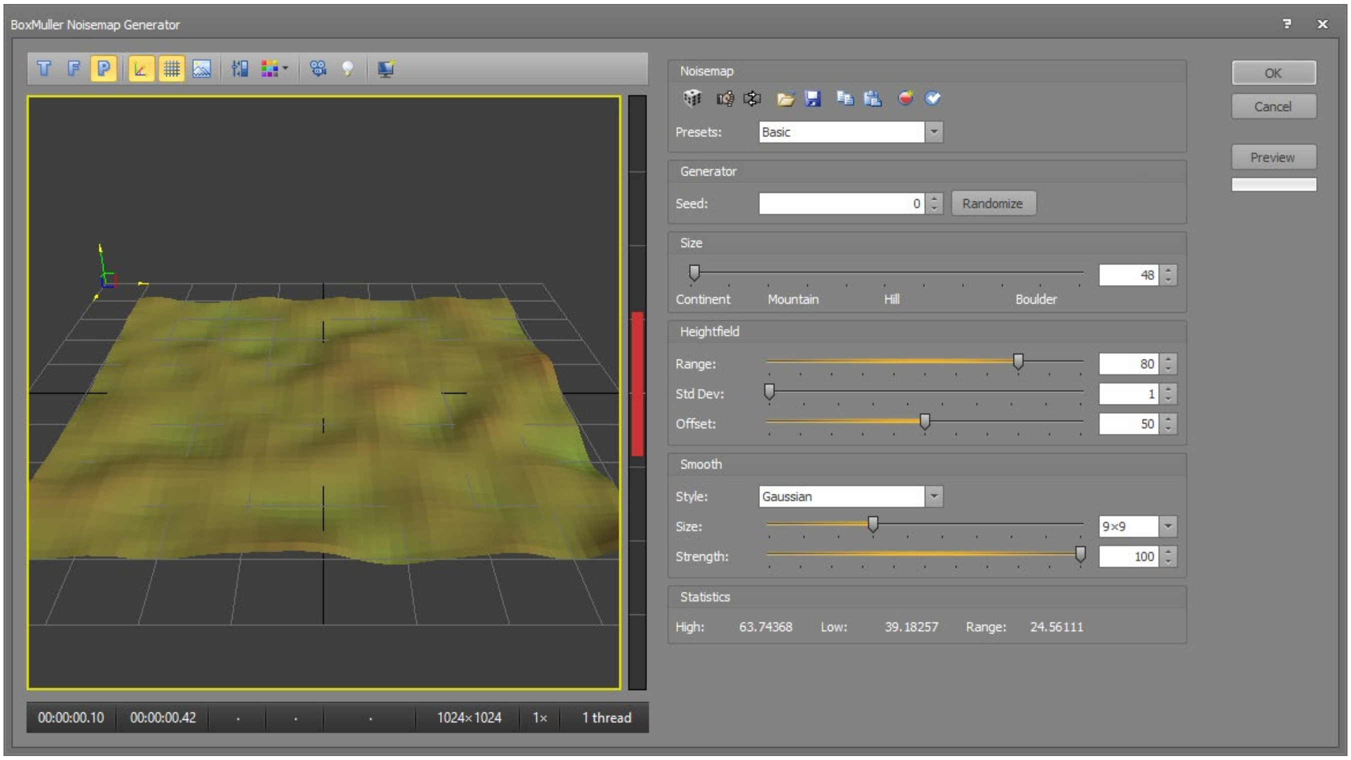
Density: The density of the noisefield detail.

Gain: The overall amplitude of the noisefield.

Offset: The noisefield 3D Y value offset.

Noisemap: BoxMuller

Generate a pseudo-random box muller normal distribution noisemap.



Heightfield Group

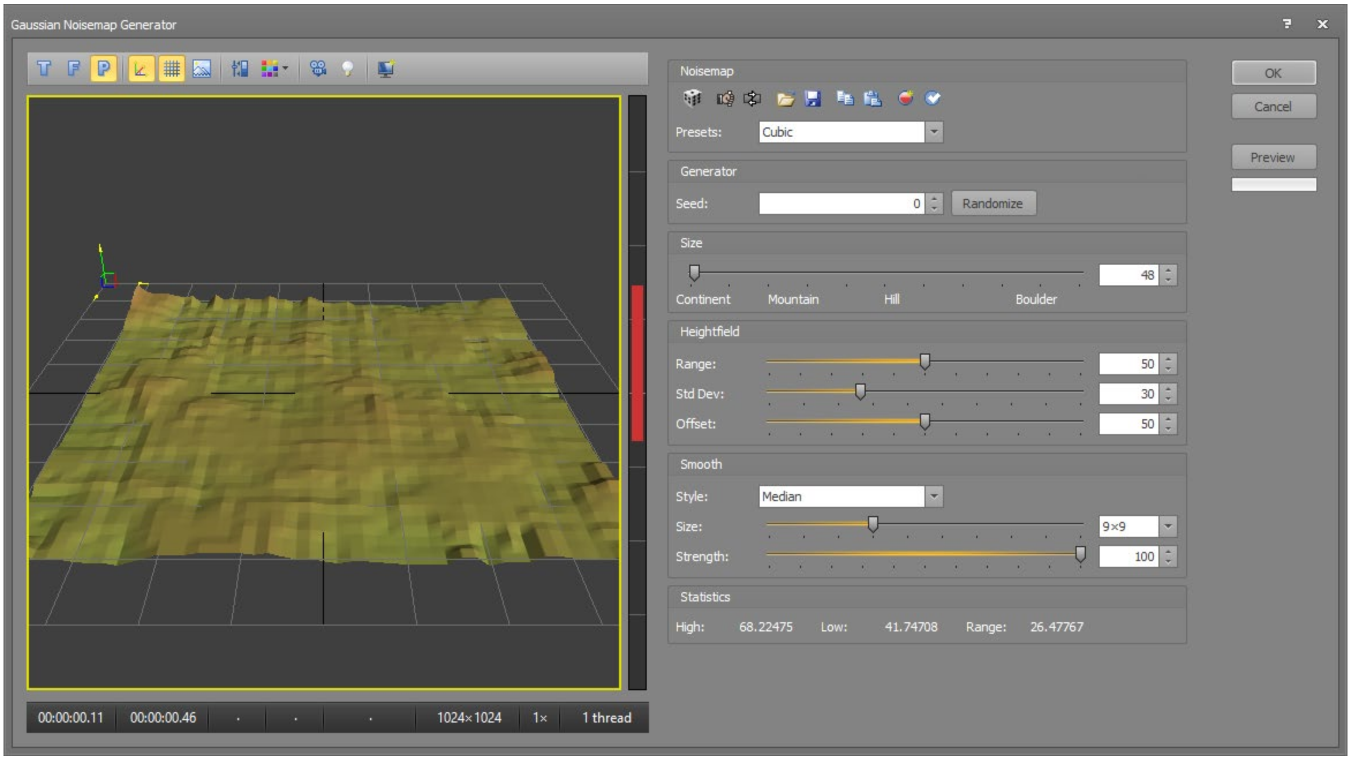
Range: The noisefield altitude range.

Std Dev: The random noise standard deviation, or variability.

Offset: The noisefield 3D Y value offset.

Noisemap: Gaussian

Generate a pseudo-random gaussian normal distribution noisemap.



Heightfield Group

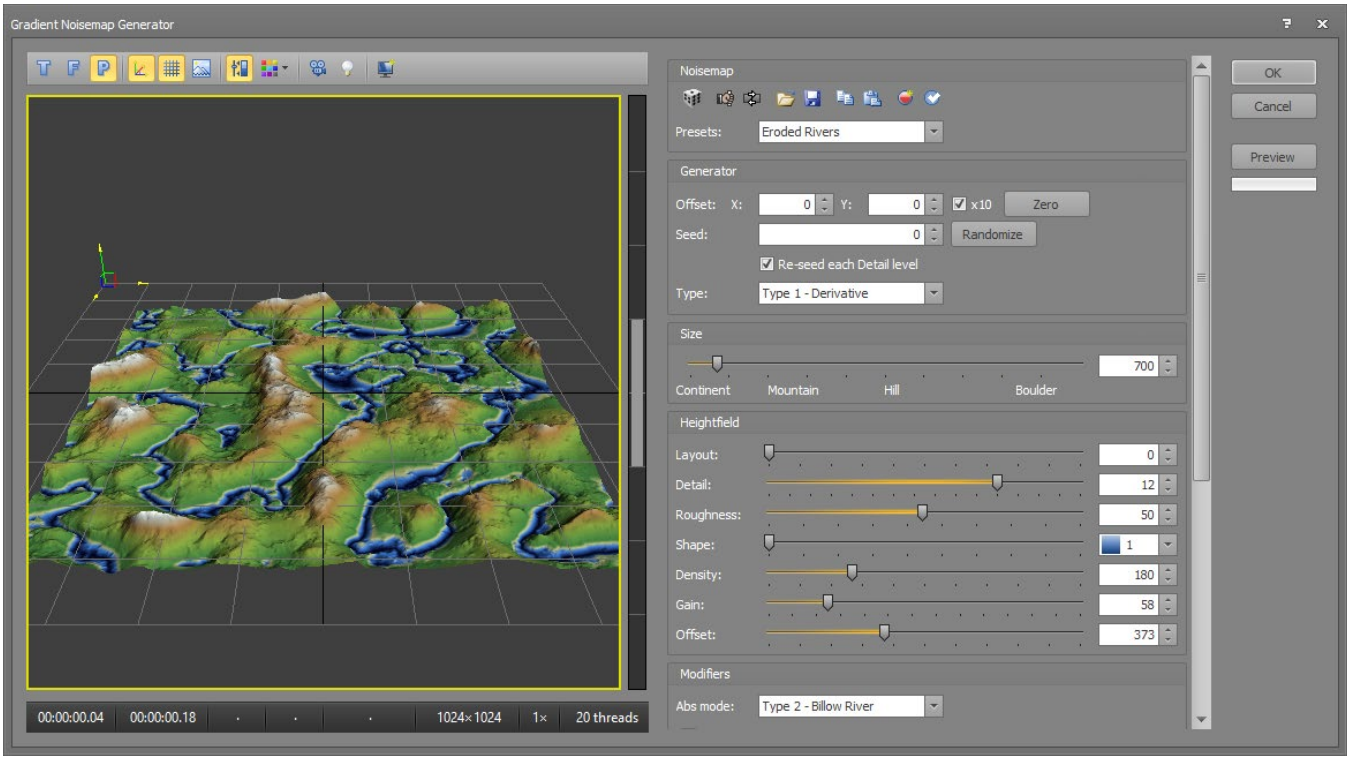
Range: The noisefield altitude range.

Std Dev: The random noise standard deviation, or variability.

Offset: The noisefield 3D Y value offset.

Noisemap: Gradient

Generate a procedural gradient noisemap that has extended gradient parameters.



Heightfield

Layout: The noisefield layout. This is essentially moving the noisemap slices along the 3D Y.

Detail: The amount of noisefield detail. This is the number of noise octaves.

Roughness: The roughness of the noisefield surface. This is the amplitude of the noise octaves.

Shape: Adds a specific shape to the noisefield roughness by varying the noise octave levels.

Density: The density of the noisefield detail.

Gain: The overall amplitude of the noisefield.

Offset: The noisefield 3D Y value offset.

Modifiers

Abs mode: The mathematical Absolute value algorithm.

Derivative X: Use the mathematical derivative X.

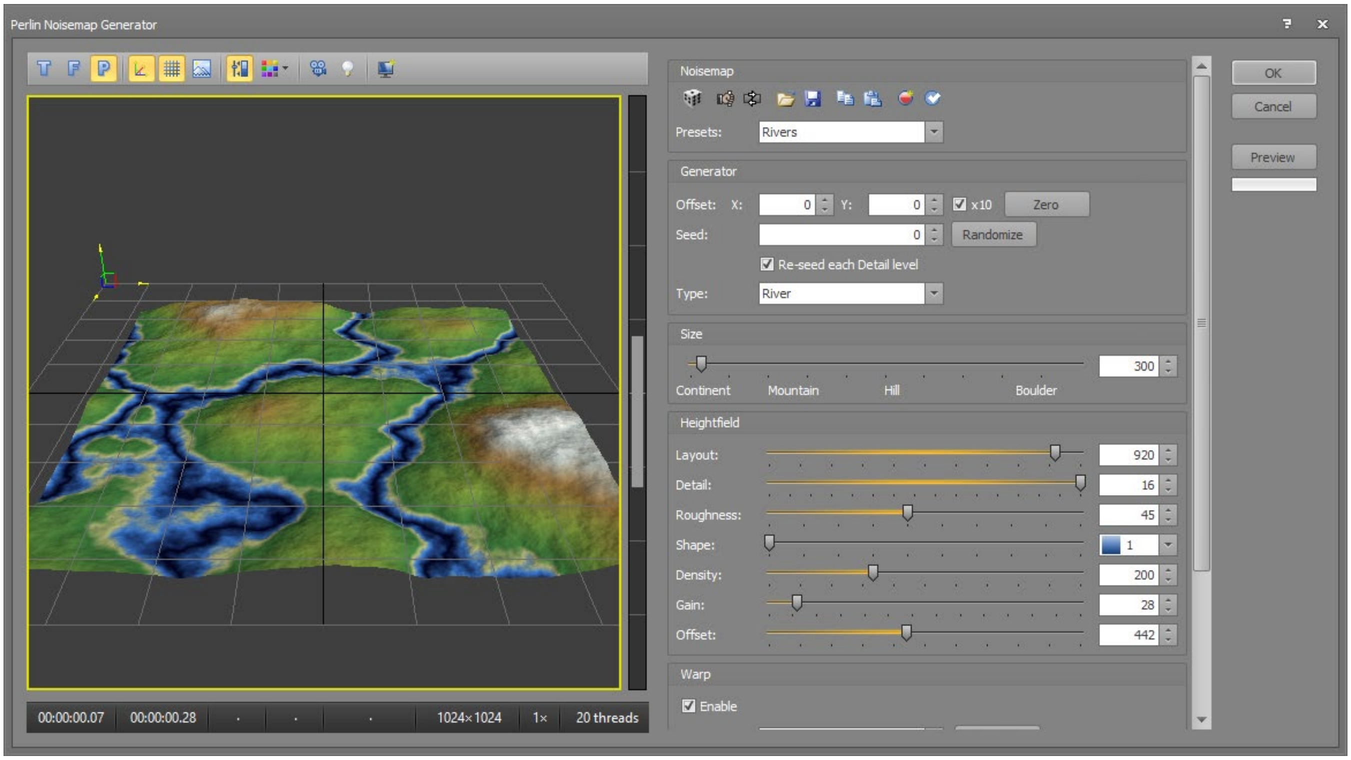
Derivative Y: Use the mathematical derivative Y.

Dampen: future.

Displace: future.

Noisemap: Perlin

Generate a procedural gradient noisemap using the standard Perlin algorithm.



Heightfield

Layout: The noisefield layout. This is essentially moving the noisemap slices along the 3D Y.

Detail: The amount of noisefield detail. This is the number of noise octaves.

Roughness: The roughness of the noisefield surface. This is the amplitude of the noise octaves.

Shape: Adds a specific shape to the noisefield roughness by varying the noise octave levels.

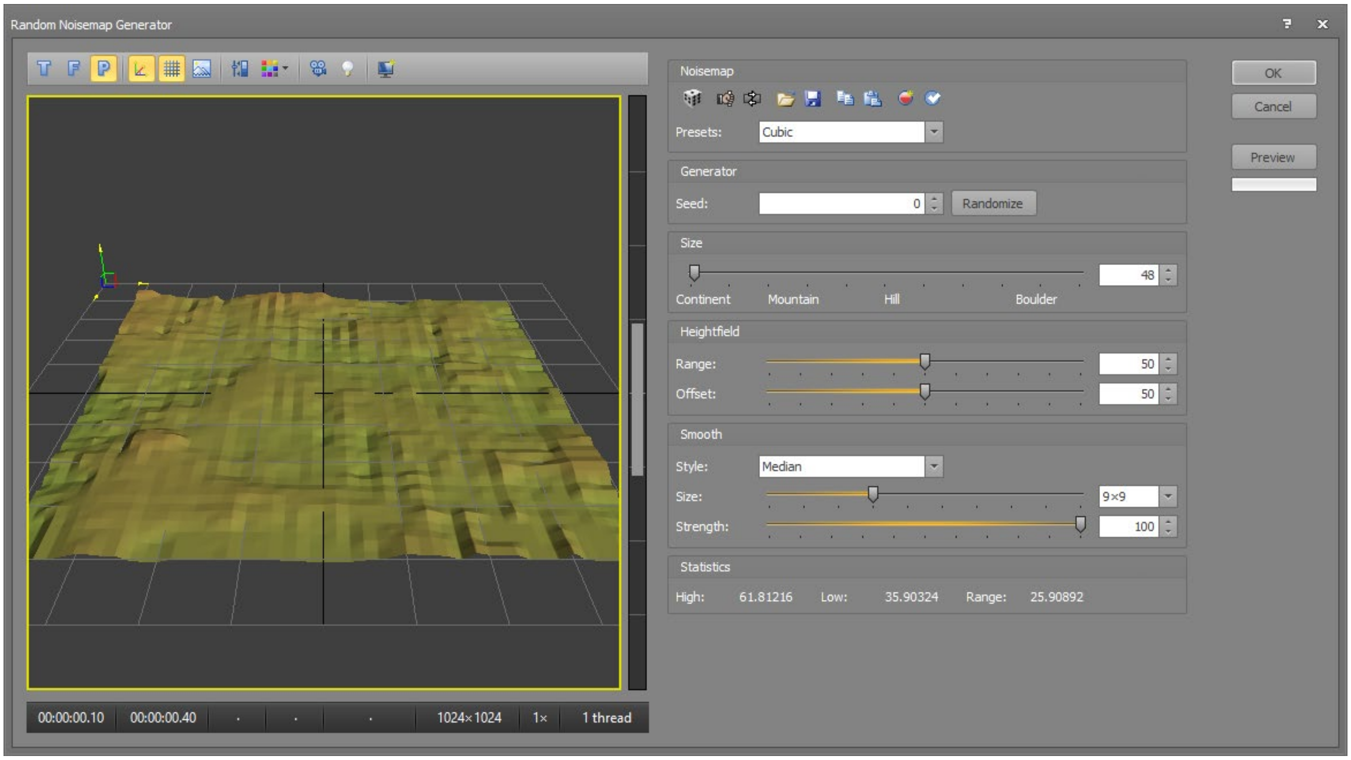
Density: The density of the noisefield detail.

Gain: The overall amplitude of the noisefield.

Offset: The noisefield 3D Y value offset.

Noisemap: Random

Generate a pseudo-random noisemap.



Heightfield

Range: . The random noise overall amplitude range.

Standard Deviation: The random noise standard deviation, the amount of variability.

Offset: The noisefield 3D Y value offset.

Smooth

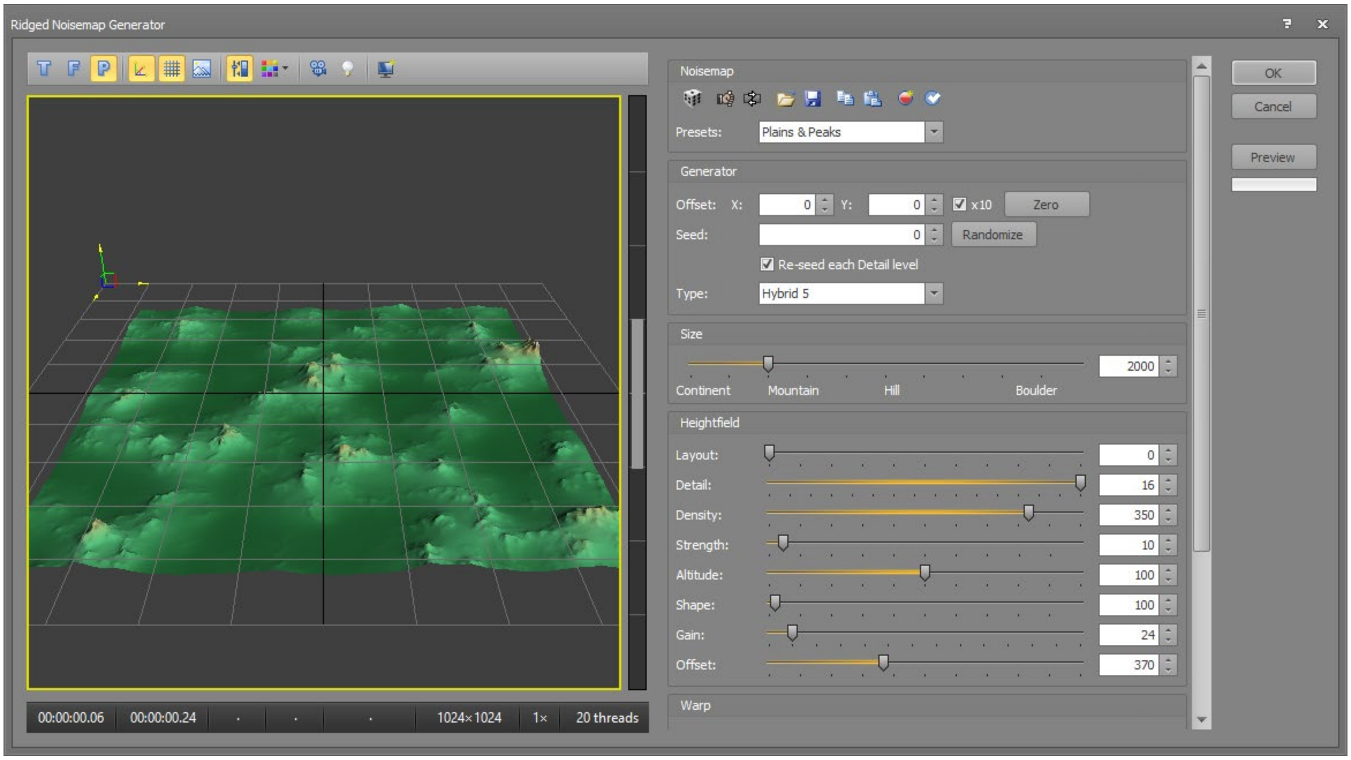
Style: The smooth style.

Strength: The smooth strength.

Size: The smooth kernel size.

Noisemap: Ridged

Generate a procedural gradient noisemap that produces spiked mountain-like noisefields.



Heightfield

Layout: The noisefield layout. This is essentially moving the noisemap slices along the 3D Y.

Detail: The amount of noisefield detail. This is the number of noise octaves.

Density: The density of the noisefield detail.

Strength: The ridge strength.

Altitude: The ridge altitude.

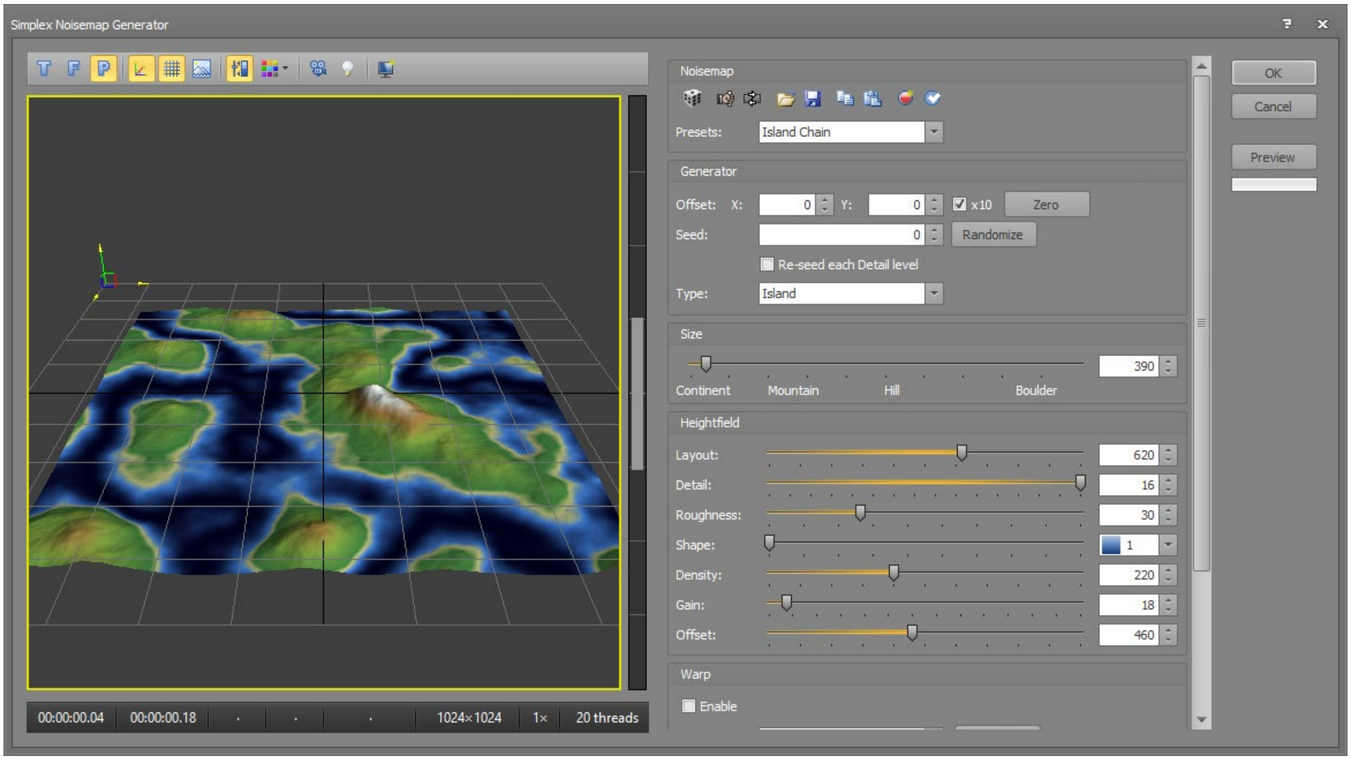
Shape: The ridge shape.

Gain: The overall amplitude of the noisefield.

Offset: The noisefield 3D Y value offset.

Noisemap: Simplex

Generate a procedural gradient noisemap using the Simplex algorithm.

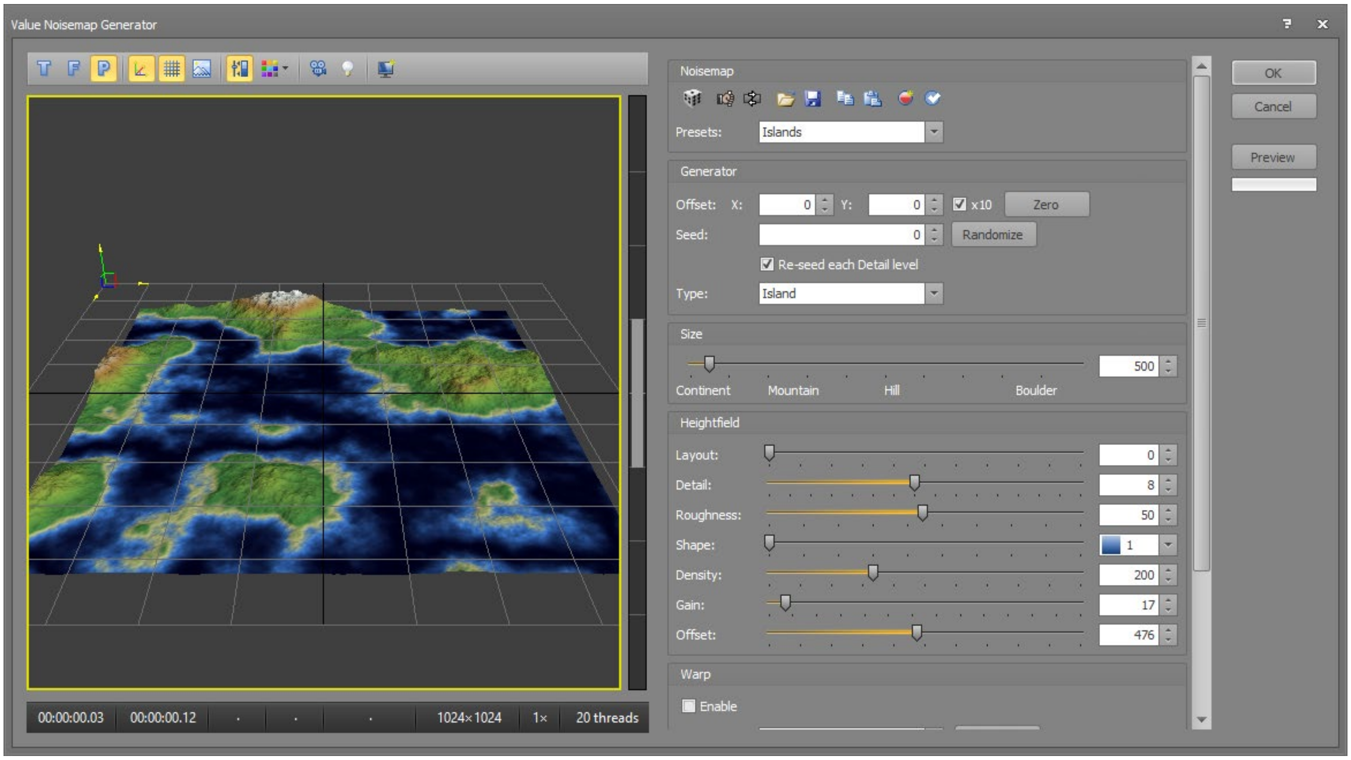


Heightfield Group

Layout:	The noisefield layout. This is essentially moving the noisemap slices along the 3D Y axis.
Detail:	The amount of noisefield detail. This is the number of noise octaves.
Roughness:	The roughness of the noisefield surface. This is the amplitude of the noise octaves.
Shape:	Adds a specific shape to the noisefield roughness by varying the noise octave levels.
Density:	The density of the noisefield detail.
Gain:	The overall amplitude of the noisefield.
Offset:	The noisefield 3D Y value offset.

Noisemap: Value

Generate a procedural gradient noisemap using the Value algorithm.



Heightfield

Layout: The noisefield layout. This is essentially moving the noisemap slices along the 3D Y.

Detail: The amount of noisefield detail. This is the number of noise octaves.

Roughness: The roughness of the noisefield surface. This is the amplitude of the noise octaves.

Shape: Adds a specific shape to the noisefield roughness by varying the noise octave levels.

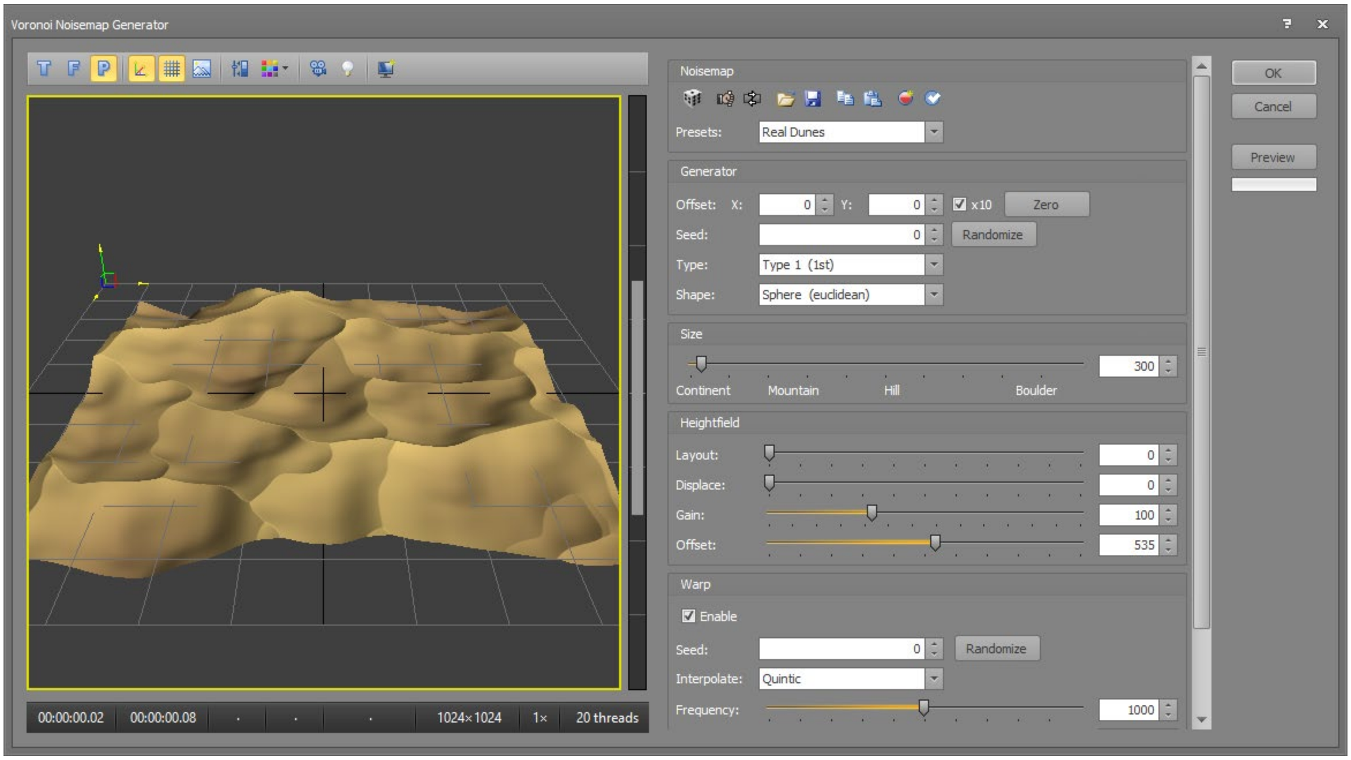
Density: The density of the noisefield detail.

Gain: The overall amplitude of the noisefield.

Offset: The noisefield 3D Y value offset.

Noisemap: Voronoi

Generate a procedural noisemap using the Voronoi algorithm.



Generator

Shape: The voronoi cell shape.

Heightfield

Layout: The noisefield layout. This is essentially moving the noisemap slices along the 3D Y.

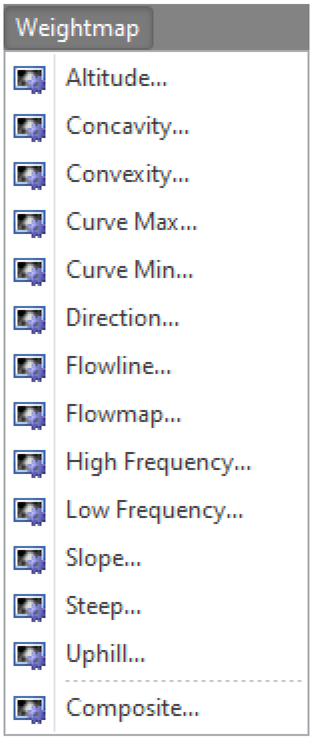
Displace: The voronoi cell feature displacement.

Gain: The overall amplitude of the noisefield.

Offset: The noisefield 3D Y value offset.

Devices Weightmap

The Weightmap menu contains devices that extract weightmap masks from heightmaps.
The Weightmap devices are typically used for creating texture masks or splatmaps.



Weightmap Overview

The weightmap extractor objects provides a variety of algorithms for extracting weightmap mask data from heightmaps.
The weightmap masks are typically used in video game engines for terrain layer systems and splatmaps and foliage mesh scattering.

Typical weightmap mask use for terrain textures or material shaders includes:
- Altitude, high: for mountain snow caps.
- Altitude, low: for oceans or lakes.
- Slope, shallow: for grasslands, for grass mesh scattering.
- Slope, steep: for cliff faces.

Each weightmap extractor dialog provides a centralized area for controlling all of the weightmap mask parameters.
The dialog includes a large 2D preview window, a toolbar and information status bars, and multiple sliders and numeric controls to modify the weightmap mask properties.

Each weightmap mask type also includes parameters for smoothing the mask.
File parameters are available for either immediate mode saving of the weightmap mask file to disk, or for specifying the auto-saved weightmap mask file properties for terrain stack builds.

Weightmap Common Properties

Smooth Group

Bypass — Bypass the smooth function.

Size: — Specify the smooth kernel size. Larger values provide more smoothing strength.

Strength: — Specify the smooth strength.

File output Group

Format: — Choose the weightmap mask file output file format.

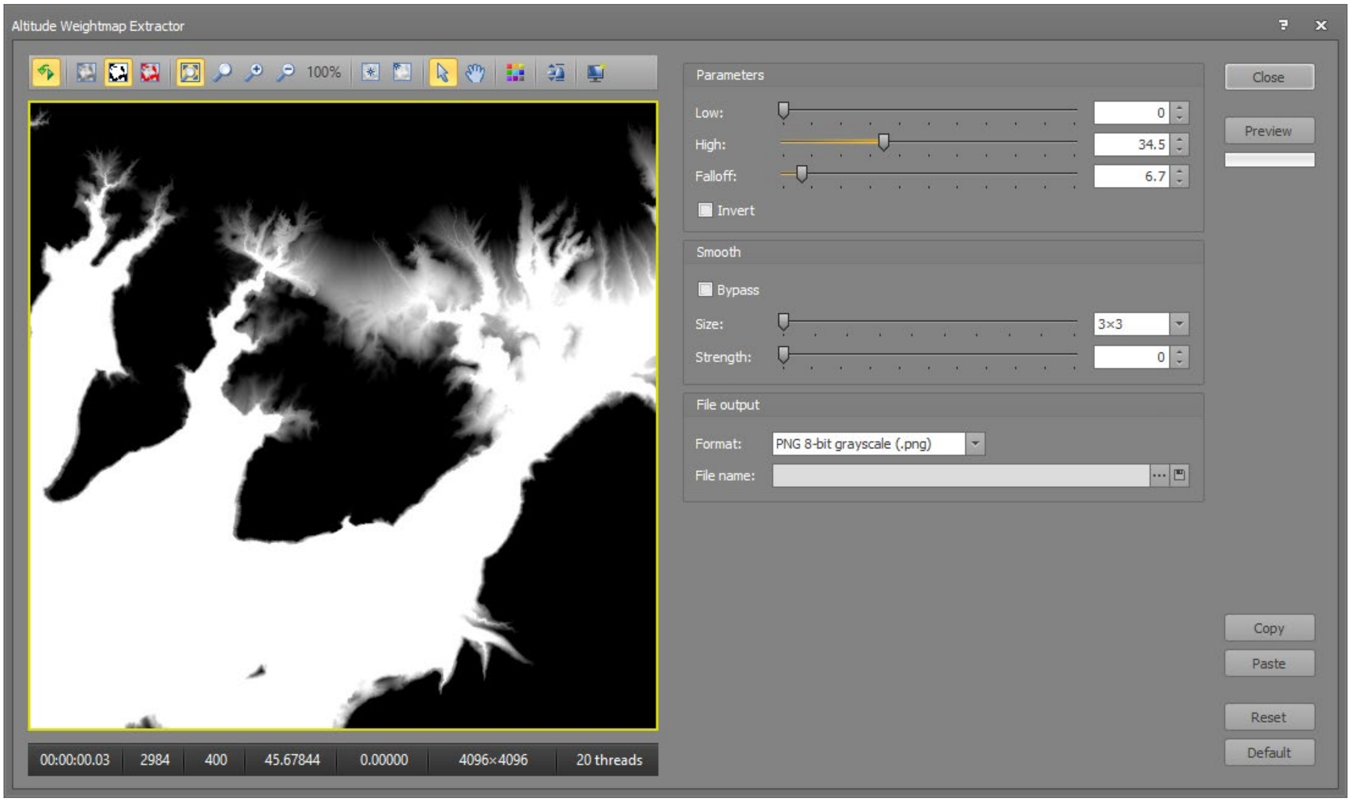
File name: — Specify the weightmap mask file output name.

Browse […]: — Browse for the output folder and file name.

Save [disk] — Save the weightmap mask file to disk.

Weightmap: Altitude

Extract mask information based on altitude.



Parameters Group

Low: The low altitude value.

High: The high altitude value.

Falloff: The altitude falloff value.

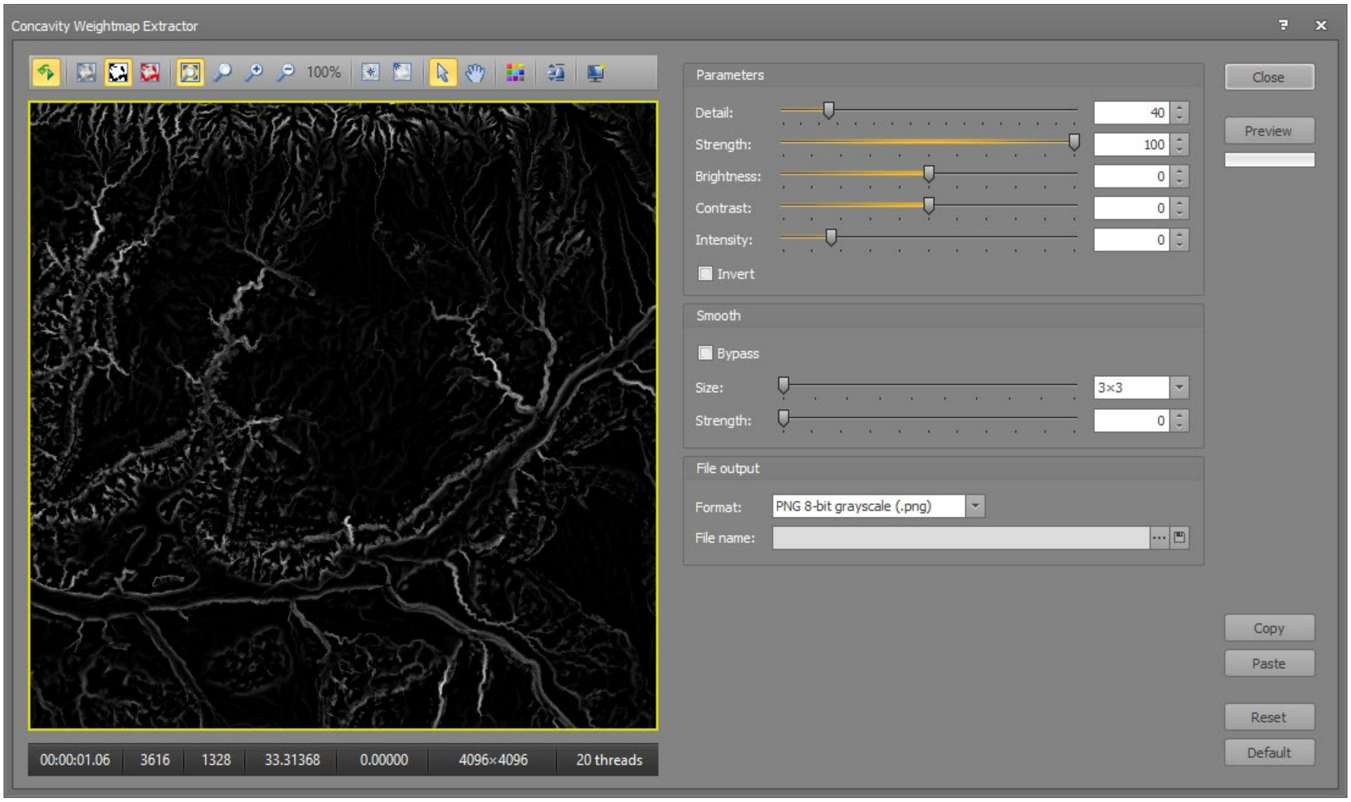
Invert Invert the mask.

Notes

This function requires 1 additional datamap memory allocation for the mask.

Weightmap: Concavity

Extract mask information based on concavity (depressions in the datamap).



Parameters Group

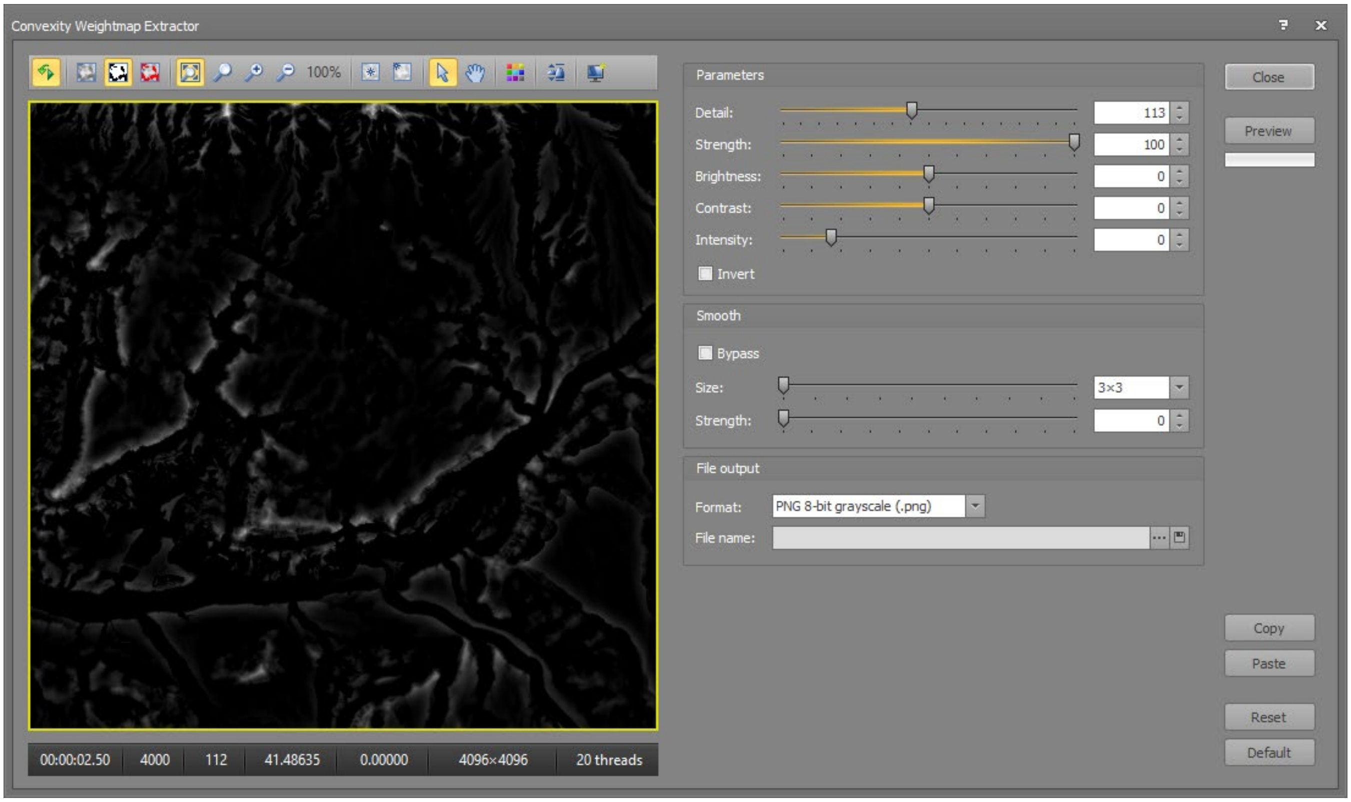
Detail:	The size of the concavity filter small to large.
Strength:	The strength of the filter.
Brightness:	Adjust the mask exposure brightness.
Contrast:	Adjust the mask exposure contrast.
Intensity:	Adjust the mask exposure intensity.
Invert:	Invert the mask.

Notes

This function requires 1 additional datamap memory allocation for the mask.

Weightmap: Convexity

Extract mask information based on convexity (mounds in the datamap).



Parameters Group

Detail: The size of the concavity filter small to large.

Strength: The strength of the filter.

Brightness: Adjust the mask exposure brightness.

Contrast: Adjust the mask exposure contrast.

Intensity: Adjust the mask exposure intensity.

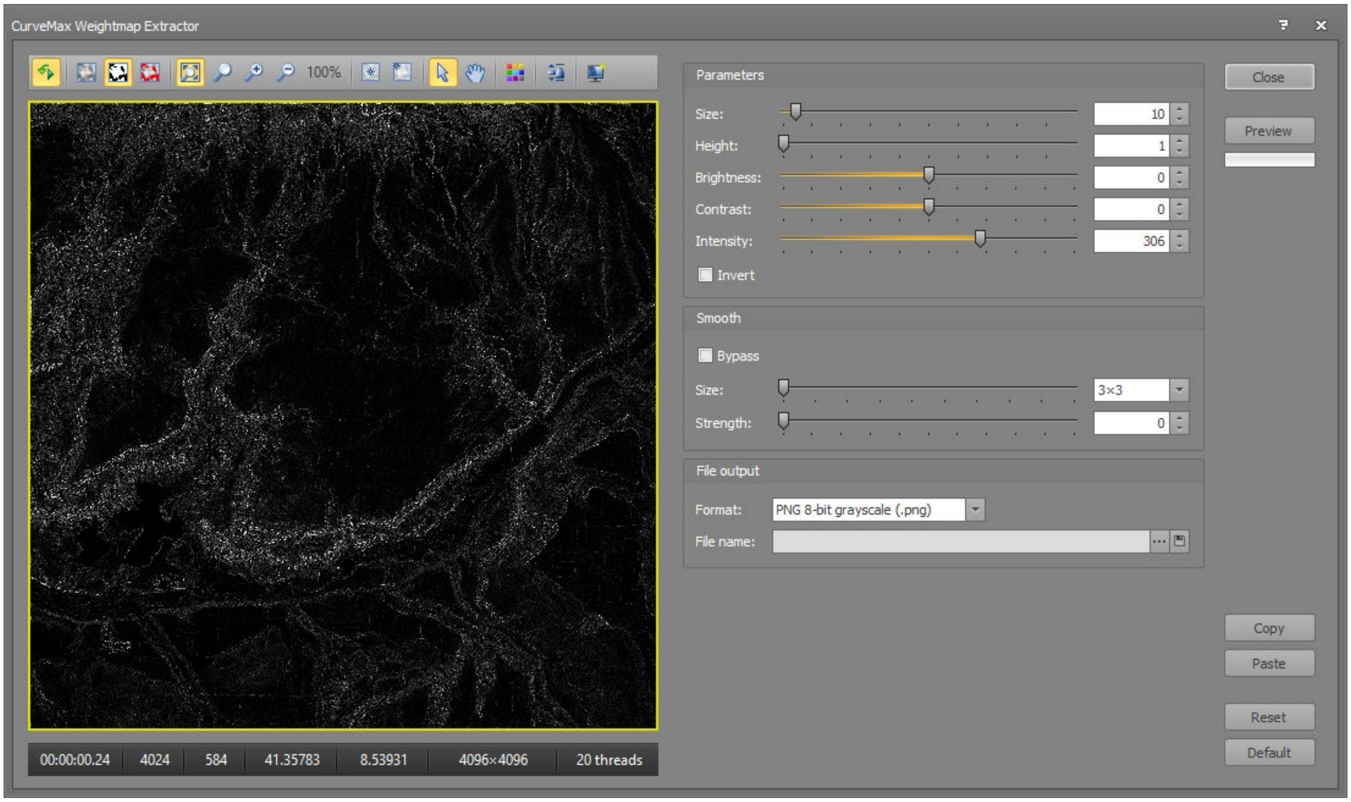
Invert: Invert the mask.

Notes

This function requires 1 additional datamap memory allocation for the mask.

Weightmap: Curve Max

Extract mask information based on the maximum curvature of the datamap.



Parameters Group

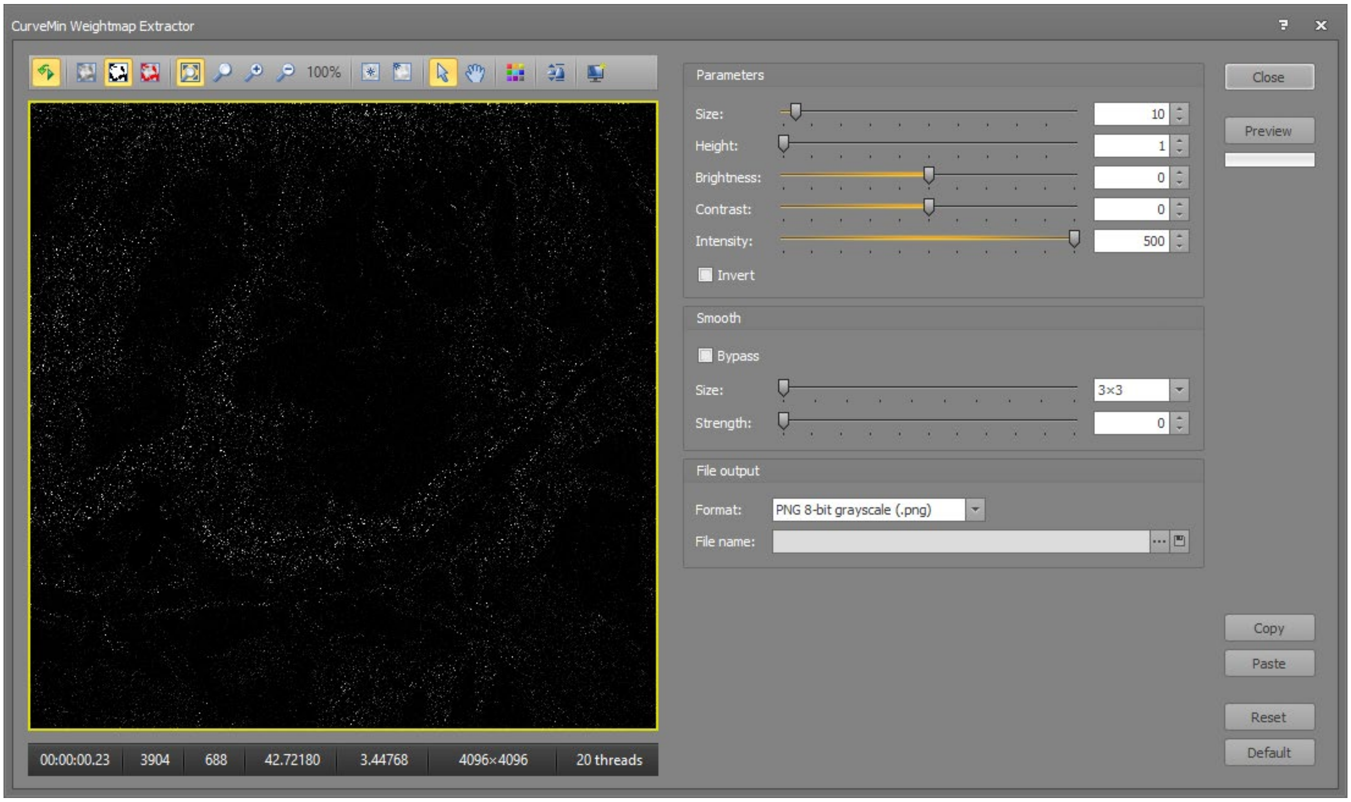
Size:	The size of the curve filter small to large.
Height:	The elevation height of the datamap, higher values filter out more detail.
Brightness:	Adjust the mask exposure brightness.
Contrast:	Adjust the mask exposure contrast.
Intensity:	Adjust the mask exposure intensity.
Invert:	Invert the mask.

Notes

This function requires 1 additional datamap memory allocation for the mask.

Weightmap: Curve Min

Extract mask information based on the minimum curvature of the datamap.



Parameters Group

Size: The size of the curve filter small to large.

Height: The elevation height of the datamap, higher values filter out more detail.

Brightness: Adjust the mask exposure brightness.

Contrast: Adjust the mask exposure contrast.

Intensity: Adjust the mask exposure intensity.

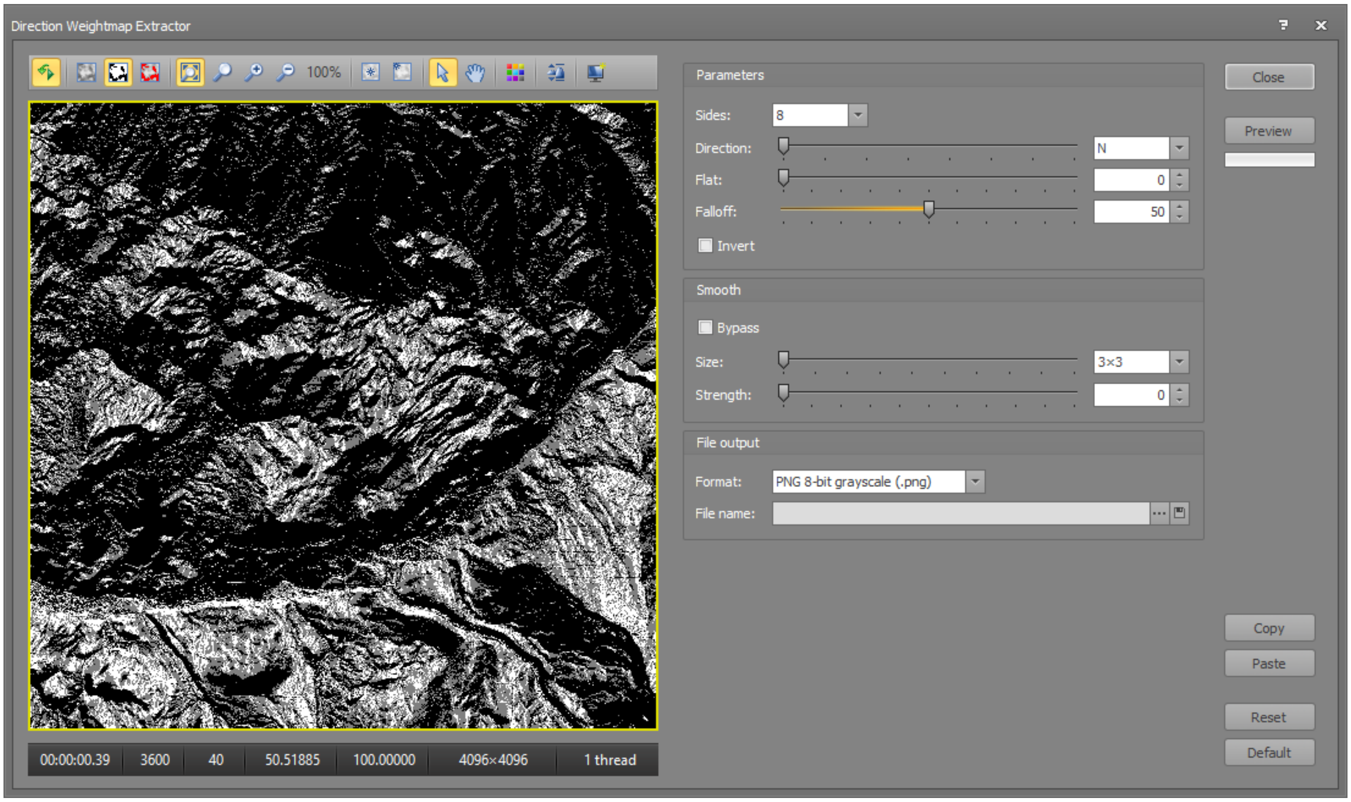
Invert: Invert the mask.

Notes

This function requires 1 additional datamap memory allocation for the mask.

Weightmap: Direction

Extract mask information based on the direction of the surface.



Parameters

Sides: The number of direction sides, 8 or 16.

Direction: Mask the terrain sides that are facing the specified compass direction.

Flat: Exclude the flatter regions.

Falloff: The direction falloff value.

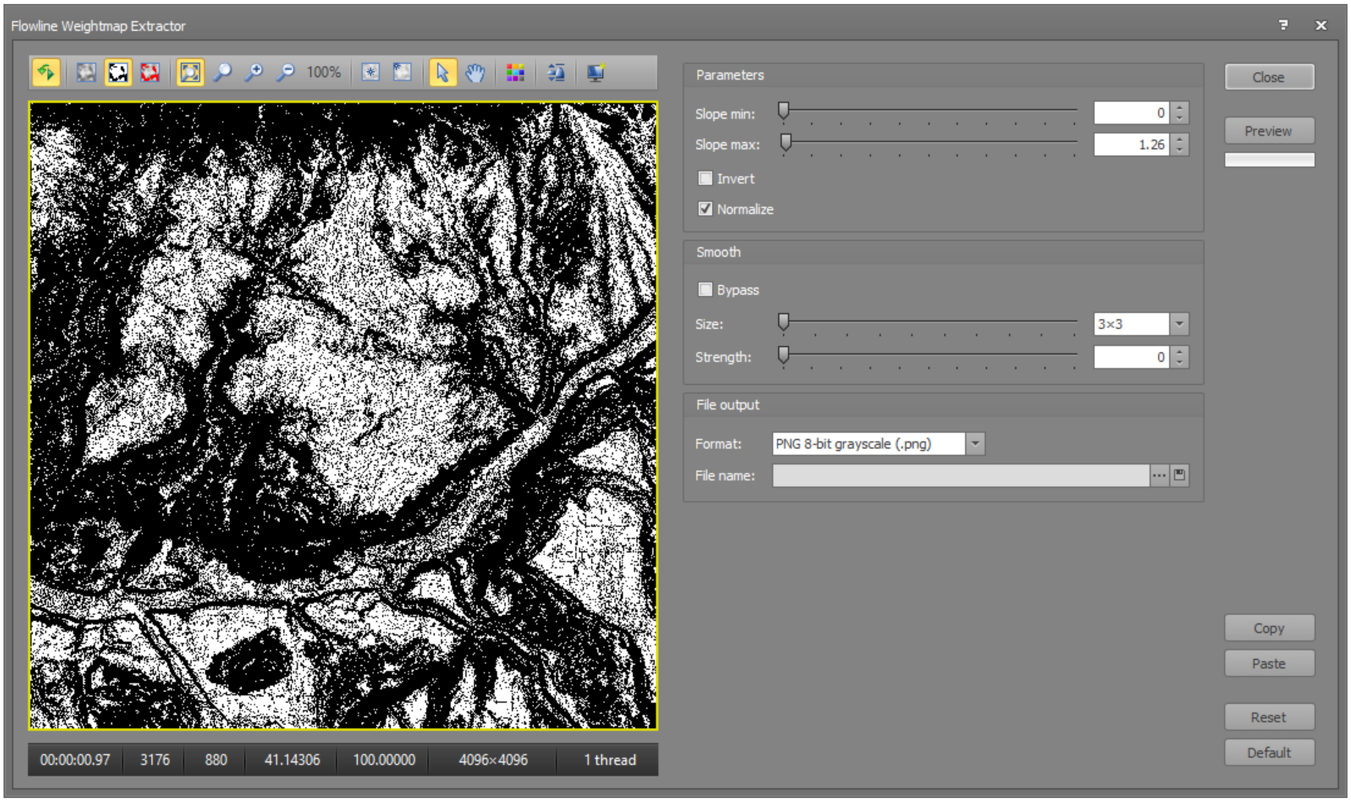
Invert: Invert the mask.

Notes

This function requires 1 additional datamap memory allocation for the mask.

Weightmap: Flowline

Extract mask information based on the surface water flow slope angles.



Parameters

Slope minimum: The slope minimum value.

Slope maximum: The slope maximum value.

Invert Invert the mask.

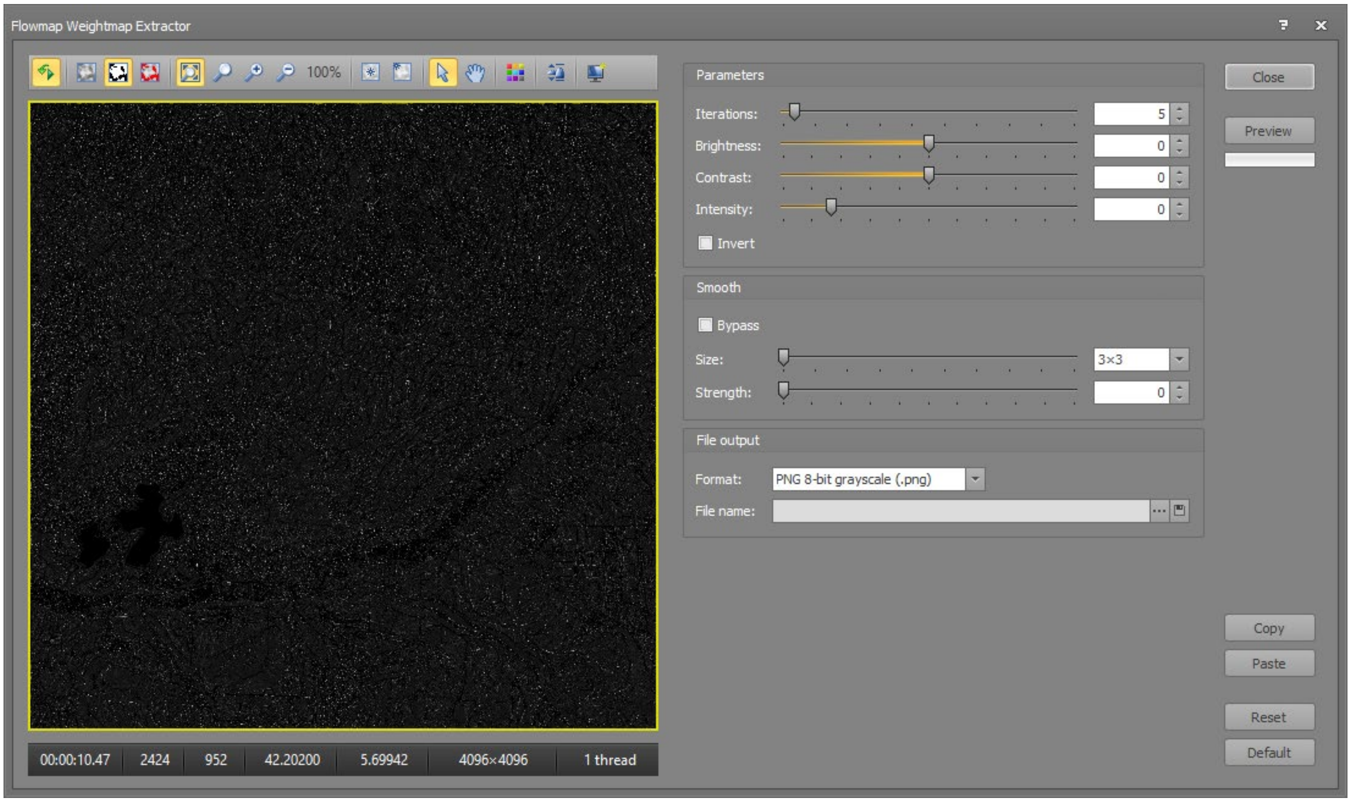
Normalize Normalize the mask.

Notes

This function requires 1 additional datamap memory allocation for the mask.

Weightmap: Flowmap

Extract mask information based on the water flow map.



Parameters Group

Iterations: The number of water flow cycles to perform.

Brightness: Adjust the mask exposure brightness.

Contrast: Adjust the mask exposure contrast.

Intensity: Adjust the mask exposure intensity.

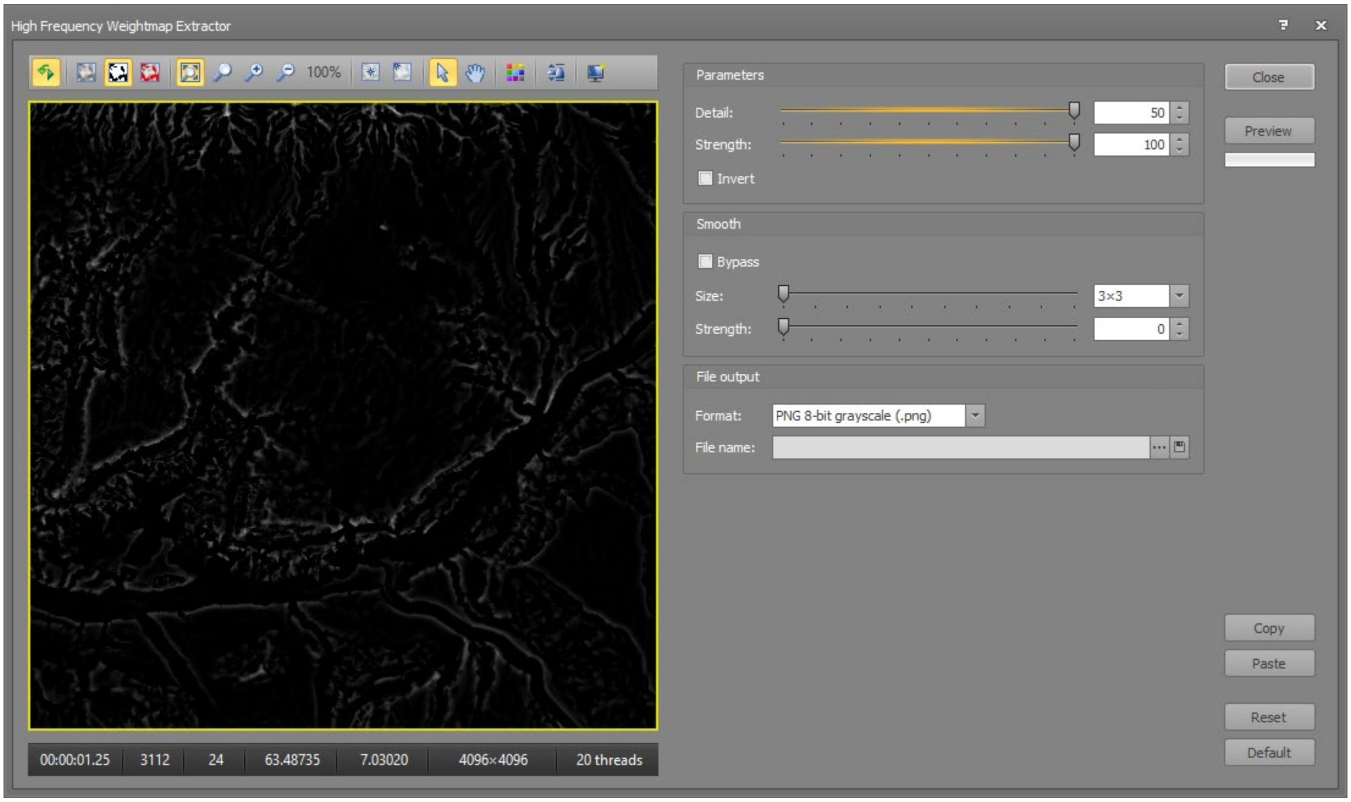
Invert: Invert the mask.

Notes

This function requires 1 additional datamap memory allocation for the mask.

Weightmap: High Frequency

Extract mask information based on the high frequency data in the datamap.



Parameters Group

Detail: The resolution of the gaussian filter.

Strength: The strength of the gaussian filter.

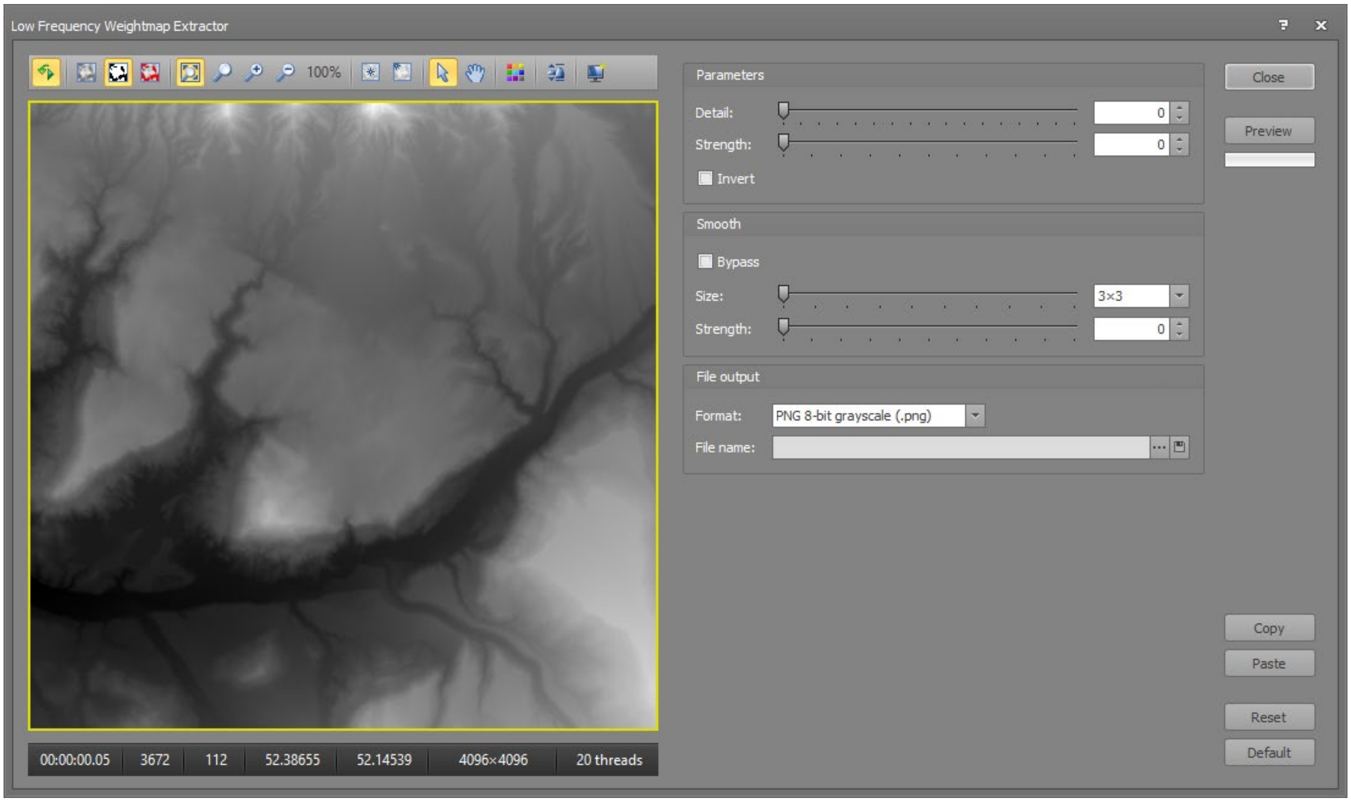
Invert: Invert the mask.

Notes

This function requires 1 additional datamap memory allocation for the mask.

Weightmap: Low Frequency

Extract mask information based on the low frequency data in the datamap.



Parameters Group

Detail: The resolution of the gaussian filter.

Strength: The strength of the gaussian filter.

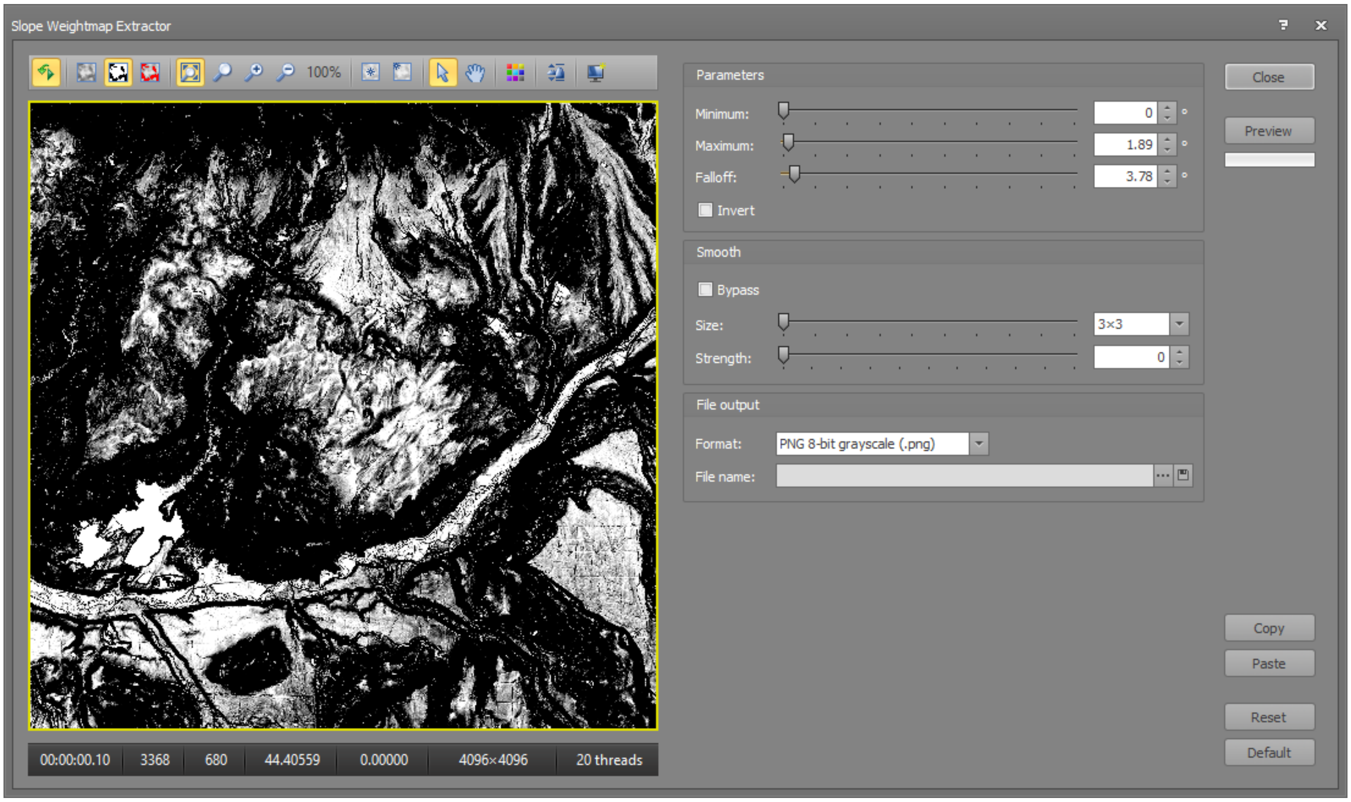
Invert: Invert the mask.

Notes

This function requires 1 additional datamap memory allocation for the mask.

Weightmap: Slope

Extract mask information based on the slope data.



Parameters

Minimum: The minimum slope angle value.

Maximum: The maximum slope angle value.

Falloff: The slope angle falloff value.

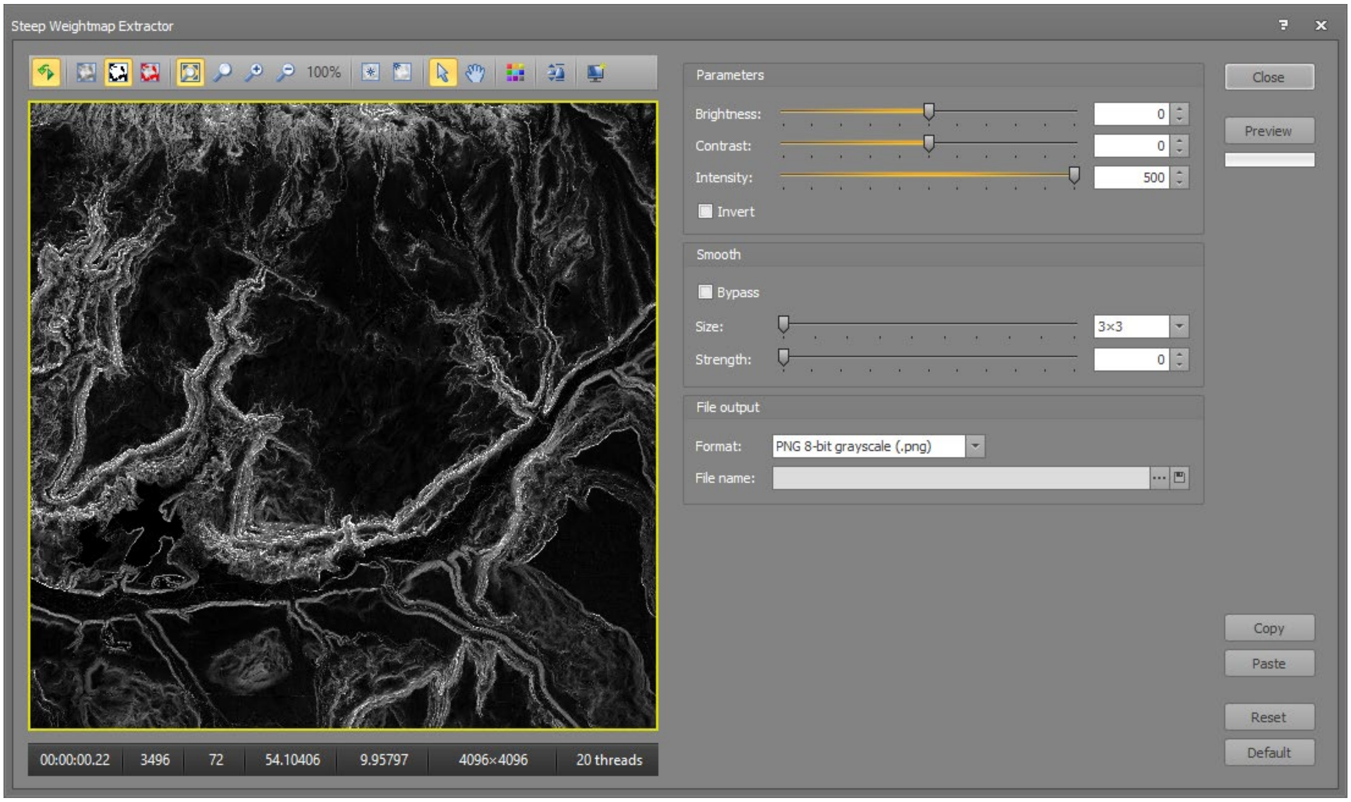
Invert Invert the mask.

Notes

This function requires 1 additional datamap memory allocation for the mask.

Weightmap: Steep

Extract mask information based on the datamap cell steepness.



Parameters Group

Brightness: Adjust the mask exposure brightness.

Contrast: Adjust the mask exposure contrast.

Intensity: Adjust the mask exposure intensity.

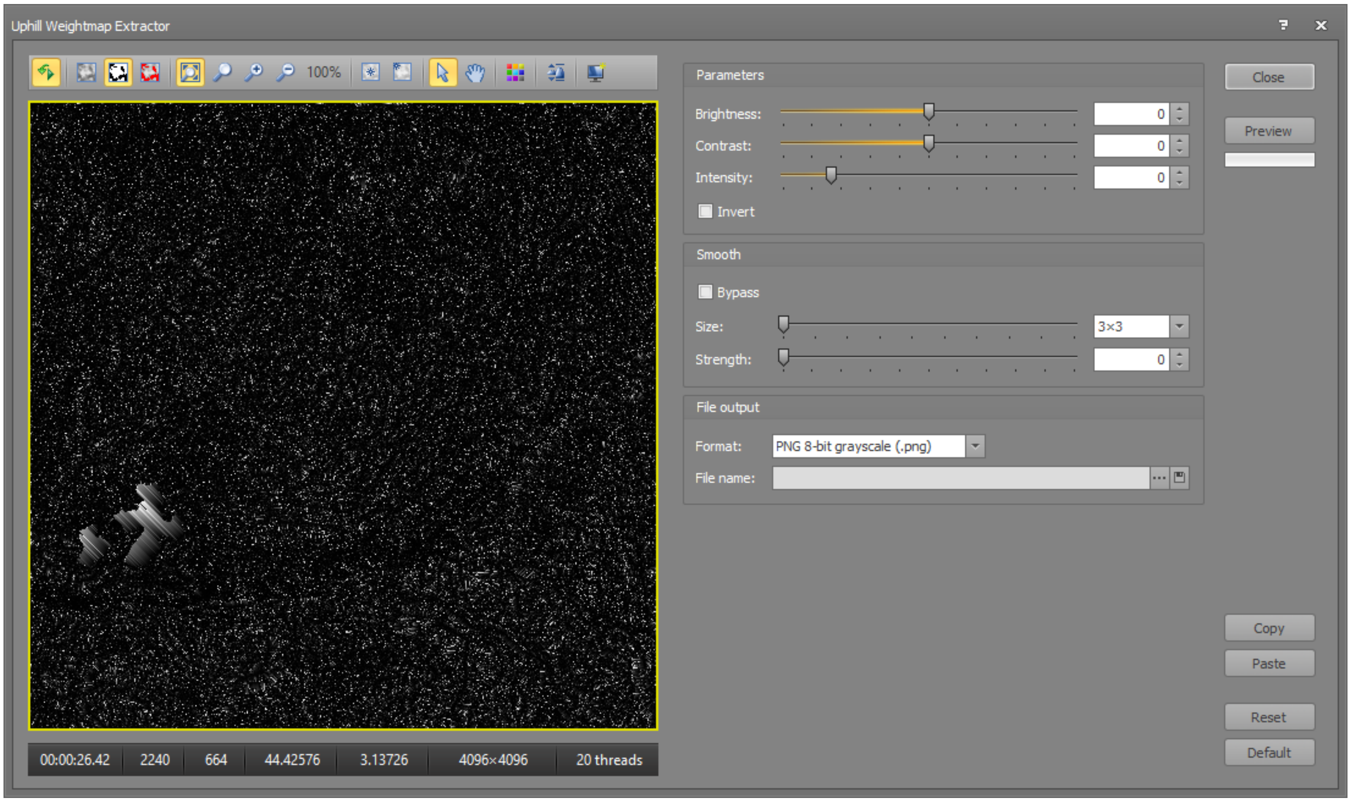
Invert: Invert the mask.

Notes

This function requires 1 additional datamap memory allocation for the mask.

Weightmap: Uphill

Extract mask information based on the datamap cell uphill traversal.



Parameters Group

Brightness: Adjust the mask exposure brightness.

Contrast: Adjust the mask exposure contrast.

Intensity: Adjust the mask exposure intensity.

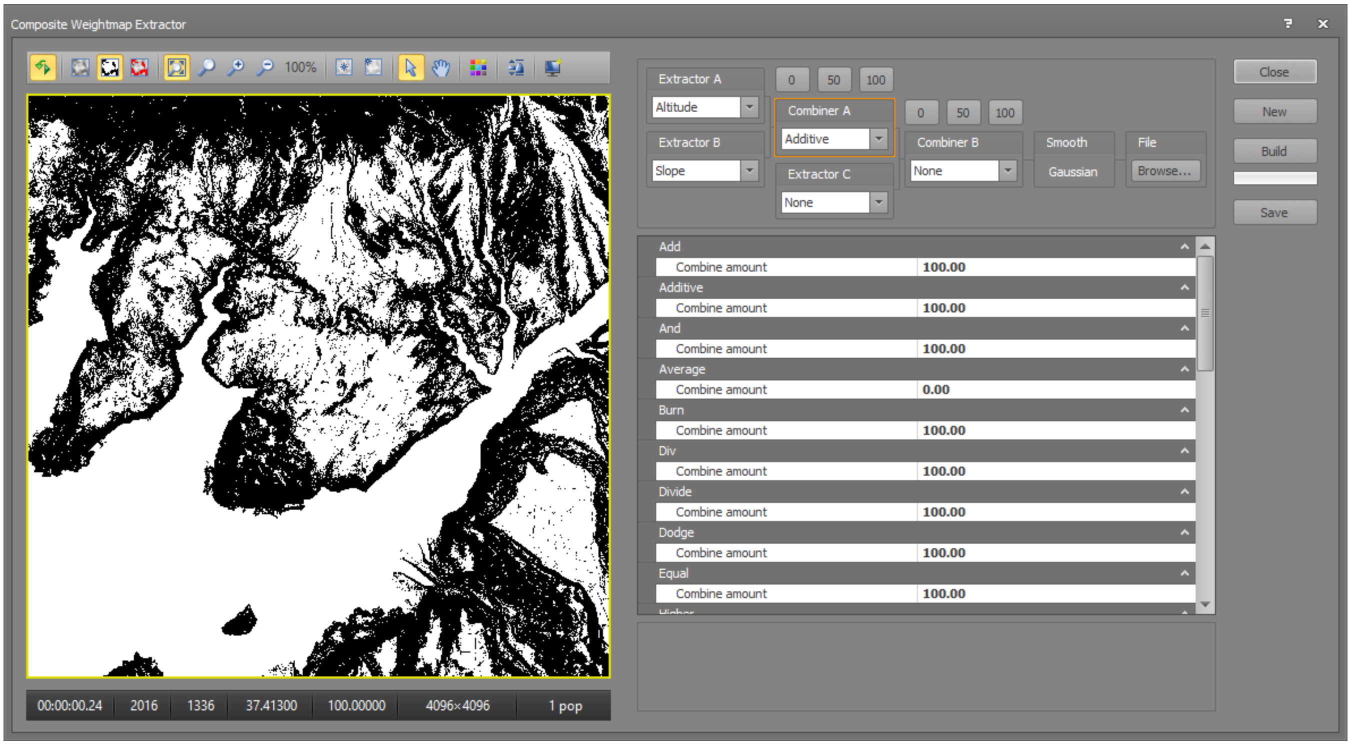
Invert: Invert the mask.

Notes

This function requires 1 additional datamap memory allocation for the mask.

Weightmap: Composite

Extract mask information based on the combination of up to three weightmap extractors.



Extractor A: Weightmap extractor A.

Extractor B: Weightmap extractor B.

0/50/100: Set the combiner output values.

Combiner A: The algorithm used to combine extractor A and B.

Extractor C: Weightmap extractor C.

0/50/100: Set the combiner output values.

Combiner B: The algorithm used to combine extractor A:B and C.

Smooth: The mask smoothing.

File: The file to save the weightmap as.

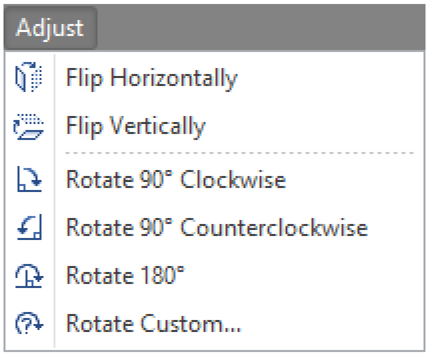
Grid: Adjust the extractor and combiner properties.

Notes

This function requires 1 additional datamap memory allocation for each mask.

Devices Adjust

The Adjust menu contains devices that modify the heightmap or mask datamap.



Adjust: Flip Horizontally

Flips the datamap along the horizontal axis.
This function occurs immediately with no options or settings.

Notes

This function requires 1 additional datamap memory allocation.

Adjust: Flip Vertically

Flips the datamap along the vertical axis.
This function occurs immediately with no options or settings.

Notes

This function requires 1 additional datamap memory allocation.

Adjust: Rotate 90° Clockwise

Rotates the datamap 90 degrees clockwise.
This function occurs immediately with no options or settings.

Notes

This function requires 1 additional datamap memory allocation.

Adjust: Rotate 90° Counterclockwise

Rotates the datamap 90 degrees counterclockwise.
This function occurs immediately with no options or settings.

Notes

This function requires 1 additional datamap memory allocation.

Adjust: Rotate 180°

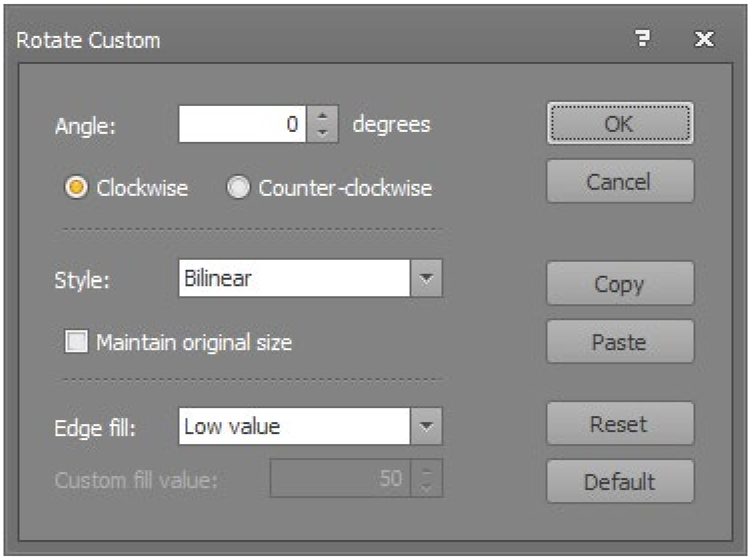
Rotates the datamap 180 degrees.
This function occurs immediately with no options or settings.

Notes

This function requires 1 additional datamap memory allocation.

Adjust: Rotate Custom

Rotates the datamap by a custom number of degrees, with additional options.
The rotation function features a high-precision accuracy rotation algorithm.



Angle:	Specify the rotation angle in degrees. The valid range is -360.00 to 360.00.
Clockwise:	The angle degrees are specified in the clockwise direction.
Counter-clockwise:	The angle degrees are specified in the counter-clockwise direction.
Style:	The rotation algorithm style. This affects the rotation quality. - Nearest Neighbor = fast nearest-neighbor. - Bilinear = high-quality bilinear.
Maintain original size:	Crop the rotated data to maintain the same dimensions as the original.
Edge fill:	The method used to fill the edges around the rotation. - Minimum = the heightmap minimum altitude. - Center = the heightmap center altitude. - Maximum = the heightmap maximum altitude. - Low value = the current heightmap low altitude. - Middle value = the current heightmap middle altitude. - High value = the current heightmap high altitude. - Custom = the altitude value specified in the Custom fill value control. - Duplicate = duplicate the value around the edge. - Fold = fold the heightmap tiled around the edge. - Mirror = mirror the heightmap tiled around the edge. - Wrap = wrap the heightmap tiled around the edge.
Custom fill value:	The custom edge fill altitude value to fill the edges around the rotated data.

Notes

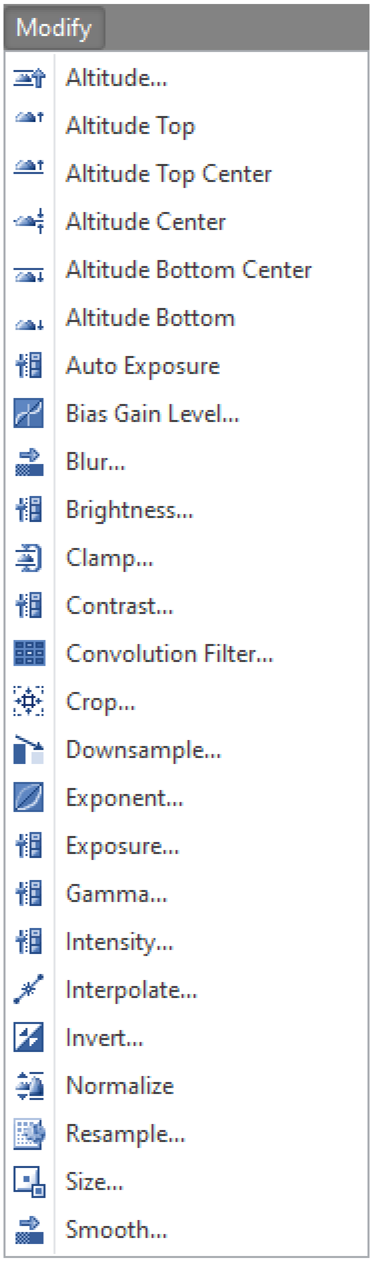
This function does not fully and precisely preserve the original altitude data in its entirety.

This function requires 1 additional datamap memory allocation.

Rotation by 0 degrees and 360 degrees is no rotation, and simply returns with no change.
Rotation by 90, 180 and 270 degrees should be accomplished using the Rotate 90 and 180 functions instead.
The Rotate Custom dialog “short-circuits” the 90, 180, 270 operation and calls the appropriate rotation function.

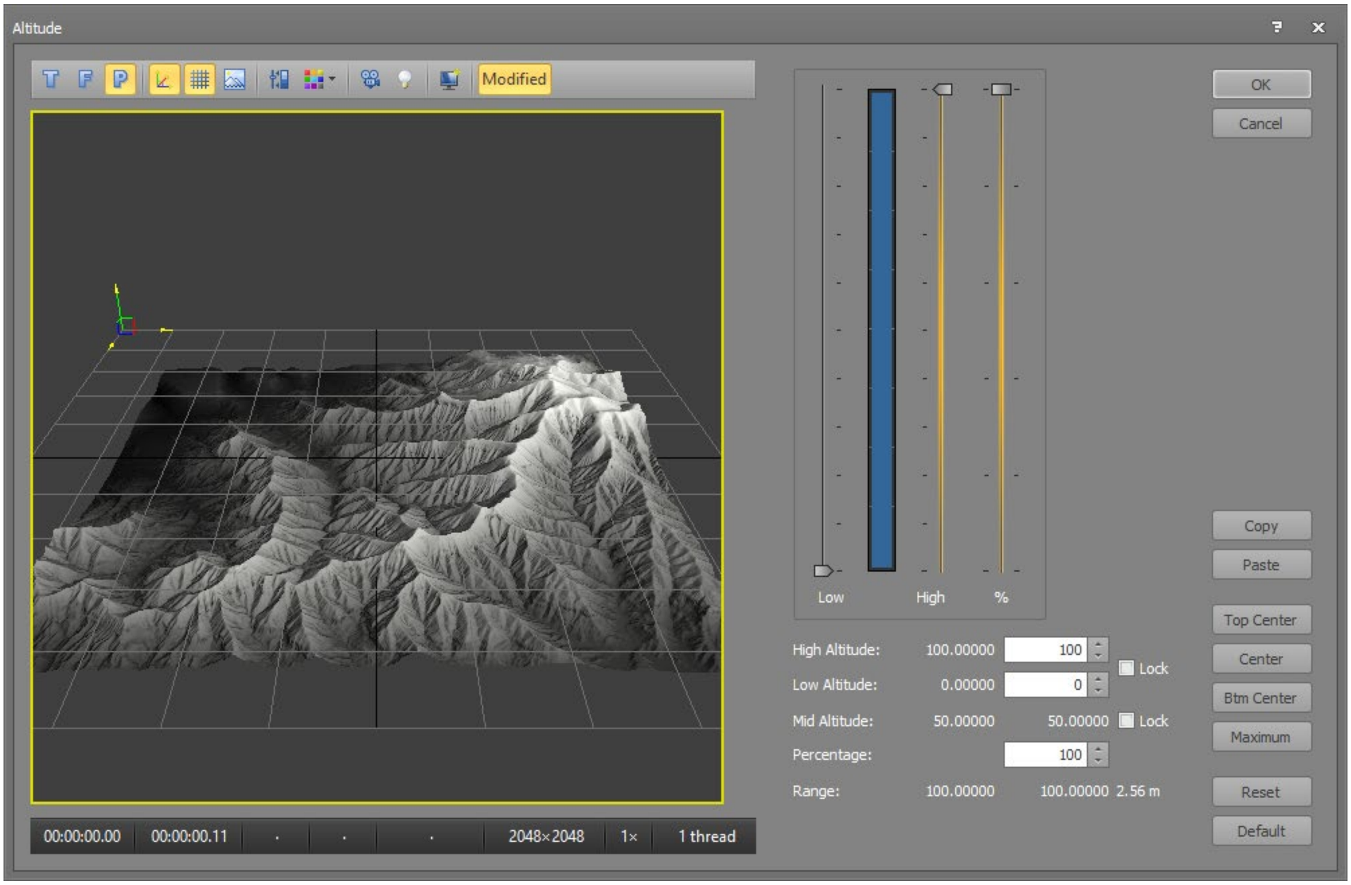
Devices Modify

The Modify menu contains devices that modify the heightmap or mask datamap.



Modify: Altitude

Allows for fine adjustments to the datamap range and altitude.



High Altitude:	Specify the high altitude value. High must be greater than Mid.
Low Altitude:	Specify the low altitude value. Low must be less than Mid.
Mid Altitude :	Specify the mid altitude value.
Percentage:	Specify the altitude range as a percentage of the original.
Range:	Displays the original and current altitude range and the range in real world units.
High/Low Lock:	Select this to lock the high and low value range difference.
Mid Lock:	Select this to lock the mid value, changes to high or low values are mirrored.
Low slider	Changes the low altitude value.
Altitude bar graph	Displays the original altitude range in gray and the current altitude range in blue.
High slider	Changes the high altitude value.
% percent slider	Changes the altitude range as a percentage of the original range.
Top Center	Move the entire heightmap to the top-center position.
Center	Move the entire heightmap to the center mid value of 50.0.
Btm Center	Move the entire heightmap to the bottom-center position.
Maximum	Change the heightmap range to the maximum range of low 0.0 through high 100.0.

Notes

Changes to the altitude range does not preserve the original altitude data.
An altitude range move causes no loss in data resolution.
An altitude compression may cause a lossy change in data resolution.

This device requires 0 additional datamap memory allocations.

Modify: Altitude Top

Moves the datamap data to the top of its altitude range.

This function occurs immediately with no options or settings.

Notes

Changes to the altitude range does not preserve the original altitude data.
An altitude range move causes no loss in data resolution.
An altitude compression may cause a lossy change in data resolution.

This function requires 0 additional datamap memory allocations.

Modify: Altitude Top-Center

Moves the datamap data to the top-center of its altitude range.

This function occurs immediately with no options or settings.

Notes

Changes to the altitude range does not preserve the original altitude data.
An altitude range move causes no loss in data resolution.
An altitude compression may cause a lossy change in data resolution.

This function requires 0 additional datamap memory allocations.

Modify: Altitude Center

Moves the ddatamap data to the center of its altitude range.

This function occurs immediately with no options or settings.

Notes

Changes to the altitude range does not preserve the original altitude data.
An altitude range move causes no loss in data resolution.
An altitude compression may cause a lossy change in data resolution.

This function requires 0 additional datamap memory allocations.

Modify: Altitude Bottom-Center

Moves the datamap data to the bottom center of its altitude range.

This function occurs immediately with no options or settings.

Notes

Changes to the altitude range does not preserve the original altitude data.
An altitude range move causes no loss in data resolution.
An altitude compression may cause a lossy change in data resolution.

This function requires 0 additional datamap memory allocations.

Modify: Altitude Bottom

Moves the datamap data to the bottom of its altitude range.

This function occurs immediately with no options or settings.

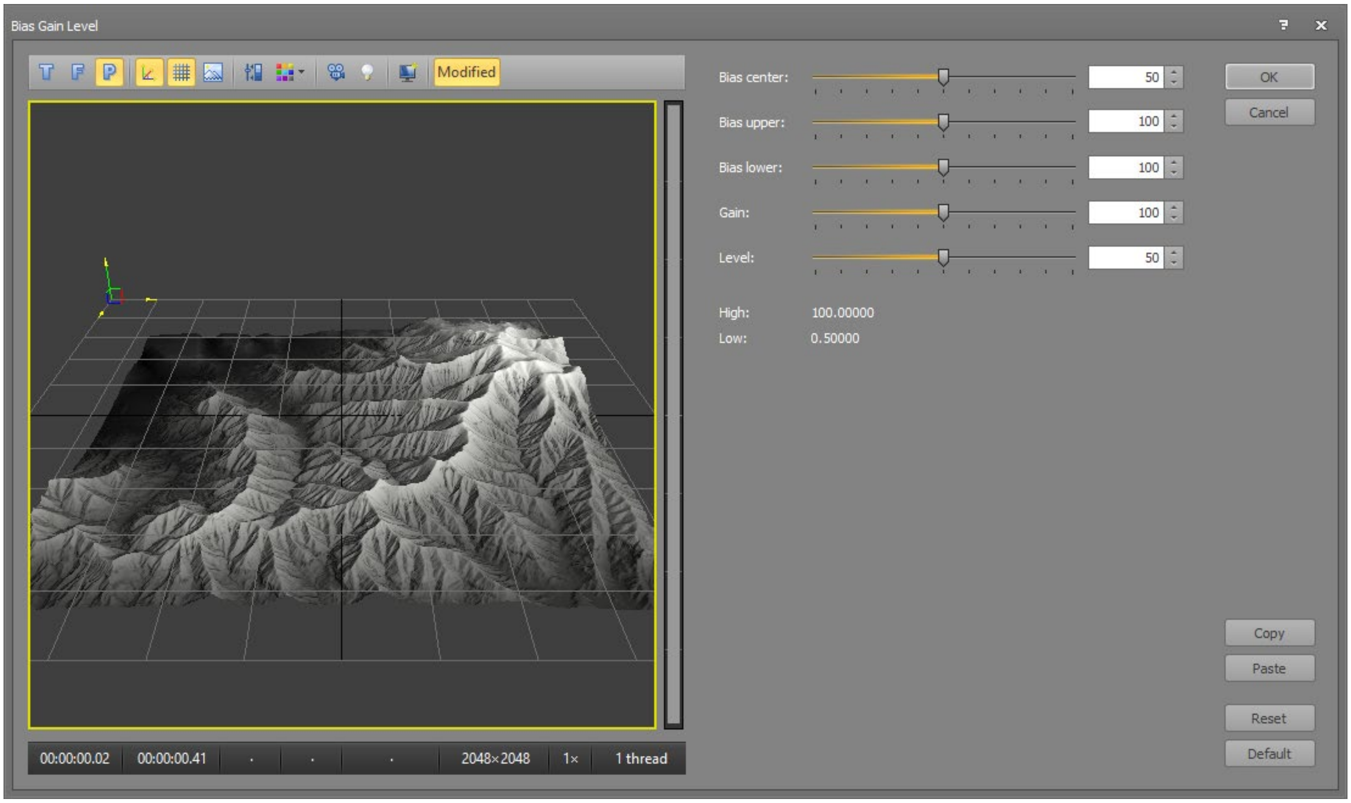
Notes

Changes to the altitude range does not preserve the original altitude data.
An altitude range move causes no loss in data resolution.
An altitude compression may cause a lossy change in data resolution.

This function requires 0 additional datamap memory allocations.

Modify: Bias Gain Level

Modifies the datamap data along a bias curve, and gain and level values.



Bias center: Specify the center altitude value that the bias curve will modify around.

Bias upper: Specify the bias multiplier to the altitude values higher than Bias center. This can be used to effectively increase mountain height for example.

Bias lower: Specify the bias multiplier to the altitude values lower than Bias center. This can be used to effectively increase ocean depth for example.

Gain: Specify the altitude range gain as a percentage of the original.

Level: Specify the center altitude level.

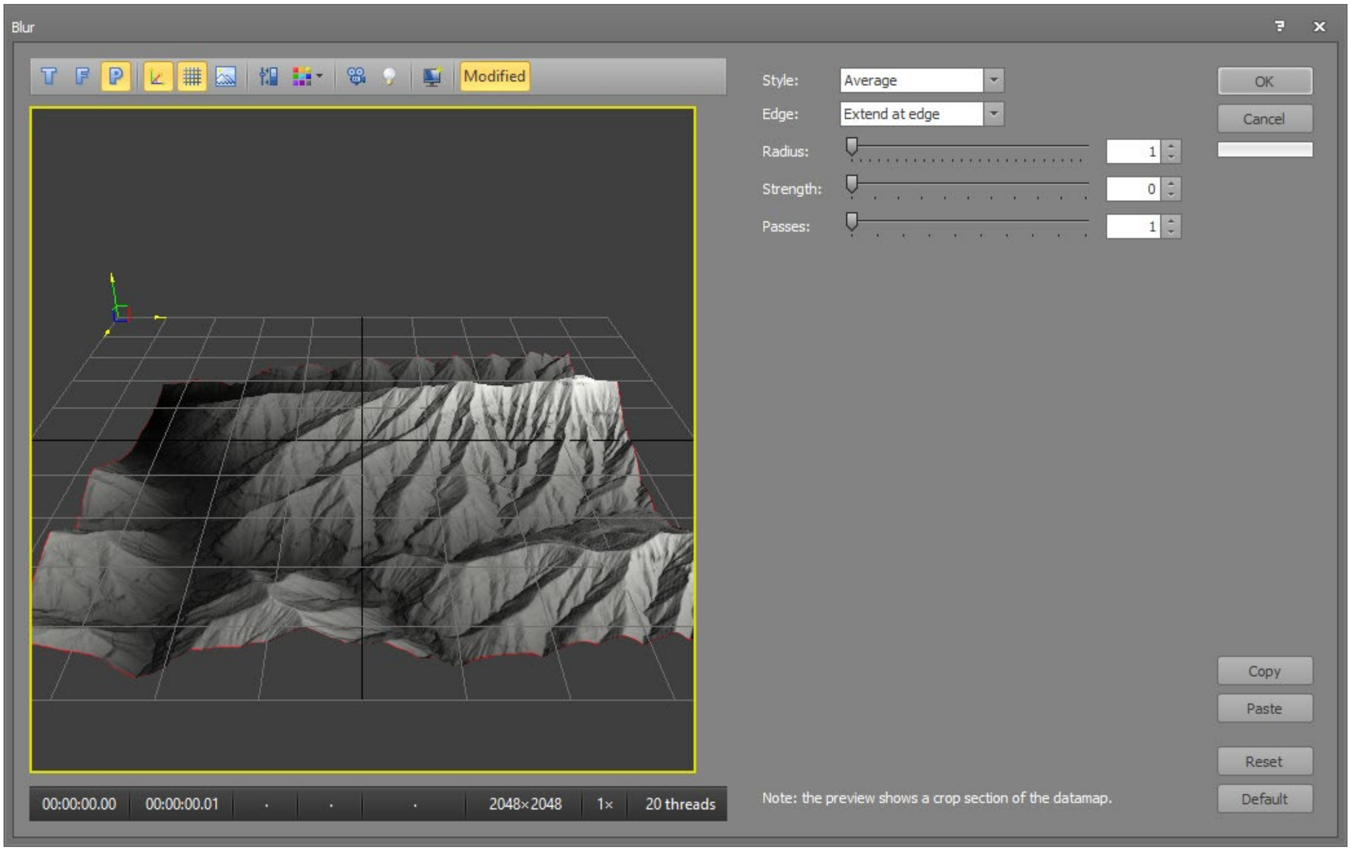
Notes

Changes to the altitude range does not preserve the original altitude data.
An altitude compression may cause a lossy change in data resolution.

This function requires 0 additional datamap memory allocations.

Modify: Blur

Smooths the datamap using a gaussian blur kernel.



Style:	The blur style. - Average - Gaussian - Radial
Edge:	The method for managing the gaussian kernel values along the datamap edges. - Extend at edge - Wrap at edge
Radius:	The gaussian kernel radius in pixels.
Strength:	The gaussian blur strength.
Passes:	The number of times to execute the blur.

Notes

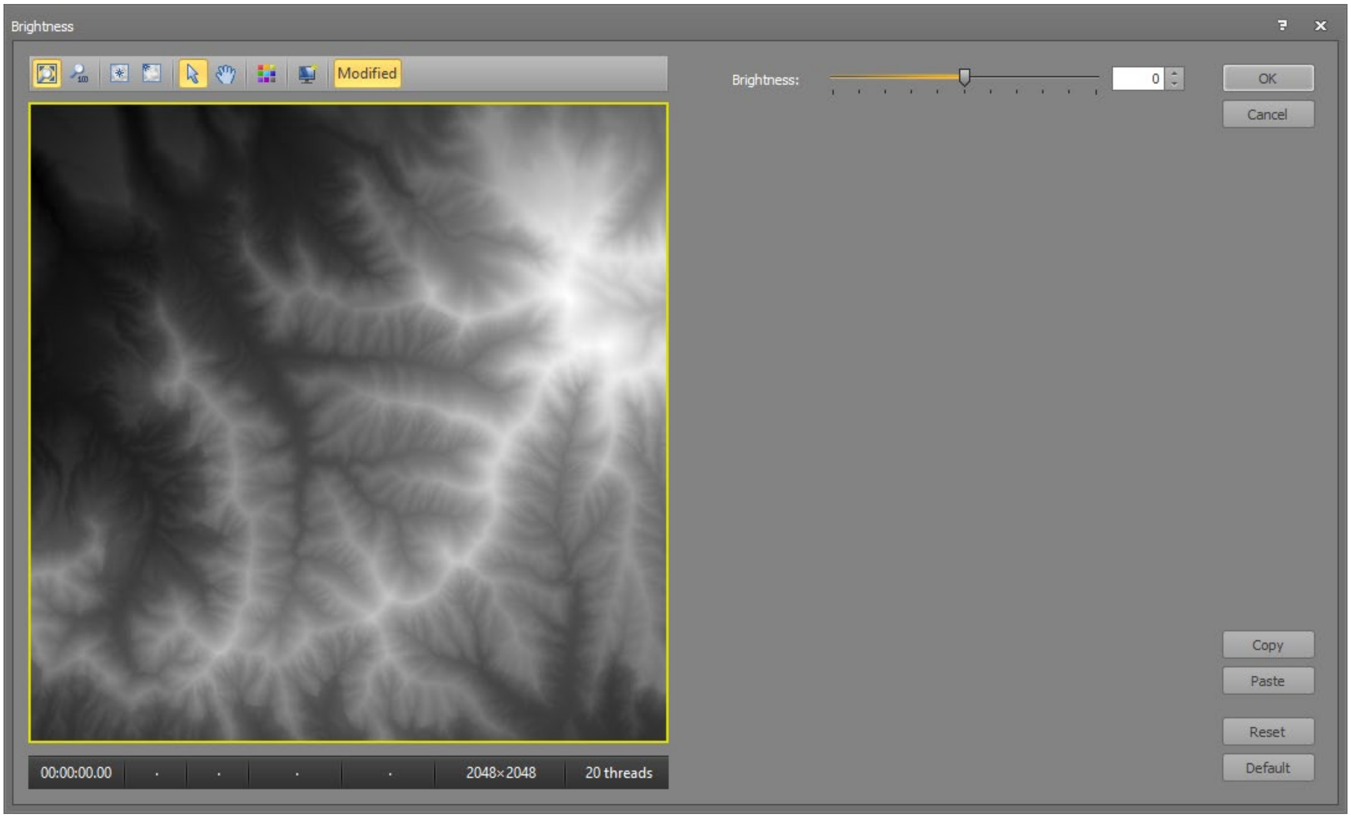
This device does not preserve the original altitude data.

This device requires 1 additional datamap memory allocation.

The Blur Device uses a 2-Pass 1D Kernel, 1-Pass horizontal and 1-Pass vertical.
This is for maximum performance. There may be slight visual anomalies on perfectly clean geometry along edges that are perfectly horizontal or vertical. This is usually not noticeable on heightmaps.
For a 1-Pass 2D Kernel blur method use the Smooth Device.

Modify: Brightness

Adjusts the exposure brightness of the datamap.



Brightness: The brightness value.

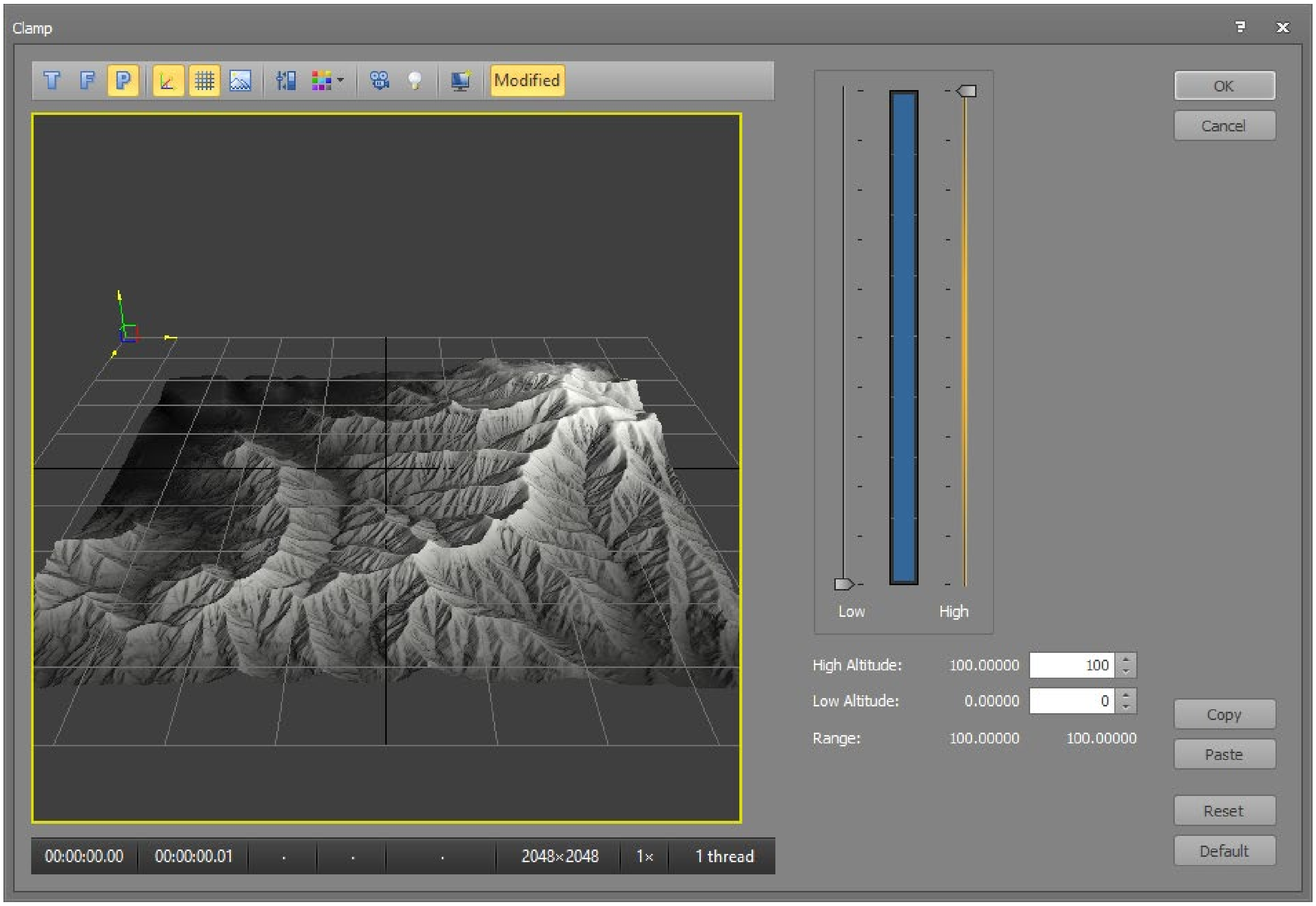
Notes

This device does not preserve the original altitude data.

This device requires 0 additional datamap memory allocations.

Modify: Clamp

Clamps the datamap altitude range within the specified high and low values.
The datamap data is hard-clipped at the clamp values.



Low slider	Changes the low altitude clamp value.
Altitude bar graph	Displays the original altitude range in gray and the clamp range in blue.
High slider	Changes the high altitude clamp value.
High Altitude:	Specify the high altitude clamp value. High must be greater than Low.
Low Altitude:	Specify the low altitude clamp value. Low must be less than High.
Range:	Displays the original and current altitude range.

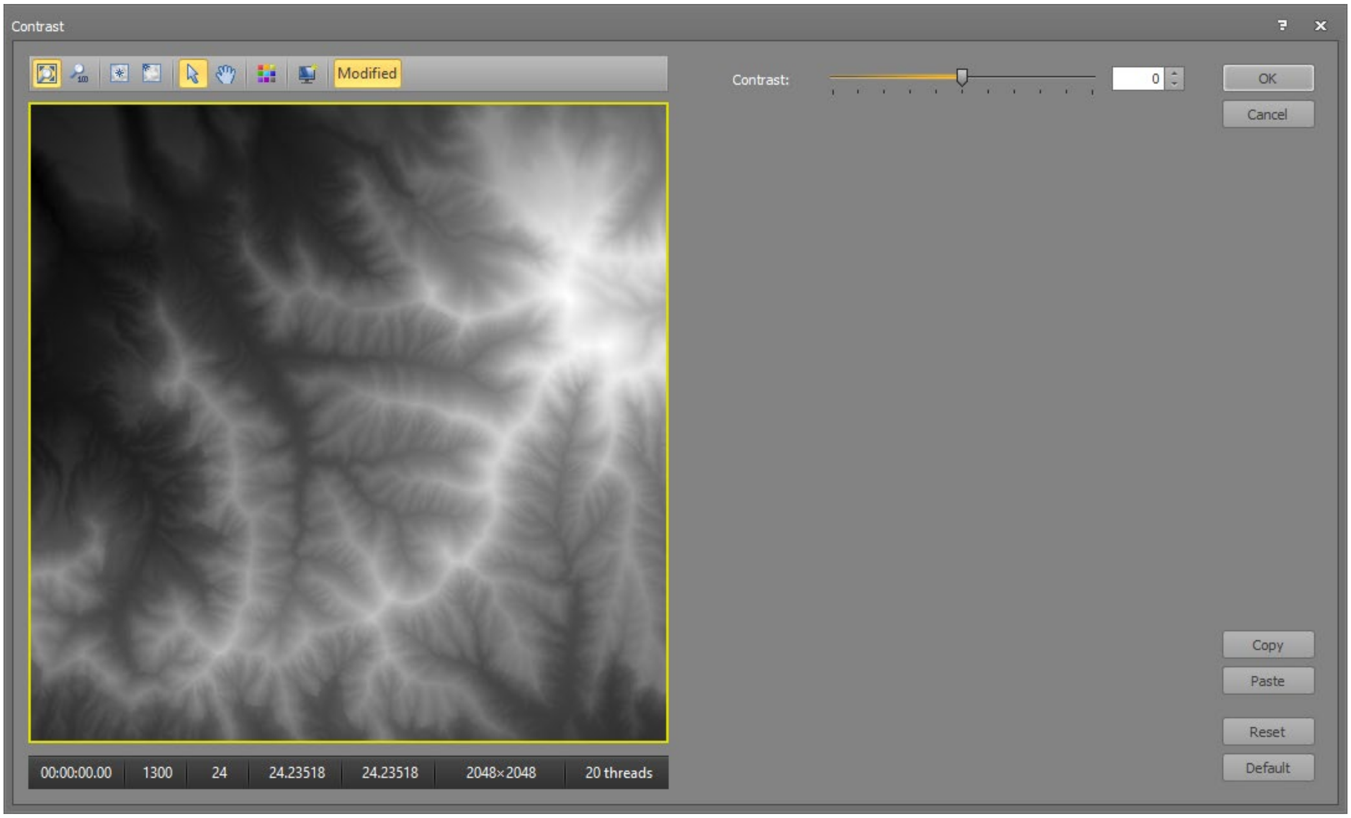
Notes

This function does not preserve the original altitude data.

This function requires 0 additional heightmap memory allocations.

Modify: Contrast

Adjusts the exposure contrast of the datamap.



Contrast: The contrast value.

Notes

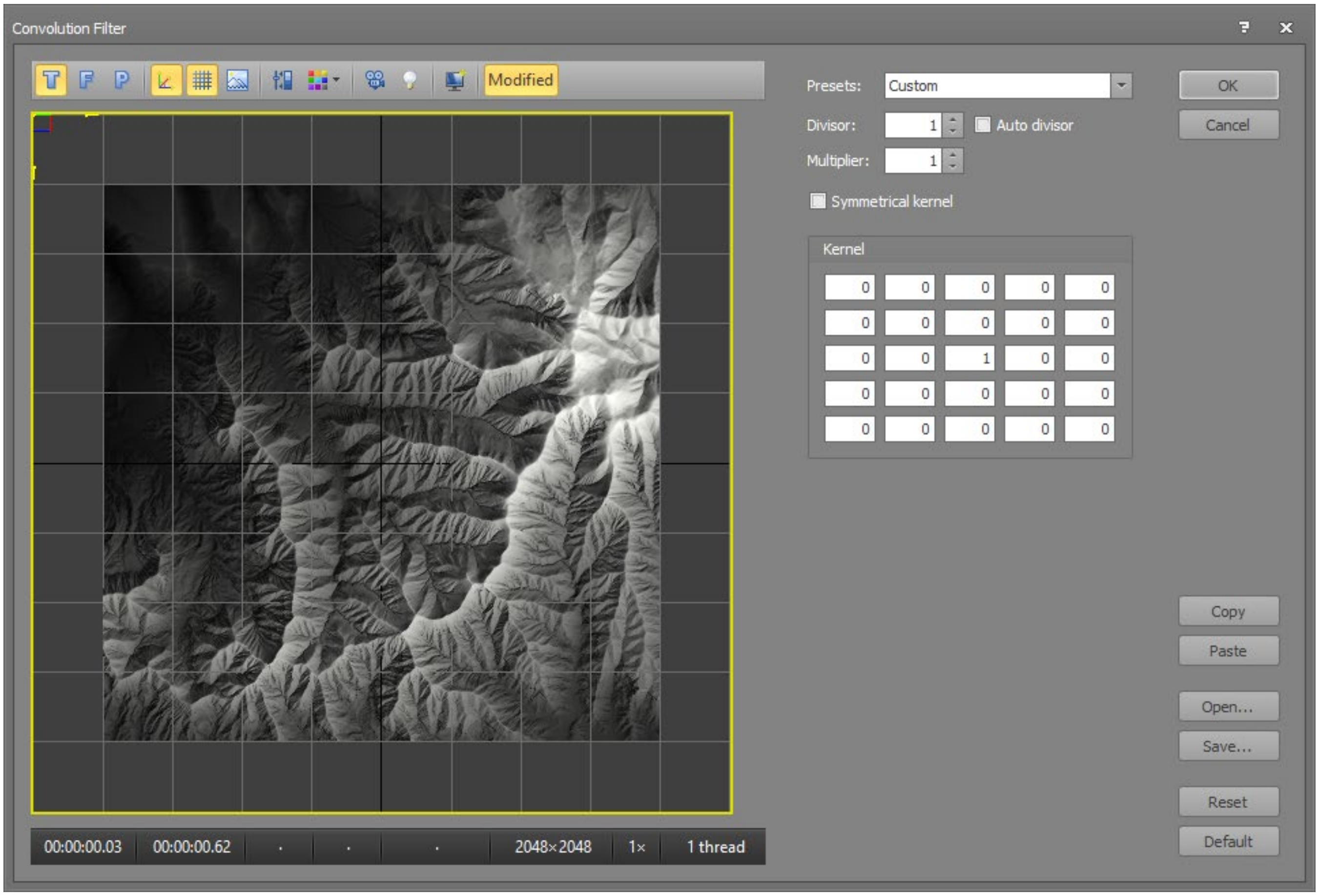
This device does not preserve the original altitude data.

This device requires 0 additional datamap memory allocations.

Modify: Convolution Filter

Performs a user-defined fixed-window convolution filter algorithm over the datamap data.

Convolution filters can provide a wide variety of adjustments to datamap data including smoothing, sharpening, edge enhancing, smear offsetting, 3D embossing, jittering, and a wide variety of other data modifications.



Presets:	Filter using these common preset settings.
Divisor:	Specify the kernel divisor, which is typically the sum of all of the Kernel values.
Auto divisor:	Automatically calculate the proper divisor based on the Kernel values.
Multiplier:	A multiplier applied to the Kernel as an offset, either darkening or brightening the result.
Symmetrical:	The Kernel value entries are set to the same value symmetrically around the center pixel.
Kernel boxes	The weight multiplier for the center and outlying pixels.

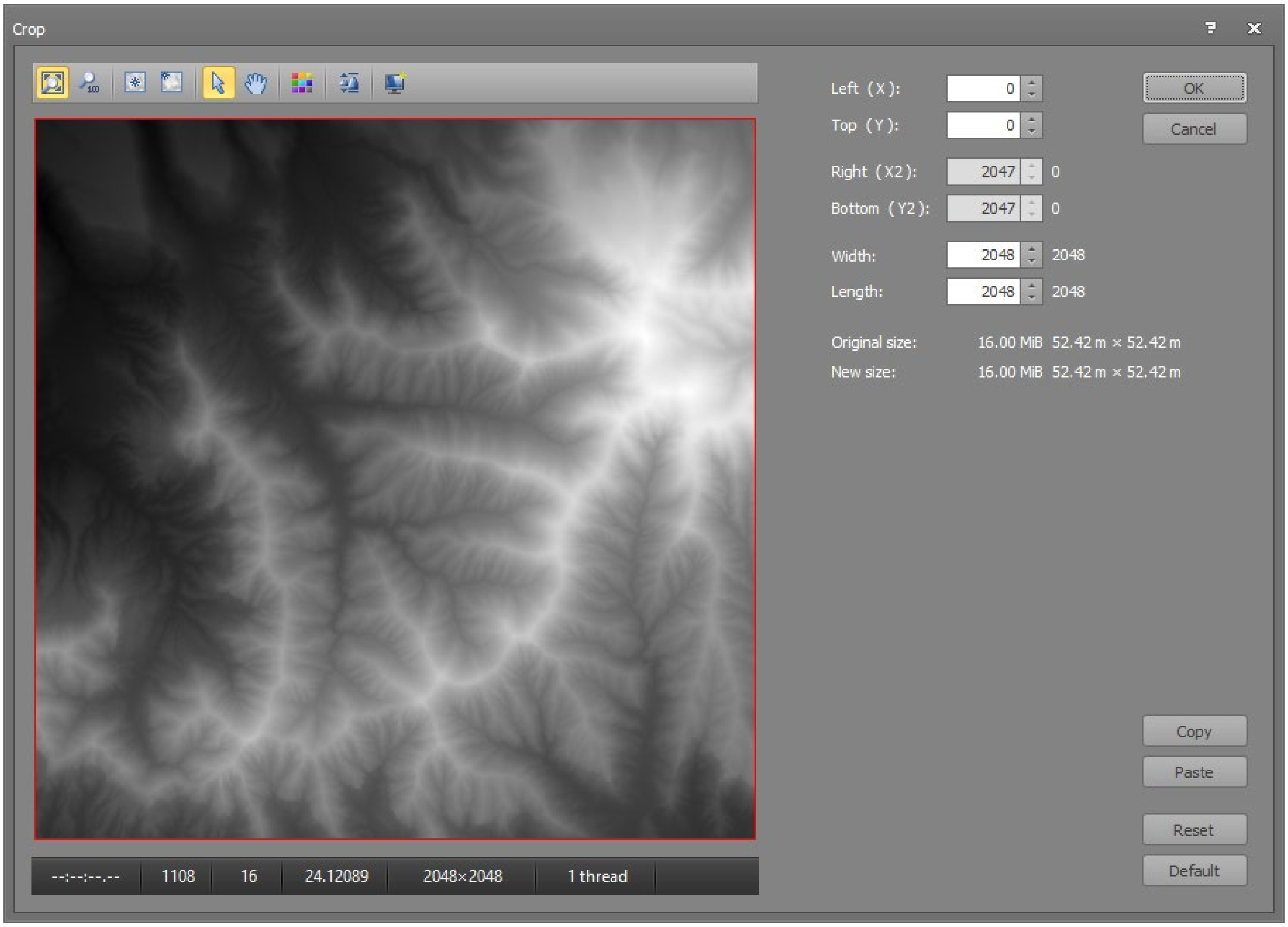
Notes

This function does not preserve the original altitude data.

This function requires 1 additional datamap memory allocation.

Modify: Crop

Crop the edges of the datamap to cut out a specific smaller area.



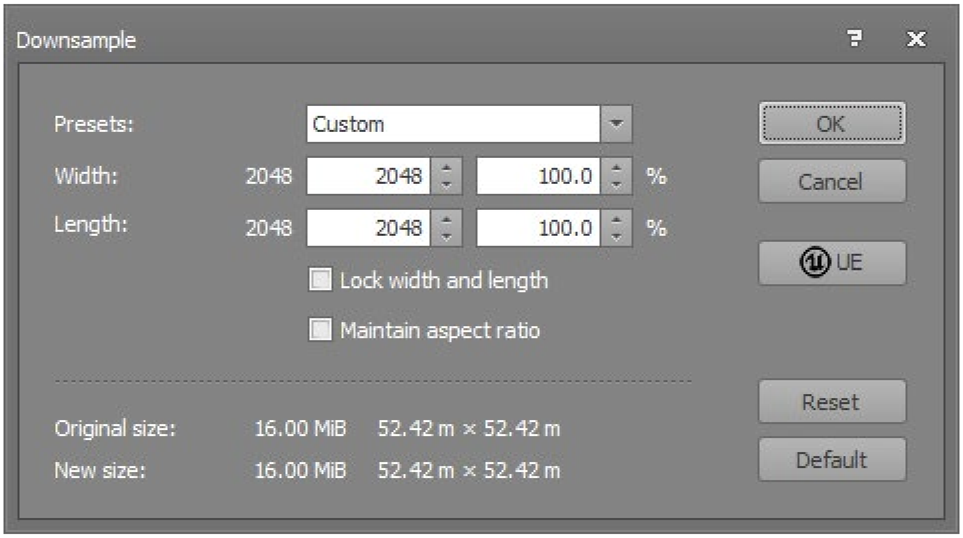
Left (X):	The left coordinate of the crop region.
Top (Y):	The top coordinate of the crop region.
Right (X2):	The right coordinate of the crop region. This value is read only and cannot be changed.
Bottom (Y2):	The bottom coordinate of the crop region. This value is read only and cannot be changed.
Width:	The width of the crop region.
Length:	The length of the crop region.

Notes

This function requires 1 additional heightmap memory allocation.

Modify: Downsample

Size the datamap smaller using a variable size window algorithm.



Presets:	Choose from preset smaller sizes.
Width:	The new datamap width.
Length:	The new datamap length.
Lock with and length:	Lock the width and length to the same value.
Maintain aspect ratio	Maintain the rectangular aspect ratio of the source datamap.

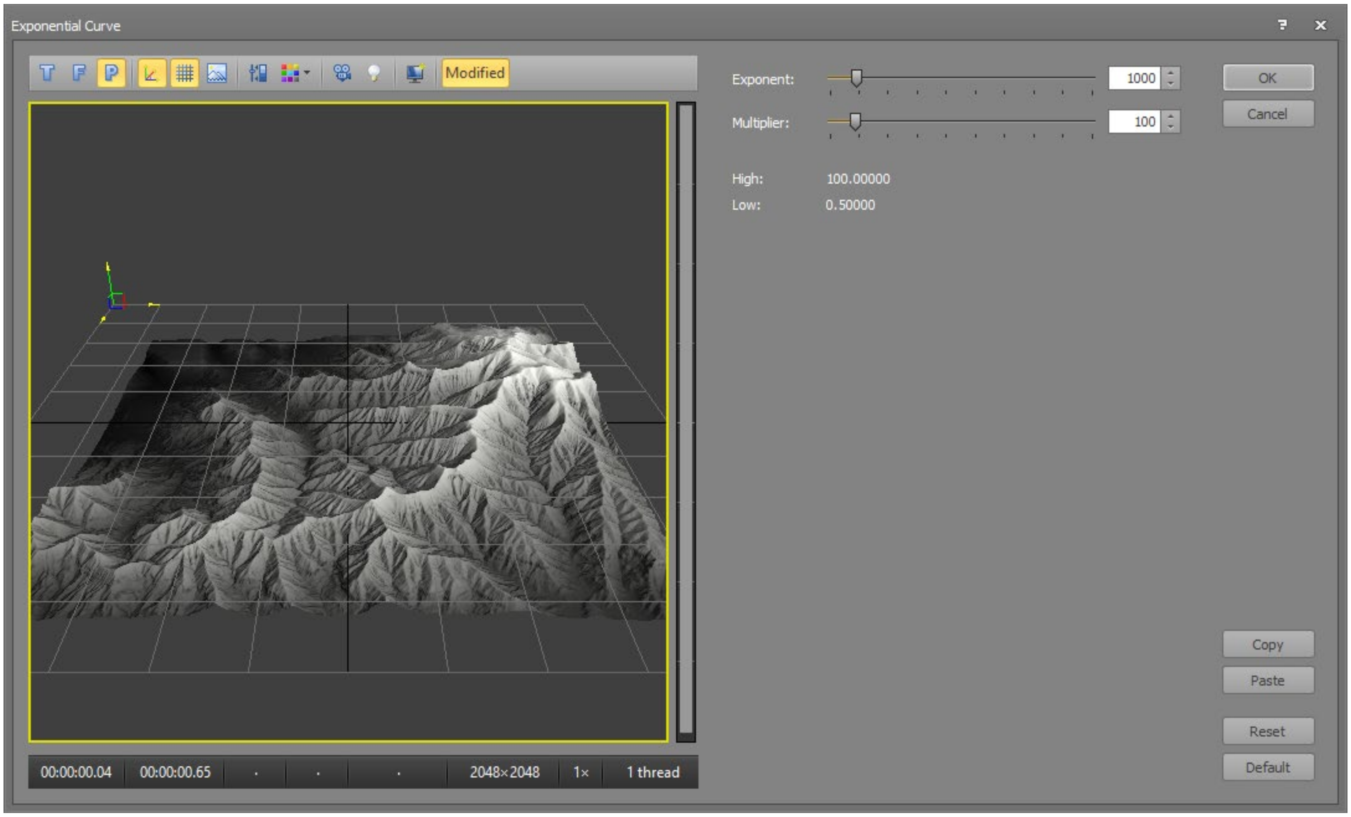
This dialog includes the Unreal Engine button if the Settings Dimensions set includes Unreal Engine.

Notes

This device requires 1 additional datamap memory allocation.

Modify: Exponent

Multiplies the datamap altitude data by the exponent value.



Exponent: The exponent value.
Multiplier: The multiplier value.

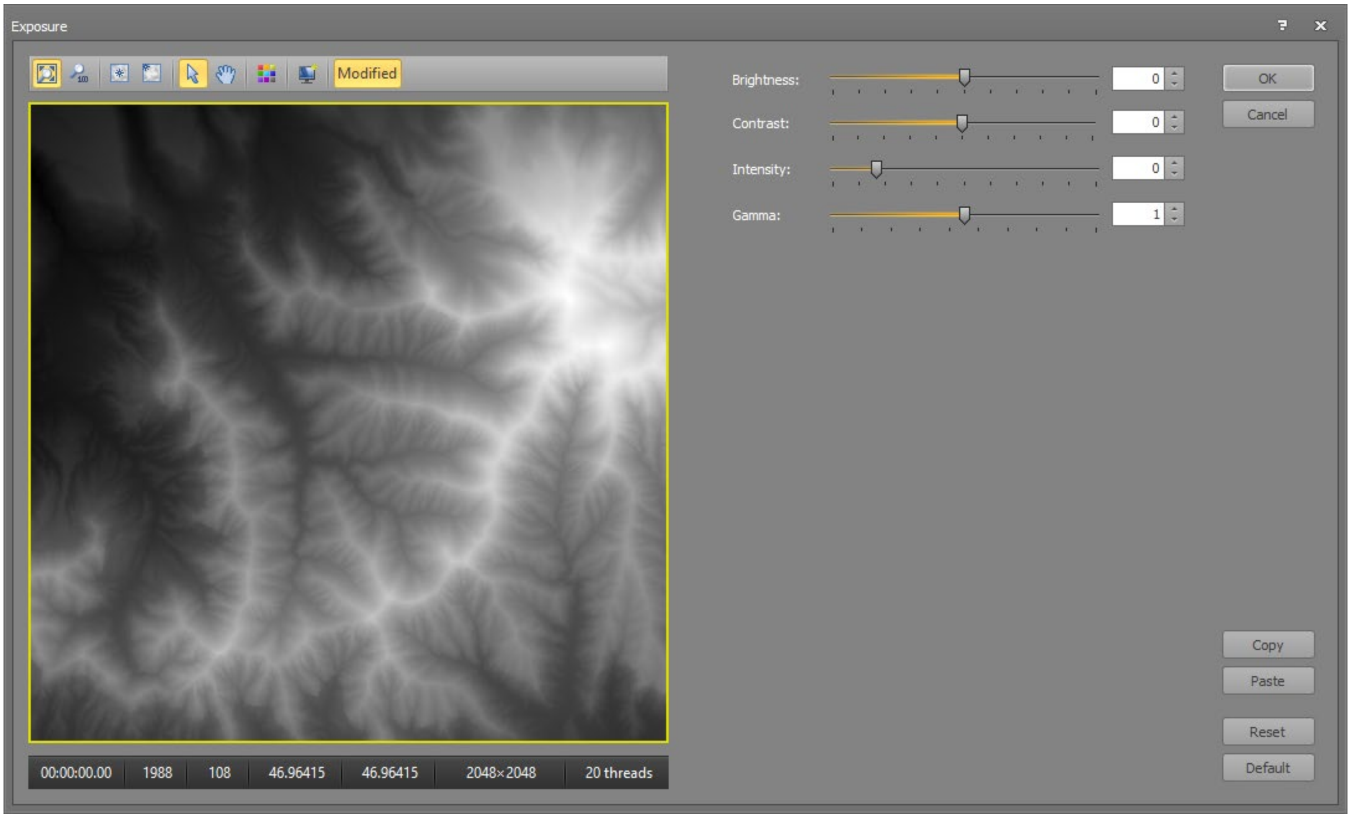
High: The altitude high value.
Low: The altitude low value.

Notes

This function requires 0 additional datamap memory allocation.

Modify: Exposure

Changes the Brightness, Contrast, Intensity and Gamma of a datamap.



Brightness:	Adjust the image brightness.	0 is no change.	The range is -100 to +100.
Contrast:	Adjust the image contrast.	0 is no change.	The range is -100 to +100.
Intensity:	Adjust the image intensity.	0 is no change.	The range is -100 to +100.
Gamma:	Adjust the image gamma.	1.00 is no change.	The range is 0.1 to 10.0.

Notes

This device does not preserve the original altitude data.

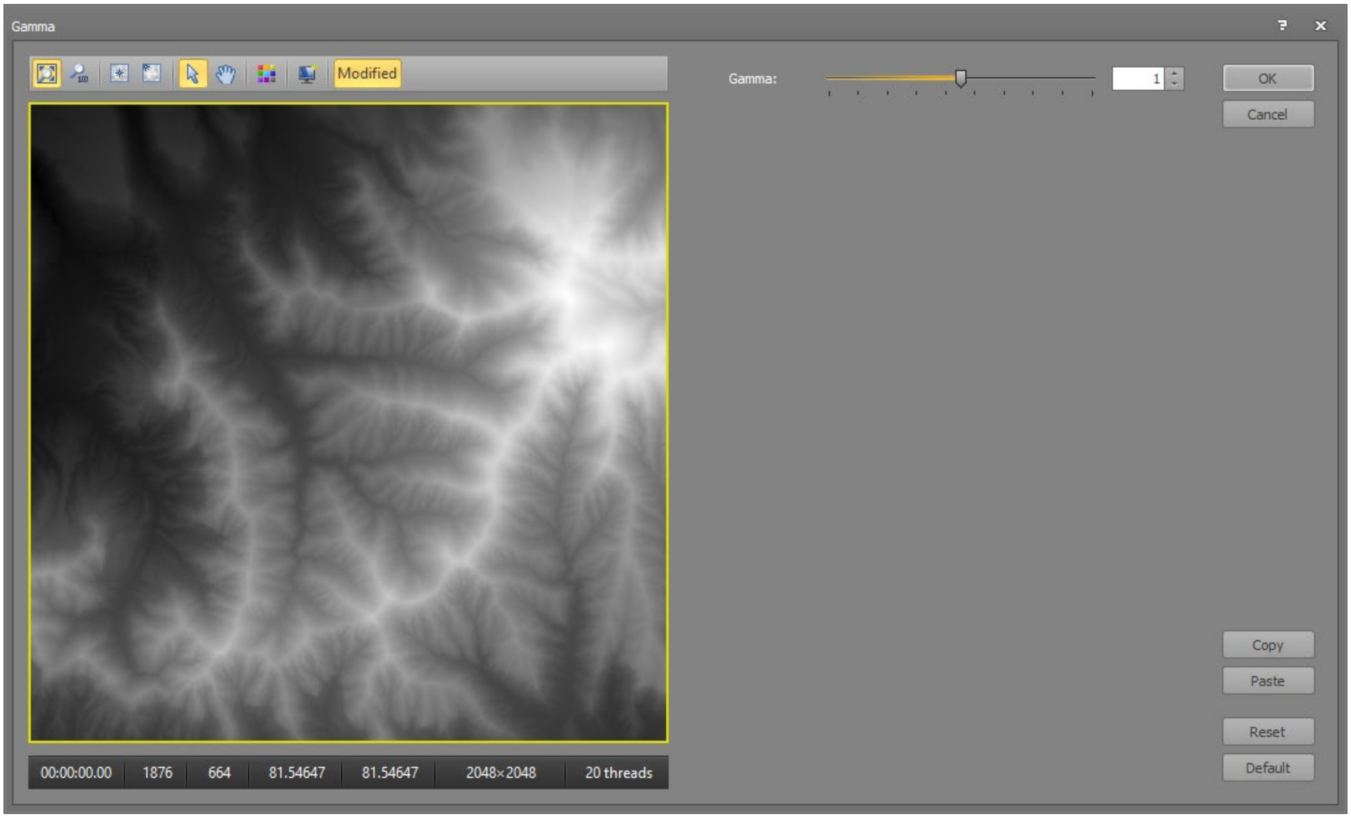
The Gamma function requires 400kb additional memory allocation.

Exposure adjustments are normally used on masks or weightmaps.

Intensity is a curve-weighted brightness that typically complements the Contrast adjustment.

Modify: Gamma

Adjust the exposure gamma of the datamap.



Gamma: The gamma value.

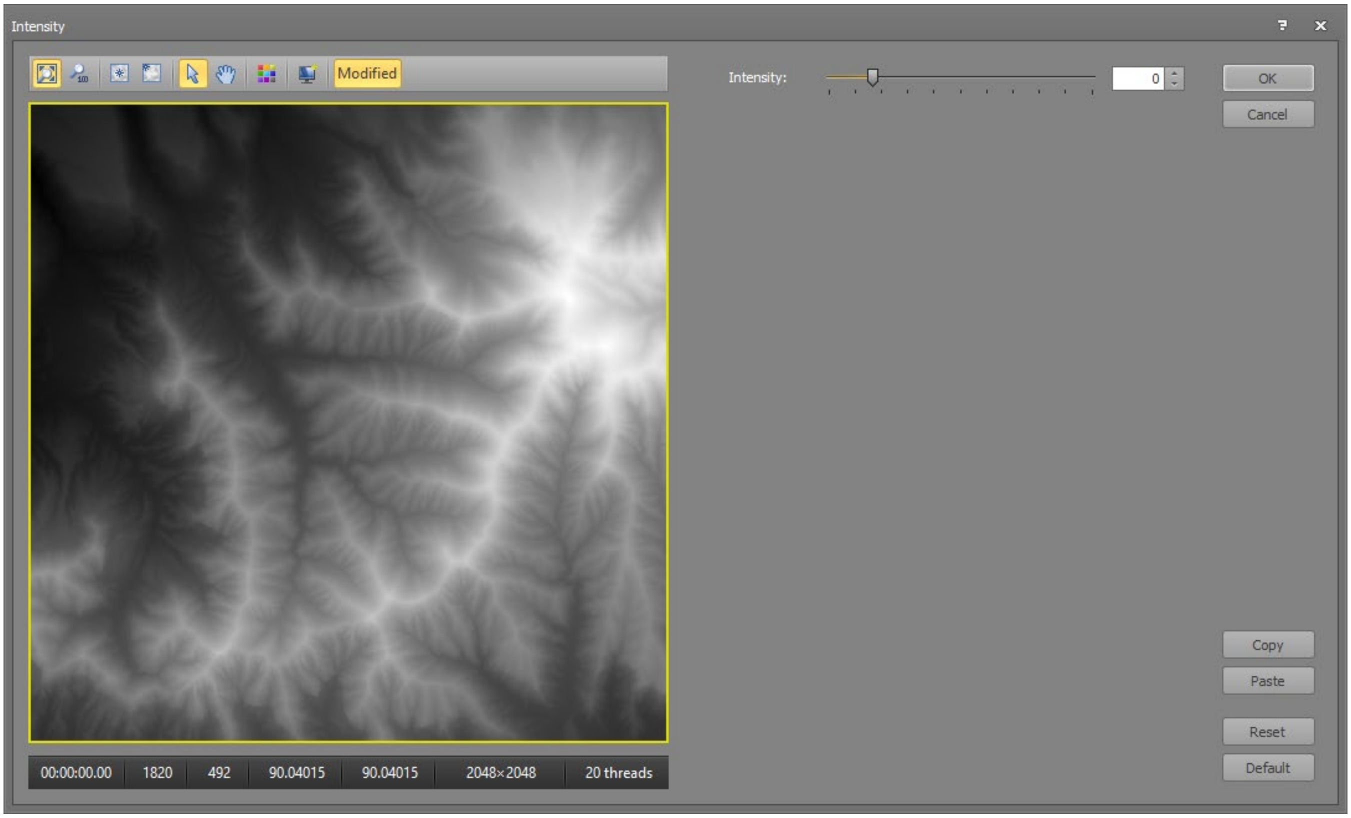
Notes

This device does not preserve the original altitude data.

This device requires 400kb additional memory allocation.

Modify: Intensity

Adjust the exposure intensity of the datamap.



Intensity: The intensity value.

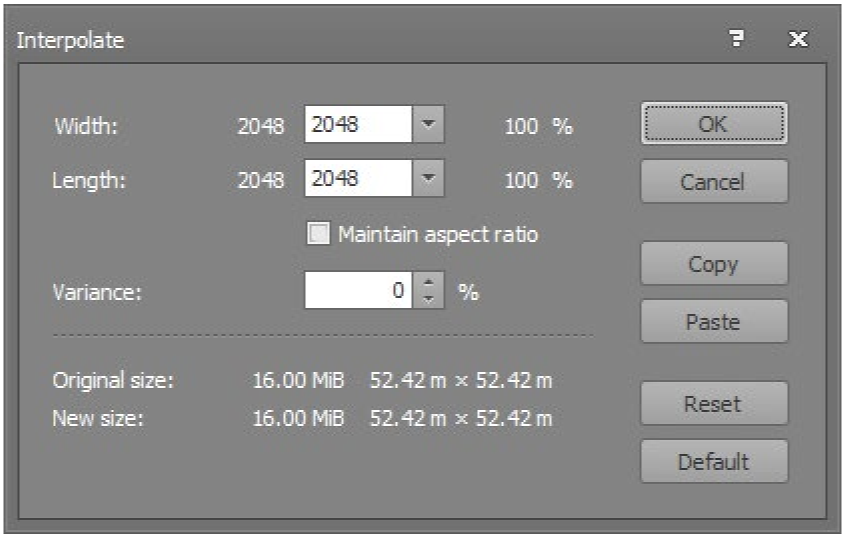
Notes

This device does not preserve the original altitude data.

This device requires 0 additional datamap memory allocations.

Modify: Interpolate

Increase the dimensions of the datamap using a linear interpolation algorithm.
Interpolation is different from Resample in that it only supports enlargement multiples such as 200%, 300%, 400%, 500%, etc. Interpolation retains all of the original altitude sample values and inserts "interpolated" altitude values to provide an increase in dimensions resolution while maintaining the exact original data.



Width:	The desired new width dimension. This can only be an integer multiple of the original.
Length:	The desired new length dimension. This can only be an integer multiple of the original.
Maintain aspect ratio:	Locks the width and length controls to maintain the same aspect ratio as the original.
Variance:	Applies a random variance to the interpolated altitude values placed between the original.
Original size:	Displays the original size information.
New size:	Displays the new size information.

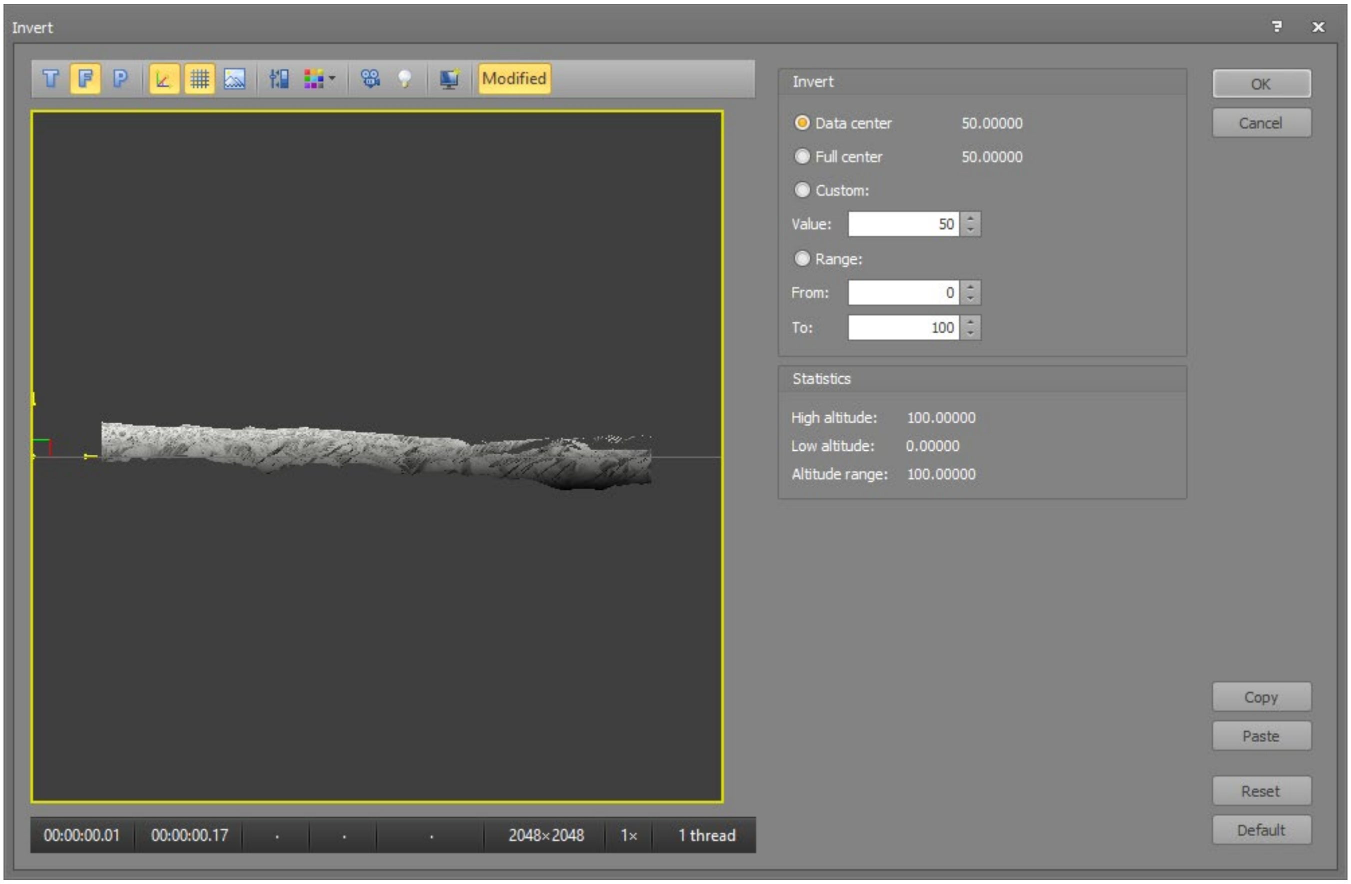
Notes

To perform a "cut" on the datamap to a smaller dimension while retaining the exact sample point altitudes for those points that are not removed, use the Resample function with the Fast Quality to an equal smaller divisor dimension such as 50%, 25%, etc.

This function requires 1 additional datamap memory allocation.

Modify: Invert

Inverts the datamap data around the specified center point.
This effectively flips the datamap data, turning hills into valleys, and valleys into hills.



Data center:	Invert at the heightmap's data center median altitude.
Full center:	Invert at the full range center altitude of 50.0.
Invert altitude:	The current invert altitude.
High altitude:	The heightmap high altitude.
Low altitude:	The heightmap low altitude.
Altitude range:	The heightmap altitude range.

Notes

This function requires 0 additional datamap memory allocations.

Modify: Normalize

Changes the altitude of the datamap to the maximum range of 0.0 to 100.0.

This function occurs immediately with no options or settings.

Notes

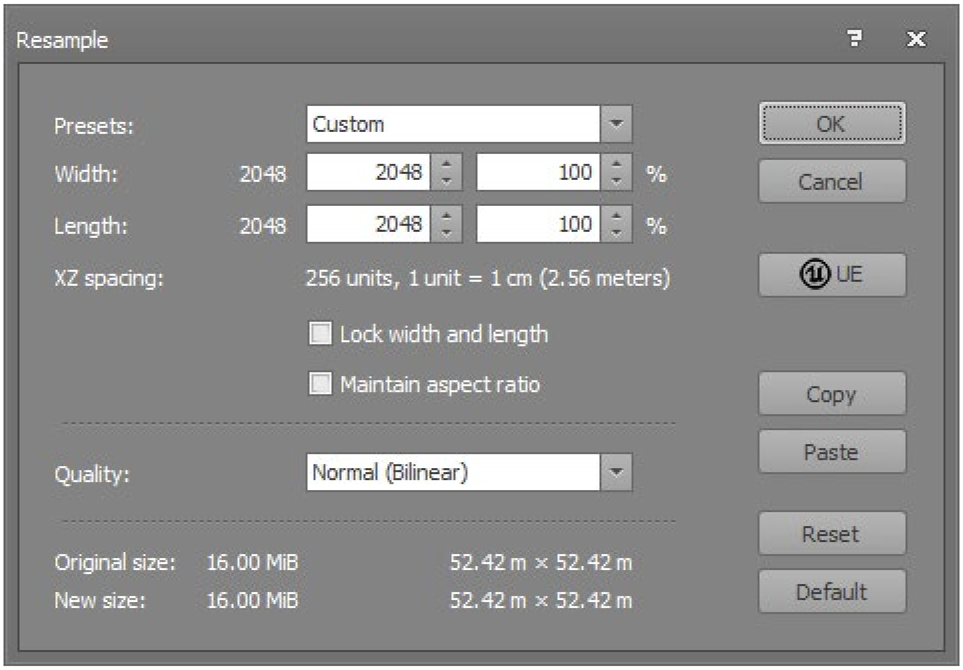
This function does not preserve the original altitude data.

This function requires 0 additional datamap memory allocations.

Modify: Resample

Allows increasing or decreasing the width and length dimensions of the datamap.
The new dimensions can be any valid values in the range of 2x2 up to the largest supported size.
The datamap data may be filtered to provide a more accurate and smoother resampling depending on the Quality value chosen.

Note that resampling does not fully preserve the original altitude data in its entirety, but provides the closest matching altitudes for the given downsampling or upsampling dimensions ratio. To accurately preserve the original datamap data when upsampling by dimension multiples, use the Interpolate function.



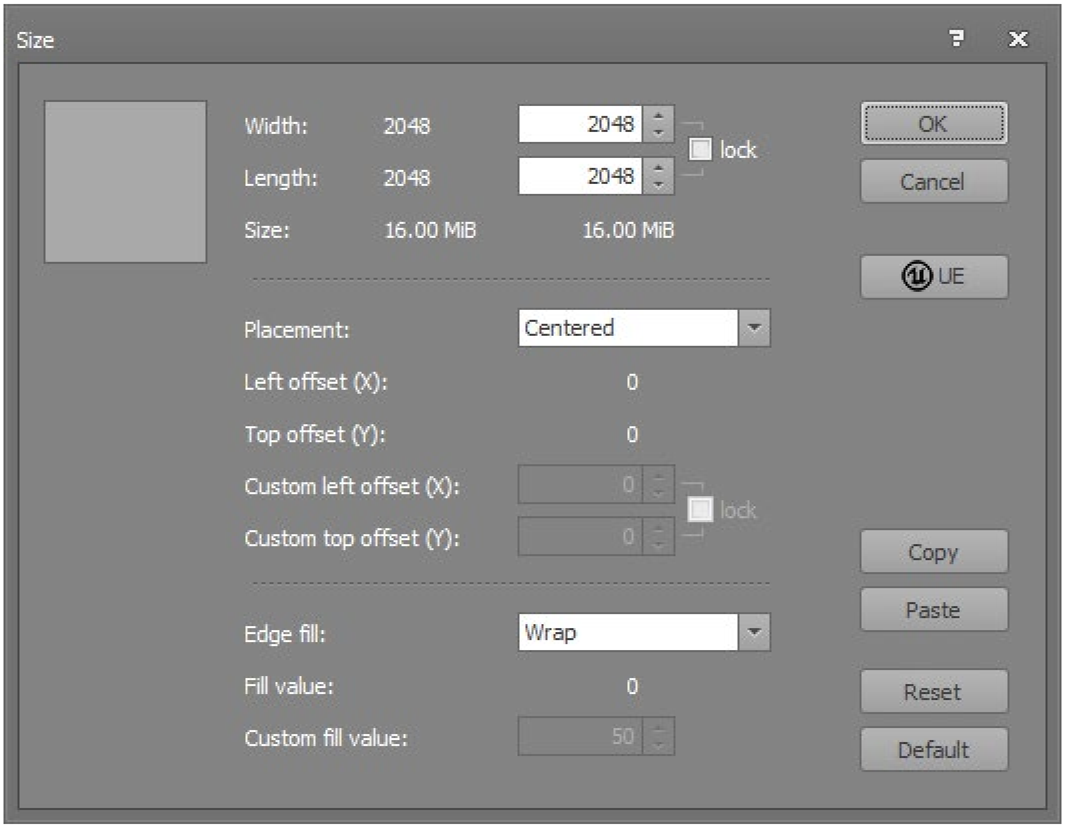
Presets:	Resample using these common preset settings. Downsample to smaller common power-of-two sizes or percentages. Upsample to larger common power-of-two sizes or percentages.
Width:	The new custom width.
Length:	The new custom length.
XZ Spacing:	The current engine XZ spacing units.
Lock width and length:	Locks the width and length controls to maintain the same values.
Maintain aspect ratio:	Locks the width and length controls to maintain the same aspect ratio as the original.
Quality:	Specifies the resampling quality, or the overall accuracy of the resampling algorithm. Fast: very accurate nearest-neighbor. Normal: variable-window averaging downsample and bilinear upsample. High: large window bicubic convolution filter. Best: large window lanczos filter.
Original size:	Displays the original memory size and unit scale dimensions.
New size:	Displays the new memory size and unit scale dimensions.
UE button	Choosing this button will display the Unreal Engine Landscape Sizes dialog. This button will be available only when Unreal Engine is enabled in the Preferences.

Notes

This function requires 1 additional datamap memory allocation.

Modify: Size

Change the size dimensions of the datamap.
For larger sizes on either dimension, the new area is filled with the specified Edge fill style.
For smaller sizes on either dimension, the original datamap is cropped.



Width:	The new Width value.
Length:	The new Length value.
Lock:	Lock the new Width and Length values.
Size:	Displays the original and new heightmap sizes
Placement:	Specify the location of the original heightmap data within the new size dimensions. - Locations: Specify the location of the original heightmap data using these preset locations. - Custom: Specify the original heightmap data location using the Left and Top offsets.
Left offset:	The offset from the left that the original heightmap data is located in the new size.
Top offset:	The offset from the top that the original heightmap data is located in the new size.
Custom Left offset:	The custom offset from the left that the original heightmap data is located in the new size.
Custom Top offset:	The custom offset from the top that the original heightmap data is located in the new size.
Lock:	Lock the Custom Left offset and Custom Top offset values.
Edge fill:	The style of edge fill if the new size is larger. - Minimum = the heightmap minimum altitude. - Center = the heightmap center altitude. - Maximum = the heightmap maximum altitude. - Low value = the current heightmap low altitude. - Middle value = the current heightmap middle altitude. - High value = the current heightmap high altitude. - Custom = the altitude value specified as the Custom fill value. - Duplicate = duplicate the value around the edge. - Fold = fold the heightmap tiled around the edge. - Mirror = mirror the heightmap tiled around the edge. - Wrap = wrap the heightmap tiled around the edge.

Fill value:	The fill value.
Custom fill value:	The custom fill value.

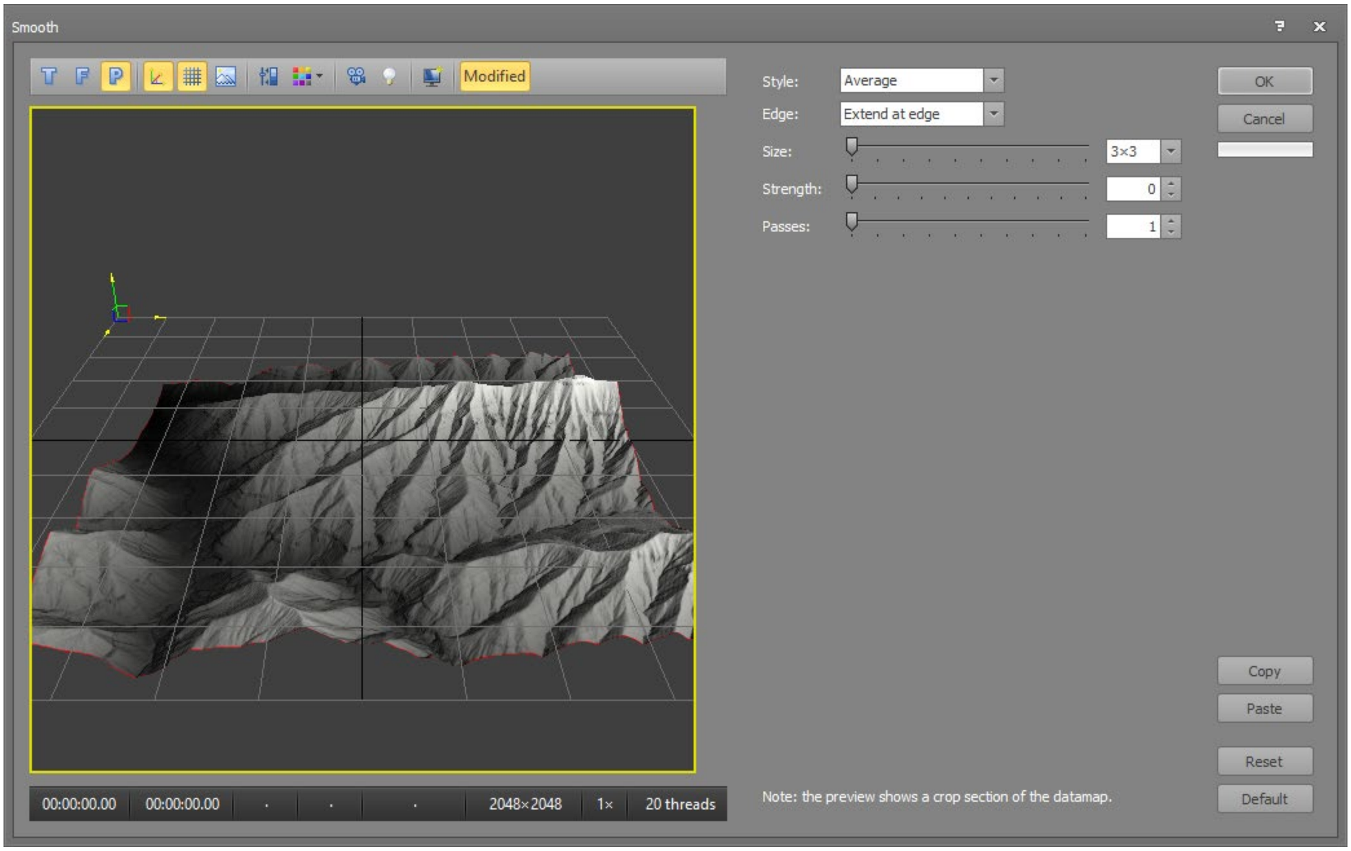
Notes

The Left and Top offset values in conjunction with the Edge fill style of Mirror allows the heightmap to be offset in any direction by the specified number of pixels.

This function requires 1 additional datamap memory allocation.

Modify: Smooth

Smoothens the surface of the datamap by adjusting the altitudes to remove steeper inclines and angles.



Style:	The smooth style algorithm.	
	Average:	Performs a variable-window averaging.
	Conservative:	Performs a variable-window conservative smooth.
	Gaussian:	Performs a variable-window gaussian weighted smooth.
	Median:	Performs a variable-window median value smooth.
	Middle:	Performs a variable-window middle value smooth.
	Radial:	Performs a variable-window radial smooth.

Size:	The size of the smoothing window.
Strength:	The applied smoothing strength.
Passes:	The number of smoothing passes.

Notes

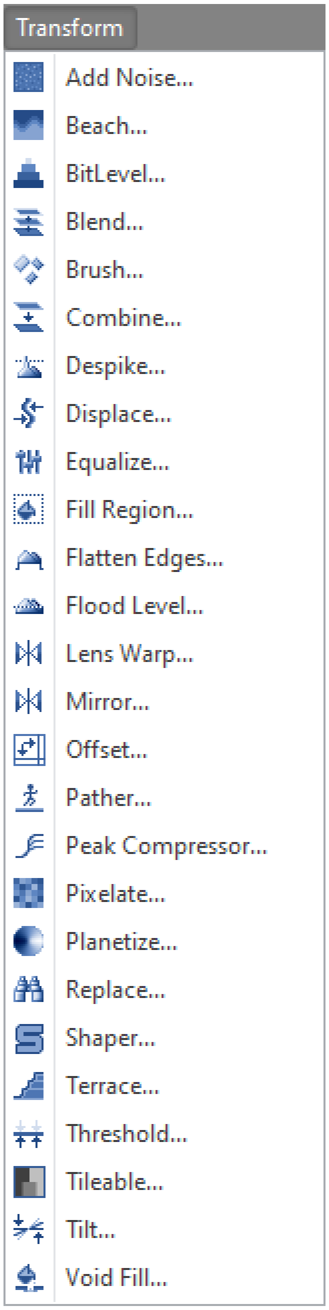
This function does not preserve the original altitude data.

This function requires 1 additional heightmap memory allocation.

The Gaussian style smooth is using a true full-radius window algorithm for higher quality. This provides a more accurate and pleasing smooth but at a cost of more time. Also see the Modify Gaussian Blur modifier.

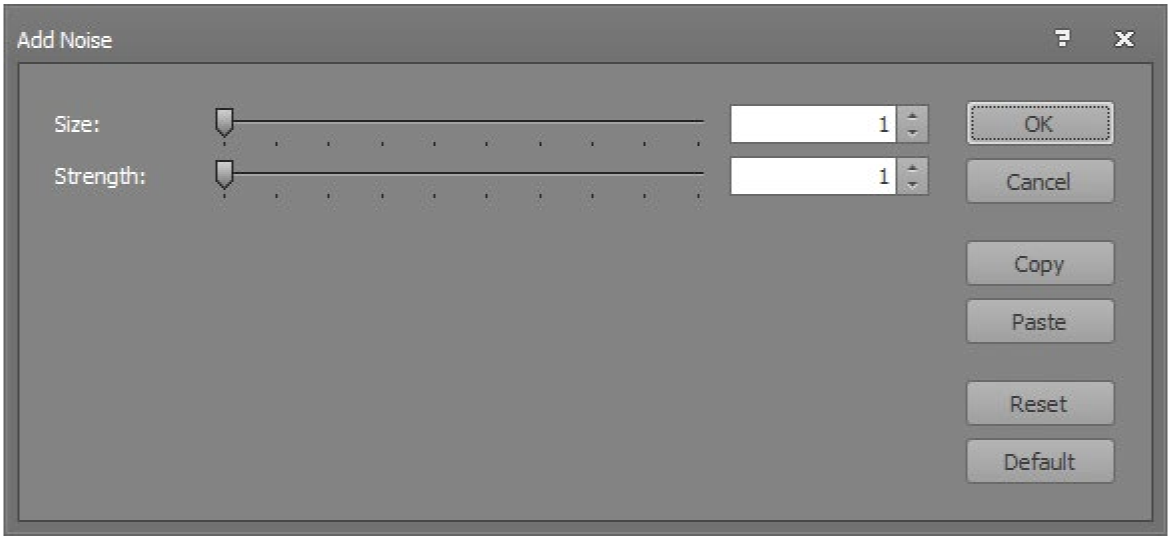
Devices Transform

The Transform menu contains devices that modify the heightmap or mask datamap.
Transform type devices typically modify the datamap data to a greater extent than modify type devices.



Transform: Add Noise

Add random noise at intervals on the datamap.



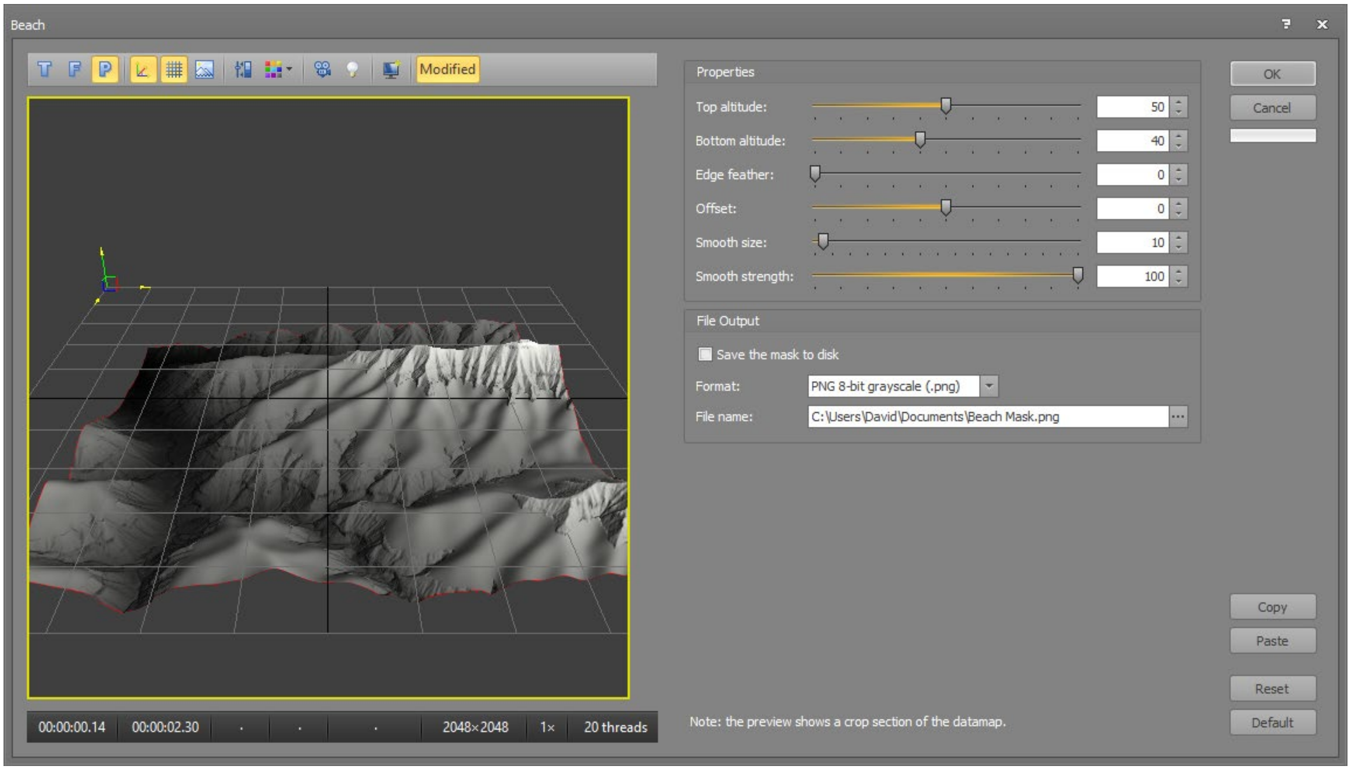
Size: The spacing between random noise elements.
Strength: The altitude strength of the random noise.

Notes

This device requires 0 additional datamap memory allocations.

Transform: Beach

Smoothen the datamap along the beach elevation range.



Properties

Top altitude:	The top altitude of the beach region.
Bottom altitude:	The bottom altitude of the beach region.
Edge feather:	The amount to feather the beach smoothing along the region edges.
Offset:	The amount to vertically offset the beach region.
Smooth size:	The beach region smooth size.
Smooth strength:	The beach region smooth strength.

File Output

Optionally save the beach mask to a file.

Notes

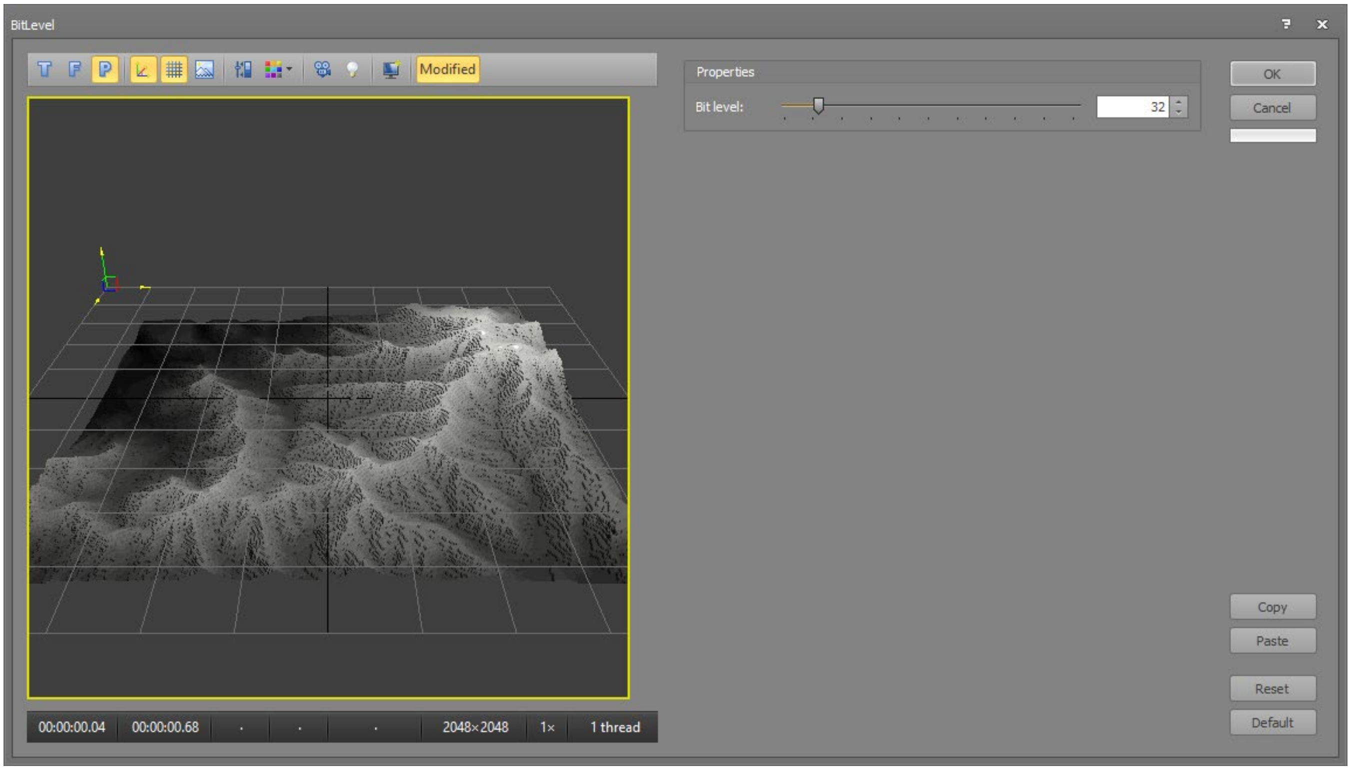
The beach mask can also be accessed on the Terrain Stack.

This device does not preserve the original altitude data.

This device requires 2 additional datamap memory allocations.

Transform: Bit Level

Reduce the datamap to the number of bit levels.



Bit level The number of bit levels of altitude resolution, 2 to 256.

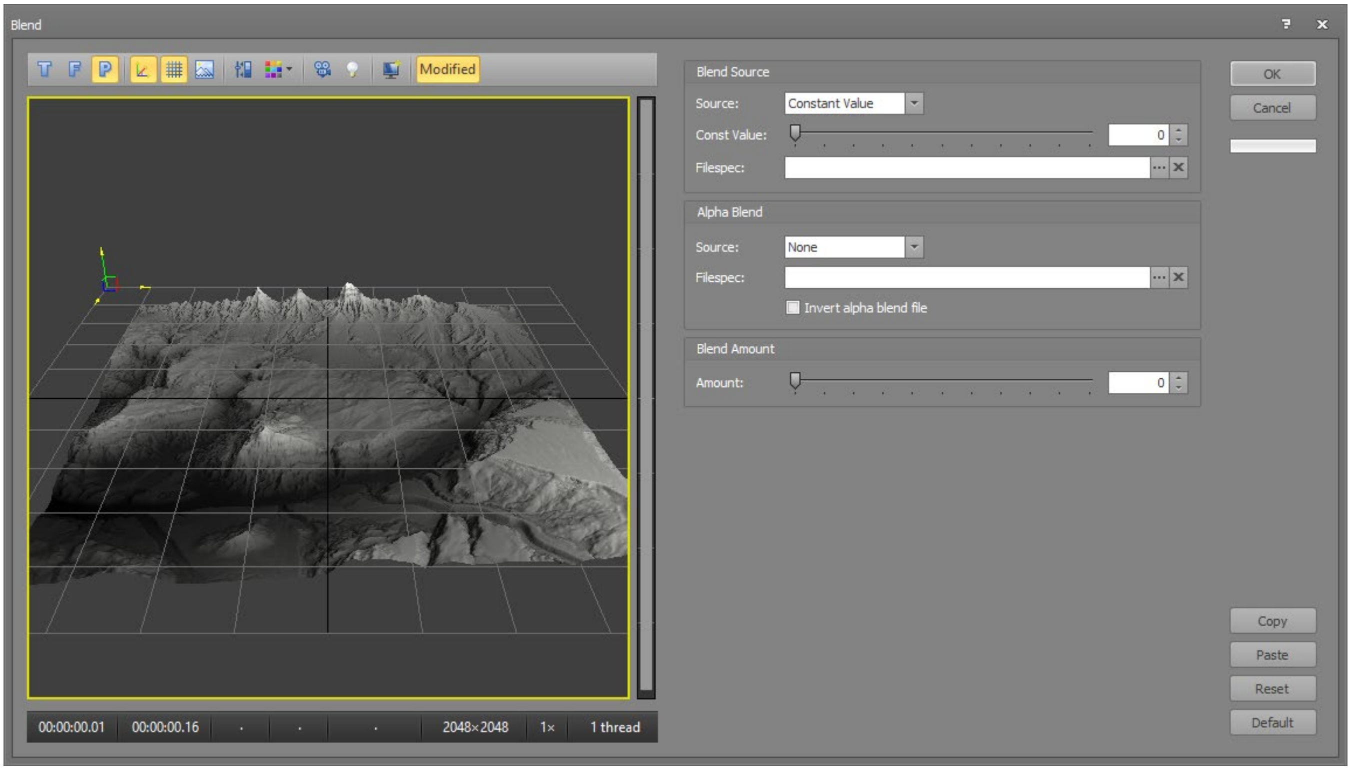
Notes

This device does not preserve the original altitude data.

This device requires 1024 bytes additional memory allocation.

Transform: Blend

Blend a datamap with a constant value or an external file.



Blend Source

Source:	The blend source. - Constant Value: Blend with the specified Constant Value. - External File: Blend with the specified Filespec.
Const Value:	Blend with the specified constant value. This typically flattens the datamap.
Filespec:	Blend with the specified external file specification.

Alpha Blend

Source:	Blend using an alpha mask so that only a portion of the source files are affected. - External File: Alpha blend with the specified Filespec.
Filespec:	Alpha blend with the specified external file specification.
Invert alpha blend file:	Invert the alpha blend mask.

Blend Amount

Amount:	The amount to blend, this is a percentage of the source datamap and the blend datamap.

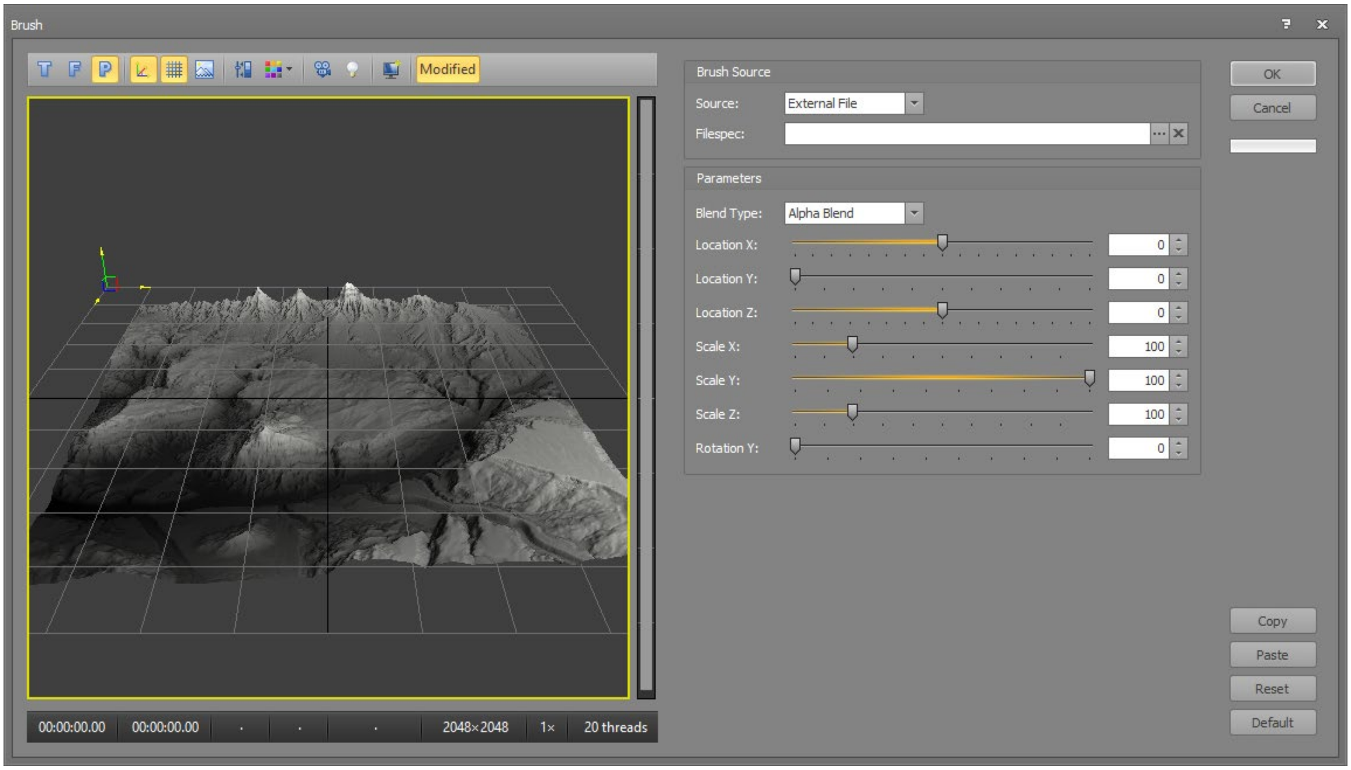
Notes

This device does not preserve the original altitude data.

This device requires 0 additional datamap memory allocations.

Transform: Brush

“Stamp” an Alpha Brush shape onto the current datamap.



Brush Source

Source:	The brush datamap source. - External File: load an external file from disk.
Filespec:	The brush filespec to load.

Parameters

Blend Type:	The brush blend type. - Alpha Blend: use the brush color as a alpha value. - IfHigher Blend: blend based on which pixel is higher.
Location X:	The brush location on the X axis.
Location Y:	The brush location on the Y axis.
Location Z:	The brush location on the Z axis.
Scale X:	The brush scale on the X axis.
Scale Y:	The brush scale on the Y axis.
Scale Z:	The brush scale on the Z axis.
Rotation Y:	The brush rotation on the Y axis.

Note that a fast rotation algorithm is used during preview which is a lower visual resolution.

Notes

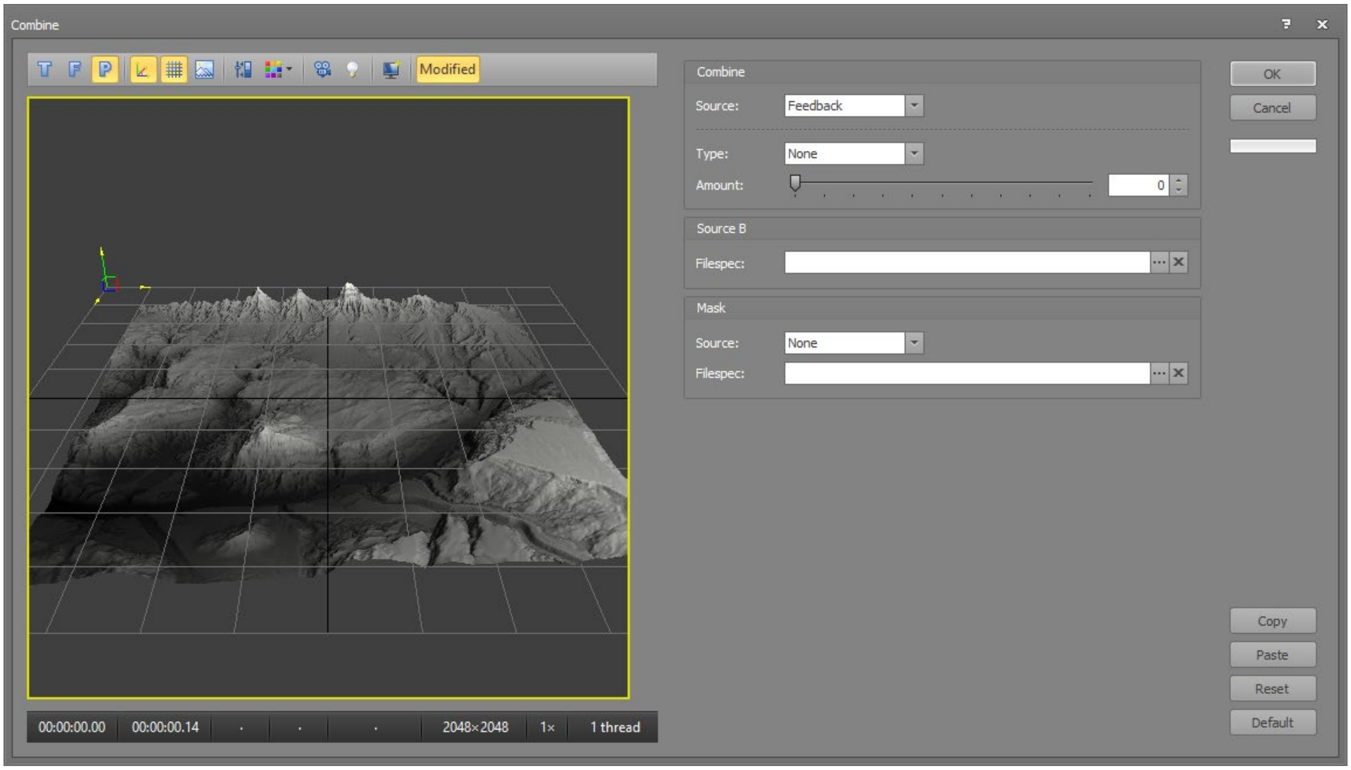
See the Google Asset Drive folder for a text file with links to hundreds of free alpha brushes of mountains and other geological features.

This device does not preserve the original altitude data.

This device requires 1 additional datamap memory allocation.

Transform: Combine

Combine the datamap using a large number of blending algorithms.



Combine

Source: The combine source.
- Feedback: feed the datamap file back onto itself.
- External File: combine with the specified external file.

Type: The combine type. This drop-down contains a large number of mathematical combinations.
Amount: The combine amount

Source B

Filespec: Combine the current datamap with the file specification.
Source: The terrain stack source datamap.

Mask

Source: The mask combine type source.
Filespec: The mask file specification.
Source: The terrain stack source datamap.

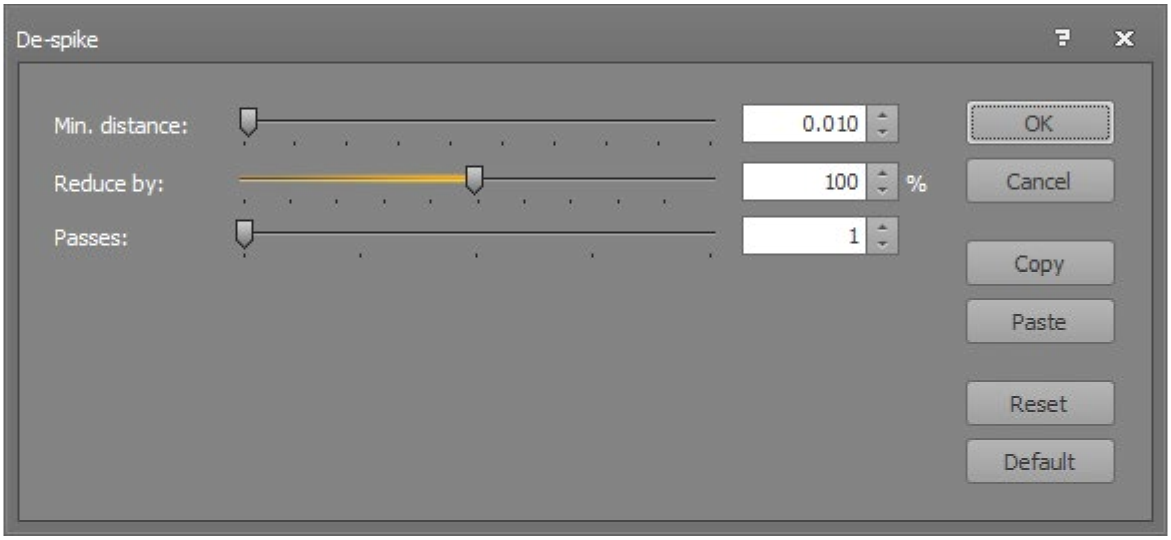
Notes

This device does not preserve the original altitude data.

This device requires 0 additional datamap memory allocations.

Transform: De-spike

Reduce or remove single-sample spikes in the datamap.
This is normally used to reduce single sample spikes in datamaps created with the Ridged Noise generator.



Min. distance:	The minimum distance in altitude difference before a sample is classified as a spike.
Reduce by:	The percentage of the distance difference to reduce the spike by.
Passes:	The number of de-spiking passes.

Notes

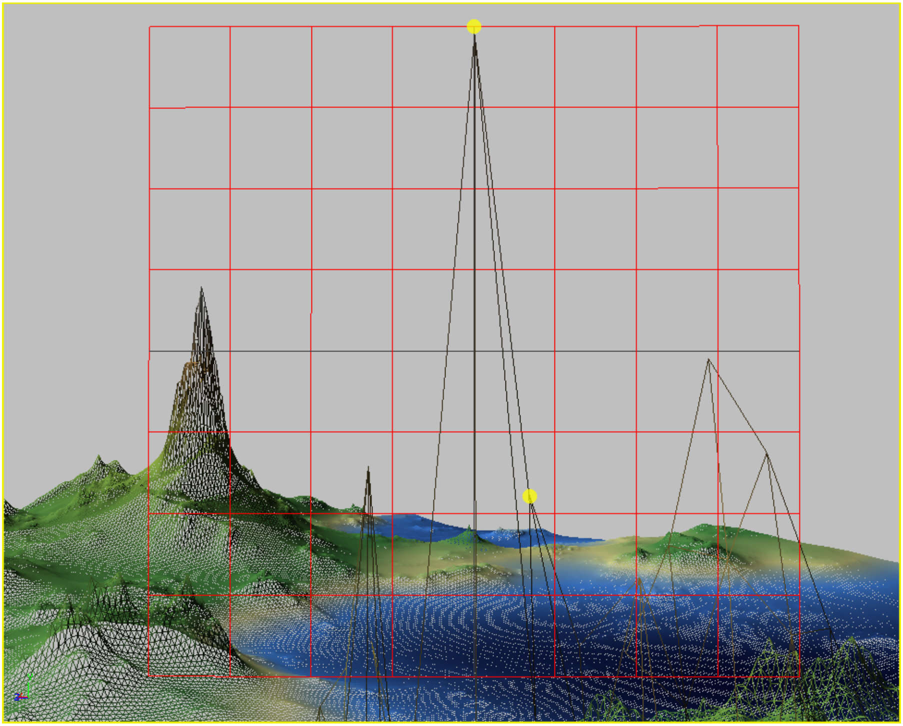
This function does not preserve the original altitude data.

This function requires 0 additional datamap memory allocations.

The Minimum distance value is the altitude distance difference between a datamap sample point and all of the sample points that surround it, ie. its neighbors. If a sample point is 20 units above all of its surrounding neighbor samples, it is classified as a spike with a Minimum distance of 20. Setting Minimum distance to 20 will catch all spike samples that are 20 or more units higher than all of their surrounding neighbors.
The Minimum distance value is not in world units but is in datamap altitude values. To convert from the datamap altitude values to the current 3D Editor vertex-based world units, divide the datamap altitude by 256, and multiply it by the current Units Y Spacing. For a Units Y Spacing of 256, the datamap values and world units are equal.

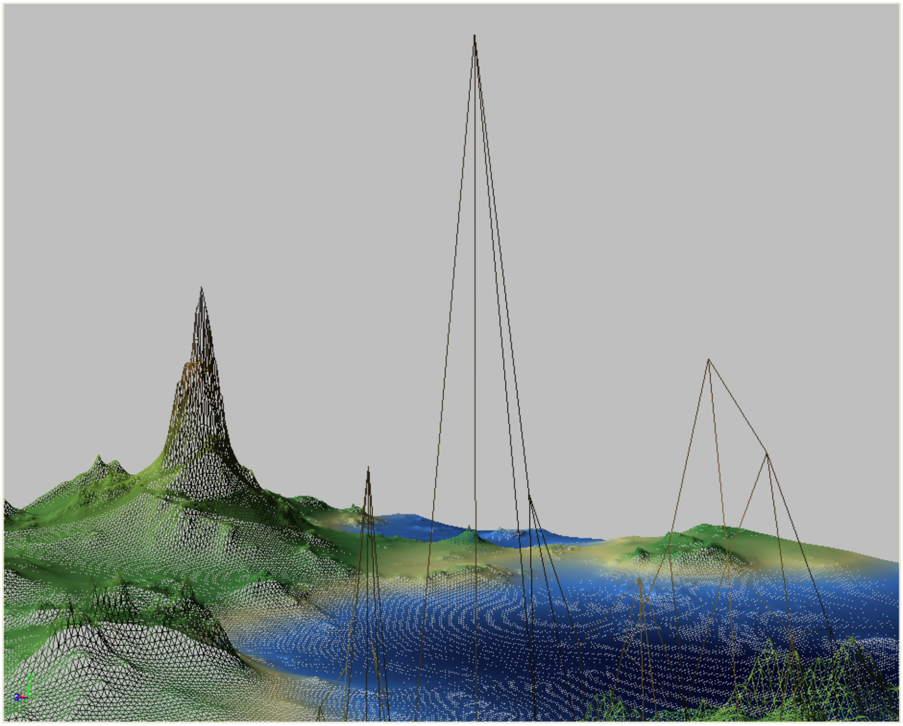
The number of de-spiking passes is only relevant if the Reduce by percentage is less than or greater than 100%. For example, if the datamap contains a number of spikes that are comprised of two side-by-side samples at varying heights, and the Reduce by value is set at 150%, the first pass will move the taller of the two samples down by 150%, making it shorter than the other sample; the second pass will then move the other taller sample down by 150%.

A typical De-spiking routine to reduce many spikes may be a sequence of:
- 50 Min. distance, 150% Reduce by, 1 Pass
- 10 Min. distance, 100% Reduce by, 1 Pass
- 1 Min. distance, 100% Reduce by, 1 Pass

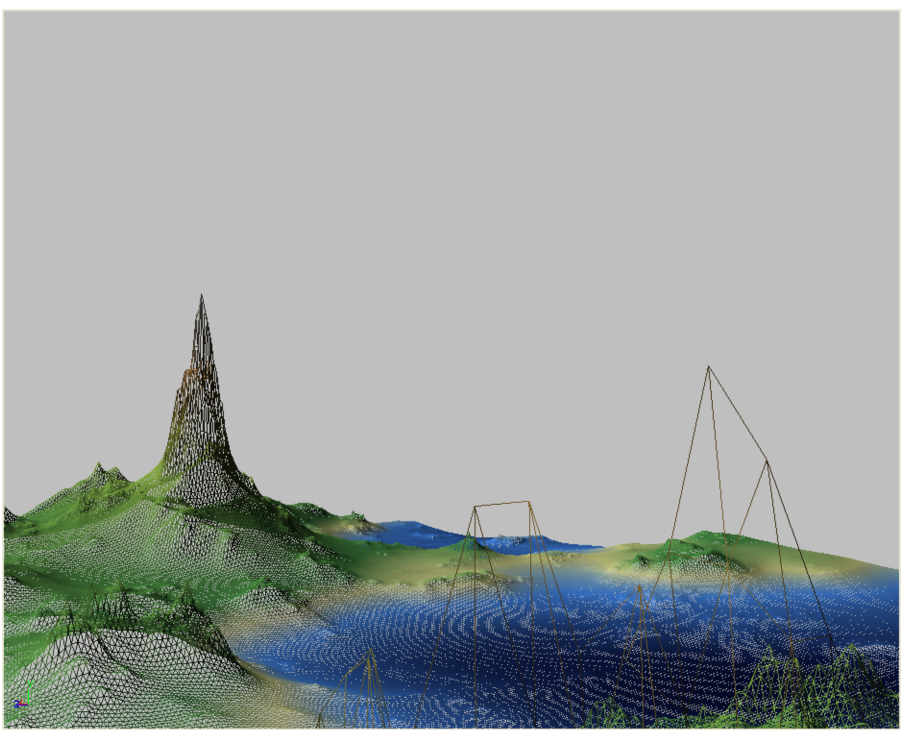


In this example, a 256 spacing user grid (in red) has been positioned at a spike in the terrain. The two yellow dots show the top-most spike vertex and the closest neighboring vertex below the spike. With a Units Y Spacing of 256, the altitude distance difference between these two heightmap samples is almost 6 grid cells which is approximately 6.0 in heightmap altitude.

A De-spike *Minimum distance* value of 5.0 will easily remove this spike.
A *Reduce by* value of 100% will lower the top spike vertex down to the next closest neighbor vertex's altitude.



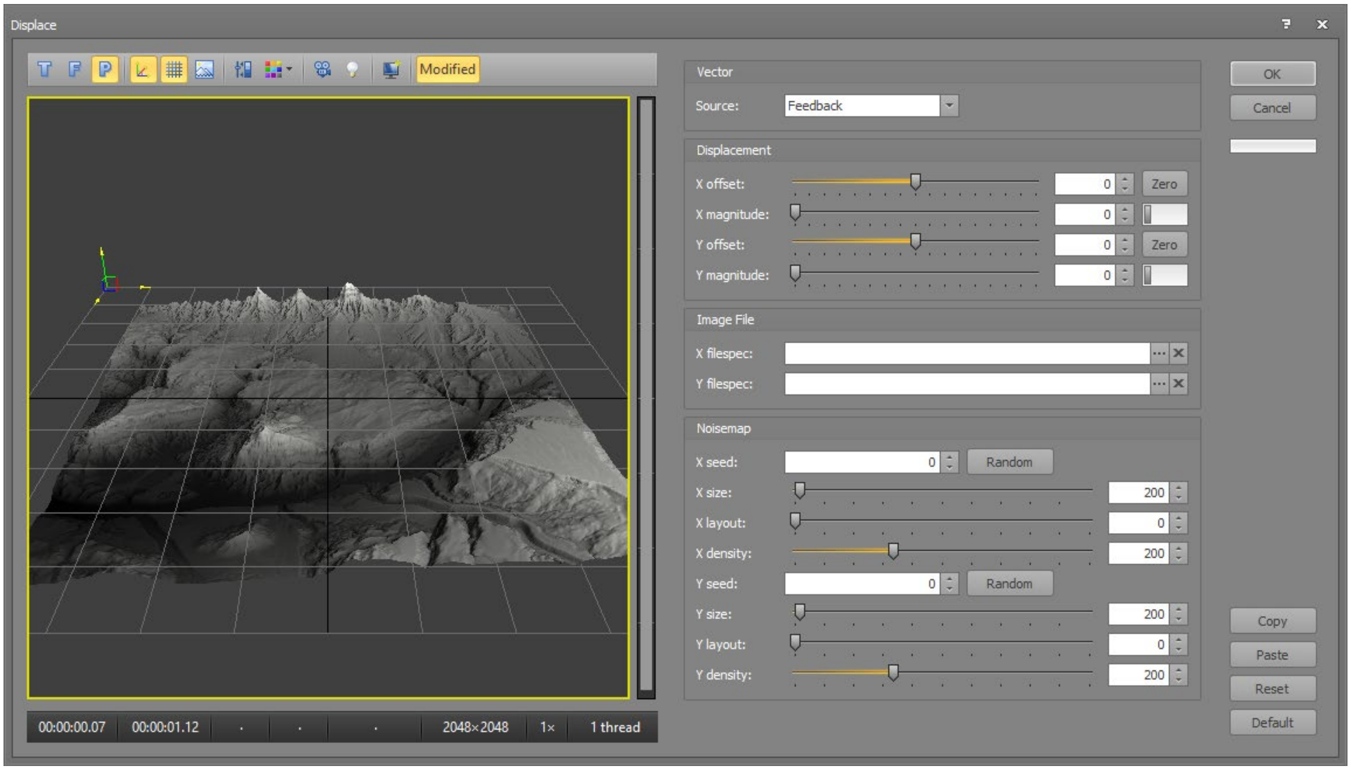
Before De-spiking.



After De-spiking.

Transform: Displace

Displace or warp the datamap data using a number of algorithms.



Vector

Source:	The displacement vector source: - Feedback - External Files - Noisemaps

Displacement

X offset:	The X axis vector offset.
Zero:	Zero the X offset.
X magnitude:	The X axis vector magnitude (amplitude level).
Flip direction:	Flip the X axis vector direction.
Y offset:	The Y axis vector offset.
Zero:	Zero the Y offset.
Y magnitude:	The Y axis vector magnitude (amplitude level).
Flip direction:	Flip the Y axis vector direction.

Image File

Filespec:	The external image file specification used for the displace vector source.

Noisemap

X seed:	The noisemap X axis random seed.
Random:	Generate a new random seed.
X size:	The noisemap X axis size.
X layout:	The noisemap X axis layout.
X density:	The noisemap X axis density.

Y seed:	The noisemap Y axis random seed.
Random:	Generate a new random seed.
Y size:	The noisemap Y axis size.
Y layout:	The noisemap Y axis layout.
Y density:	The noisemap Y axis density.

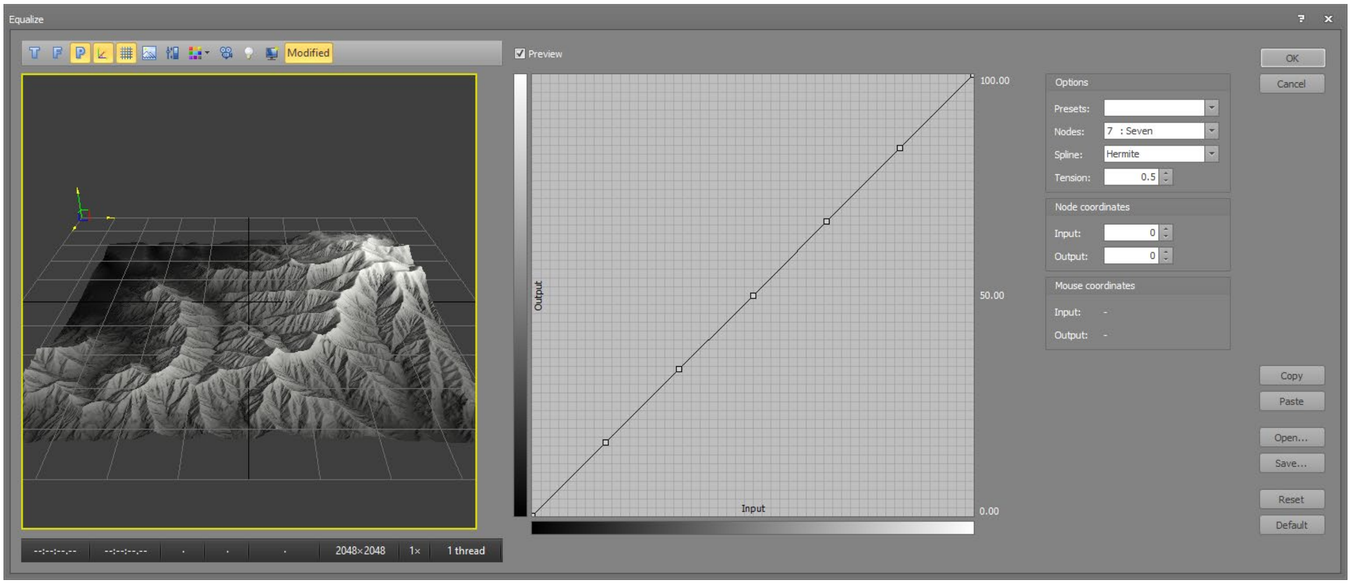
Notes

This device does not preserve the original altitude data.

This device requires 3 additional datamap memory allocations.

Transform: Equalize

Modifies the datamap data based on the spline equalization graph.



Preview: Toggle the 3D Preview window visibility.

Equalize graph Provides a visual editor for the graph spline control points.

Presets: A set of common preset equalize graphs.
Nodes: The number of spline nodes: 4, 5, 7, 9, 11.
Spline: Chooses from a set of specific spline interpolation algorithm types.
Tension: Sets the spline tension around the control point.

Node Input: The currently selected spline control point node input value.
Node Output: The currently selected spline control point node output value.

Mouse Input: The current mouse coordinates along the input scale.
Mouse Output: The current mouse coordinates along the output scale.

Notes

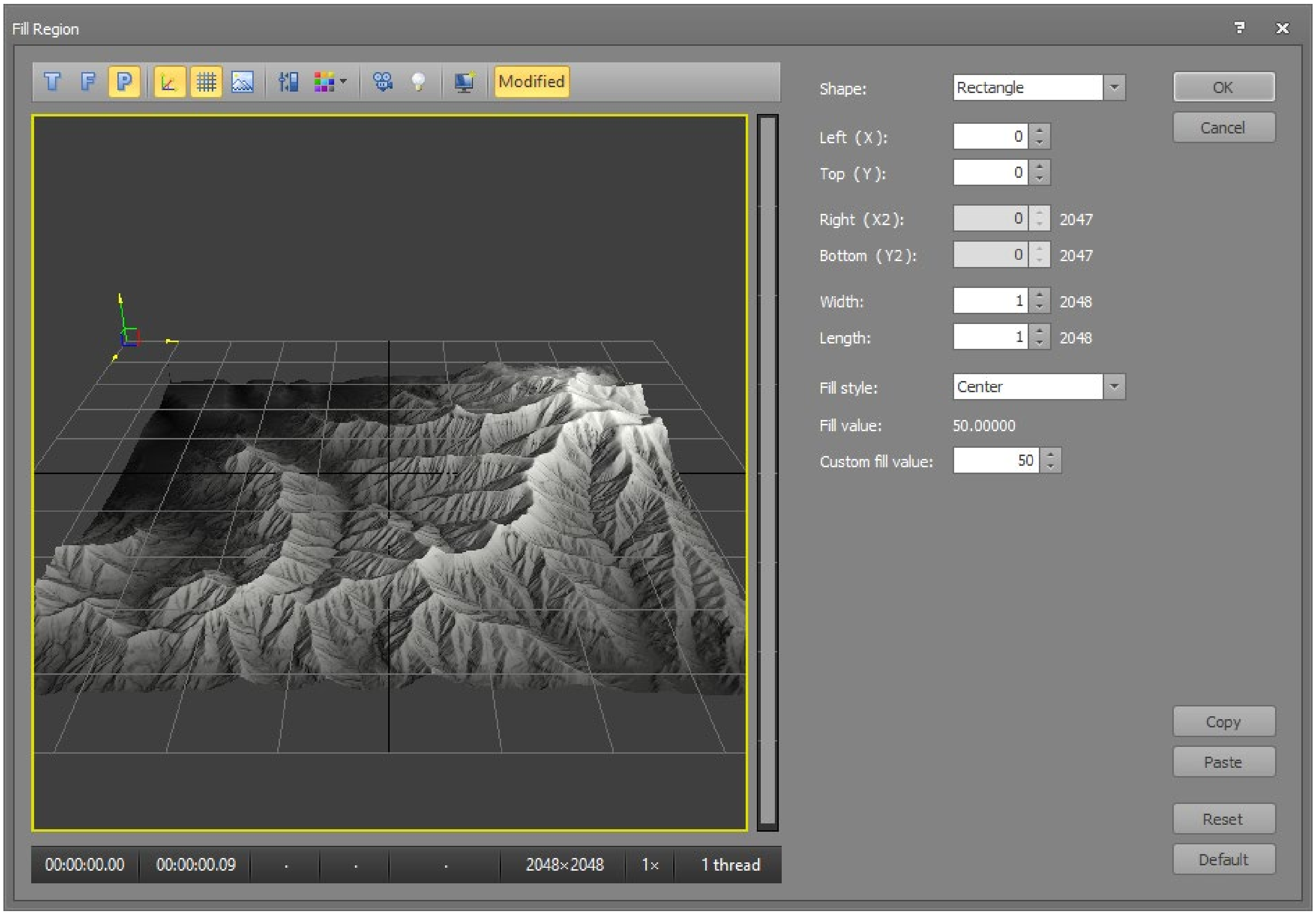
This function does not preserve the original altitude data.

This function requires 0 additional datamap memory allocations.

The available spline types vary in their accuracy and smoothness, with Cubic as low quality, Catmull-Rom as medium quality, and Hermite as high quality.

Transform: Fill Region

Fill the selected region with the specified altitude value.



Shape:	The fill region shape.
Left (X):	The fill region left coodinate.
Top (Y):	The fill region top coordinate.
Right (X2):	The fill region right coordinate.
Bottom (Y2):	The fill region bottom coordinate.
Width:	The fill region width.
Length:	The fill region length.
Fill style:	The fill style: - Minimum = the heightmap minimum altitude. - Center = the heightmap center altitude. - Maximum = the heightmap maximum altitude. - Low value = the current heightmap low altitude. - Middle value = the current heightmap middle altitude. - High value = the current heightmap high altitude. - Custom = the altitude value specified in the Custom fill value control.
Fill value:	The fill value.
Custom fill value:	The custom fill value.

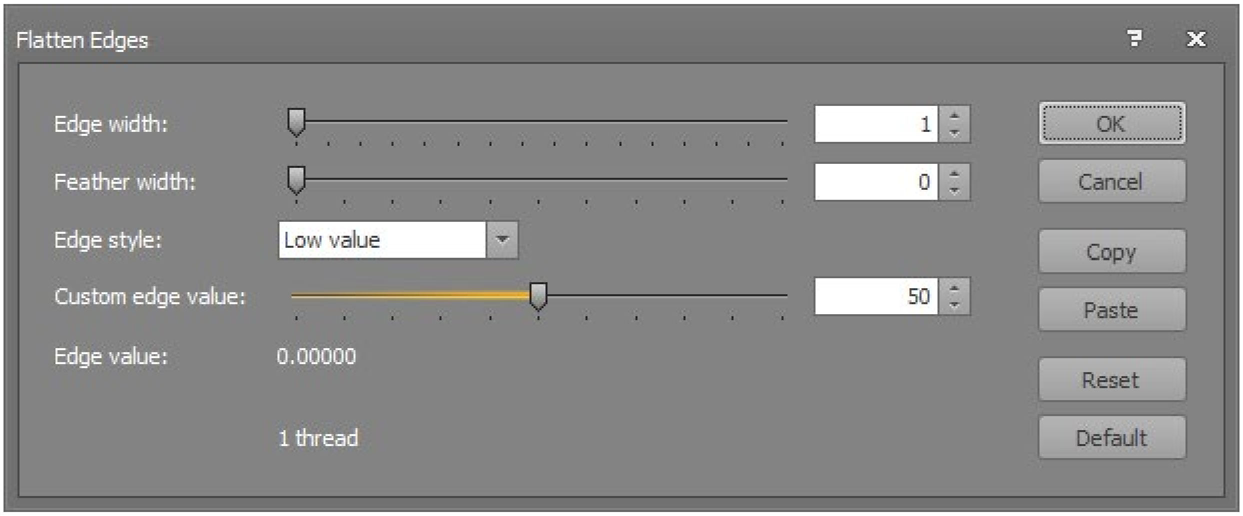
Notes

This function does not preserve the original altitude data within the fill region.

This function requires 0 additional heightmap memory allocations.

Transform: Flatten Edges

Changes the outer edges of the heightmap to the specified fixed altitude value.



Edge width: The number of samples (pixels or vertices) around the edges to flatten to the edge altitude.
Feather width: The number of pixels to smooth the edge.
Edge style: The edge flatten altitude style presets:
- Minimum = the heightmap minimum altitude.
- Center = the heightmap center altitude.
- Maximum = the heightmap maximum altitude.
- Low value = the current heightmap low altitude.
- Middle value = the current heightmap middle altitude.
- High value = the current heightmap high altitude.
- Custom = the altitude value specified in the Custom fill value control.

Custom edge value: The custom edge altitude value to flatten the edges to.
Edge value: The edge value.

Notes

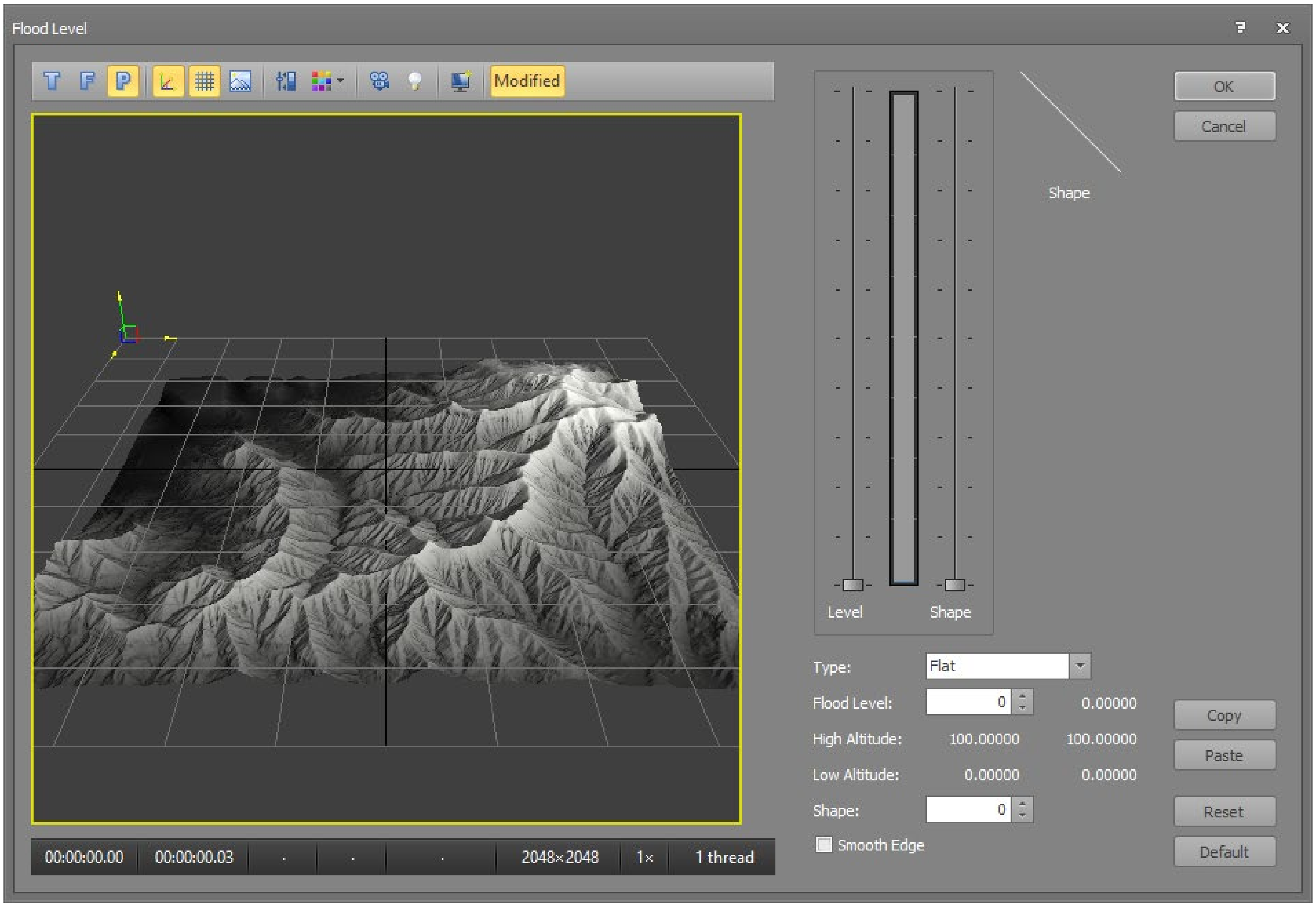
This function does not preserve the original altitude data around the heightmap edges.

This function requires 0 additional heightmap memory allocations.

If the source heightmap is larger than the terrain rendering LOD, then the front and right edge may not visually look like it is flattened to the specified altitude. This is due to the resampling function that occurs to the heightmap data before it is converted to the viewport rendering mesh.

Transform: Flood Level

Simulates flooding the heightmap with water.



Type:	The flood level shape type. - Flat: the flood level is clipped flat at the level altitude. - Curved: the flood level is angled at the level altitude by the shape percent.
Flood Level:	The positive offset altitude where the flood level starts.
High altitude:	The terrain high altitude.
Low altitude:	The terrain low altitude.
Shape:	The percent that the altitudes below Level are flooded. Curved Type only.
Smooth Edge:	Applies smoothing around the flood level edge. Flat or Curve 100 only.

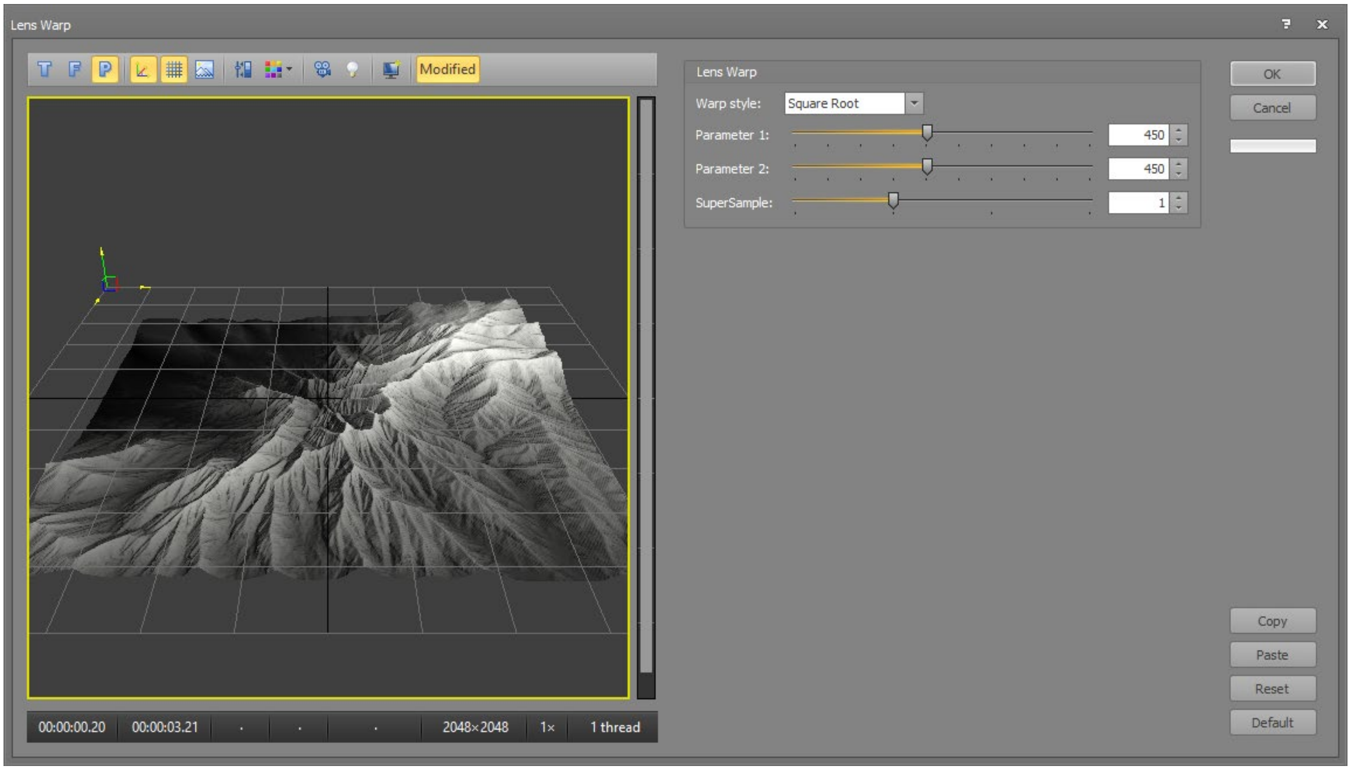
Notes

This function does not preserve the original altitude data.

This function requires 1 additional datamap memory allocations if Smooth Edge is enabled.

Transform: Lens Warp

Warp the datamap using pinch and punch displacement.



Warp style:	The warp style. - Square Root - Sine Cartesian - Square Cartesian - Cartesian - Logarithmic
Parameter 1:	Warp parameter 1.
Parameter 2:	Warp parameter 2.
Super Sample:	Bilinear smoothing amount.

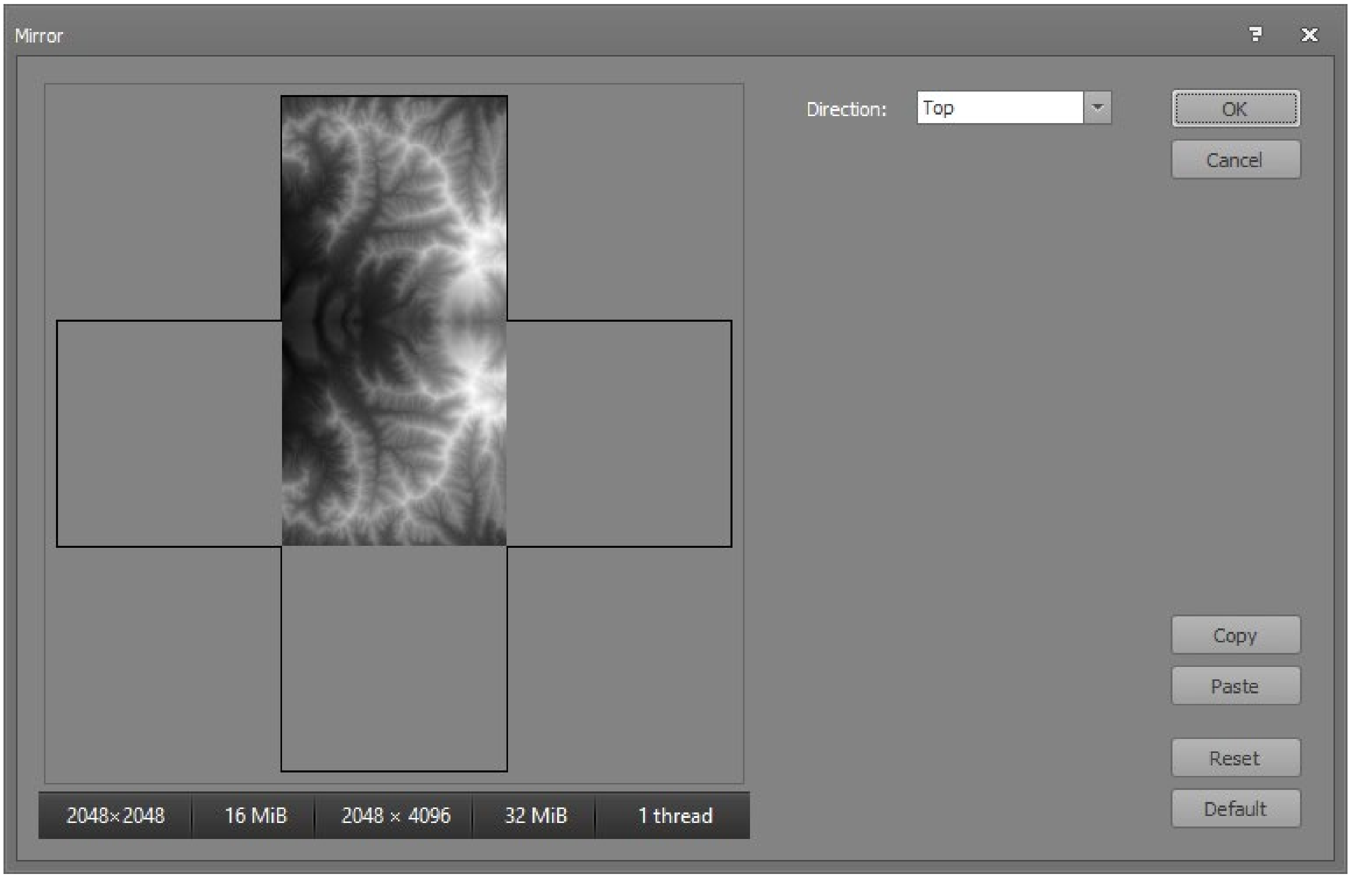
Notes

This device does not preserve the original altitude data.

This device requires 1 additional datamap memory allocation.

Transform: Mirror

Mirrors the heightmap on one of its four sides, typically for symmetrical map designs.



Direction: Specifies the heightmap side to mirror to.

Notes

The real-time preview display can also be used to select the desired mirror direction using the mouse. Hover the mouse over any mirror side to choose that direction, then click to accept the choice.

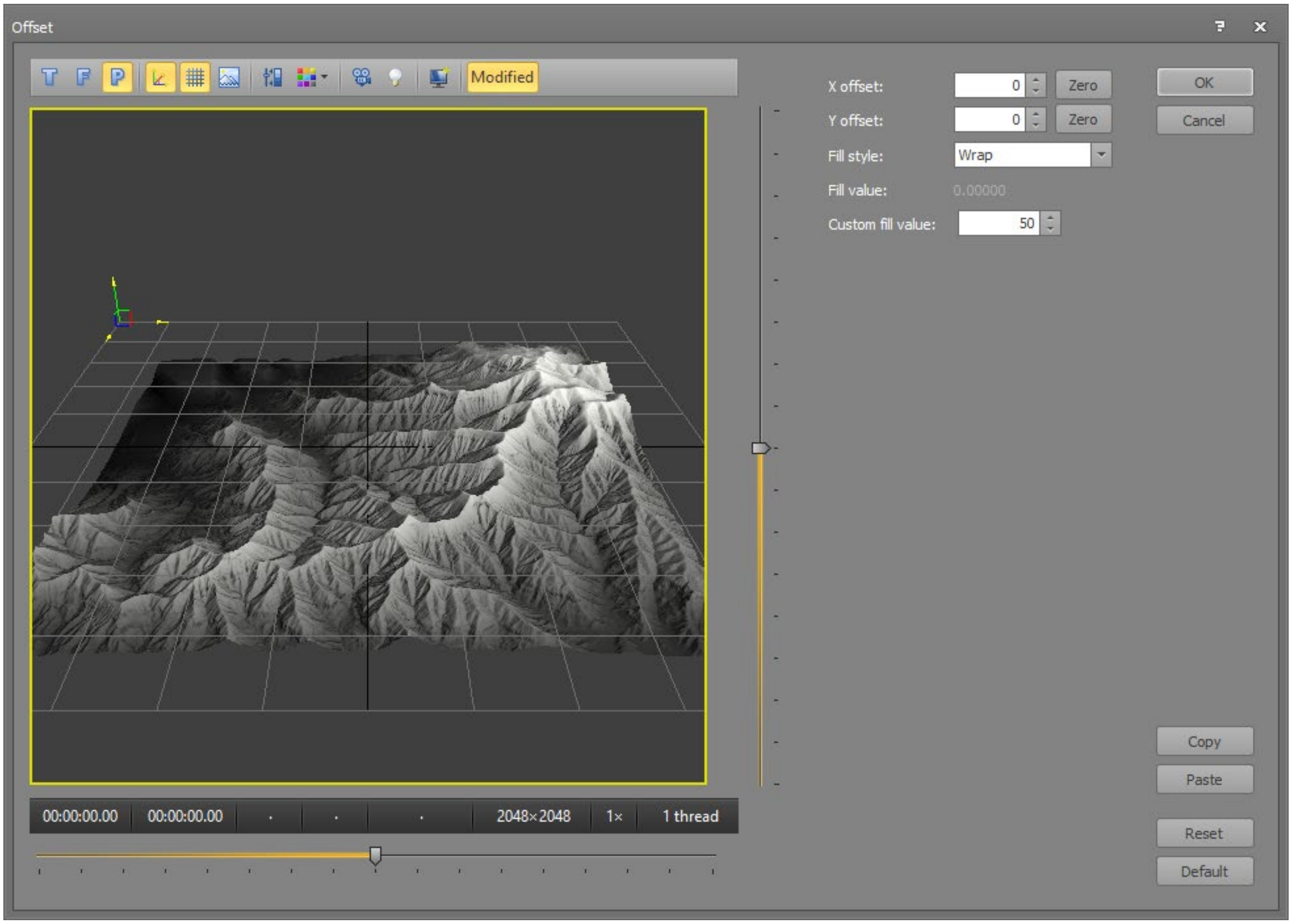
The real-time preview display does not show an aspect-correct thumbnail version of the source heightmap. This is by design so that heightmaps with very tall or very wide aspect ratios can still be previewed more easily.

This function is typically used to create symmetrical datamaps for specific fps game types such as capture-the-flag. The terrain for one team side can be created, and mirrored to provide proper symmetry for the second team.

This function requires 1 additional array memory allocation.

Transform: Offset

Offsets the datamap by the specified number of units (sample, pixels or vertices).



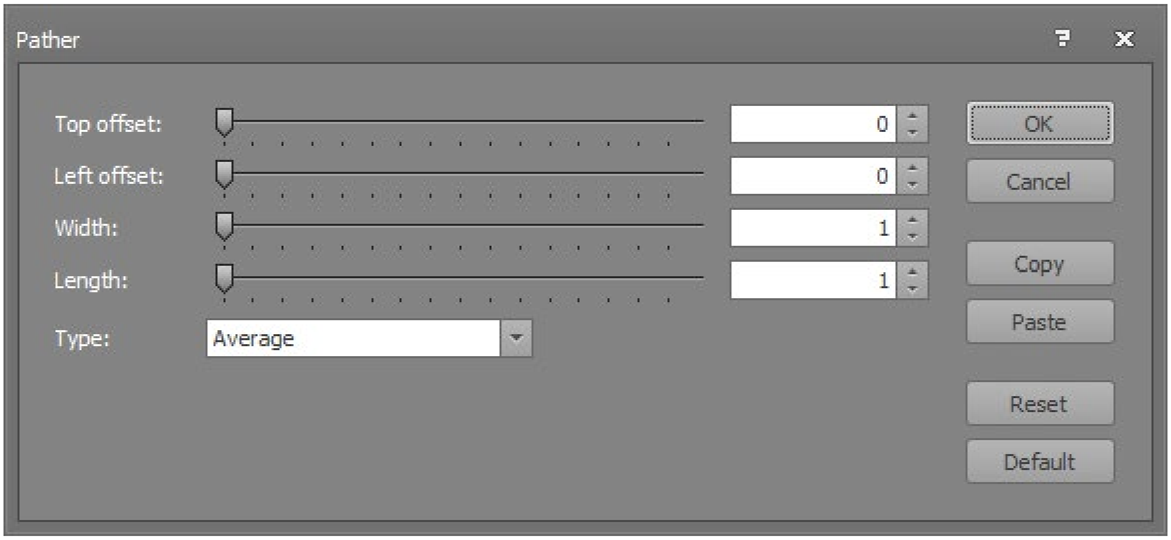
X offset:	The number of samples to offset on the heightmap X direction.
Y offset:	The number of samples to offset on the heightmap Y direction.
Fill style:	The fill style: - Minimum = the heightmap minimum altitude. - Center = the heightmap center altitude. - Maximum = the heightmap maximum altitude. - Low value = the current heightmap low altitude. - Middle value = the current heightmap middle altitude. - High value = the current heightmap high altitude. - Custom = the altitude value specified as the Custom fill value. - Duplicate = duplicate the value around the edge. - Fold = fold the heightmap tiled around the edge. - Mirror = mirror the heightmap tiled around the edge. - Wrap = wrap the heightmap tiled around the edge.
Fill value:	The fill value.
Custom fill value:	The custom fill value.

Notes

This function requires 1 additional datamap memory allocations.

Transform: Pather

Create a flattened path along the edge of a datamap for the use as a side-scroller terrain.



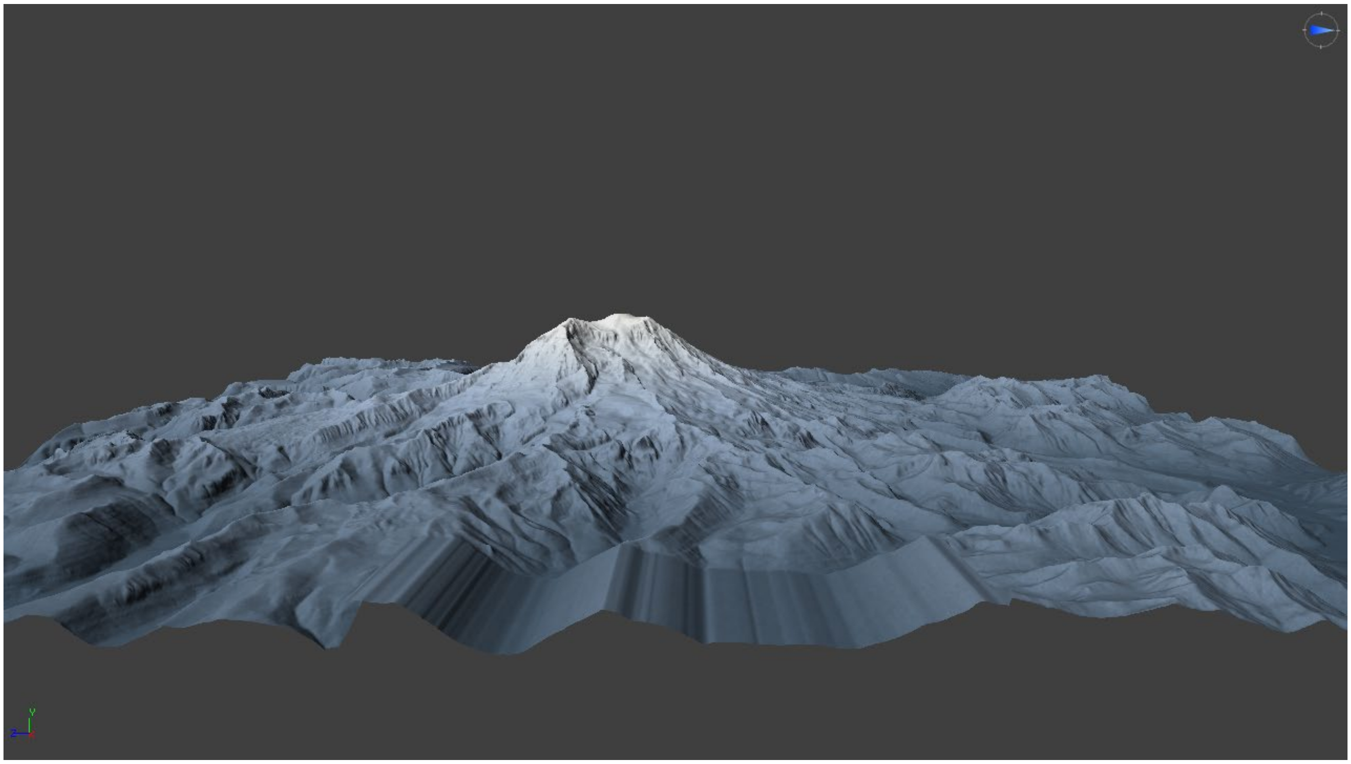
Top offset:	The flattened path top coordinate.
Left offset:	The flattened path left coordinate.
Width:	The flattened path width.
Length:	The flattened path length.
Type:	The path flattening type. - Average: use the average of the left and right pixel altitude. - Left: flatten flatten the path using the left pixel altitude. - Right: flatten the path using the right pixel altitude.

Notes

This device does not preserve the original altitude data.

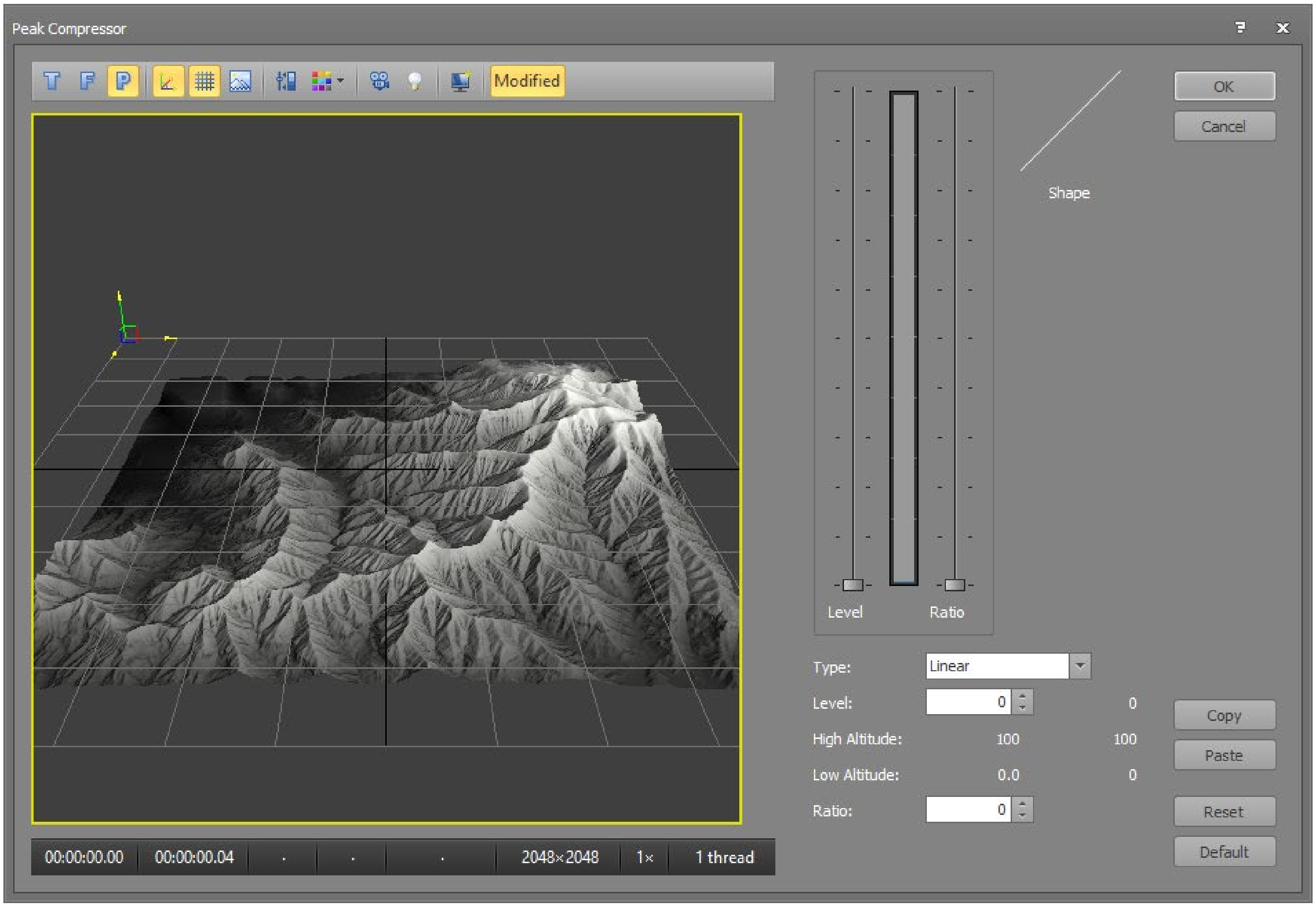
This device requires 0 additional datamap memory allocations.

An example of the pather creating a flattened wide path along the edge of a heightmap for use in a side-scroller video game.



Transform: Peak Compressor

Applies compression to the upper peak altitudes of the datamap.



Type:	The peak compressor type. - Linear: the compression is linear across the level altitude and the crossover point. - Curve 1: a C curve, the compression is curved across the altitude range. - Curve 2: an S curve, the compression is curved across the altitude range.
Level:	The positive offset altitude where the compression starts.
High Altitude:	The heightmap high altitude value.
Low Altitude:	The heightmap low altitude value.
Ratio:	The compression ratio percent. 0 = none, 100 = full.

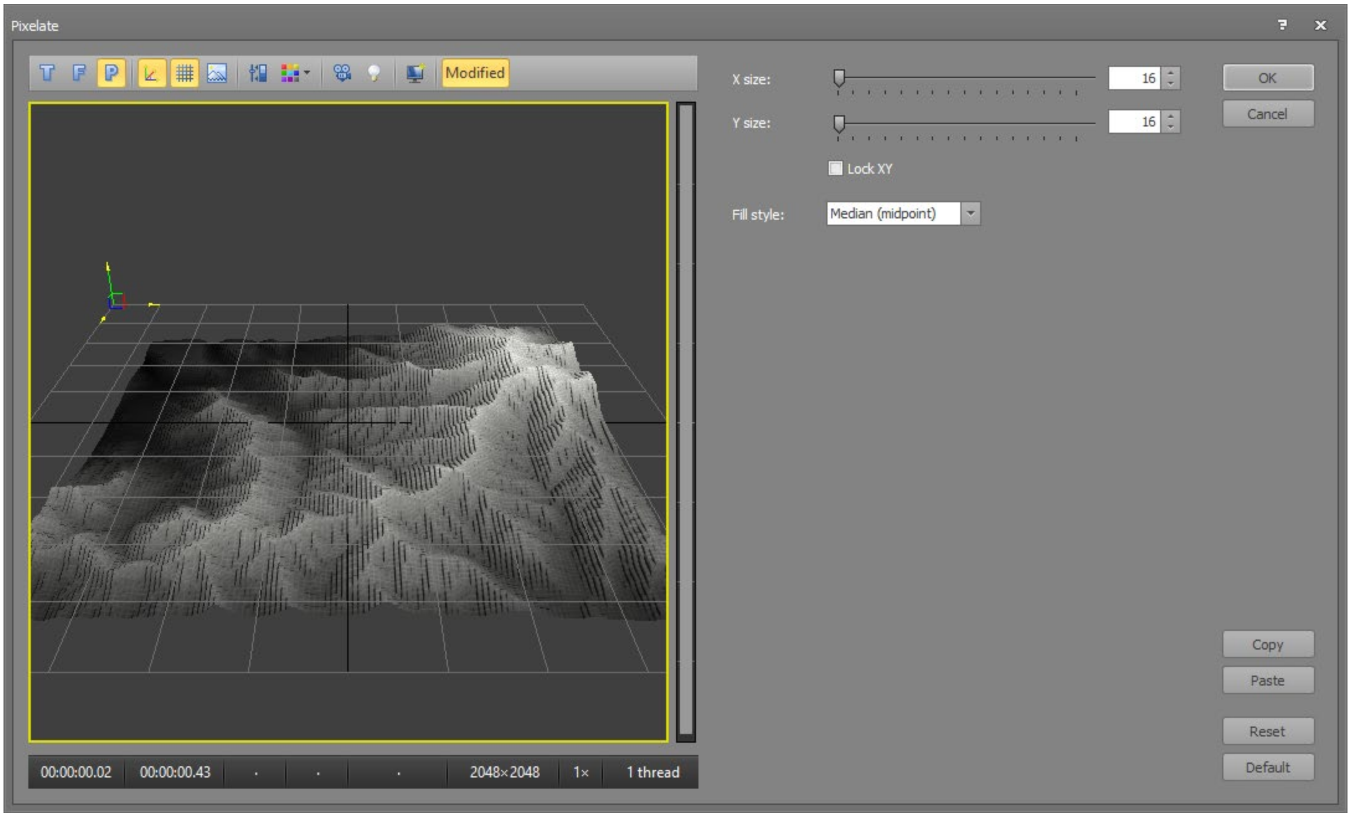
Notes

This function does not preserve the original altitude data.

The curved compression shape varies non-linearly across its range.

Transform: Pixelate

Applies an XY axis pixelation resolution reduction to the datamap.
The result of this transform function is more for effect or to create Minecraft like block terrain.



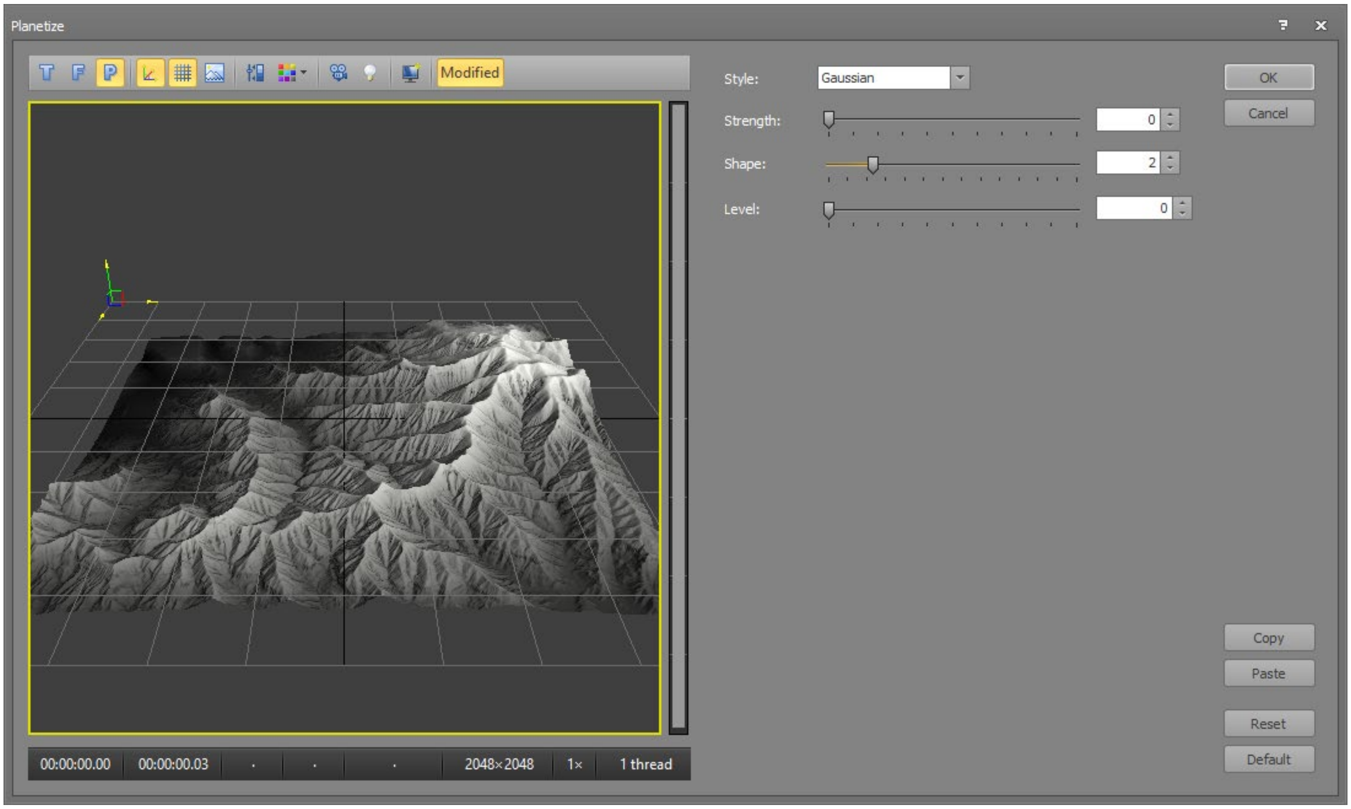
X size: The heightmap X axis block size in samples.
Y size: The heightmap Y axis block size in samples.
Lock XY: Lock the Y value to the X value.
Fill style: The block region fill style:
- Low value = the low altitude from the samples in the block.
- Middle value = the middle altitude from the samples in the block.
- High value = the high altitude from the samples in the block.

Notes

This function does not preserve the original altitude data.

Transform: Planetize

Applies a curve to the datamap surface to round it like a section from a planet, or inverted like a crater or bowl.



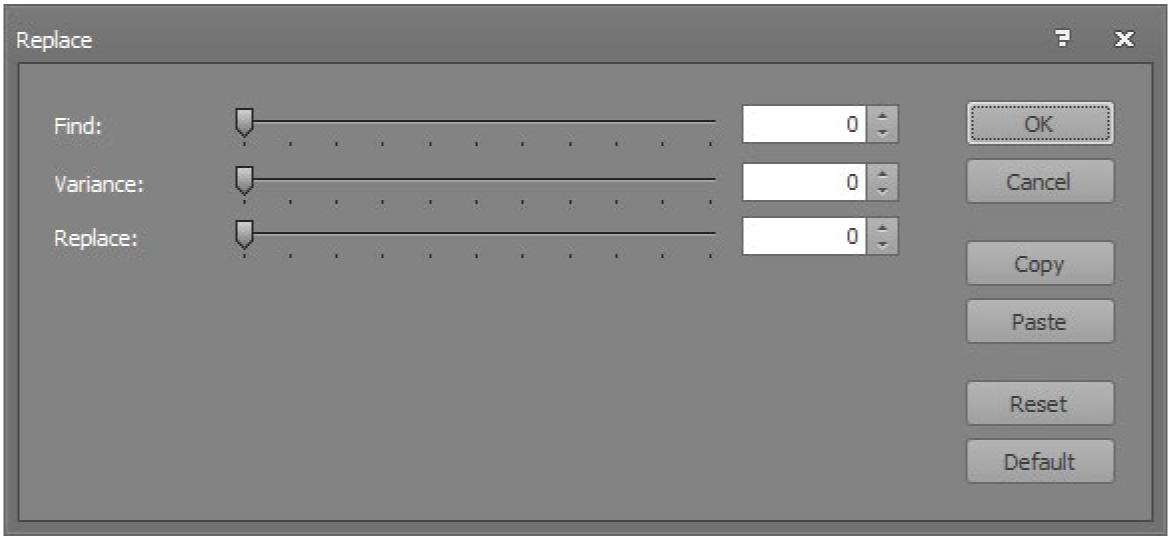
Style:	The curve style: - Gaussian = a gaussian curve. - Radial = a radial curve. - Gaussian inverted = an inverted gaussian curve. - Radial inverted = an inverted radial curve.
Strength:	The curve strength.
Shape:	The curve shape.
Level:	The base terrain altitude level.

Notes

This function does not preserve the original altitude data.

Transform: Replace

Replace the specified altitude value in the datamap with a new value.



Find:	The datamap altitude value to find.
Variance:	The amount of variance on the value to find, for example 50 +/- 10.
Replace:	The altitude value to replace the Find value with.

Notes

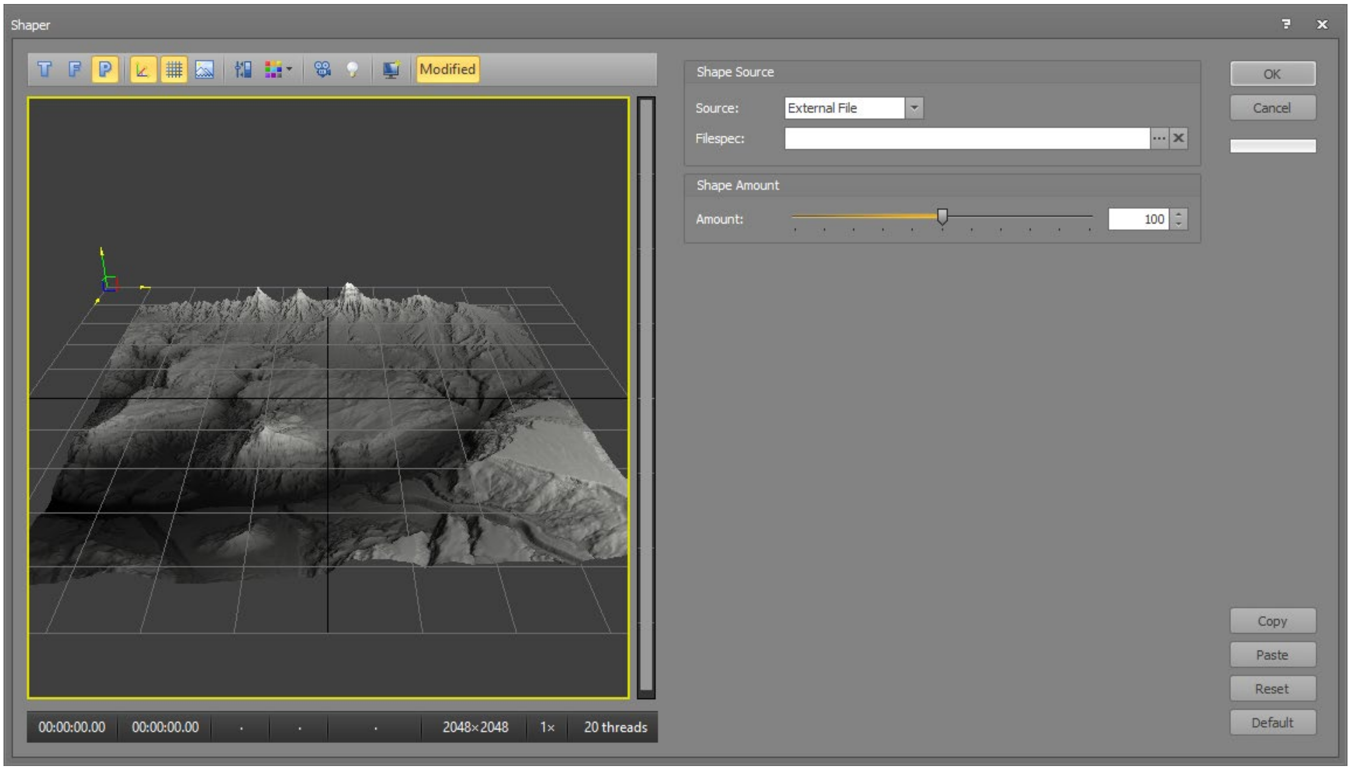
This device can also be used to remove Void regions from a Digital Elevation Model datamap.

This device does not preserve the original altitude data.

This device requires 0 additional datamap memory allocations.

Transform: Shaper

Use a mask to create an island shape.



Shape Source

Source: The shaper mask source.
External File: use an external file as the mask source.
Terrain Stack: use a terrain stack item datamap as the mask source.

Filespec: The shaper mask source file specification.

Shape Amount

Amount: The blend amount for the shaper mask.

Notes

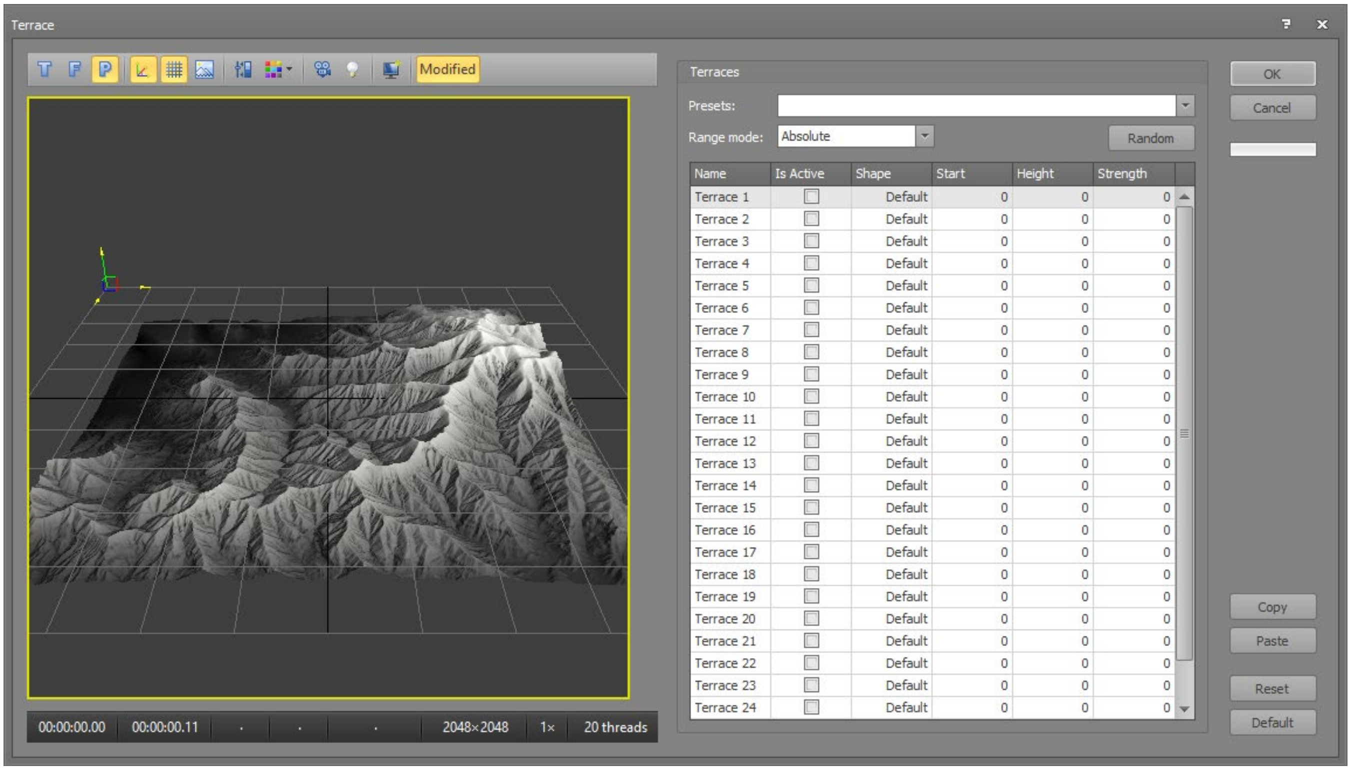
A mask file can be created in external software such as Photoshop. The external file should be the same dimensions as the main editor datamap, it will be resampled if it is a different size.
A Generator Filled Shape can be distorted and used as a Terrain Stack datamap item for the mask source.

This device does not preserve the original altitude data.

This device requires 0 additional datamap memory allocations.

Transform: Terrace

Creates geological terraces on the datamap.



Presets:	Choose from a large number of typical terrace preset types.
Range mode:	Whether the terrace start and height values are absolute or relative to the datamap altitude.

25 Terrace Items

Is Active:	Whether this terrace item is active.
Shape:	The terrace item shape.
Start:	The terrace item start altitude.
Height:	The terrace item height.
Strength:	The terrace item strength.

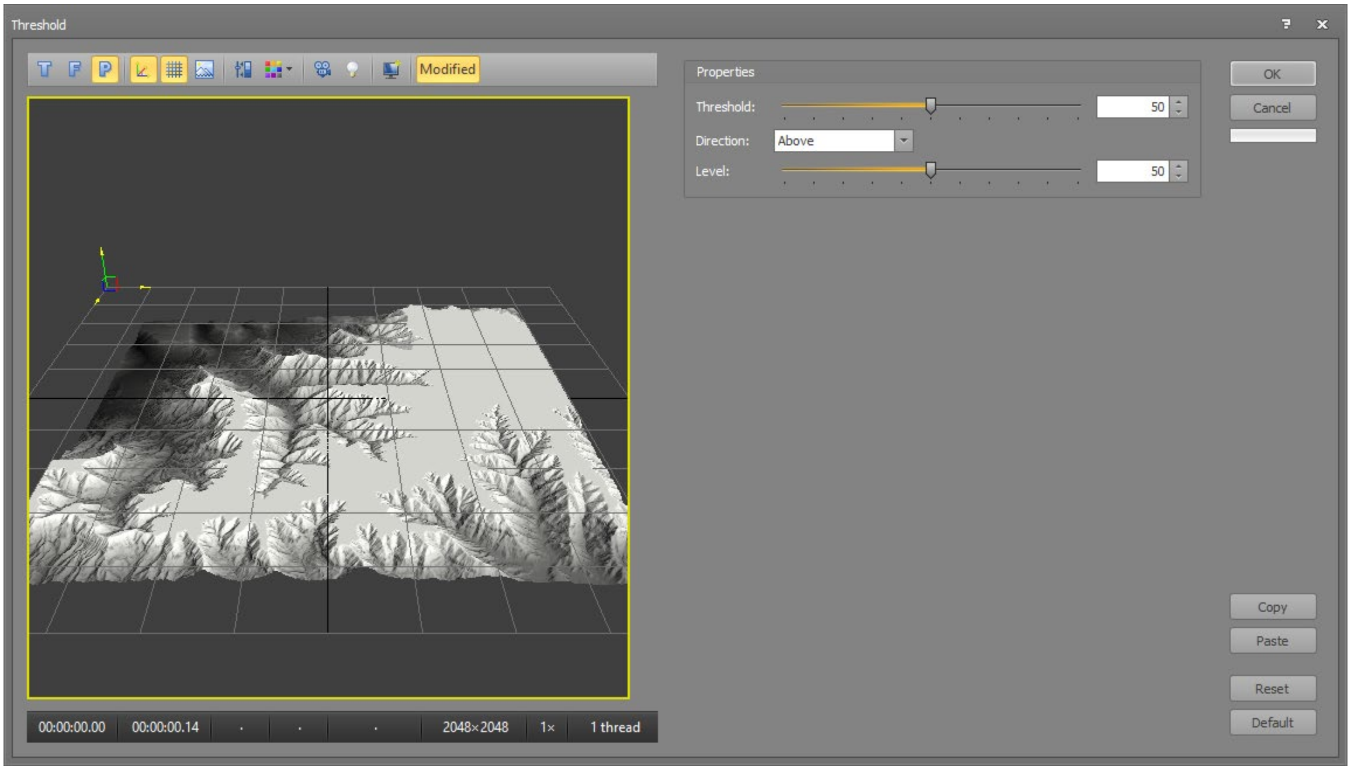
Notes

This device does not preserve the original altitude data.

This device requires 0 additional datamap memory allocations.

Transform: Threshold

Adjust the altitude levels up or down above or below the specified threshold altitude.



Threshold: The threshold altitude where everything specified by Direction is set to Level.

Direction: The direction that the Level property affects.
- Above: every altitude above Threshold is set to Level.
- Below: every altitude below Threshold is set to Level.

Level: The new altitude level.

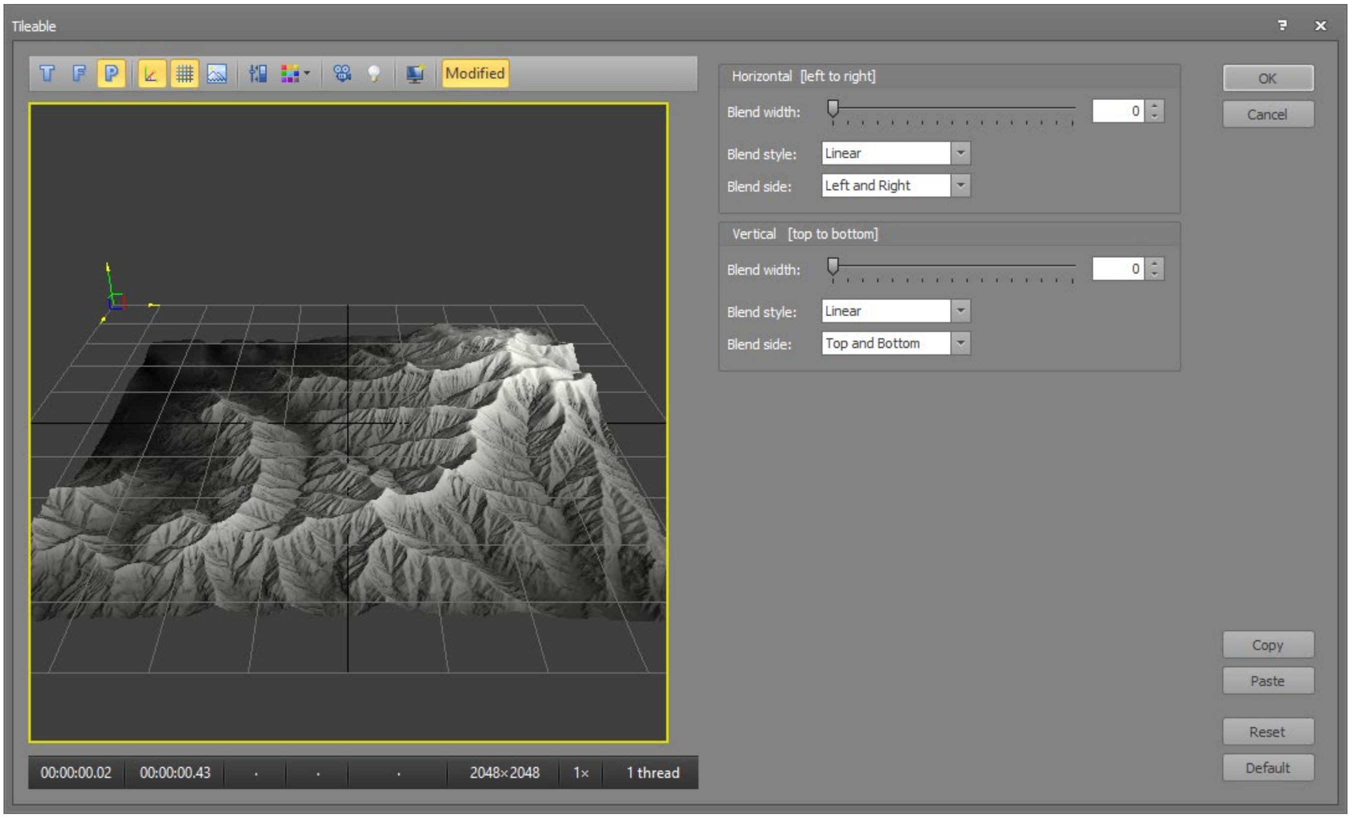
Notes

This device does not preserve the original altitude data.

This device requires 0 additional datamap memory allocations.

Transform: Tileable

Modify the edges of a datamap so that it becomes tileable.



Blend width: The number of samples to use along the axis for blending the edges.
Blend style: The blend style:
- Linear = a linear ramp blend.
- Curved = a curved ramp blend.

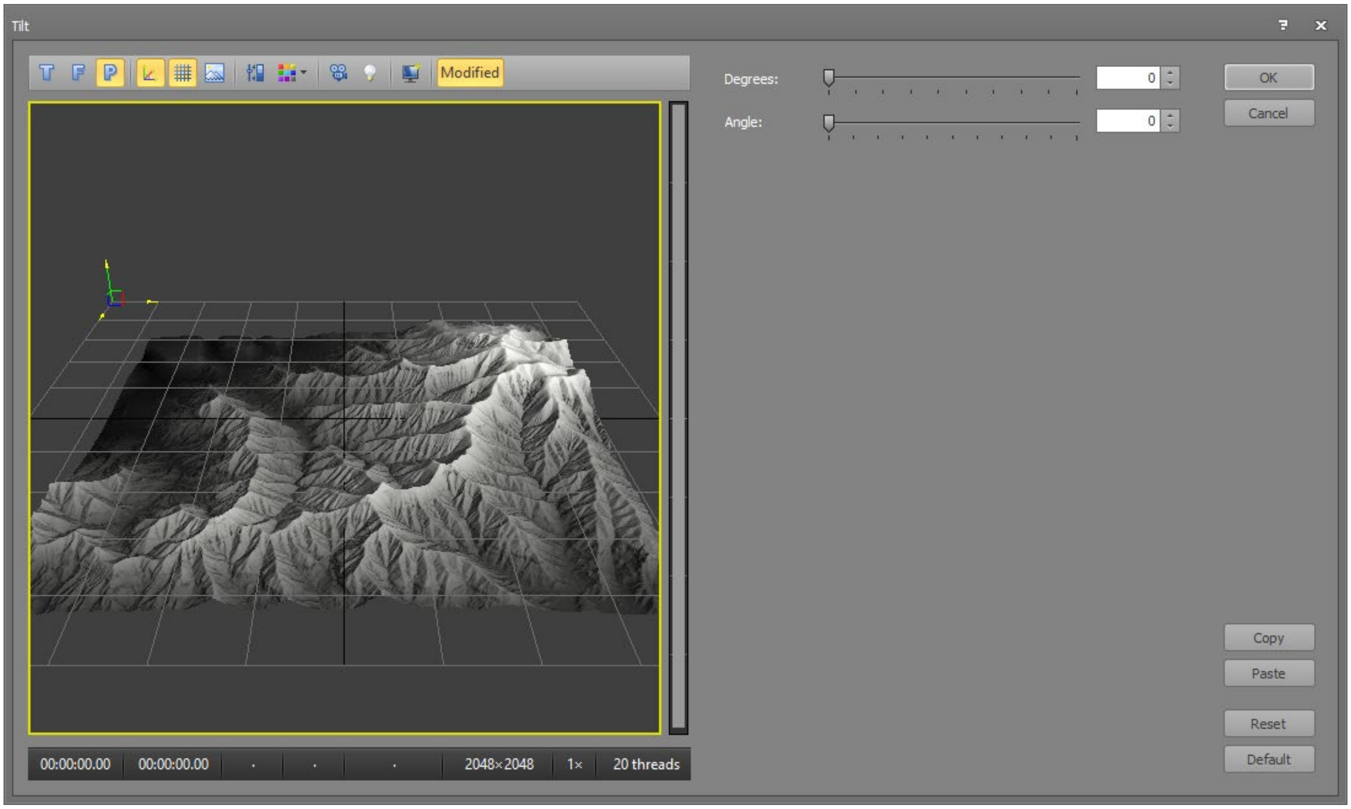
Blend side: Whether to blend the left, right, top, or bottom sides.

Notes

This function does not preserve the original altitude data.

Transform: Tilt

Tilt the datamap at an angle on the specified rotation degrees.



Degrees: The tilt degrees, 0 to 360.
Angle: The tilt angle.

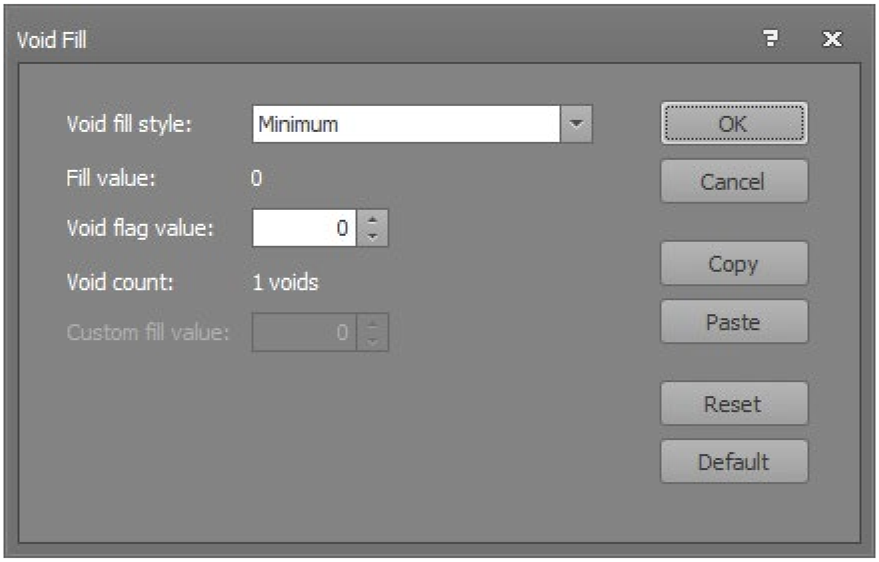
Notes

This device does not preserve the original altitude data.

This device requires 1 additional datamap memory allocation.

Transform: Void Fill

Fill Digital Elevation Model voids in the datamap.



Void fill type:	The void fill type. - Minimum: fill voids with the value 0.0. - Center: fill voids with the value 50.0. - Maximum: fill voids with the value 100.0. - Low value: fill voids with the low value of the heightmap. - Middle value: fill voids with the middle value of the heightmap. - High value: fill voids with the high value of the heightmap. - Linear Interpolation: fill voids using horizontal line interpolation. - Proxy Heightmap: fill voids from a lower resolution proxy heightmap of the same region. - Custom: fill voids with the custom specified value.
Fill value:	The void fill value for single value fill types.
No data value:	The void or no-data value to fill.
Void count:	The number of voids found in the datamap.
Custom fill value:	The custom void fill value.

Notes

This device does not preserve the original altitude data.

This device requires 1 additional datamap memory allocation for some of the void fill algorithms.

Devices Erosion

Applies an erosion algorithm over the heightmap to simulate real-world erosion effects.

Some of the erosion algorithms are extremely computation and memory intensive, and can therefore take many hours to complete on large heightmaps. It is always best to try a less intense erosion first to determine whether it produces the desired effects.

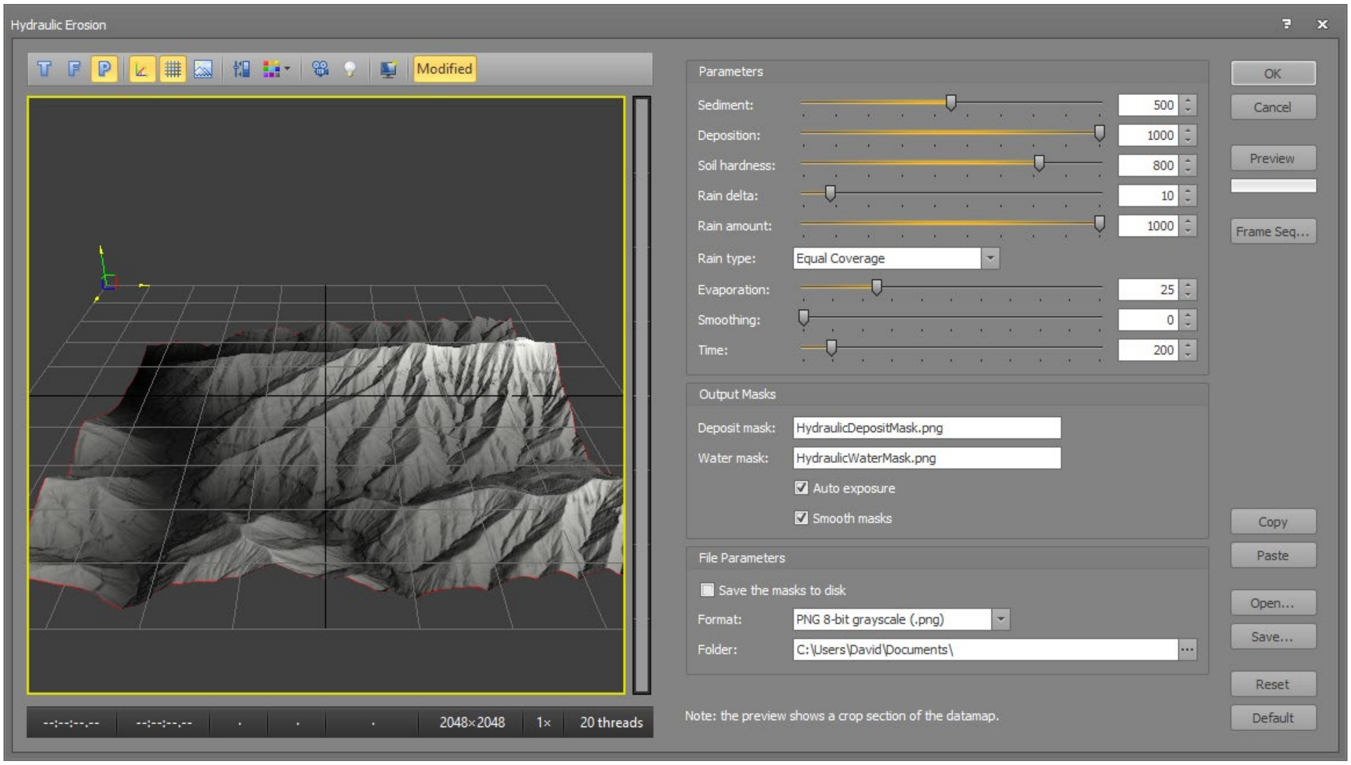
The erosion algorithms are not a fast immediate real-time operation, so the Preview button must be used to generate an erosion preview, followed by a wait until the erosion function is complete, as indicated on the preview progress bar.

Different erosion types produce different erosion results. Each erosion type is suited for specific visual looks and different terrain layouts.

Masks are created during the erosion process, which can be saved as files and used for texture weightmaps, splatmap textures, or image editing masks.

Erosion: Hydraulic

Hydraulic erosion simulates rainfall with soil erosion and movement from higher altitudes to lower altitudes.



Sediment:	The amount of sediment that the water can carry.
Deposition:	The sediment deposit rate.
Soil hardness:	The rate at which soil converts to sediment.
Rain delta:	The amount of time between each rainfall.
Rain amount:	The amount of rain that falls for each time step.
Rain type:	The rainfall type: - Equal coverage = the rain amount is equal over the entire map. - Adiabatic weighted = more rainfall at higher altitudes (natural). - Inverse Adiabatic weighted = more rainfall at lower altitudes (unnatural).
Evaporation:	The rate of rain water evaporation at each time step.
Smoothing:	The amount of smoothing applied after the erosion.
Time:	The number of erosion passes to simulate the amount of time passed.
Deposit mask:	The Deposit mask file name.
Water mask:	The Water mask file name.
Save the masks	Save the masks to disk.
Format:	The mask file format to save as.
Folder:	The file folder where the masks are saved.

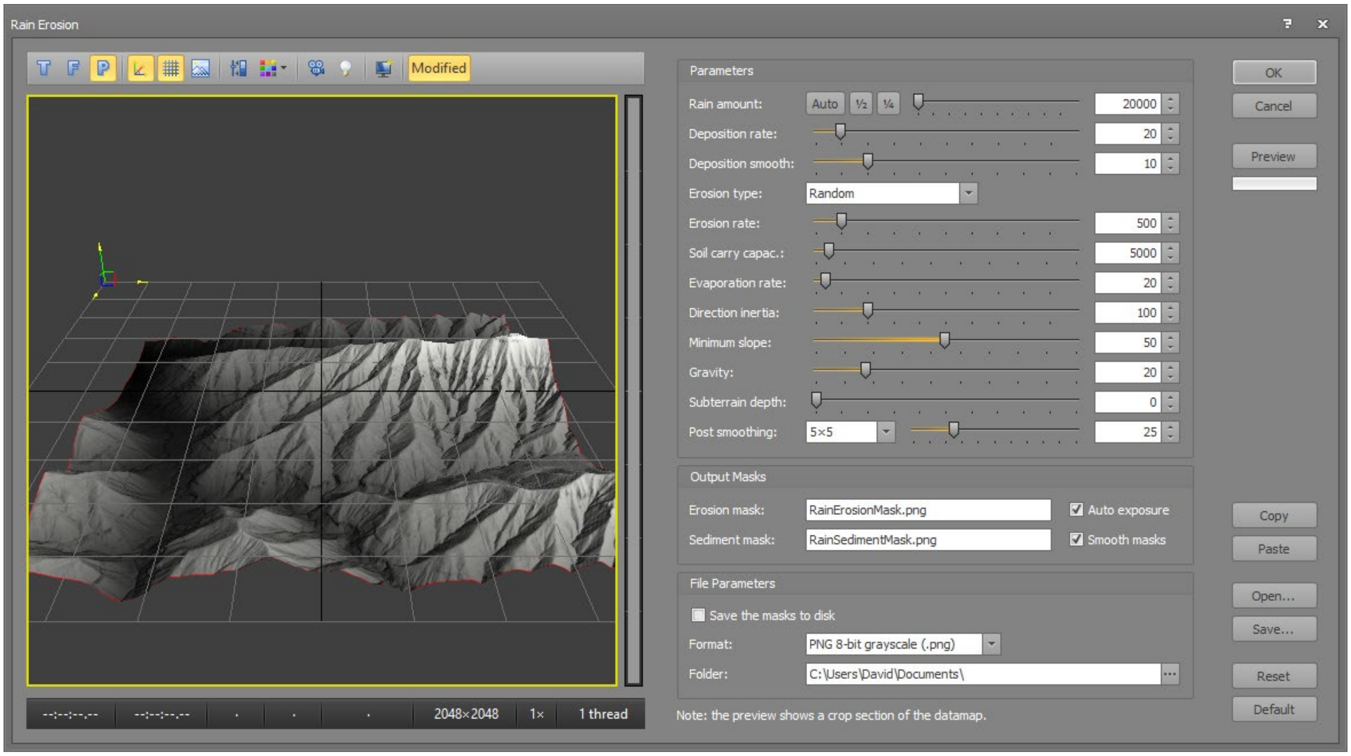
Notes

This device does not preserve the original altitude data.

This device requires 2 masks and 4 floating-point temporary arrays.

Erosion: Rain

Rain erosion simulates particles of rain that carve out erosion flow maps on the datamap.



Rain amount:	The number of rain particles.
Deposition rate:	The sediment deposit rate.
Deposition smooth:	Smoothing applied after sediment is dropped.
Erosion type:	The erosion particle type.
Erosion rate:	The erosion rate, the hardness of the terrain rock.
Soil carry capacity:	The amount of soil that can be carried within a particle.
Evaporation rate:	The particle water evaporation rate.
Direction inertia:	The speed that the particle can change direction.
Minimum slope:	The minimum slope where the particle stops moving.
Gravity:	The amount of gravity affecting the particle velocity.
Subterrain depth:	How much the particles can take the terrain below altitude 0.
Post smoothing:	Smoothening applied to the datamap after the erosion.

Erosion mask:	The erosion mask file name.
Sediment mask:	The sediment mask file name.

Save the masks to disk:	Whether to save the masks to disk.
Format:	The mask file format.
Folder:	The mask file folder.

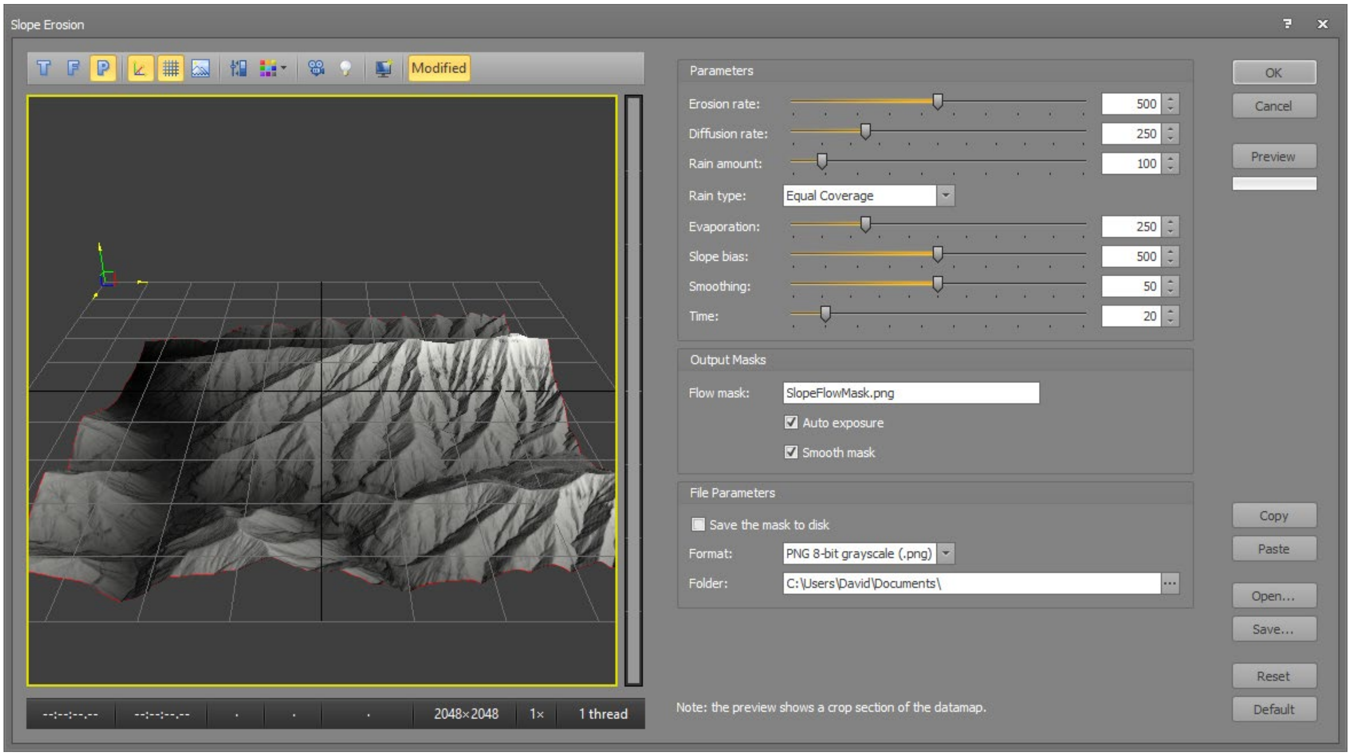
Notes

This device does not preserve the original altitude data.

This device requires 2 datamap masks and 0 temporary datamaps.

Erosion: Slope

Slope erosion simulates water flowing down the slope of each patch of the terrain, carving a fluvial path downhill.



Erosion rate:	The rate of cellular erosion for each time step.
Diffusion rate:	The rate of cellular diffusion for each time step.
Rain amount:	The amount of rain that falls for each time step.
Rain type:	The rainfall type: - Equal coverage = the rain amount is equal over the entire map. - Adiabatic weighted = more rainfall at higher altitudes (natural). - Inverse Adiabatic weighted = more rainfall at lower altitudes (unnatural).
Evaporation:	The rate of rain water evaporation for each time step.
Slope bias:	Erosion slope bias, how the water follows the slope of the terrain.
Smoothing:	The amount of smoothing applied after the erosion.
Time:	The number of erosion passes to simulate the amount of time passed.
Flow mask:	The Flow mask file name.
Save the masks	Save the masks to disk.
Format:	The mask file format to save as.
Folder:	The file folder where the masks are saved.

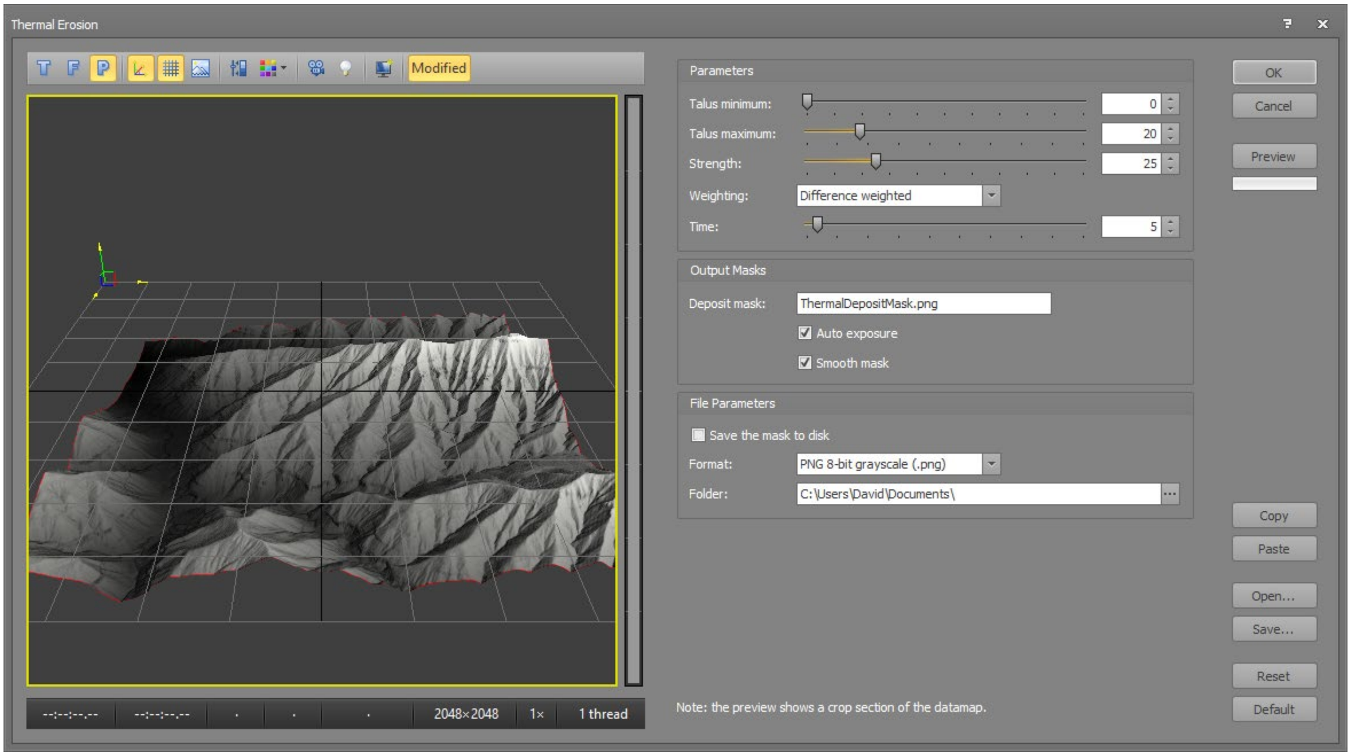
Notes

This device does not preserve the original altitude data.

This device requires 1 mask and 5 floating point temporary arrays.

Erosion: Thermal

Thermal erosion simulates the breaking up of soil due to thermal expansion and contracting.



Talus min:	The minimum altitude difference before erosion occurs.
Talus max:	The maximum altitude difference when erosion occurs.
Strength:	The erosion strength
Weighting:	The erosion deposit weighting type: - Difference weighted. - Maximum average weighted.
Time:	The number of erosion passes to simulate the amount of time passed.
Deposit mask:	The Deposit mask file name.
Save the masks	Save the masks to disk.
Format:	The mask file format to save as.
Folder:	The file folder where the masks are saved.

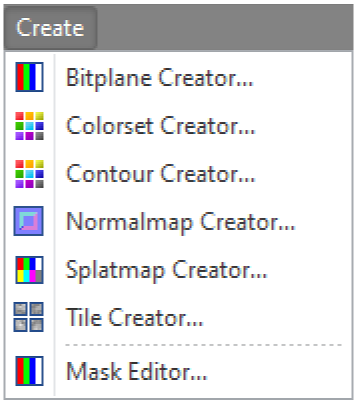
Notes

This device does not preserve the original altitude data.

This device requires 1 mask and 2 floating point temporary arrays.

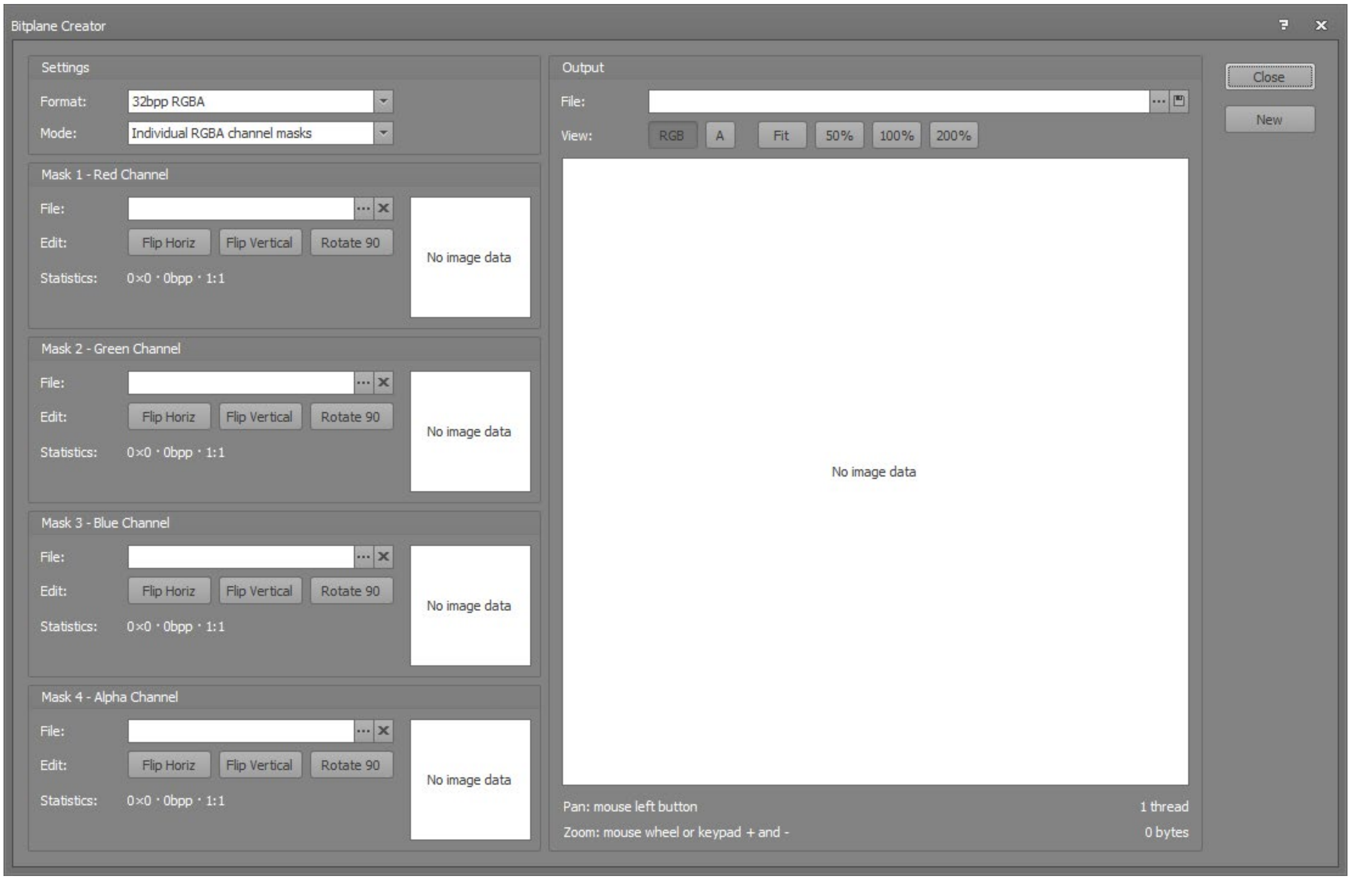
Create Menu

The create menu contains tools that are used for creating image and texture and video game assets.



Bitplane Creator

Pack up to four grayscale masks into a single RGBA texture.

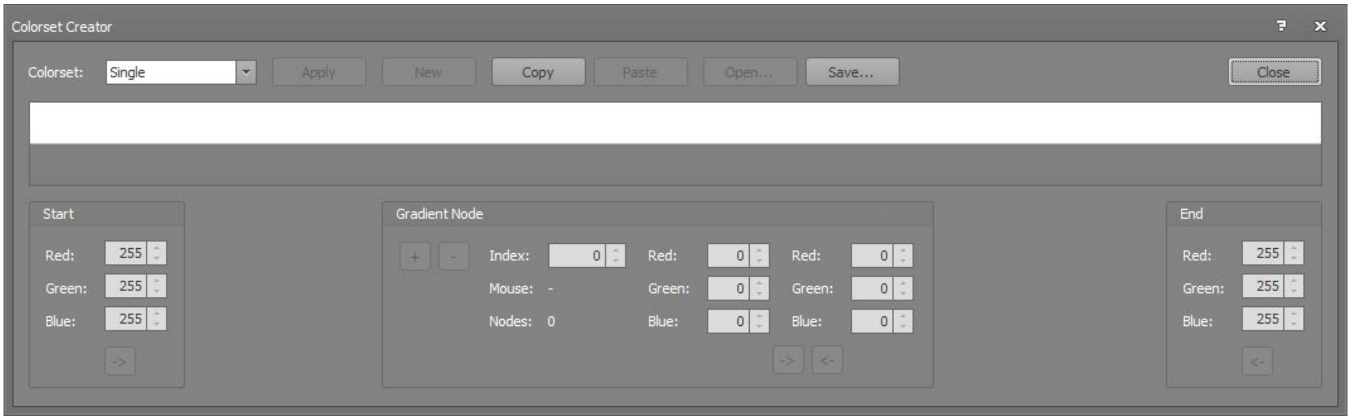


Notes

The image tools are basically designed for creating 3D DirectX and OpenGL textures up to 16384 × 16384.
There are maximum image resolutions imposed by the Microsoft Windows Imaging APIs.
The 24-bit RGB texture format has a resolution limit of 26754 × 26754.
The 32-bit RGBA texture format has a resolution limit of 23170 × 23170.

Colorset Creator

Create custom colorsets for the main editor terrain rendering.

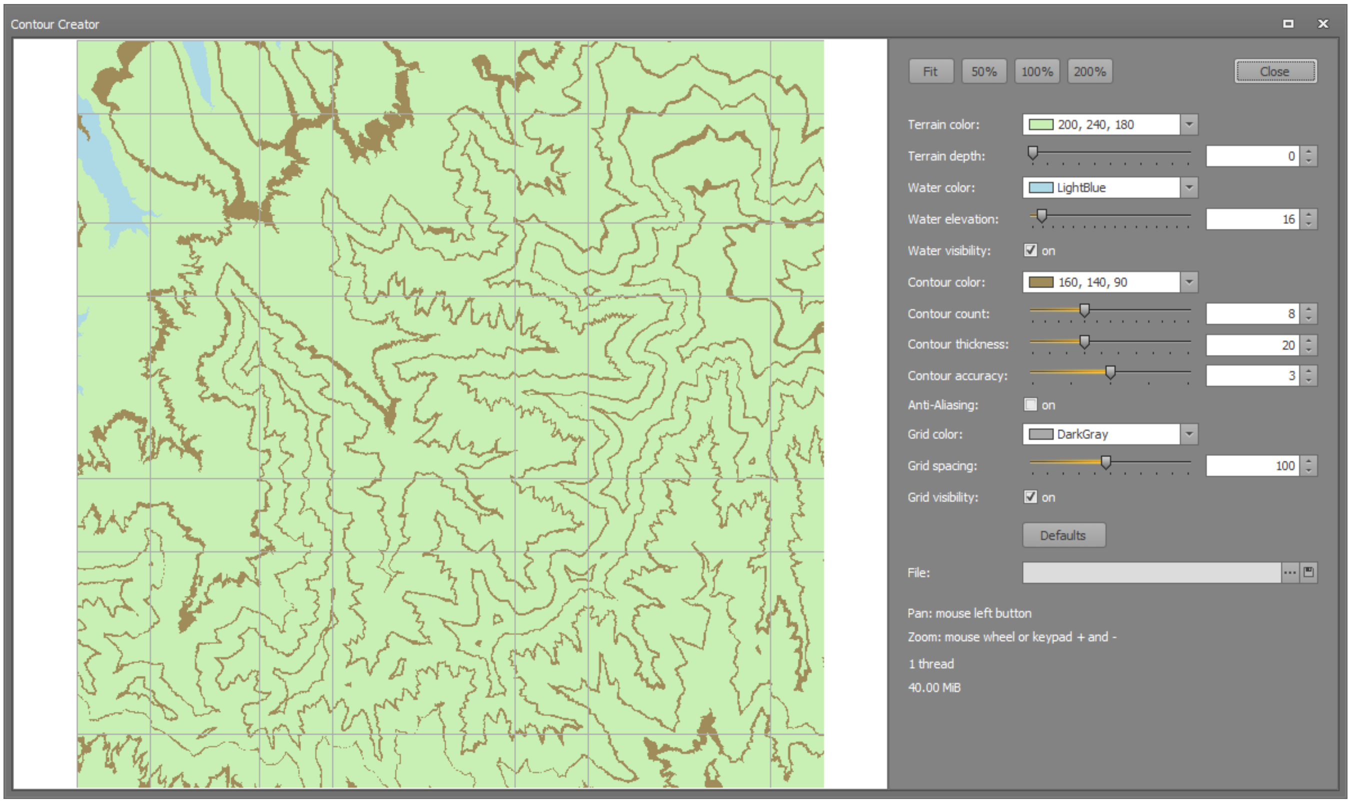


Notes

The Colorset Creator supports up to four Custom Colorsets.

Contour Creator

Convert the main editor datamap into a contour map.

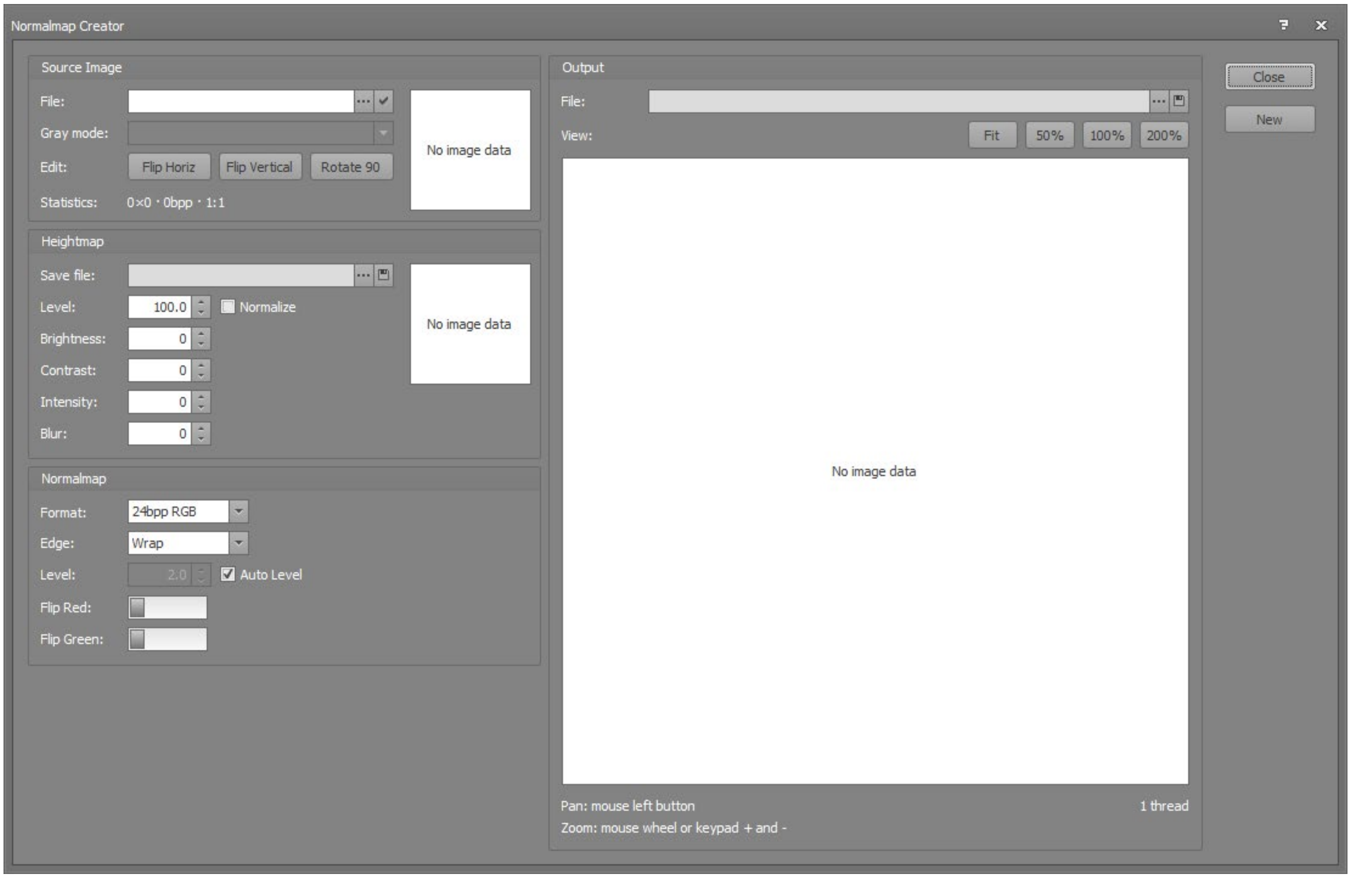


Notes

The image tools are basically designed for creating 3D DirectX and OpenGL textures up to 16384 × 16384.
There are maximum image resolutions imposed by the Microsoft Windows Imaging APIs.
The 24-bit RGB texture format has a resolution limit of 26754 × 26754.
The 32-bit RGBA texture format has a resolution limit of 23170 × 23170.

Normalmap Creator

Convert any image or grayscale image into a normalmap.

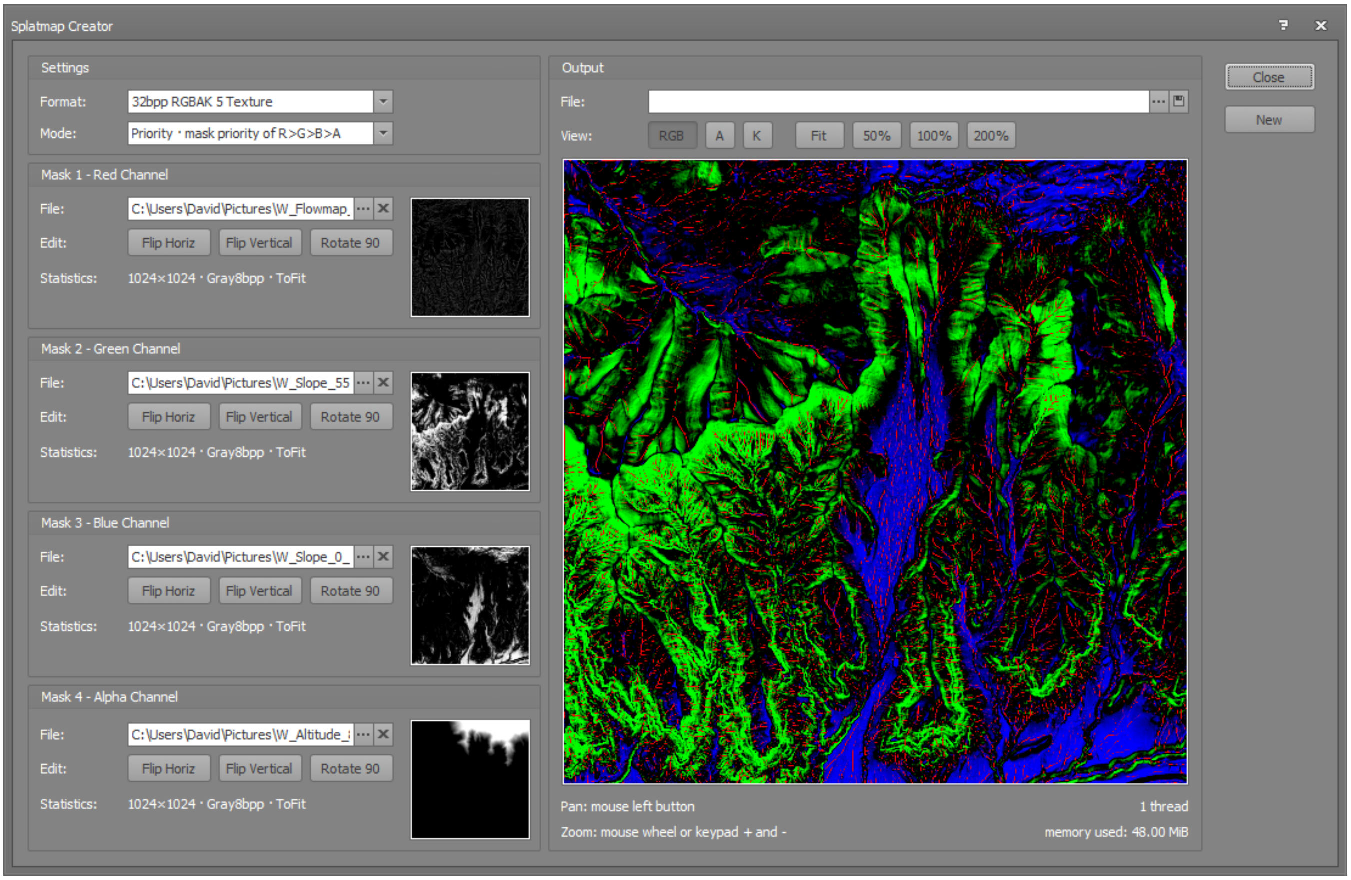


Notes

The image tools are basically designed for creating 3D DirectX and OpenGL textures up to 16384 × 16384.
There are maximum image resolutions imposed by the Microsoft Windows Imaging APIs.
The 24-bit RGB texture format has a resolution limit of 26754 × 26754.
The 32-bit RGBA texture format has a resolution limit of 23170 × 23170.

Splatmap Creator

Create splatmap texture files for RG, RGB, RGBA, and RGBAK splatmaps.

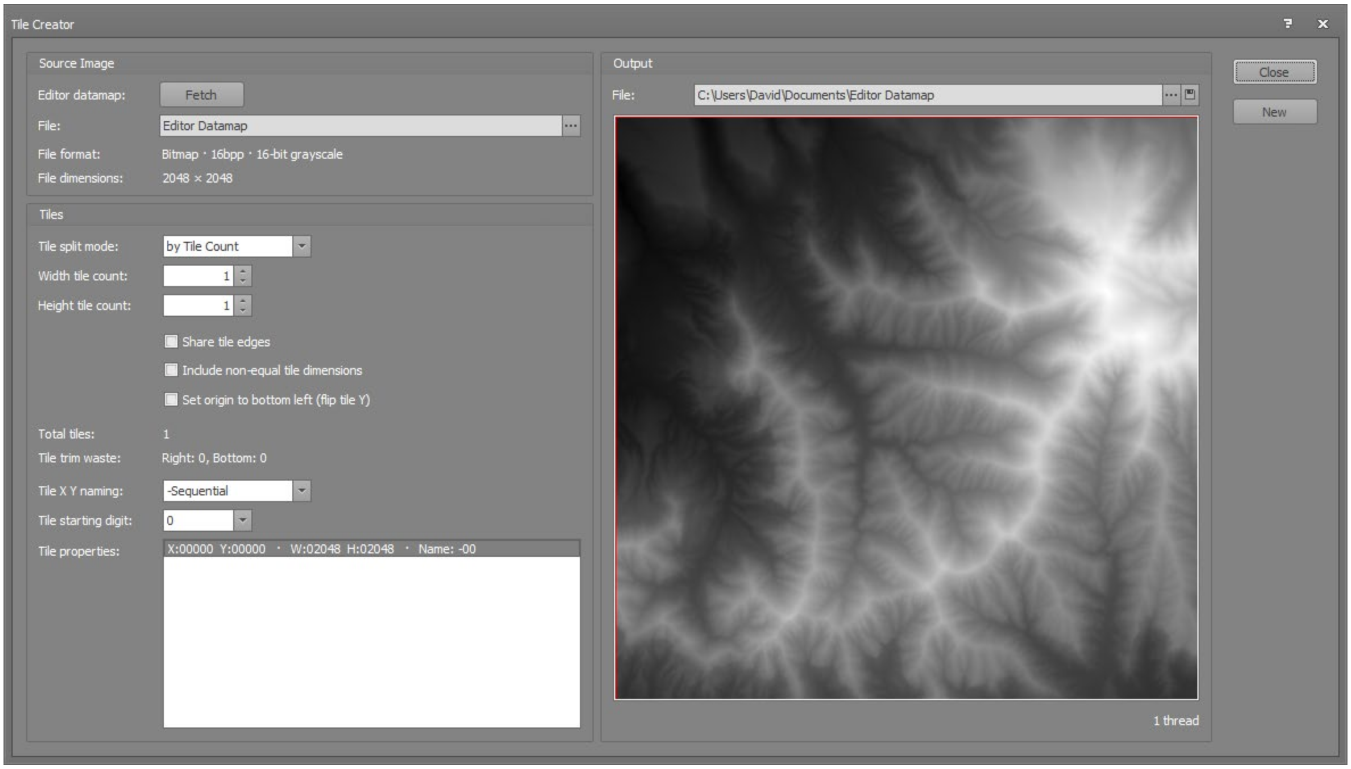


Notes

The image tools are basically designed for creating 3D DirectX and OpenGL textures up to 16384 × 16384.
There are maximum image resolutions imposed by the Microsoft Windows Imaging APIs.
The 24-bit RGB texture format has a resolution limit of 26754 × 26754.
The 32-bit RGBA texture format has a resolution limit of 23170 × 23170.

Tile Creator

Split any grayscale or RGB texture file or the main editor datamap into tiles.



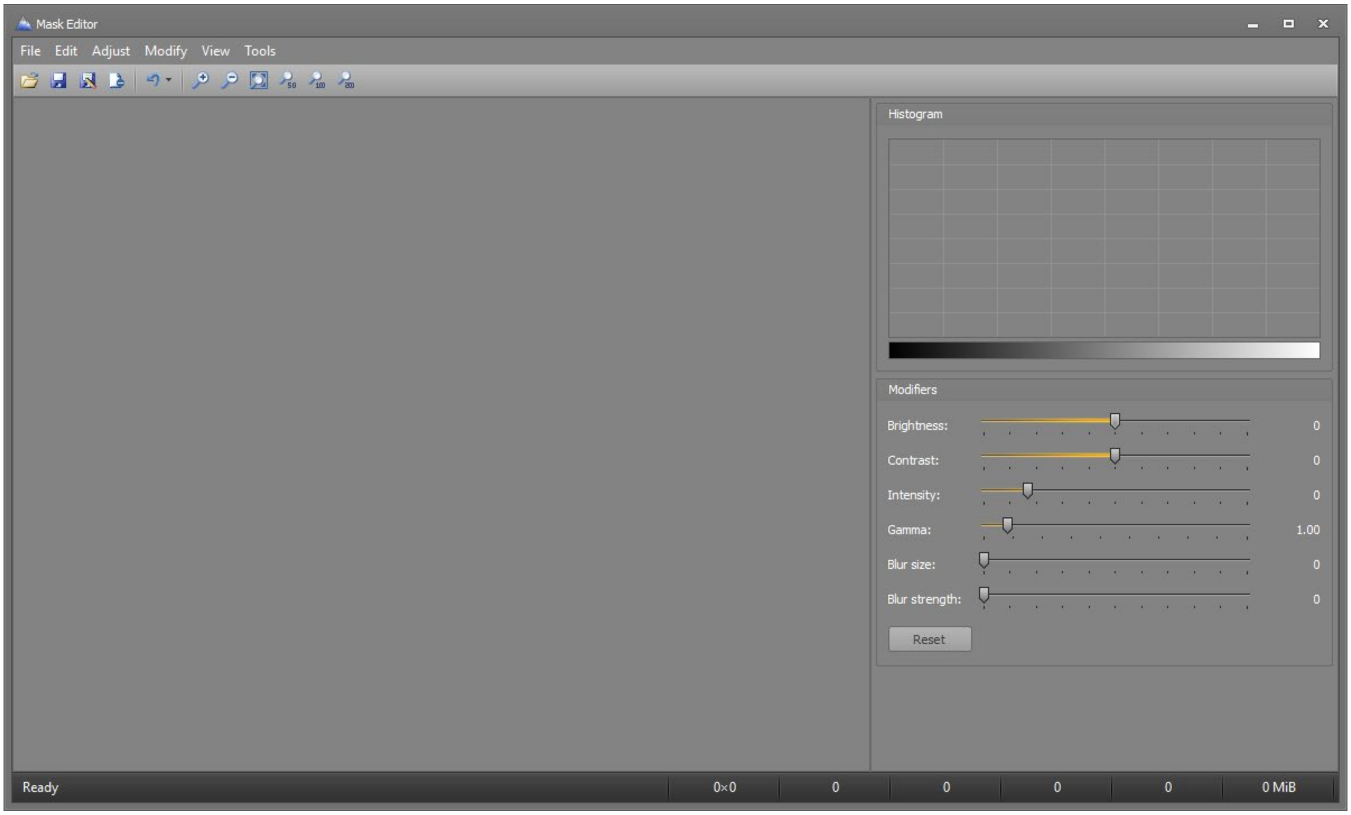
Notes

The maximum number of tiles is 52 × 52.

The image tools are basically designed for creating 3D DirectX and OpenGL textures up to 16384 × 16384.
There are maximum image resolutions imposed by the Microsoft Windows Imaging APIs.
The 24-bit RGB texture format has a resolution limit of 26754 × 26754.
The 32-bit RGBA texture format has a resolution limit of 23170 × 23170.

Mask Editor

Edit grayscale masks.

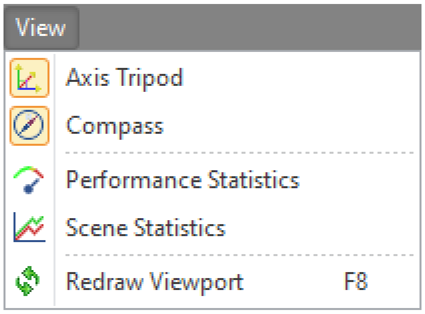


Notes

The image tools are basically designed for creating 3D DirectX and OpenGL textures up to 16384 × 16384.
There are maximum image resolutions imposed by the Microsoft Windows Imaging APIs.
The 24-bit RGB texture format has a resolution limit of 26754 × 26754.
The 32-bit RGBA texture format has a resolution limit of 23170 × 23170.

View Menu

The view menu toggles information display sets on the main editor viewport.



Axis Tripod – Toggle the editor viewport axis tripod visibility.
The axis tripod can be disabled in the Settings Scene settings.

Compass – Toggle the editor viewport compass icon visibility.

Performance Statistics – Display the viewport rendering performance statistics.
The performance statistics include the frame render time.
See the chapter on *Viewport Statistics*.

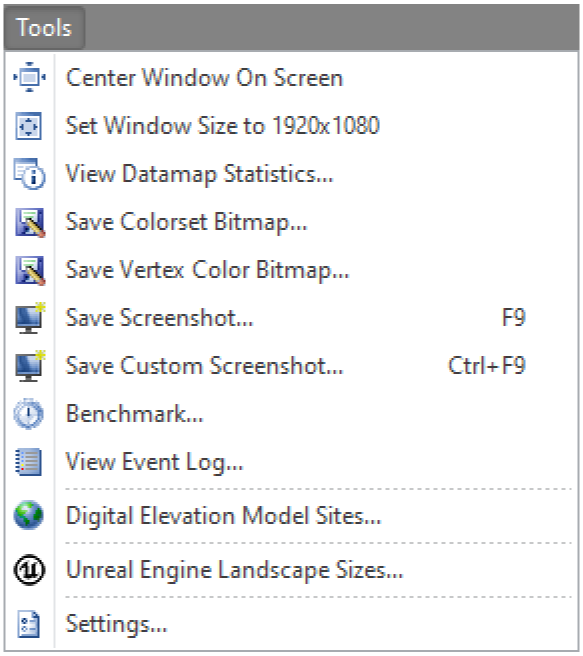
Scene Statistics – Display the viewport rendering scene statistics.
See the chapter on *Viewport Statistics*.

Redraw Viewport – Redraw the viewport scene.

The statistics display font can be changed in the Settings Viewport settings.
The performance statistics and scene statistics can be enabled in the Settings Scene settings.
The performance statistics units can be changed in the Settings Scene settings.

Tools Menu

Contains special tools items.



Center Window on Screen – Center the application window on the screen. This properly handles multi-monitor setups.

Set Window Size to 1920x1080 – Set the main window size to 1920x1080.

Tools: View Datamap Statistics

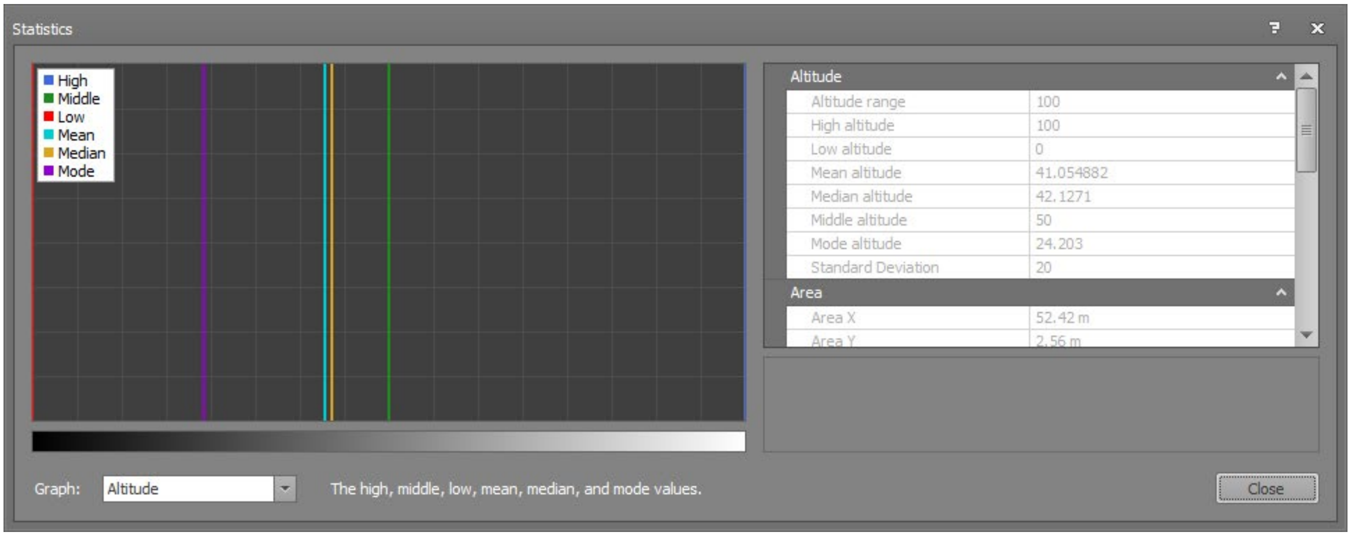
The Statistics dialog displays a set of statistical values for the current datamap, along with a variety of statistical graphing functions.

The statistical values list contains in-depth information on the current datamap.
The available graph types include Altitude, Deviation, Histogram, and Range.
Each graph is based on a horizontal altitude from 0.0 to 100.0 with the gradient bar indicator referencing 0.0 as black and 100.0 as white.

Altitude Statistics

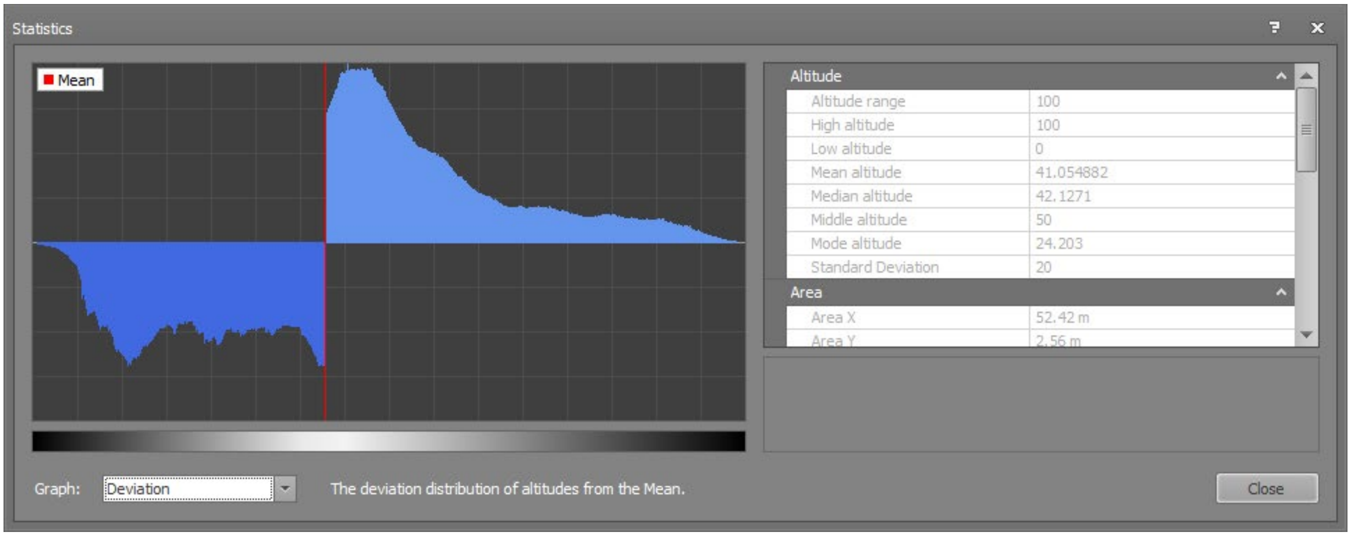
This graph displays the heightmap altitude values of high, low, mean, median, and mode.

High: the highest altitude.
Low: the lowest altitude.
Mean: the mean altitude, the mathematical average value.
Median: the median altitude, the midpoint value.
Mode: the mode altitude, the most frequently occurring value.



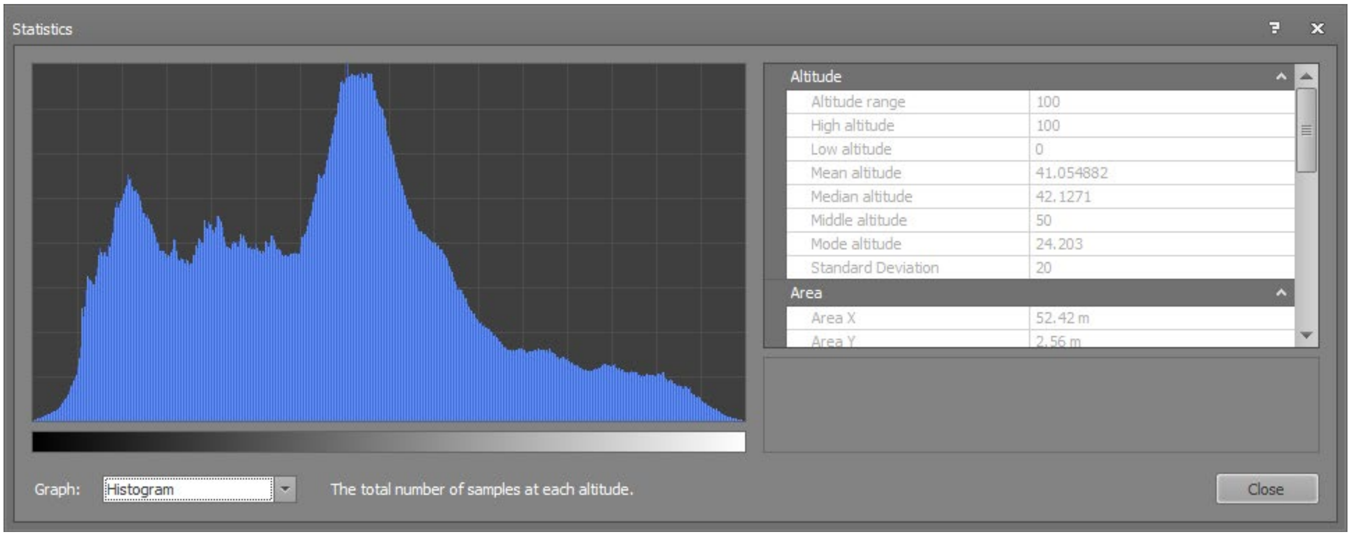
Deviation Statistics

This graph displays a deviation curve of the heightmap data.
The statistical deviation is the distribution of all of the heightmap altitudes, positive and negative, from the Mean mathematical average value.



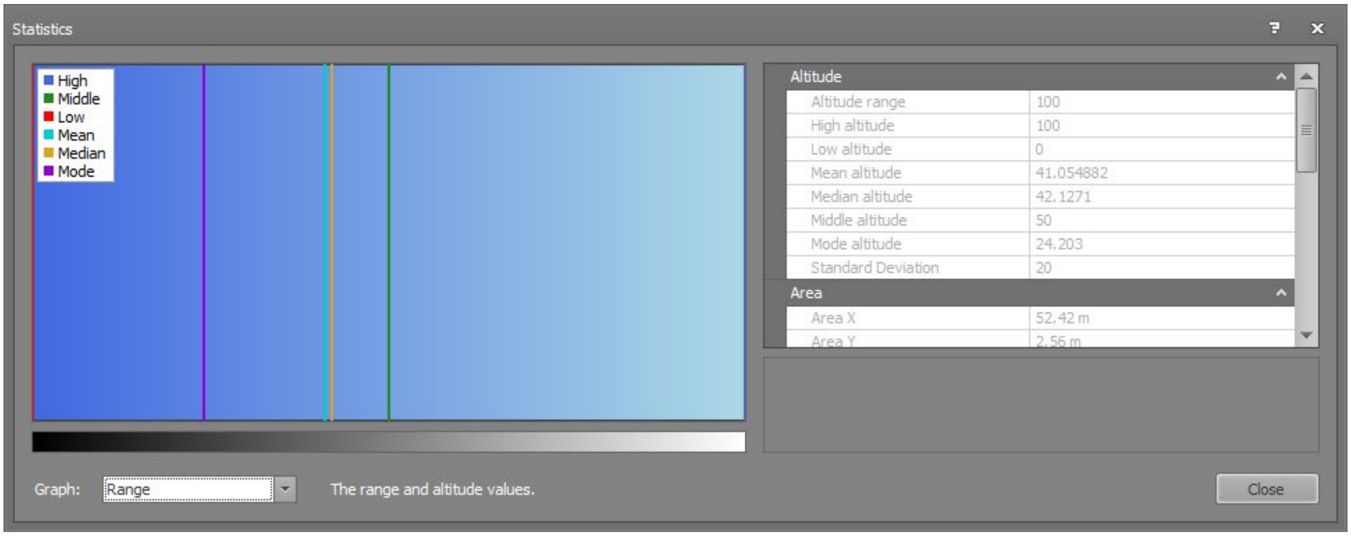
Histogram Statistics

This graph displays a histogram curve of the heightmap data.
The histogram is the frequency distribution of the data, which is a total count of each individual altitude.



Range Statistics

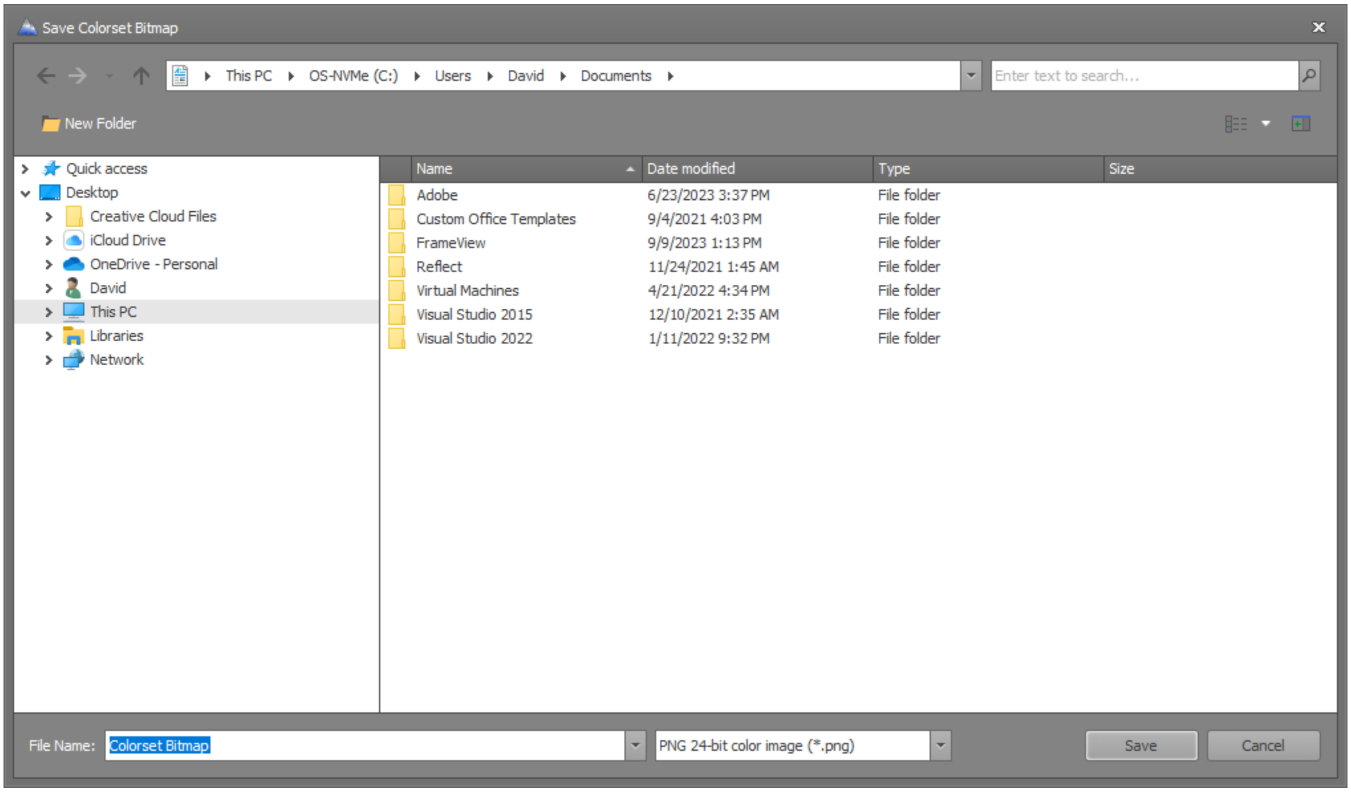
This graph is similar to the Altitude graph but includes a gradient region that depicts the full range of the heightmap data.



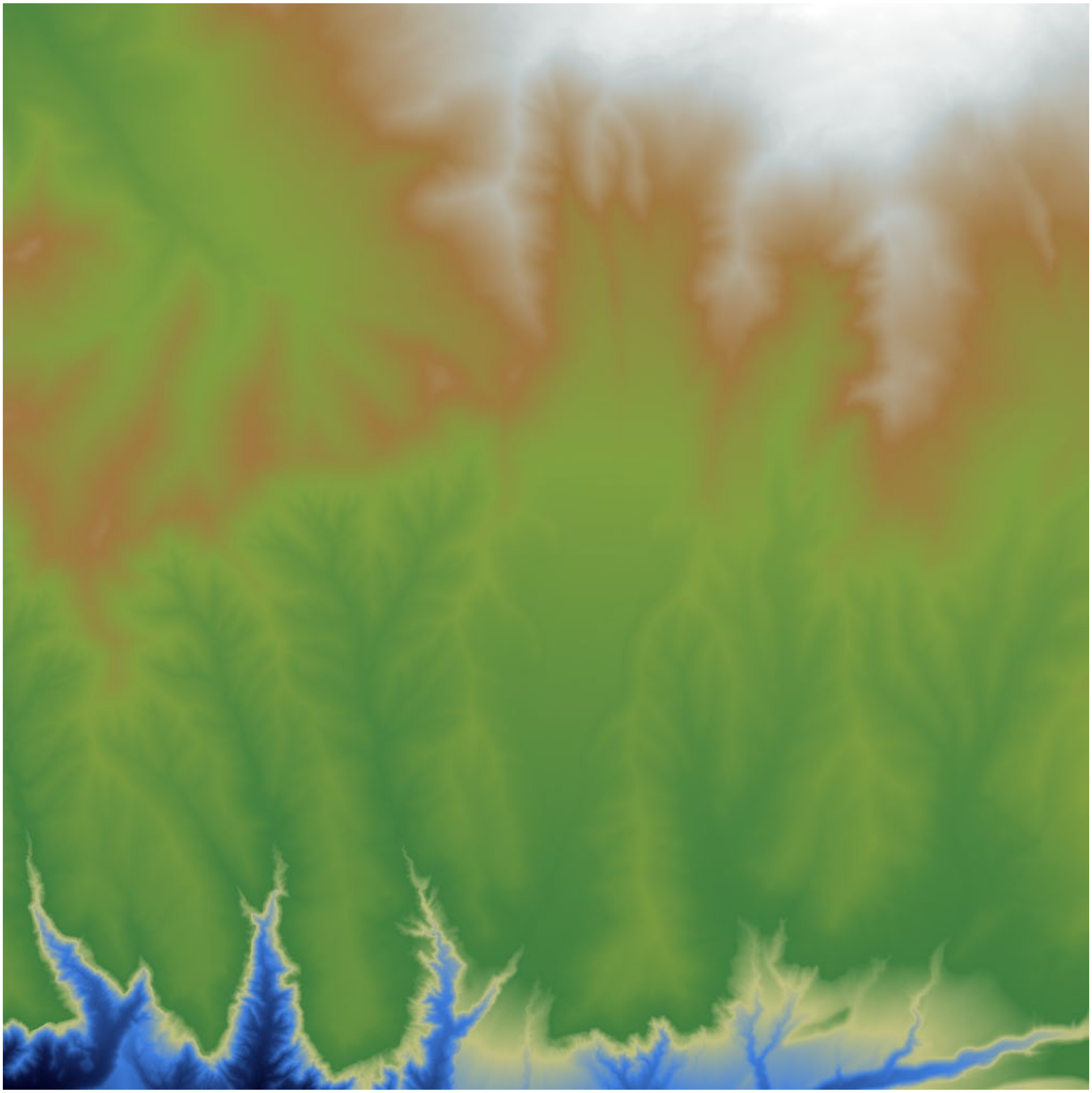
Tools: Save Colorset Bitmap

Save the heightmap colorset material as an image file.

This function will display a file dialog prompting for the image file to save.
The image file will be a copy of the heightmap that is colored with the current Colorset.
Note that this file will be the same resolution as the heightmap, so large heightmaps will result in large image files.



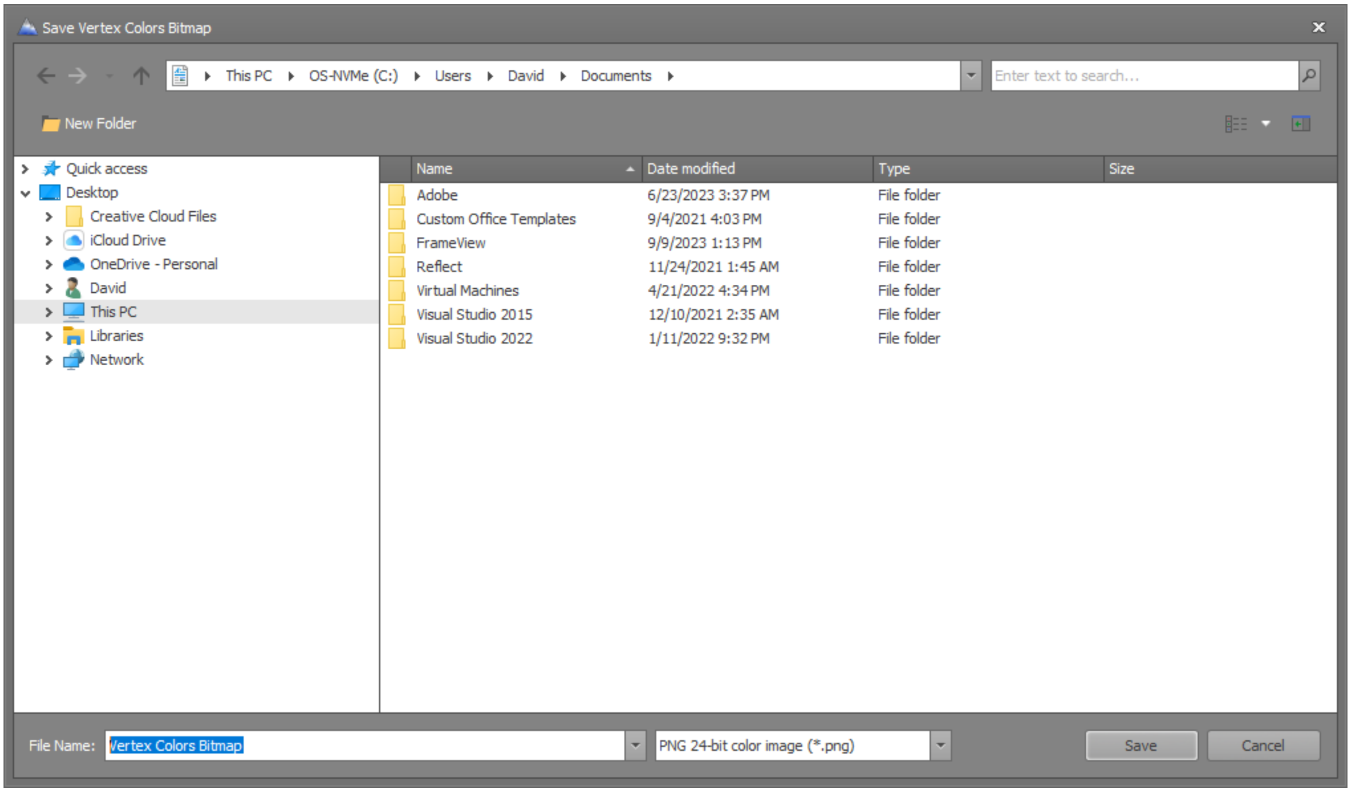
This example image is a digital elevation model colored with the Earth colorset.



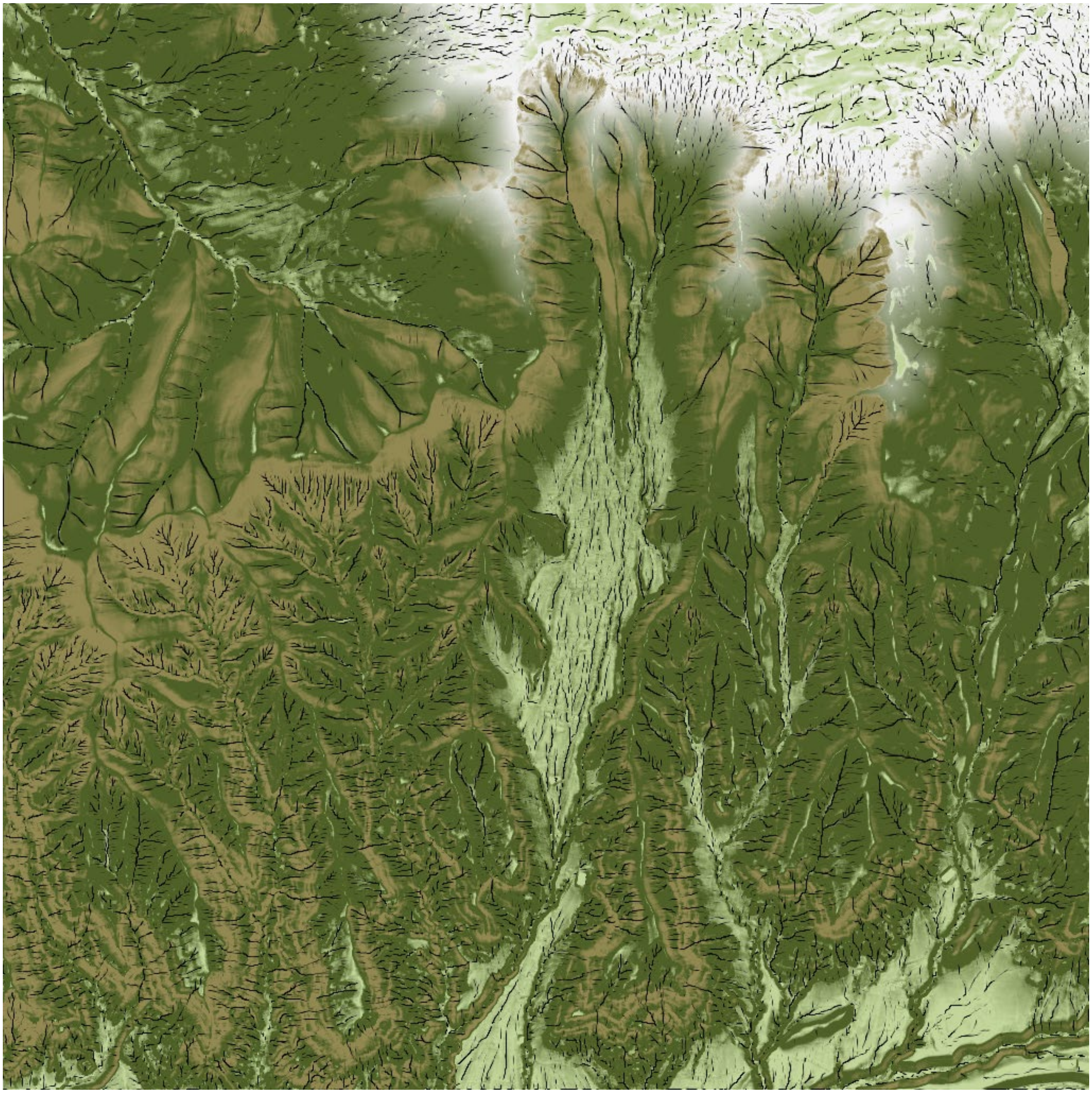
Tools: Save Vertex Color Bitmap

Save the terrain mesh colorset material as an image file.

This function will display a file dialog prompting for the image file to save.
The image file will be a copy of the terrain mesh that is colored with the current Colorset or Colormap or Texture.
Note that this file will be the same resolution as the terrain mesh, so the maximum size will be 4096x4096.

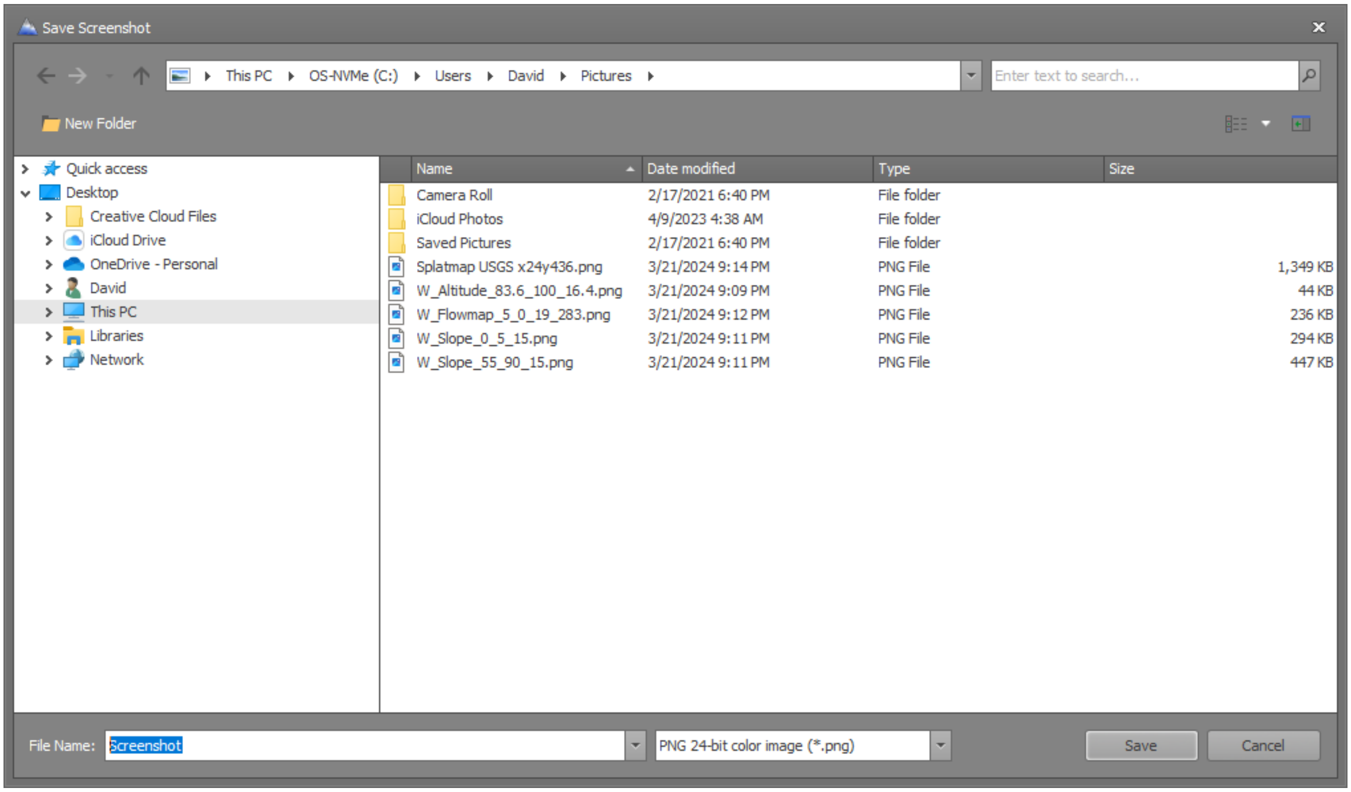


This example image is a digital elevation model using a splatmap colormap with grassy earthtone coloring.

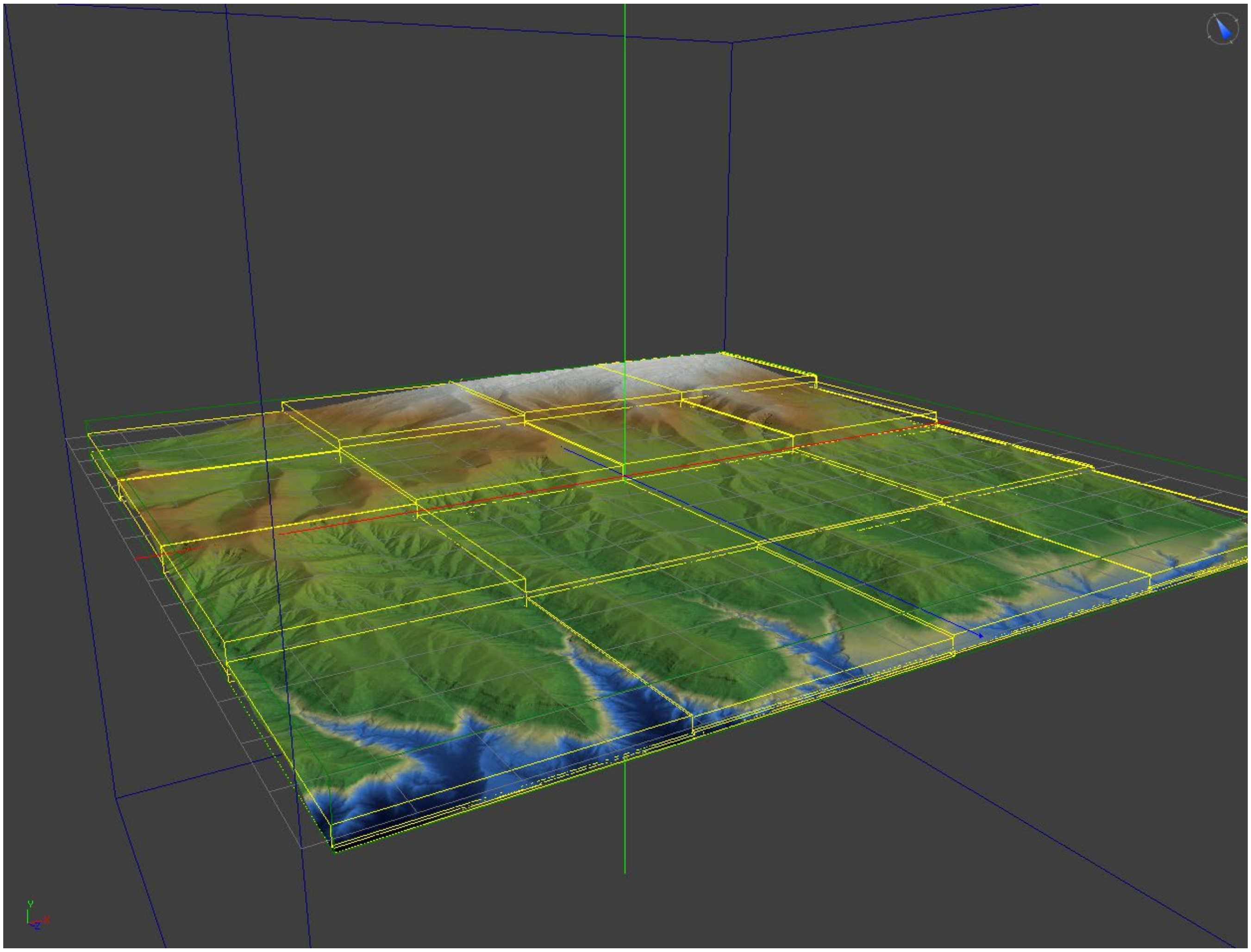


Tools: Save Screenshot

Save the current contents of the viewport as an image file.
This function is valid for all orthogonal and perspective views.



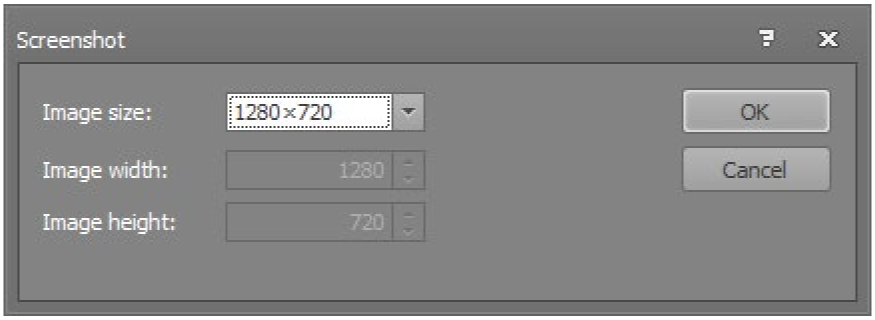
The viewport with a digital elevation model heightmap, and some of the Scene Objects visible.

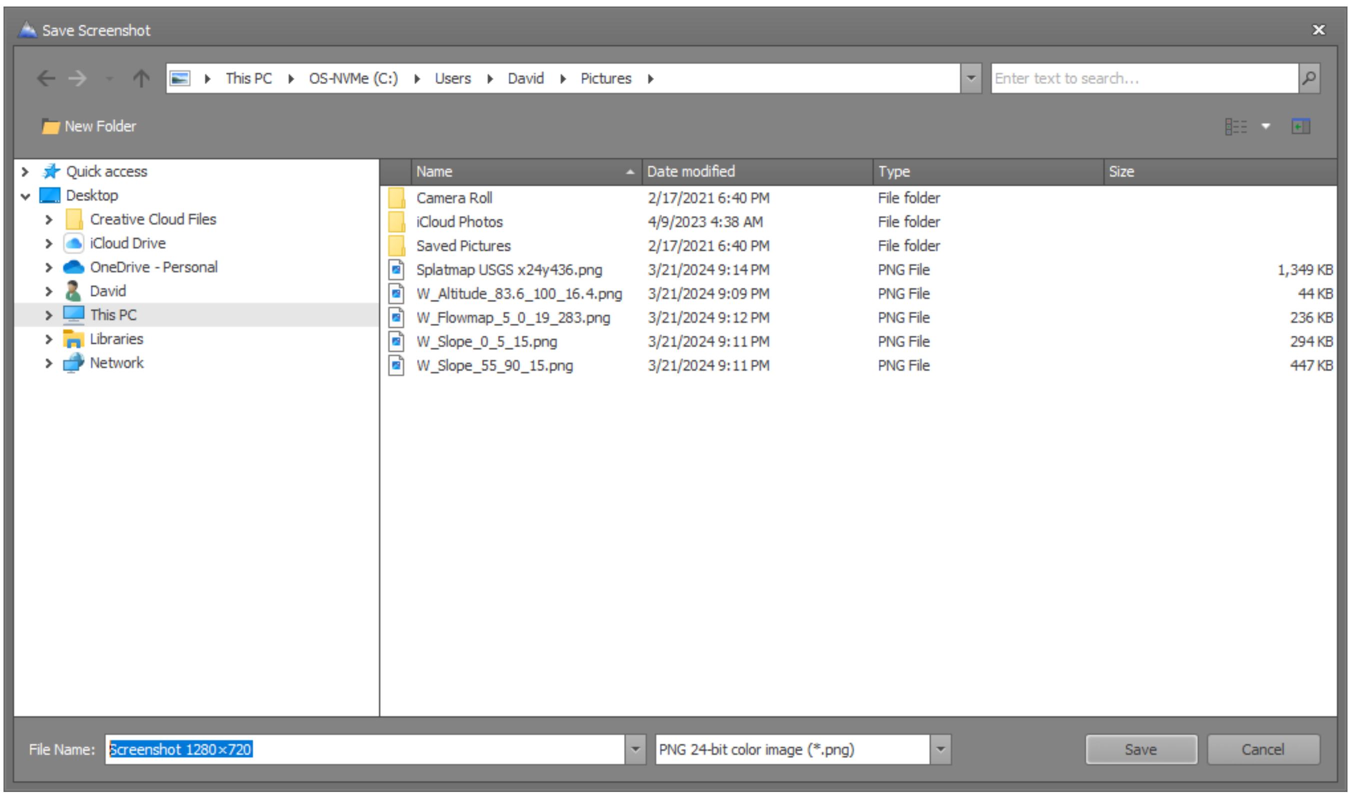


Save Custom Screenshot

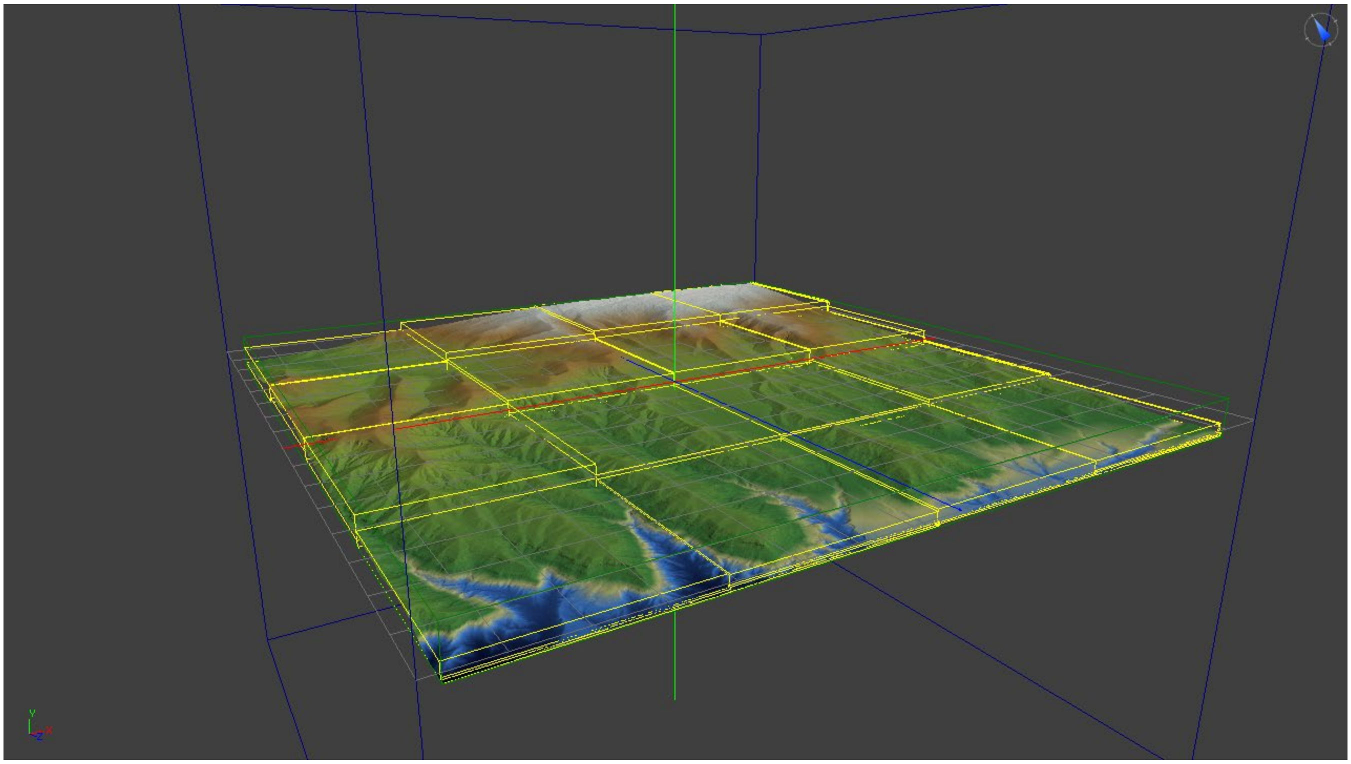
Save the current contents of the viewport as an image file of the specified resolution.
This function is valid for all orthogonal and perspective views.

Choose the size of the custom screenshot.
The preset values include resolutions from 1280x720 to 15360x8640.





The 1280x720 screenshot.



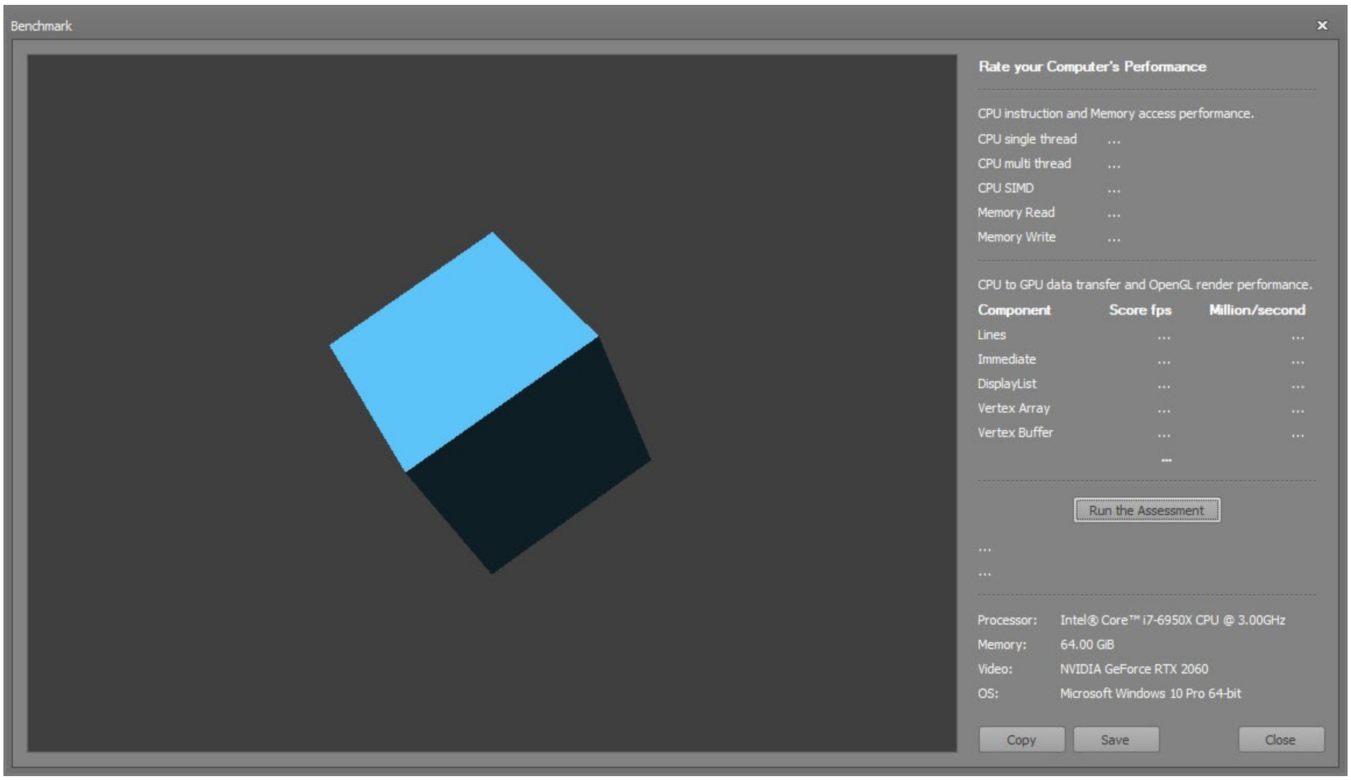
Tools: Benchmark

The benchmark dialog runs a test of the computer system's data transfer and rendering performance.

Choose the Benchmark item on the Tools menu to launch the Benchmark dialog.
Click on the *Run the Assessment* button to start the benchmark. The benchmark process will require approximately one minute to complete.

The score fps is the number of frames per second achieved while rendering a specific component type.
The million/second is the millions of lines or triangles rendered per second.
The computer system's final benchmark score number will be displayed in the speedometer graphic.
The score number is an average of all of the results from the individual component tests.

The most important rating in the benchmark is the Vertex Buffer score as this is the most common 3D entity type used by TerreSculptor.



Benchmark Results for an i7-6950X 10-Core, 64GB memory, RTX-2060.
Note that Vertical Sync is on hence the 60FPS cap.

Rate your Computer's Performance

CPU instruction and Memory access performance.

CPU single thread	249.62 million ops/sec
CPU multi thread	3,303.96 million ops/sec
CPU SIMD	682.83 million ops/sec
Memory Read	1.64 billion ops/sec
Memory Write	1.54 billion ops/sec

CPU to GPU data transfer and OpenGL render performance.

Component	Score fps	Million/second
Lines	60.20	1.20 M lines
Immediate	60.20	12.48 M triangles
DisplayList	60.00	12.44 M triangles
Vertex Array	60.10	12.46 M triangles
Vertex Buffer	60.10	12.46 M triangles
	60 fps	

Run the Assessment

Benchmark complete.

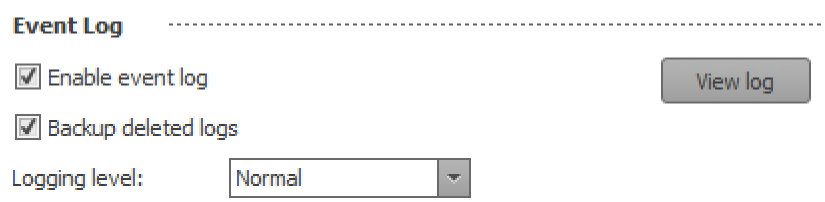
Processor:	Intel® Core™ i7-6950X CPU @ 3.00GHz
Memory:	64.00 GiB
Video:	NVIDIA GeForce RTX 2060
OS:	Microsoft Windows 10 Pro 64-bit

Tools: Event Log

TerreSculptor includes an event log system that is useful for both troubleshooting software issues and for obtaining general application operational status information.

Event Log Settings

The application Settings dialog includes a number of settings for controlling the operation of the event log. The event log settings are located on the Settings dialog's System tab.



Enable event log	Enable writing of events to the application event log file.
Backup deleted logs	Create a backup copy of prior event logs that are deleted on startup.
Logging level	The level of events that are logged: Normal or Debug.
View log	Open the Event Log Viewer dialog.

The View Log button allows for opening the Event Log Viewer dialog while in the Settings. The Event Log Viewer dialog is typically accessed through the Tools menu.

Event Log Levels

The event log contains a variety of application events that fall into five different levels of event importance.

System:	Important events that are always written to the event log.
Debug:	Extended information for application debugging purposes.
Error:	Fatal errors that halt the execution of the application or cause an app crash message.
Warning:	Non-fatal warnings for severe events that the application attempts to handle.
Information:	General verbose messages for the operation and status of the application.

On slower computers or systems with smaller hard drive space it is recommended to set the Logging Level option to *Normal* only. Setting the Logging Level option to *Debug* will cause the application to spend additional processing time writing to the log file, and the log file size will increase substantially.

Event Log File Format

The event log file contains an identification header line followed by the event entries.
It is not recommended to edit the event log file while the application is running.

The general format of the event log file entries is:

Event Date and Time	Event Level	Event ID	Source Class	Event Message
yyyy.mm.dd hh:mm:ss	see above	32-bit ID number	class name	event text message

Event Log File Location

The event log file is located in the same folder as the application ini file.
The parent folder may be hidden in Windows Explorer by default.
For Windows Vista, 7, 8, 10, and 11, this folder is located at:
C:\Users\<username>\AppData\Local\Demenzun Media\TerreSculptor

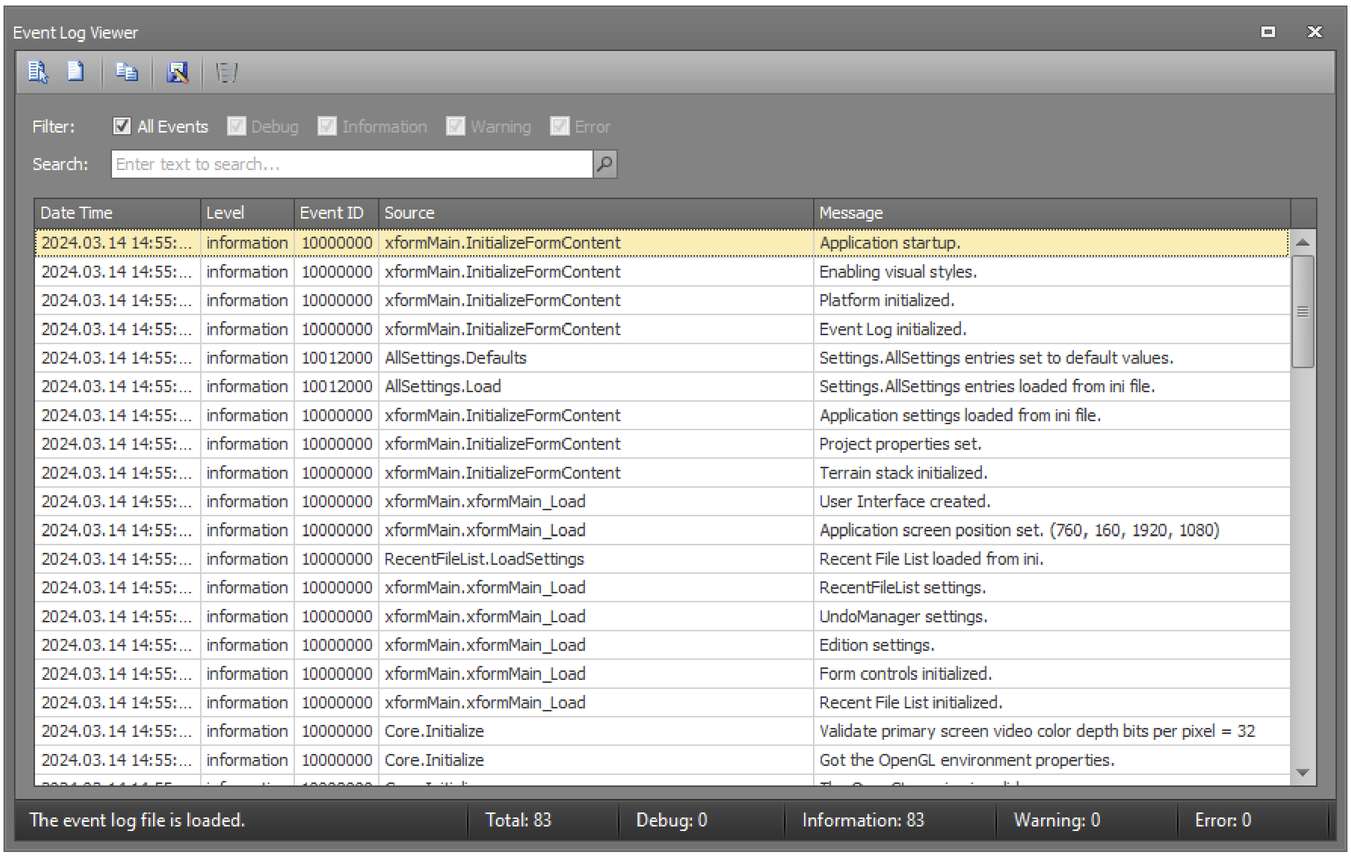
The name of the log file is TerreSculptor 2.0.log.

A new log file is generated every time that the TerreSculptor application is ran, and the previous log file is deleted and overwritten. If the *Backup deleted logs* option is enabled, the previous event log file is renamed as a backup by appending the file extension *.bak*. And any prior event log backup file will be sent to the recycle bin.

Viewing the Event Log

The Event Log Viewer is displayed by either choosing the View Event Log item on the Tools menu, or by clicking on the View Log button in the application Settings System tab.

The Event Log Viewer dialog contains four regions of controls: the filter options, the edit toolbar, the event list, and the status bar.



Filter Options

The filter options allow you to filter the event levels that appear in the event list.
Selecting the All Events checkbox displays all events in the list.
Deselecting the All Events checkbox and selecting any combination of Debug, Information, Warning, or Error, displays only those event level types in the list.

Edit Toolbar

The edit toolbar contains functions for working with the event list.

Select all	Select all of the events in the list.
Select none	De-select all of the events in the list.
Copy events	Copy the selected events to the clipboard.
Save events	Save the selected events to a text file.
Clear event log	Clear the entire event log.

Event List

The event list contains all of the current event log entries, as specified by the Filter selections.
The event log entries are color-coded by event level.

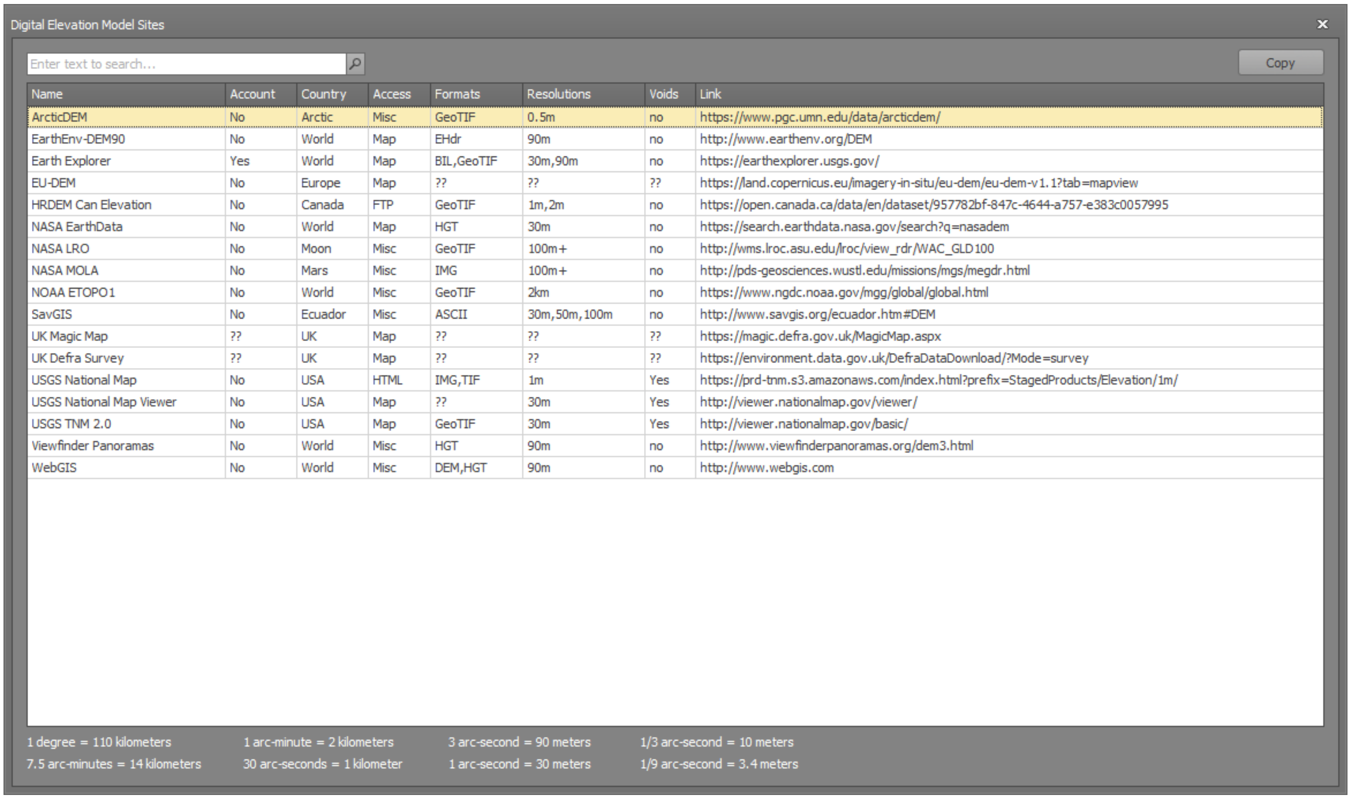
A mouse button right-click on the event list will display a context-sensitive menu that contains most of the edit toolbar functions.

Status bar

The status bar contains information and statistics on the current event log entries.

Tools: DEM Sites

The DEM Sites dialog contains a list of common Digital Elevation Model web sites.
These sites can be used to source real world heightmaps.



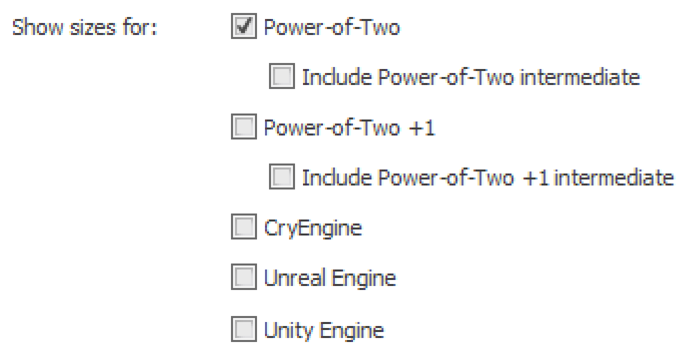
Name	Account	Country	Access	Formats	Resolutions	Voids	Link
ArcticDEM	No	Arctic	Misc	GeoTIF	0.5m	no	https://www.pgc.umn.edu/data/arcticdem/
EarthEnv-DEM90	No	World	Map	EHdr	90m	no	http://www.earthenv.org/DEM
Earth Explorer	Yes	World	Map	BIL,GeoTIF	30m,90m	no	https://earthexplorer.usgs.gov/
EU-DEM	No	Europe	Map	??	??	??	https://land.copernicus.eu/imagery-in-situ/eu-dem/eu-dem-v1.1?tab=mapview
HRDEM Can Elevation	No	Canada	FTP	GeoTIF	1m,2m	no	https://open.canada.ca/data/en/dataset/957782bf-847c-4644-a757-e383c0057995
NASA EarthData	No	World	Map	HGT	30m	no	https://search.earthdata.nasa.gov/search?q=nasadem
NASA LRO	No	Moon	Misc	GeoTIF	100m+	no	http://wms.lroc.asu.edu/lroc/view_rdr/WAC_GLD100
NASA MOLA	No	Mars	Misc	IMG	100m+	no	http://pds-geosciences.wustl.edu/missions/mgs/megdr.html
NOAA ETOPO1	No	World	Misc	GeoTIF	2km	no	https://www.ngdc.noaa.gov/mgg/global/global.html
SavGIS	No	Ecuador	Misc	ASCII	30m,50m,100m	no	http://www.savgis.org/ecuador.htm#DEM
UK Magic Map	??	UK	Map	??	??	??	https://magic.defra.gov.uk/MagicMap.aspx
UK Defra Survey	??	UK	Map	??	??	??	https://environment.data.gov.uk/DefraDataDownload/?Mode=survey
USGS National Map	No	USA	HTML	IMG,TIF	1m	Yes	https://prd-tnm.s3.amazonaws.com/index.html?prefix=StagedProducts/Elevation/1m/
USGS National Map Viewer	No	USA	Map	??	30m	Yes	http://viewer.nationalmap.gov/viewer/
USGS TNM 2.0	No	USA	Map	GeoTIF	30m	Yes	http://viewer.nationalmap.gov/basic/
Viewfinder Panoramas	No	World	Misc	HGT	90m	no	http://www.viewfinderpanoramas.org/dem3.html
WebGIS	No	World	Misc	DEM,HGT	90m	no	http://www.webgis.com

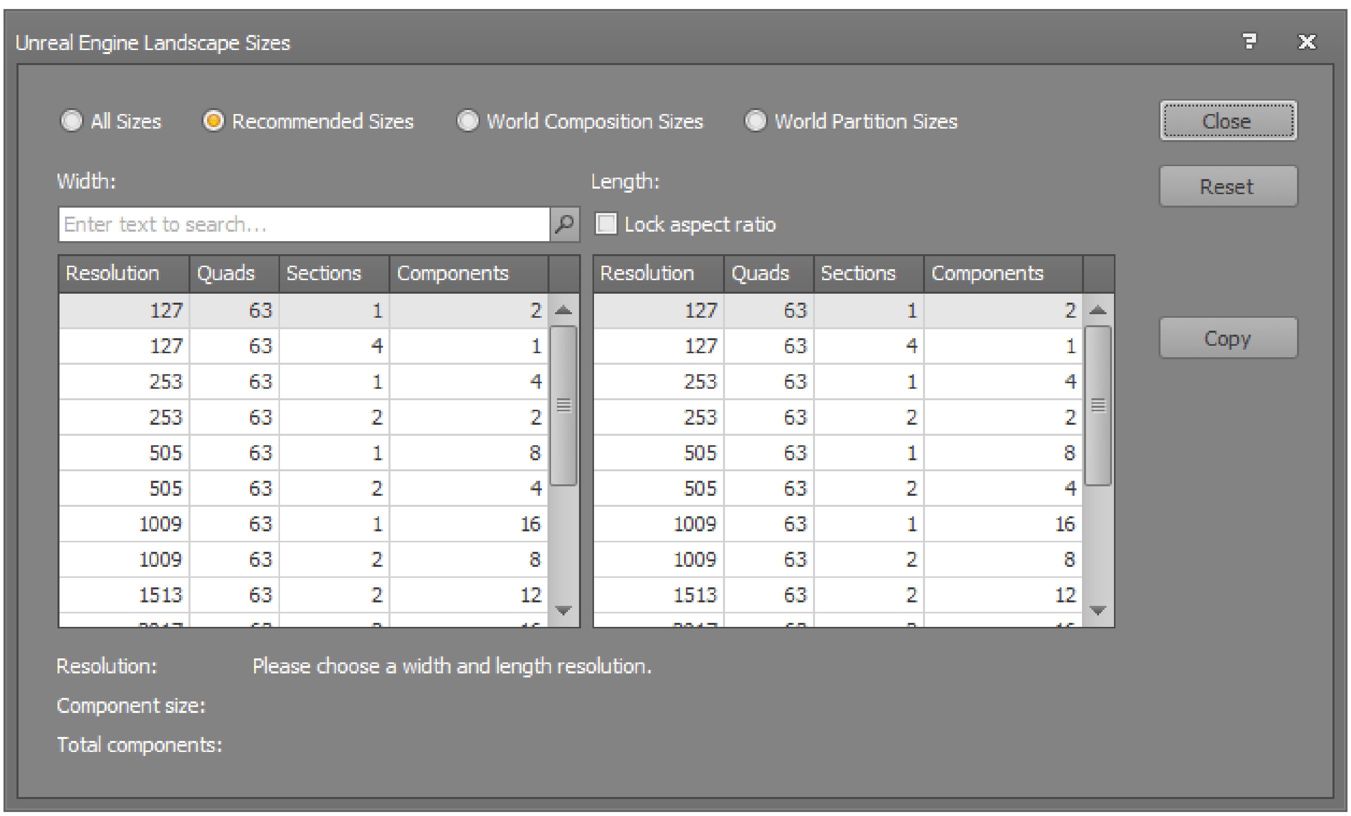
Tools: Unreal Engine Landscape Sizes

The Unreal Engine Landscape Sizes dialog allows choosing a heightmap resolution that is compatible with the Epic Unreal Engine Landscape actor.
The dialog supports the Unreal Engine Landscape Actor's default sizes, plus the sizes for World Composition and World Partition modes.

The Landscape Sizes dialog is available in the Editor when creating a New project, and when Resampling, or Sizing the current heightmap.

The Landscape Sizes "UE" button will be available on the New, Resample, and Size dialogs only when the Unreal Engine option is enabled on the Dimensions tab Dimensions group.





Width: The heightmap width dimension.
Length: The heightmap length dimension.
Lock aspect ratio: Locks the Length value to the Width value.

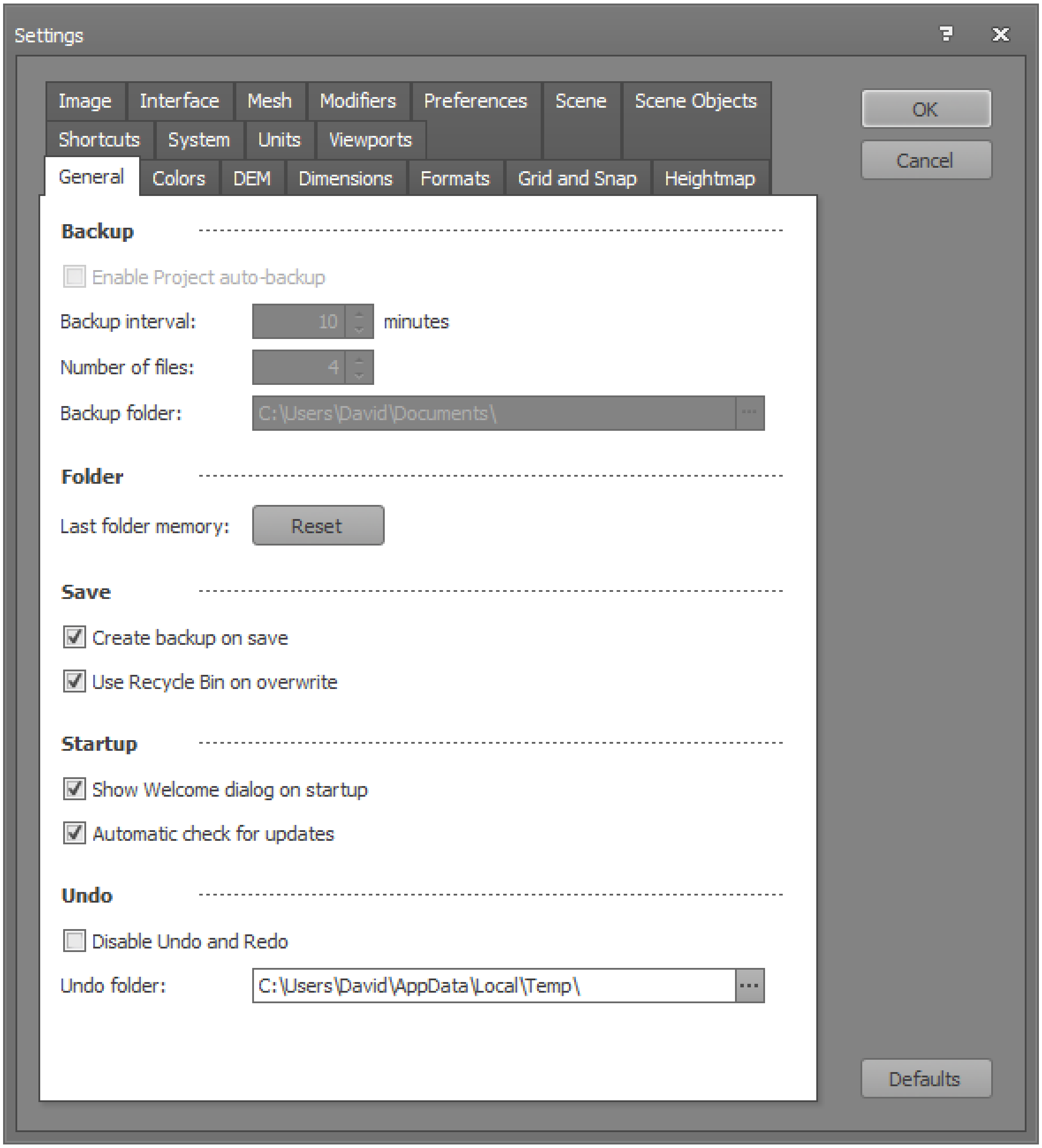
Status lines: Displays the selected resolution and Landscape component information.

To use the Landscape Sizes dialog, first choose the desired Width dimension. The Length list will then fill with all of the length dimensions that are compatible with the chosen width. Choose the desired Length dimension. If the Total number of components listed in the status area is more than 1024, choose a different set of dimensions. See the Epic Documentation for additional information on using Landscape.

Tools: Settings

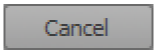
The application settings are available on a multi-tabbed dialog that is launched from the Editor's Tools menu. The settings allow the end-user to specify the default settings and values for a number of the application functions.

The application ini file that contains the application startup defaults can also be set back to its original "new" state and contents by clicking on the *Defaults* button and restarting the application.



Command Buttons

Accept the current settings and close the dialog.

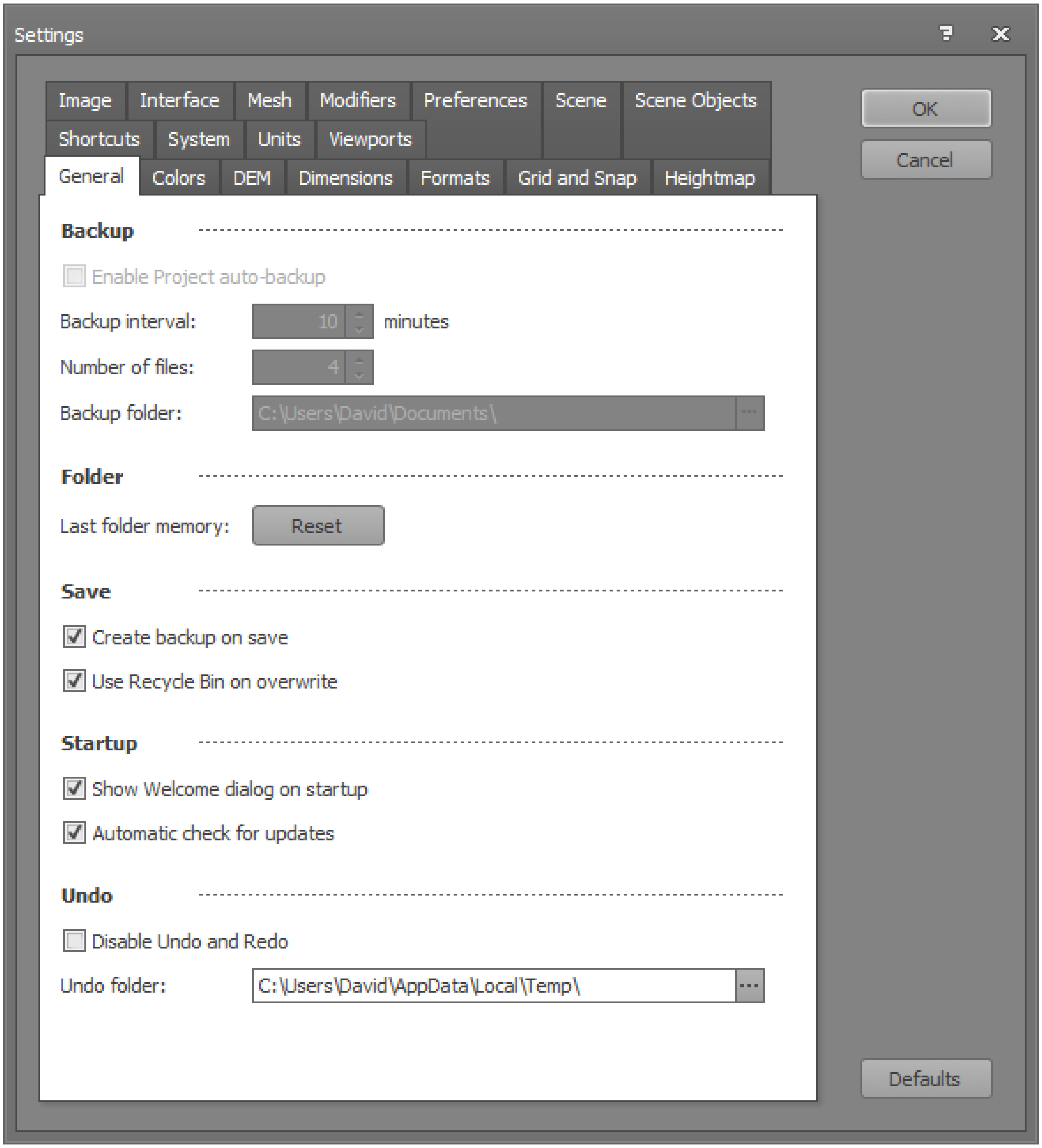


Cancel and close the dialog.

Set all application ini settings to the default values. This requires an application restart.

Settings: General

This tab contains the application general settings.



Backup

Enable Project auto-backup:	Enable or disable the auto backup feature.
Backup interval:	The time in minutes between backup file creation.
Number of files:	The number of backup files to maintain, older files are deleted.
Backup folder:	The folder where the backup files are saved. Default is the Documents folder.

File

Last folder memory:	Resets all of the last folder memories to their default system folder locations. See the *Last Folder Memory* chapter.

Save

Create backup on save:	Whether to create a backup file when saving will result in a file overwrite.
Use Recycle Bin on overwrite:	Whether to move files to the Windows Recycle bin that are being overwritten.

Startup

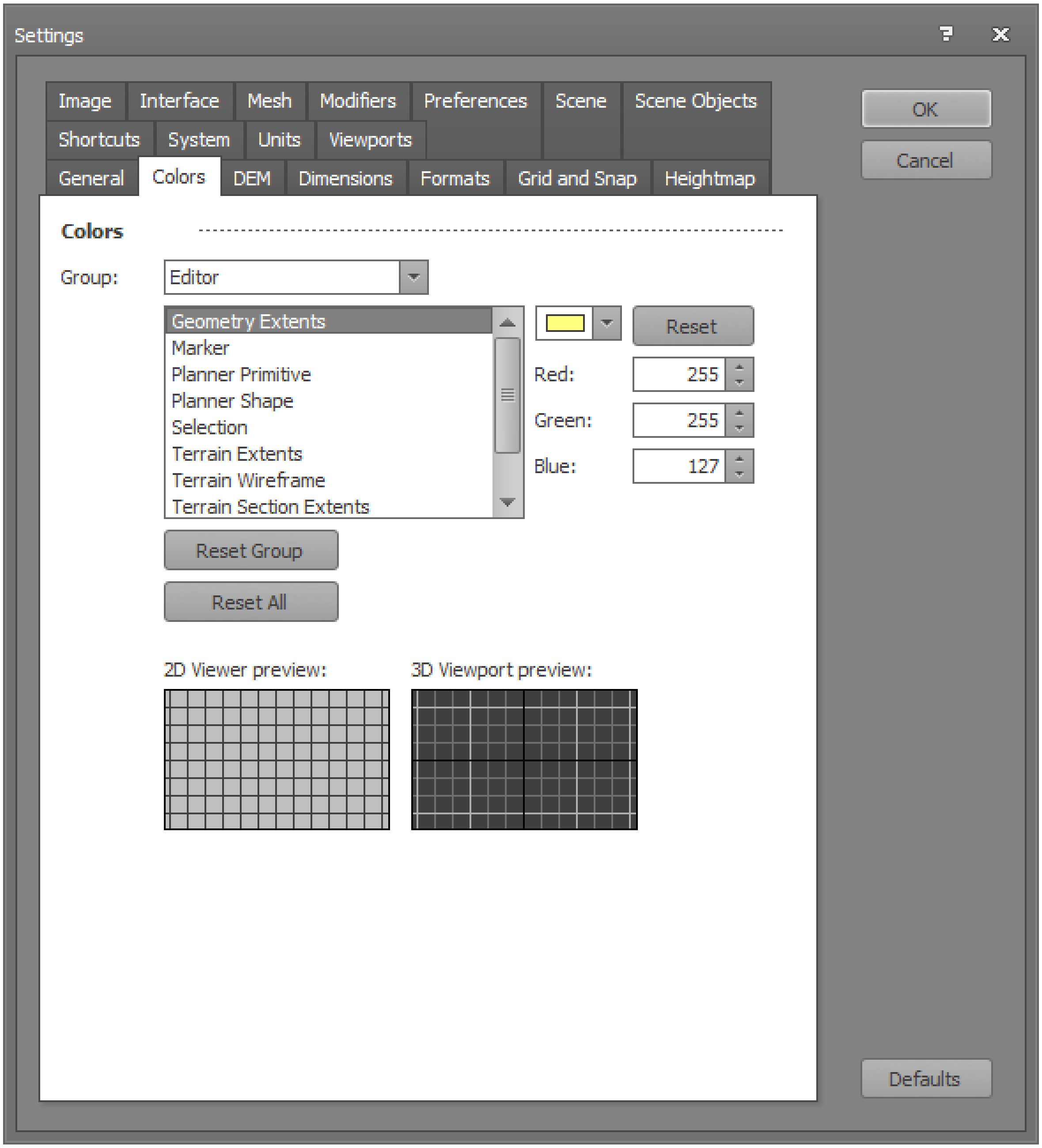
Show Welcome on startup:	Whether the Welcome dialog is displayed on application startup.
Automatic check for updates:	Whether TerreSculptor checks for software updates automatically.

Undo

Disable Undo and Redo:	Whether to disable the Edit menu undo system.
Undo folder:	The system folder where the undo and redo files are temporarily saved.

Settings: Colors

This tab contains the application object colors settings.
This tab and its controls allow for customization of the colors for various application editors and objects.



Colors

Group:	The application group.
Object list:	The list of objects with the group.
Color button:	The current color of the selected object in the group.
Red, Green, Blue:	The current color red, green, and blue values for the selected object in the group.
Reset:	Reset the selected object to its default color.
Reset Group:	Reset all objects in the group to their default colors.
Reset All:	Reset all objects to their default colors.
Viewer preview:	A visual graphical preview of the 2D viewer and grid coloring. The 2D viewer colors are used on the Heightmap Converter, Mask Editor, and Sky Converter.

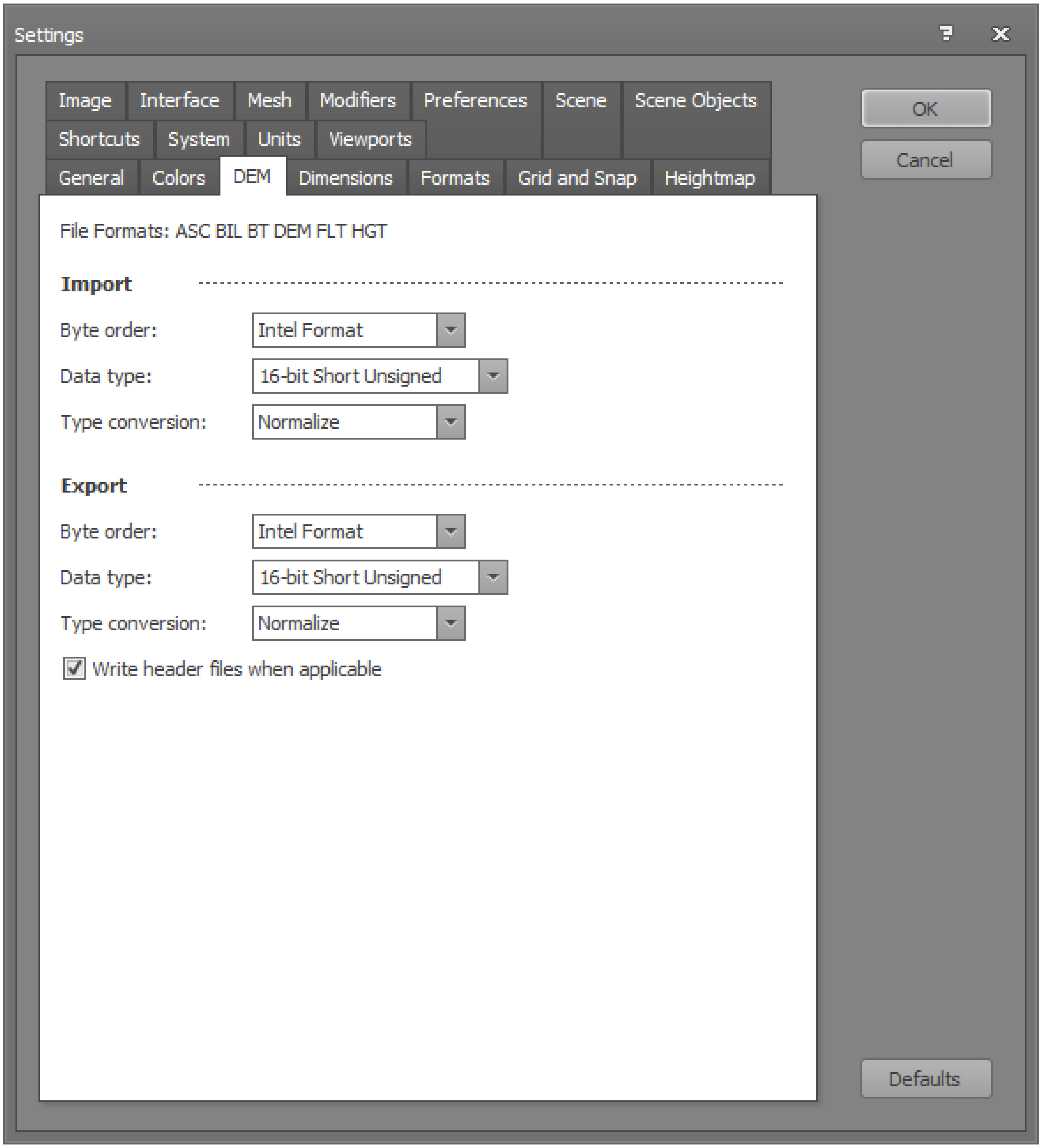
Viewport preview: A visual graphical preview of the 3D viewport and grid coloring.
The 3D viewport colors are used on the Editor, Mesh Converter, and Normalmap Creator.

Theme

Choose the application color theme. Many of the application controls will change color to follow the theme.

Settings: DEM

This tab contains the settings for the Digital Elevation Model file formats.



Import

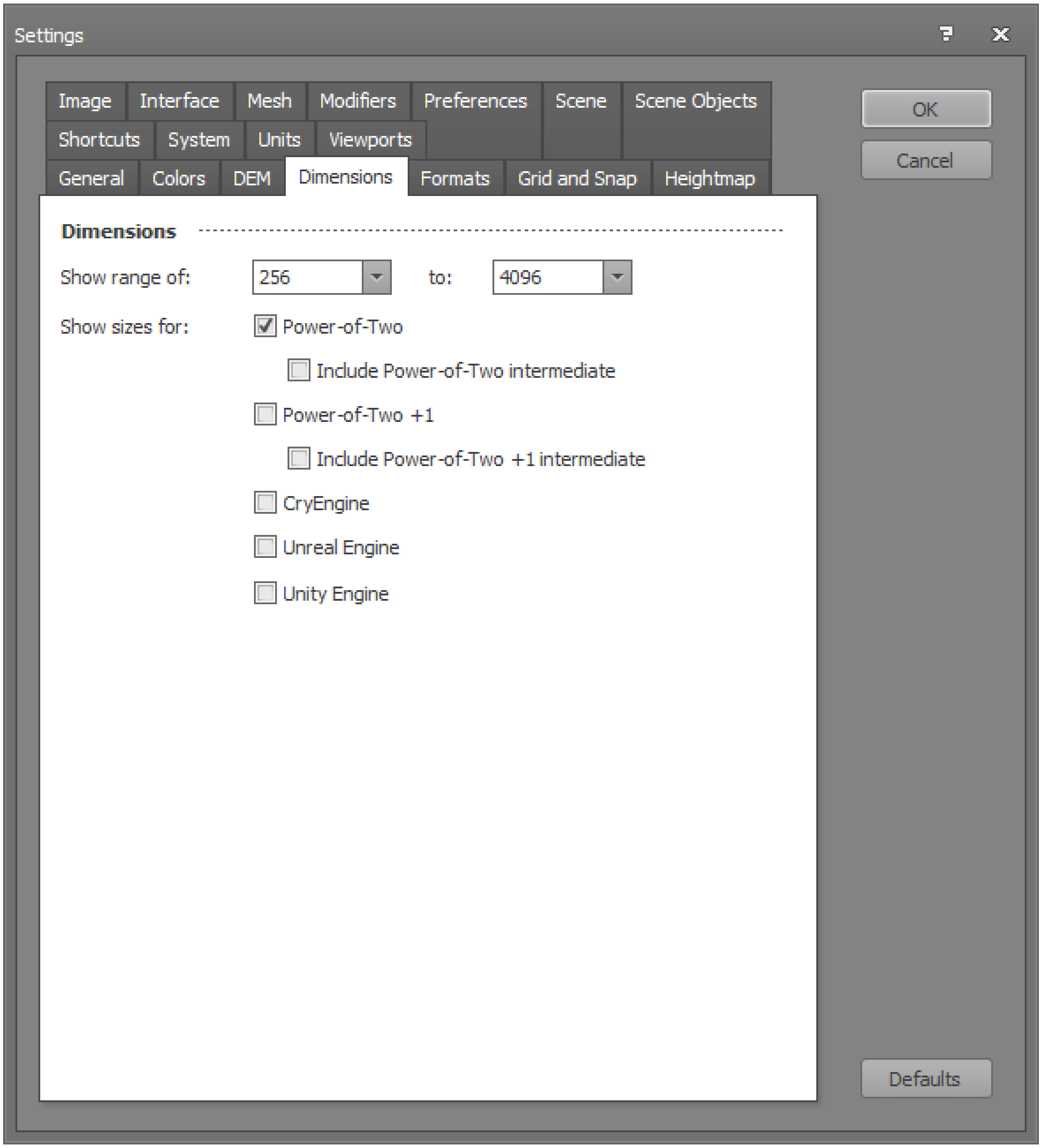
Byte order:	The default byte order.
Data type:	The default data type.

Export

Byte order:	The default byte order.
Data type:	The default data type.
Write header files:	Write out the text header files for the DEM formats that support header files.

Settings: Dimensions

This tab contains the application heightmap and mask dimensions settings.
The properties specify the dimension range that is shown on certain dialogs.



Dimensions

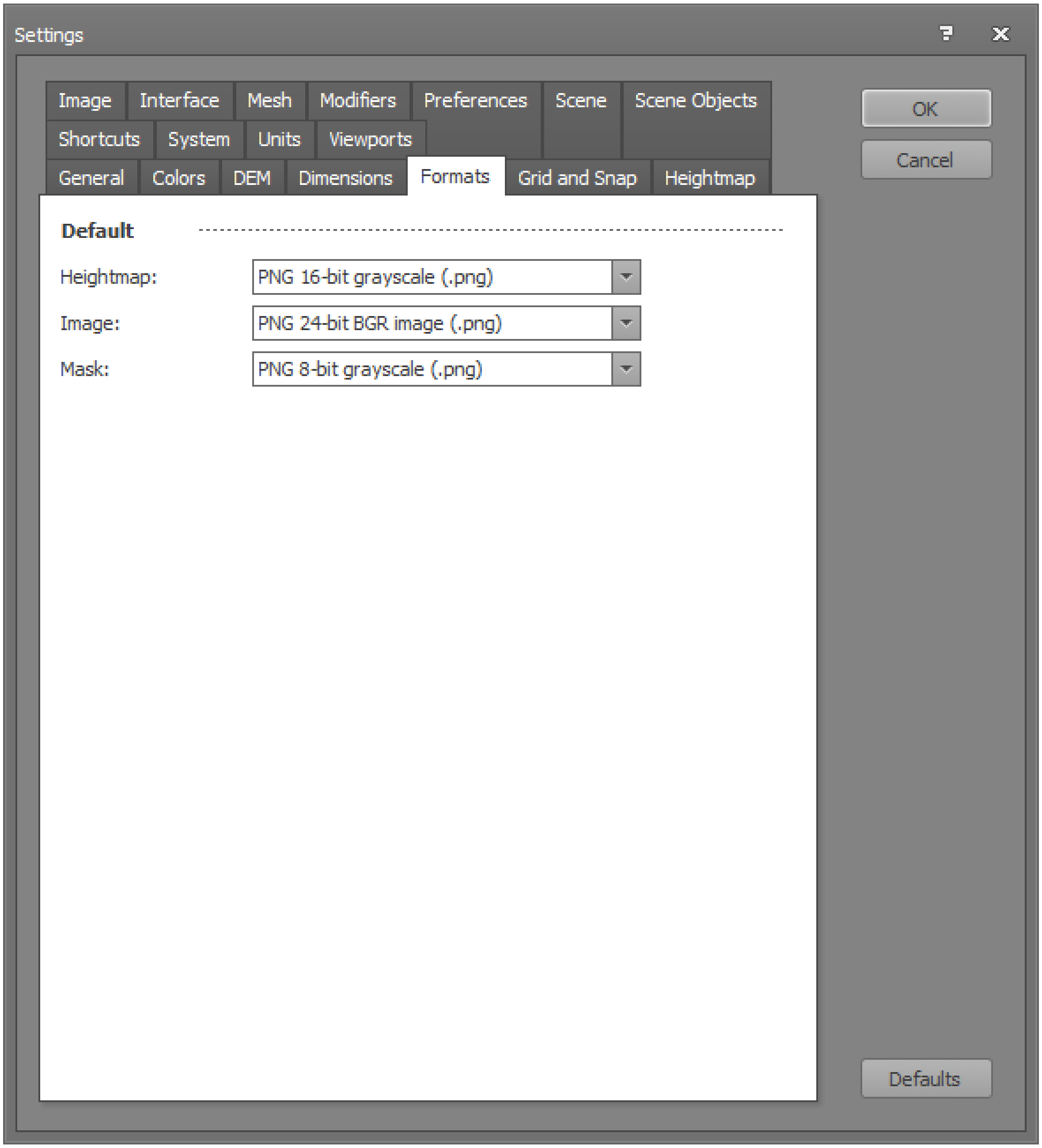
Show range of: Specify the dimension range to show on specific dialogs such as New.
This allows you to specify only those values that are used in your projects.

Power-of-Two: Whether the New and Resample dialogs display power-of-two dimensions.
Power-of-two dimensions are values that are 2^n where n = 1, 2, 3, 4, etc.,
such as 2^8 = 256, 2^10 = 1024, 2^12 = 4096.
Power-of-two dimensions result in terrain meshes that are power-of-two -1 quads,
2^8 = 256 dimension = 256 vertices = 255 terrain quads.

Include PoT intermediate:	Whether to include the Power-of-two intermediate values. Intermediate values include those that are multiples of power-of-two values, such as 96, 192, 384, 768, etc., which lay typically between p-o-t value.
Power-of-Two +1:	Whether the New and Resample dialogs display power-of-two +1 dimensions. Power-of-two +1 dimensions are values that are 2^n +1 where n = 1, 2, 3, etc., such as 2^8 +1 = 257, 2^10 + 1 = 1025, 2^12 + 1 = 4097. Power-of-two +1 dimensions result in terrain meshes that are power-of-two quads, 2^8 +1 = 257 dimension = 257 vertices = 256 terrain quads.
Include PoT intermediate:	Whether to include the Power-of-two + 1 intermediate values. Intermediate values include those that are multiples of power-of-two + 1 values, such as 97, 193, 385, 769, etc., which lay typically between p-o-t+1 value.
CryEngine:	Whether the New and Resample dialogs display CryEngine dimensions.
Unreal Engine:	Whether the New and Resample dialogs display UE Landscape dimensions. A common set of UE Landscape dimensions are provided, plus a UE size dialog. See the UE online documentation for additional dimension procedures.
Unity Engine:	Whether the New dialog displays Unity terrain dimensions.

Settings: Formats

This tab contains the application default file formats settings.

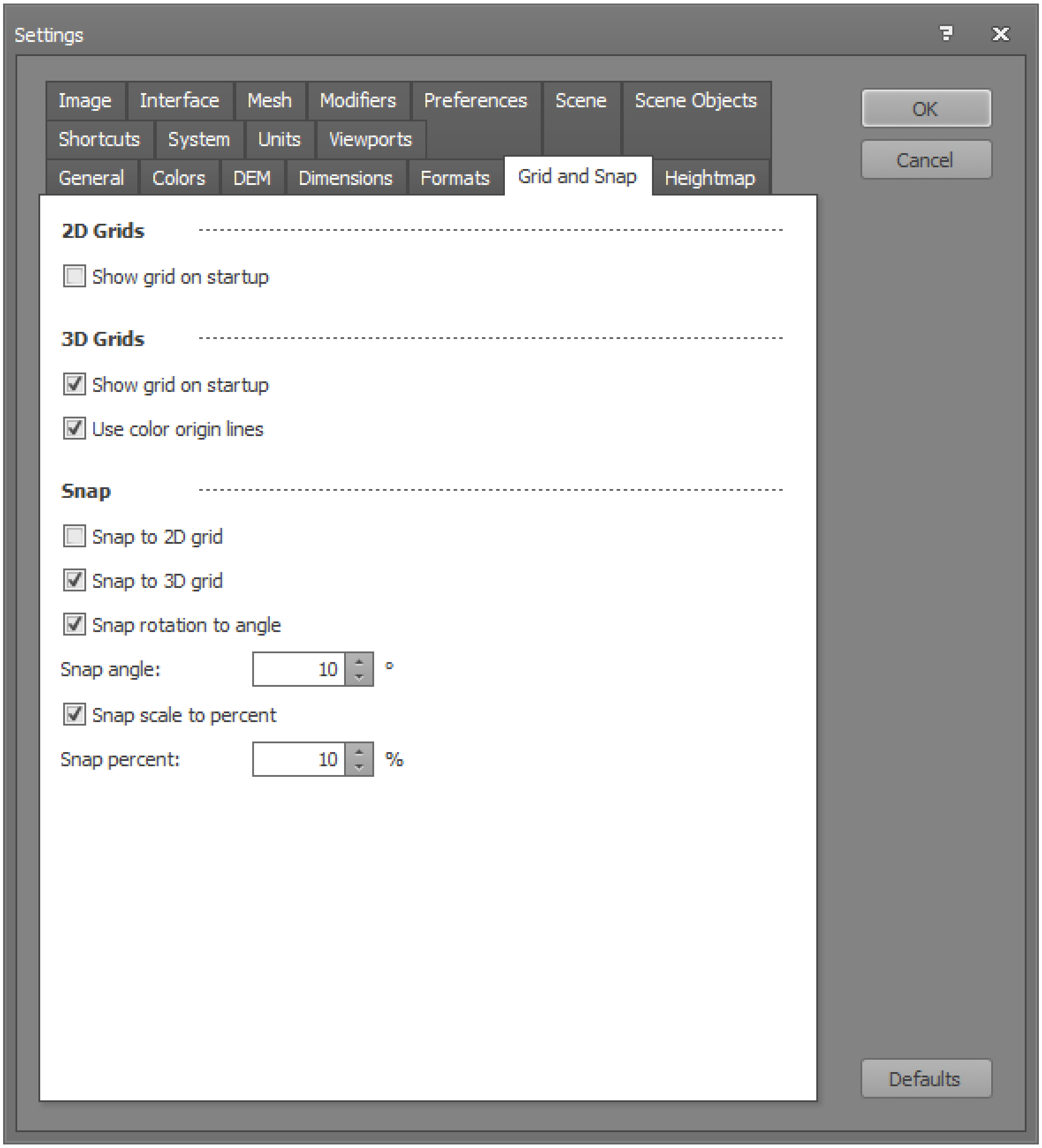


Default Formats

Heightmap:	The default heightmap file format.
Image:	The default image file format (screenshot, etc.).
Mask;	The default mask file format.
Weightmap:	The default weightmap file format.

Settings: Grid and Snap

This tab contains the application settings for the grids and object snapping.



2D Grids

Show grid on startup: Whether to show the 2D grids on application startup.

3D Grids

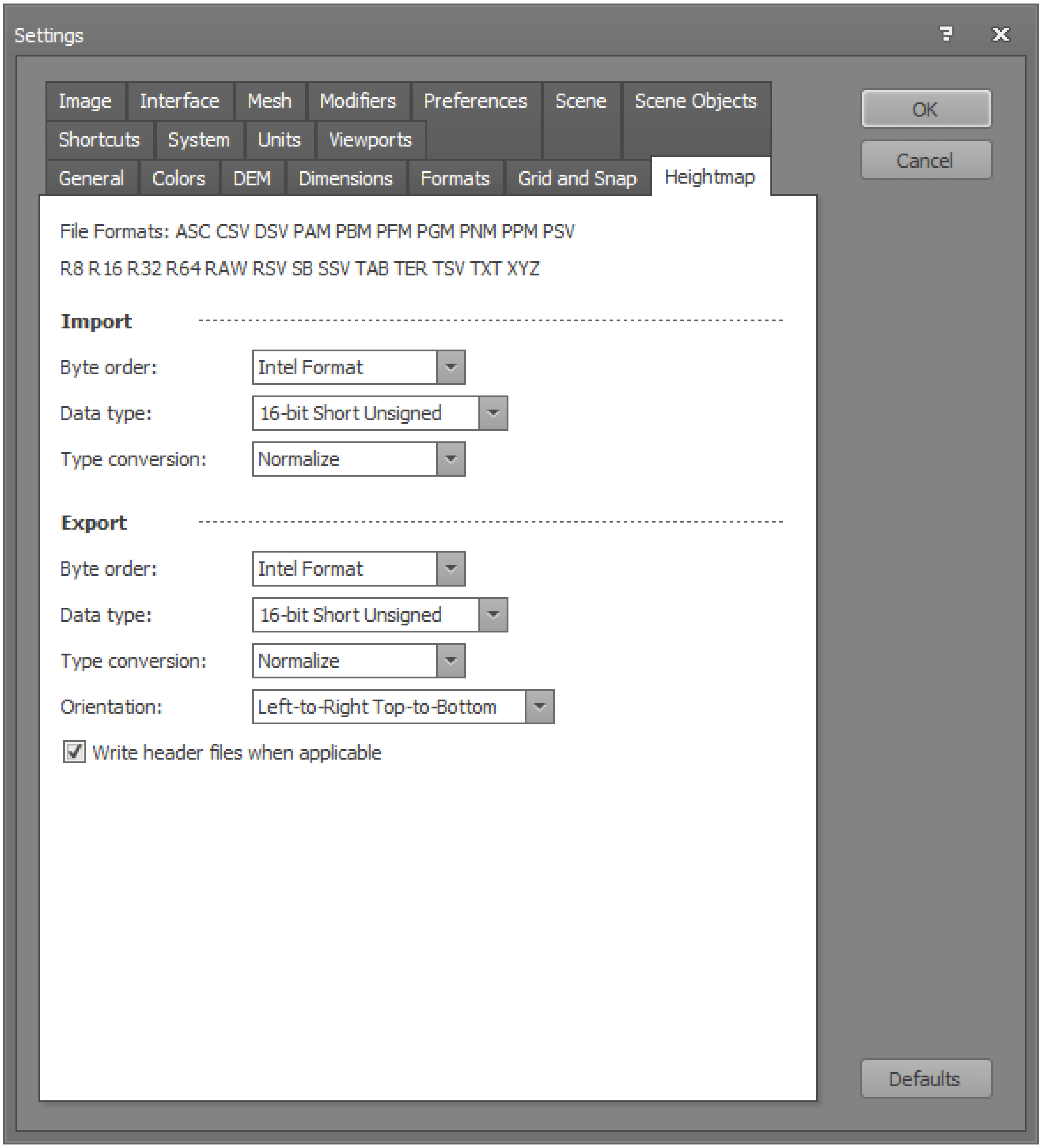
Show grid on startup: Whether to show the 3D grids on application startup.
Use color origin lines: Whether the 3D grid origin lines will be color-coded to their X,Y,Z axis color.

Snap

Snap to 2D grid:	future feature.
Snap to 3D grid:	future feature.
Snap rotation to angle:	future feature.
Snap angle:	future feature.
Snap scale to percent:	future feature.
Snap percent:	future feature.

Settings: Heightmap

This tab contains the application settings for the default import and export settings for heightmap type files. The individual option usage varies by the specific file format importer/exporter.



Import

Byte order:	The integer or float data byte order: Motorola (big-endian) or Intel (little-endian).
Data type:	The data type: 8-bit, 16-bit, 32-bit, 64-bit, Integer and Float, Signed and Unsigned.
Type conversion:	The data type conversion: Real (actual), Scaled (1.0), Auto (to fit).

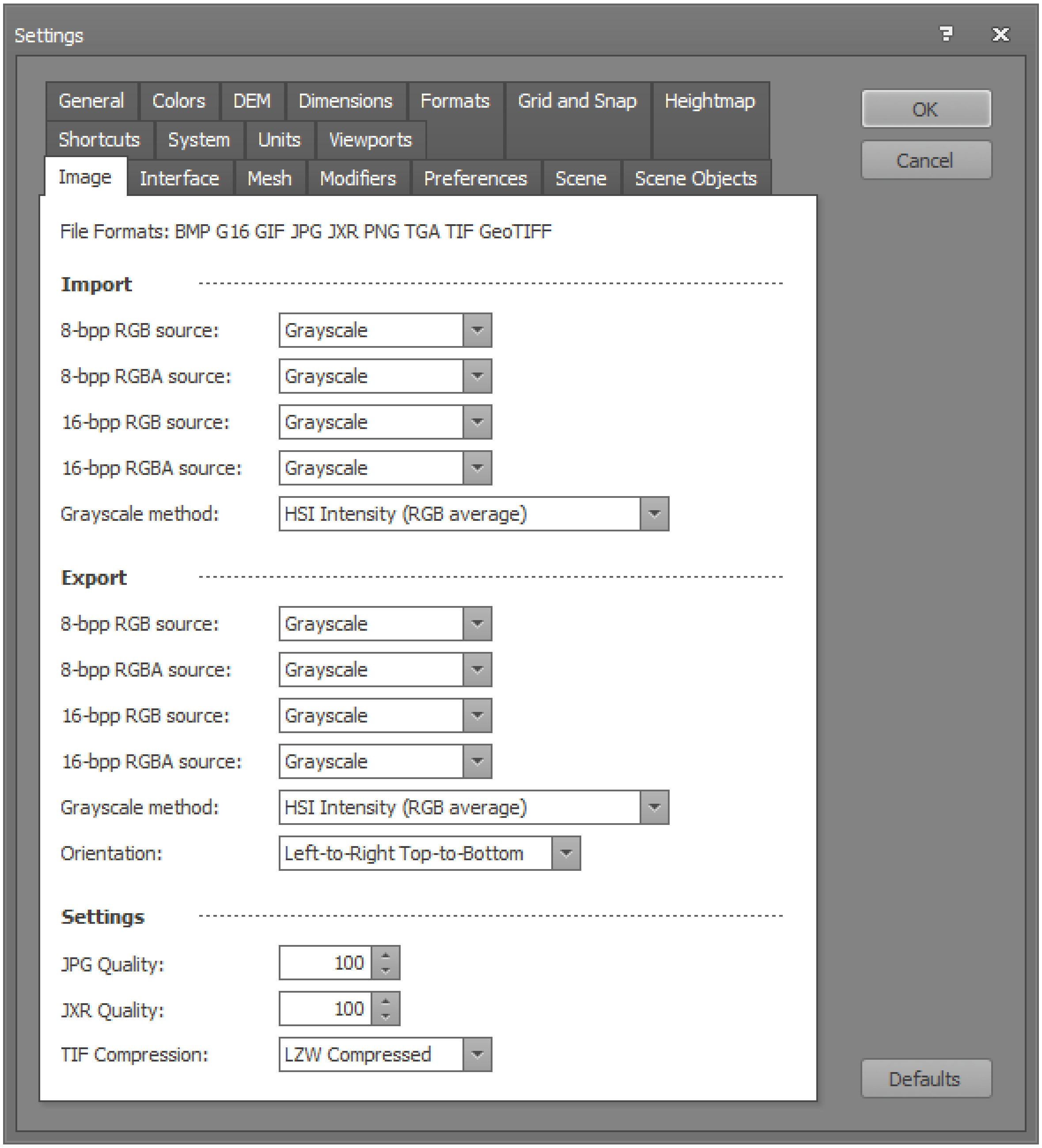
Export

Byte order:	The integer or float data byte order: Motorola (big-endian) or Intel (little-endian).
Data type:	The data type: 8-bit, 16-bit, 32-bit, 64-bit, Integer and Float, Signed and Unsigned.
Type conversion:	The data type conversion: Real (actual), Scaled (1.0), Auto (to fit).

Orientation:	The orientation of the data in the file.
Optimized 8-bit:	Whether the data is automatically scaled to use the widest 8-bit range.
Write header:	Whether a separate header file is written for header-less file formats.
G16 uses DWORD stride:	A hack to fix the UE3 G16 file stride bug.

Settings: Image

This tab contains the application settings for the default import and export settings for image type files. The individual option usage varies by the specific file format importer/exporter.



Import

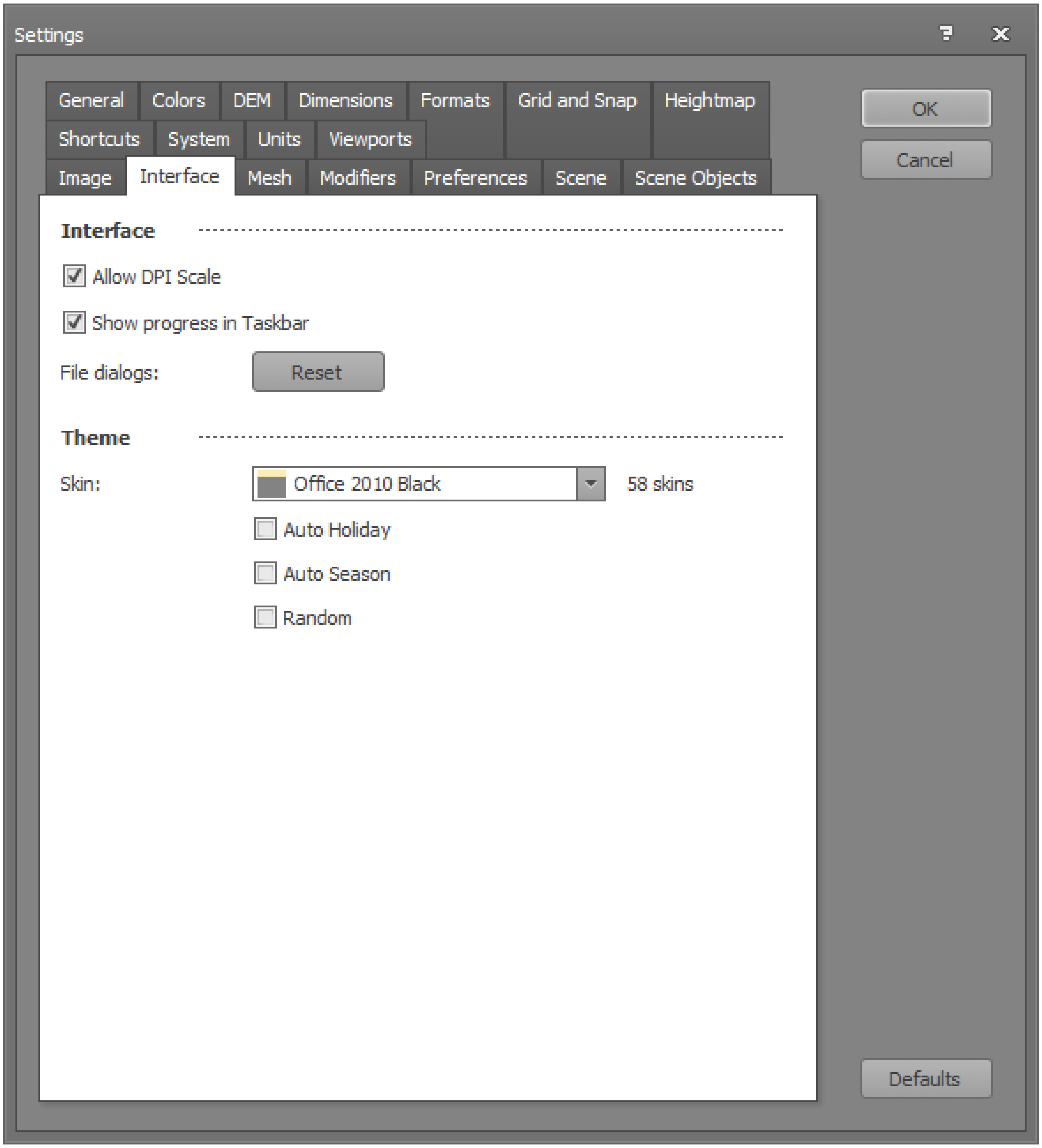
8-bpp RGB Source:	The color plane to use for the import source on 8-bit-per-pixel RGB files.
8-bpp RGBA Source:	The color plane to use for the import source on 8-bit-per-pixel RGBA files.
16-bpp RGB Source:	The color plane to use for the import source on 16-bit-per-pixel RGB files.
16-bpp RGBA Source:	The color plane to use for the import source on 16-bit-per-pixel RGBA files.
Grayscale method:	The algorithm method to use when converting color to grayscale.

Export

8-bpp RGB Source:	The color plane to use for the export source on 8-bit-per-pixel RGB files.
8-bpp RGBA Source:	The color plane to use for the export source on 8-bit-per-pixel RGBA files.
16-bpp RGB Source:	The color plane to use for the export source on 16-bit-per-pixel RGB files.
16-bpp RGBA Source:	The color plane to use for the export source on 16-bit-per-pixel RGBA files.
Grayscale method:	The algorithm method to use when converting color to grayscale.
Orientation:	The orientation of the data in the file.

Settings: Interface

This tab contains optional settings for the user interface.



Interface

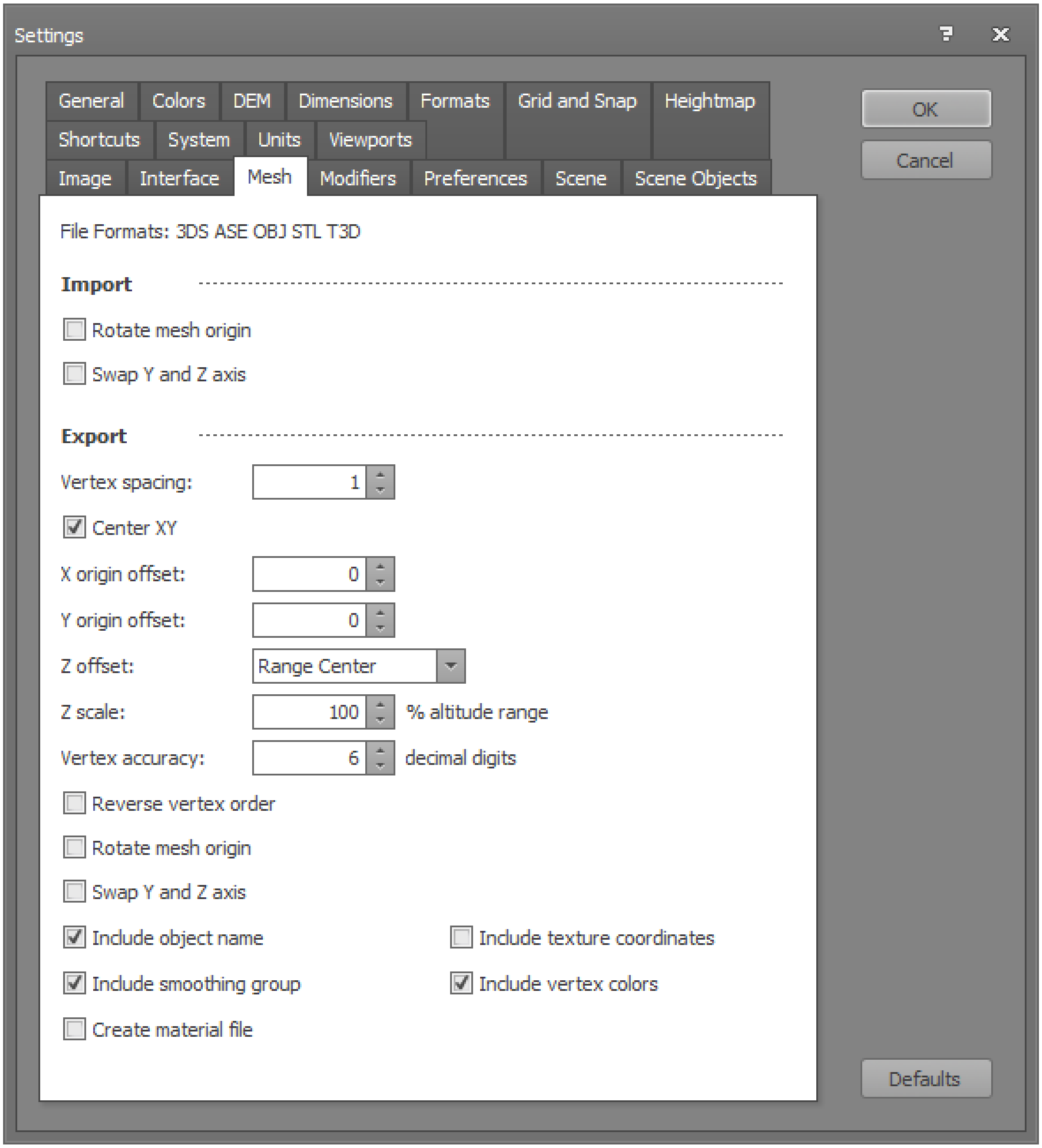
Allow DPI Scale:	Allow DPI Scaling Mode on High DPI 4K displays.
Show progress in Taskbar:	Show the progress bar graph on the application taskbar icon.
File dialogs:	Reset all file dialog settings.

Theme

Skin:	The software application skin theme.
Auto Holiday:	Automatically display the skin themes during holidays like Christmas.
Auto Season:	Automatically display the skin themes for the four seasons.
Random:	Use a random skin each time the software is launched.

Settings: Mesh

This tab contains the application settings for the default import and export settings for mesh type files.
The individual setting usage varies by the specific file format importer/exporter.
Mesh files are typically stored as a rectangular grid-plane of constant-spaced XY coordinates with Z axis altitudes.



Import

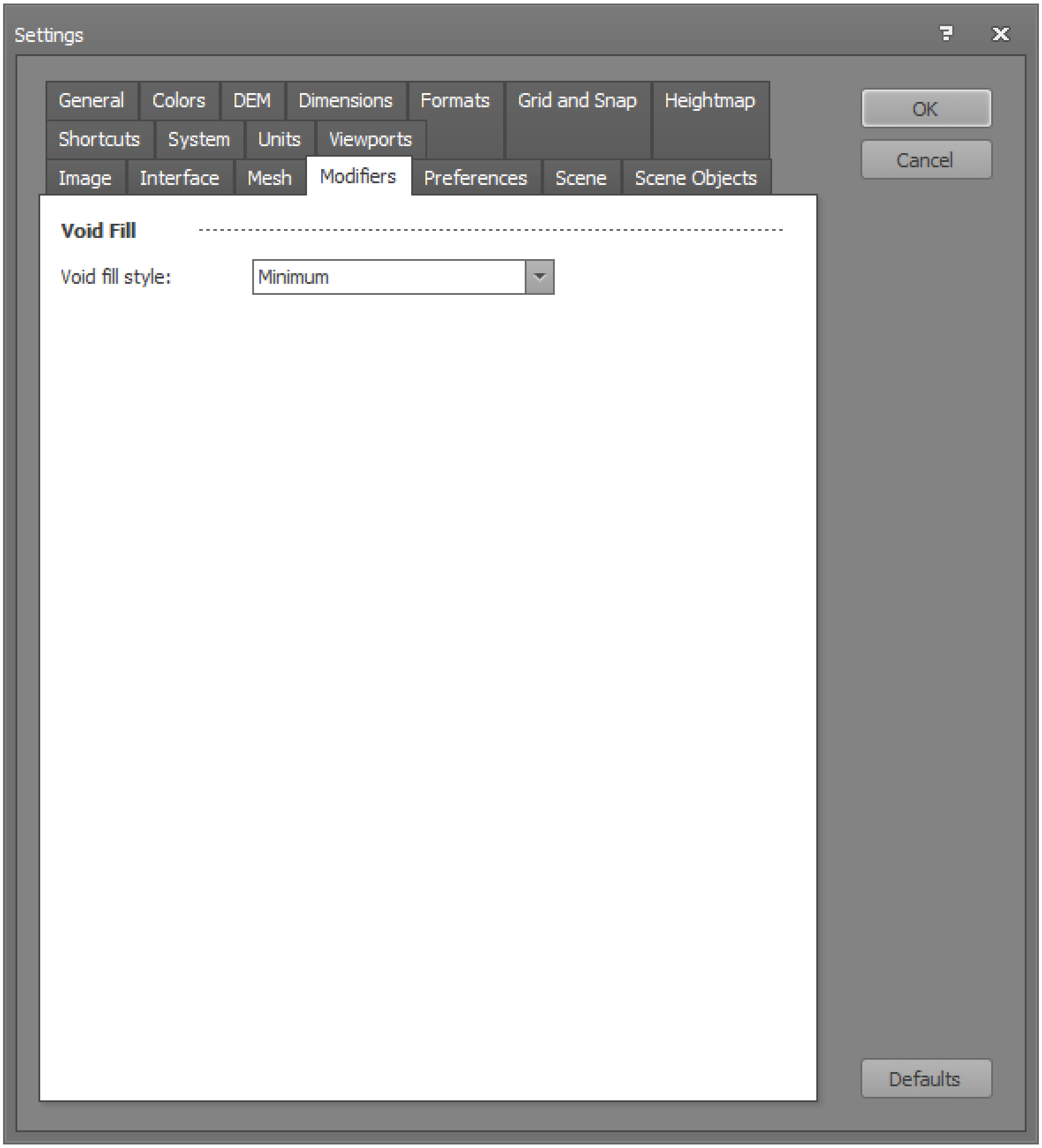
Rotate mesh origin:	Whether to rotate the mesh origin by 90 degrees clockwise.
Swap Y and Z axis:	Whether to swap the mesh Y and Z axis for meshes that are using Z-up coordinates.

Export

Vertex spacing:	The vertex spacing multiplier.
X origin offset:	The amount to offset the X origin.
Y origin offset:	The amount to offset the Y origin.
Z offset:	Whether to offset the mesh Z axis data.
Z scale:	Whether to scale the mesh Z axis data.
Vertex accuracy:	The number of digits of numerical accuracy for text-format mesh files.
Reverse vertex order:	Whether the triangle vertex order is reversed to flip the face orientation.
Rotate mesh origin:	Whether to rotate the mesh origin by 90 degrees clockwise.
Swap Y and Z axis:	Whether to swap the mesh Y and Z axis for meshes that are using Z-up coordinates.
Include smoothing group:	Whether the smoothing group properties are included in the file.
Include object name:	Whether the object name property is included in the file.

Settings: Modifiers

This tab contains the application settings for the specified modifiers.

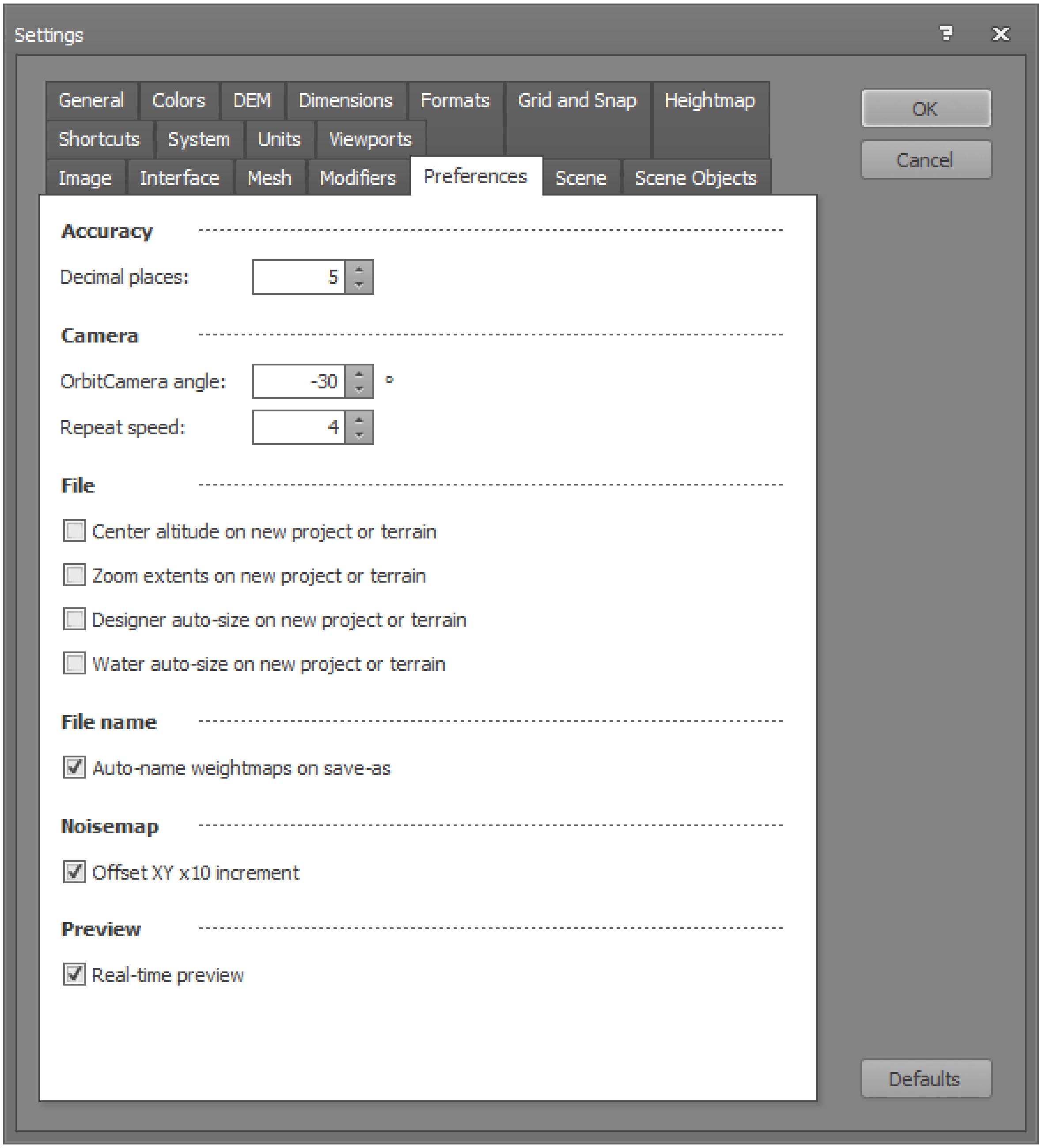


Void Fill

Void fill style: The default style of void fill to use.

Settings: Preferences

This tab contains the application user preferences.



Accuracy

Decimal places: The number of decimal places that the numeric up-down controls will show.

Camera

OrbitCamera angle: The orbit camera navigation pad angle in degrees.
Repeat speed: The camera navigation pad repeat speed.

File

Center altitude on import:	Whether imported heightmaps are moved to the centered altitude.
Zoom extents on New or Import:	Whether the orbit camera zooms to extents on New or Import.
Designer auto-size on New or Import:	Whether the Designer plane auto-sizes on New or Import.
Water auto-size on New or Import:	Whether the Water plane auto-sizes on New or Import.

Noisemap

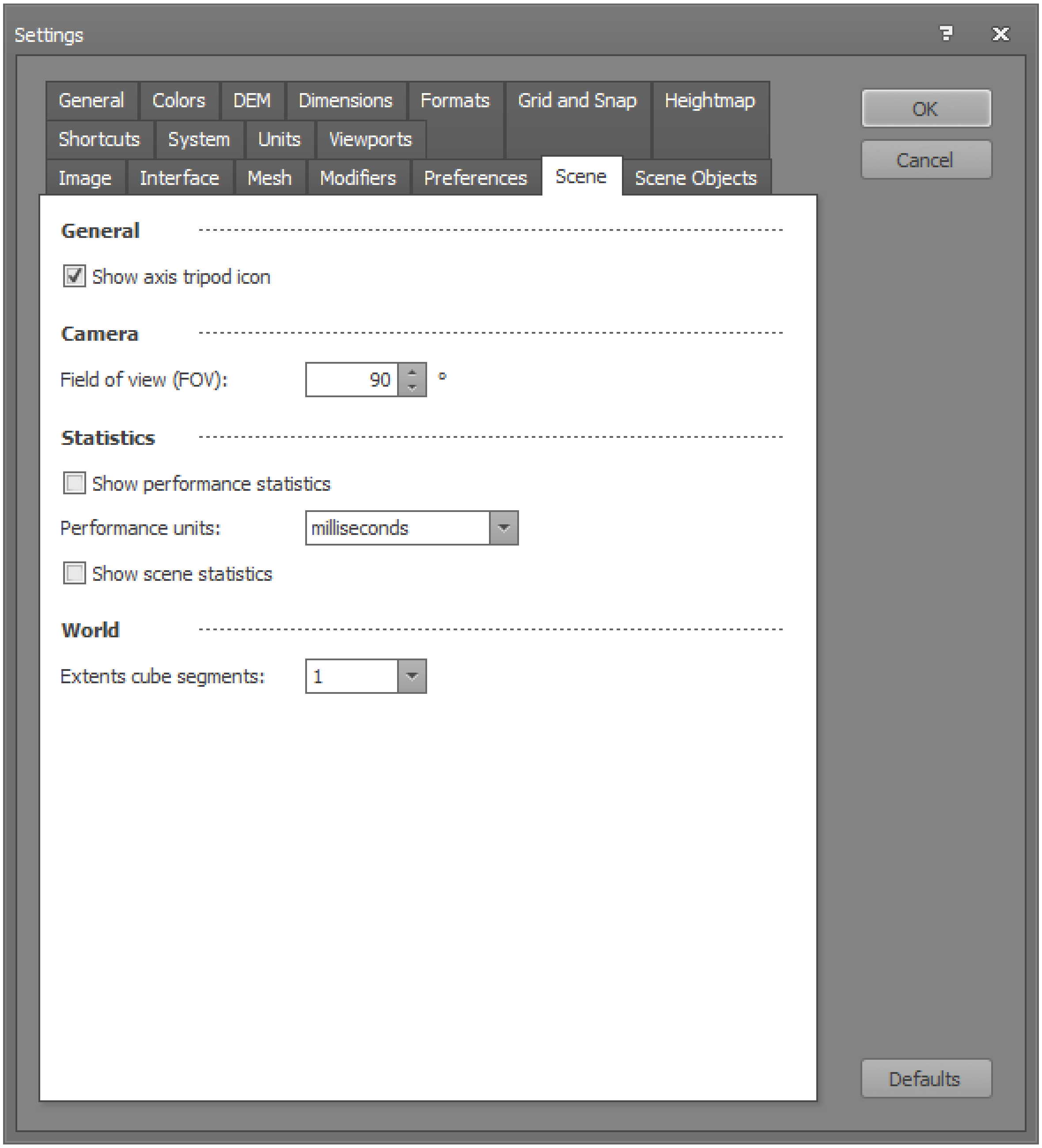
Offset XY x10 increment:	Whether the Noise Generator Offset X/Y controls increment by 10 times the value.

Preview

Real-time preview:	Whether the preview window updates automatically or requires user interaction. Real-time preview should be set to off for slower computers.

Settings: Scene

This tab contains the application settings for the Editor scene.



General

Show axis tripod icon: Whether the XYZ axis icon is displayed in the viewport lower-left corner.

Camera

Field of view (FOV): Determines the Editor viewport camera FOV (field of view).
The range is 60 to 120 degrees. The default is 90 degrees.
Smaller values are narrow-angle lenses.
Larger values are wide-angle lenses.

Stats

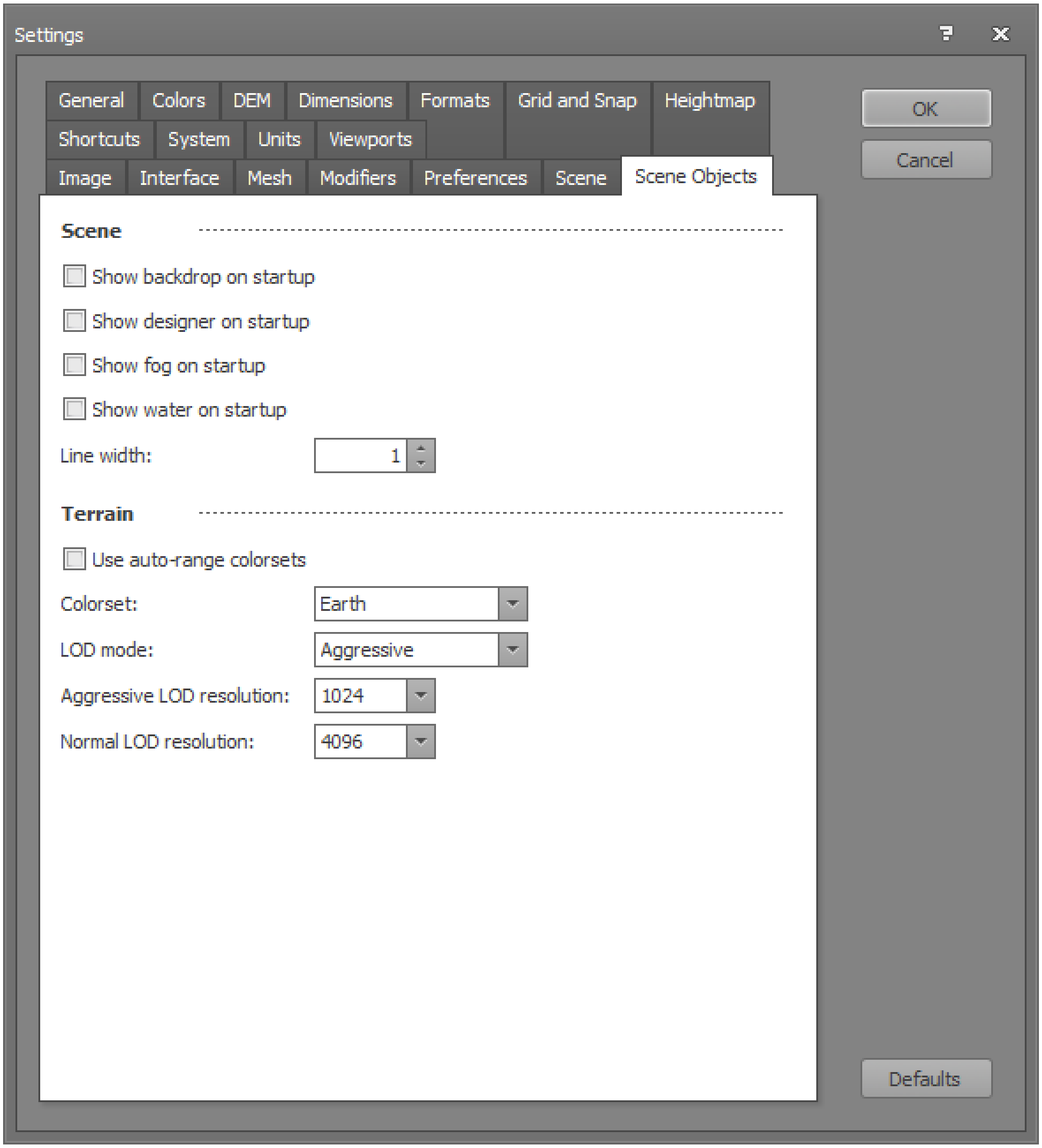
Show performance statistics:	Whether the render engine performance statistics are shown on the viewport.
Performance unit:	The performance statistics units.
Show scene statistics:	Whether the render engine scene statistics are shown on the viewport.

World

Extents cube segments:	The number of wireframe segments in the world extents cube.

Settings: Scene Objects

This tab contains the application options for the Editor scene objects.



Scene

Show backdrop on startup:	Whether the backdrop is shown on application startup.
Show designer on startup:	Whether the designer plane is shown on application startup.
Show fog on startup:	Whether the fog is shown on application startup.
Show water on startup:	Whether the water plane is shown on application startup.

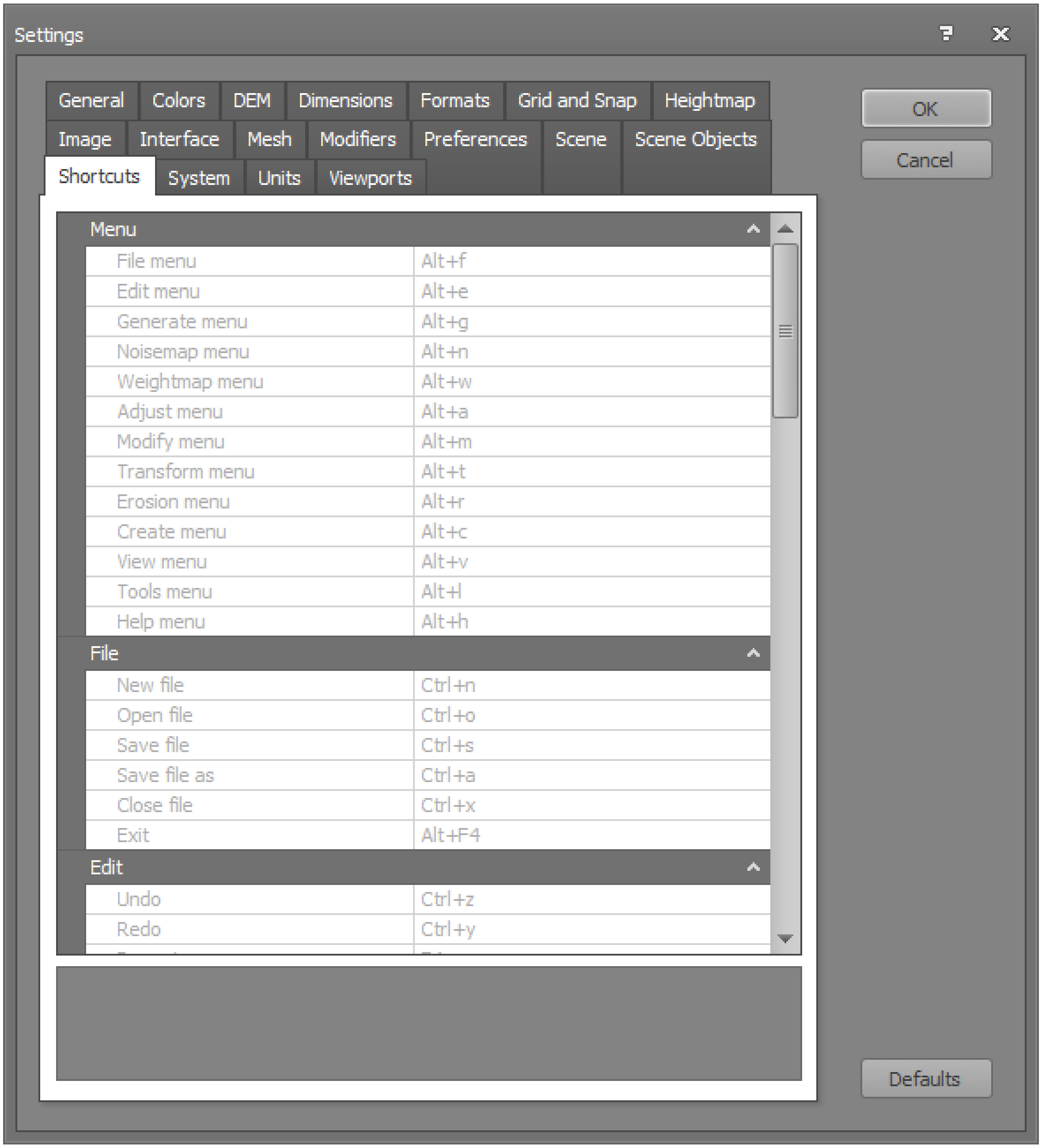
Terrain

Use auto-range colorsets:	Whether to use auto-range colorsets by default.
Colorset:	The terrain mesh default colorset.
LOD mode:	The default terrain level of detail mode.
Aggressive LOD resolution:	The maximum dimensions of the terrain in aggressive lod mode.
Normal LOD resolution:	The maximum dimensions of the terrain in normal lod mode.
Progressive LOD distance:	future feature.

Settings: Shortcuts

This tab contains the application shortcut accelerator keys information.

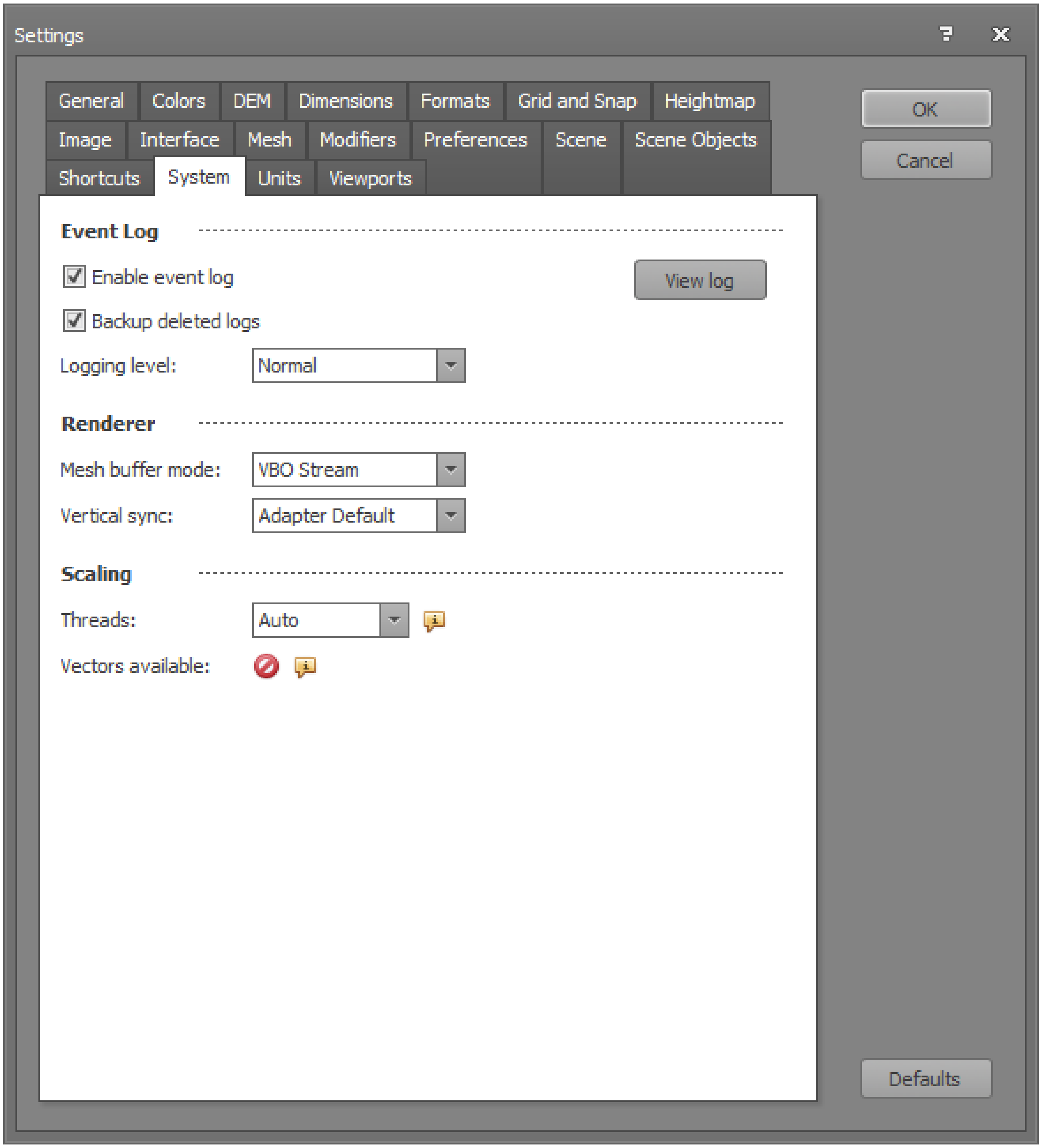
The combination keys include lowercase and uppercase letter versions which determine whether the Shift key is pressed. eg. Ctrl+b = press the Ctrl key and B key, Ctrl+B = press the Ctrl key and Shift key and B key.



There are no user-configurable settings on this tab.

Settings: System

This tab contains the application system settings.
These are settings related to the low-level operation of the system processor and video hardware rendering.



Event Log

Enable event log:	Enable writing of events to the application event log file.
Backup deleted logs:	Create a backup copy of prior event logs that are deleted on startup.
Logging level:	The level of events that are logged: Errors, Errors and Warnings, Verbose Information, Enhanced Debug.
View log:	Open the Event Log Viewer dialog.

Preview

Preview resolution:	The resolution of the preview window heightmap. Five preview resolutions from 128 to 512 are supported. Preview resolutions above 256 should only be used on high-end computers.

Renderer

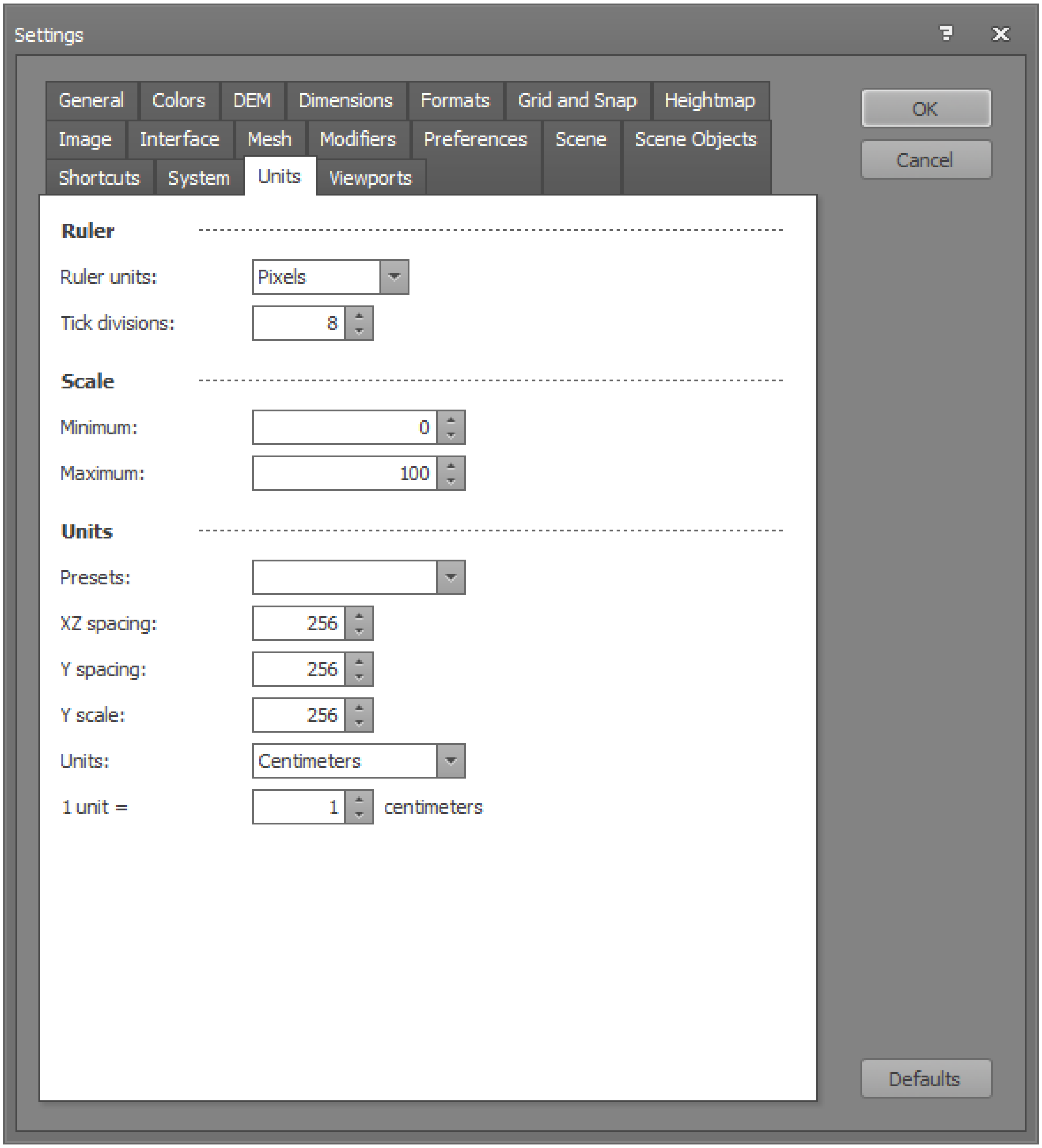
Mesh buffer mode:	This is for handling special rendering circumstances and should not be changed.
Vertical sync:	Whether the rendering context waits for the display vertical sync. Note that this setting will not override the vsync setting in the system video driver. The video driver vsync typically must be set to Application Control for this to work.

Scaling

Threads:	The number of processor threads to use for running specific intensive algorithms. This option should be set to *Auto* to allow TerreSculptor to choose the best setting. When choosing a specific threads value, typically use the number of logical processors. This option can be set to a lower number than the number of available system threads to allow concurrent applications to run faster.

Settings: Units

This tab contains the application settings for the ruler measuring system and the engine dimensioning units.



Ruler

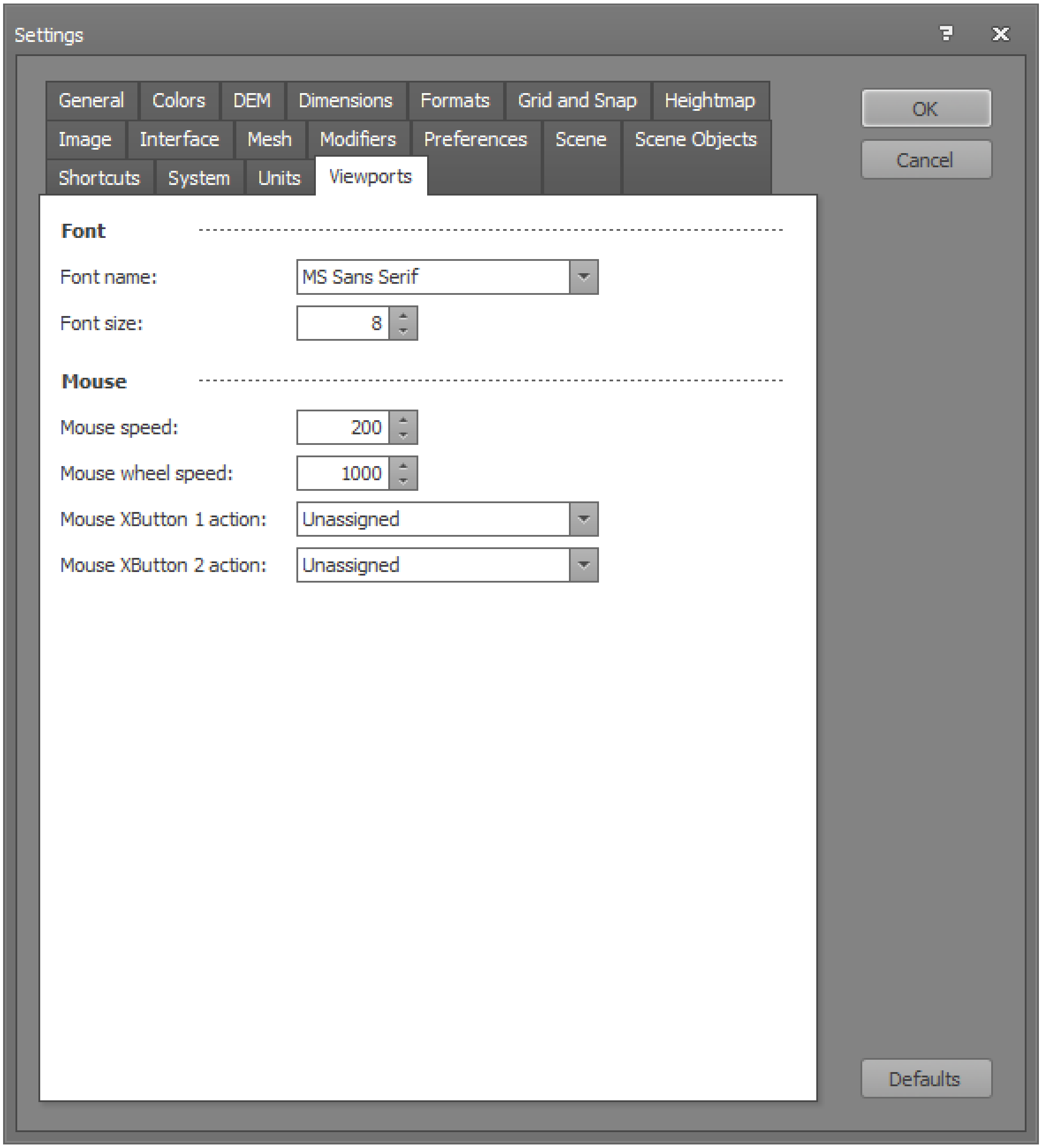
Ruler units:	The Heightmap Editor ruler units.
Tick divisions:	The Heightmap Editor ruler tick divisions.

Units

Presets:	Units presets for common video game engine matching.
XZ spacing:	The default engine spacing on the XZ axes.
Y spacing:	The default engine spacing on the Y axis.
Y scale:	The default Y axis scaling so that an equal XYZ value set creates a cubic area.
Units:	The engine dimensioning base unit type.
1 unit = :	The engine dimensioning unit.

Settings: Viewports

This tab contains the application settings for the 3D viewports.



Font

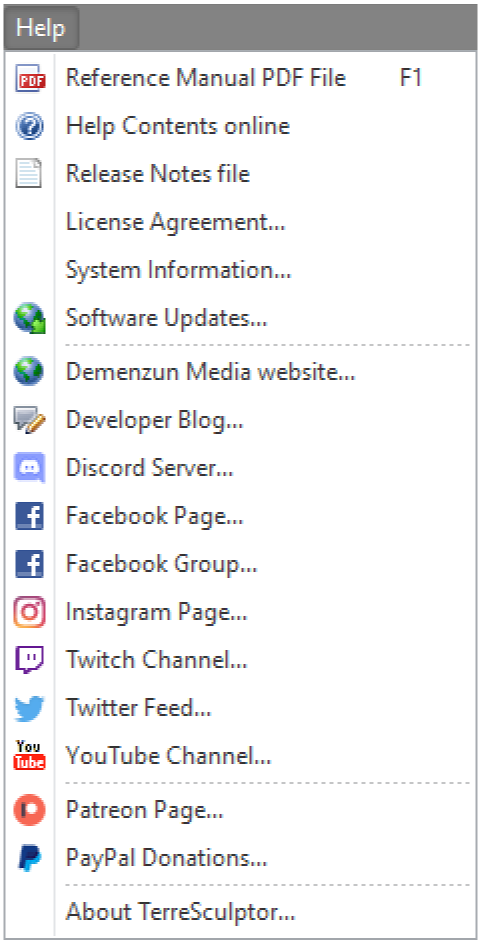
Font name:	The viewport text font name.
Font size:	The viewport text font size.

Mouse

Mouse speed:	The base mouse movement speed.
Mouse wheel speed:	The base mouse wheel speed.
Mouse XButton 1 action:	The action assigned to mouse X-button 1. A 5+ button mouse is required.
Mouse XButton 2 action:	The action assigned to mouse X-button 2. A 5+ button mouse is required.

Help Menu

Contains links to the software reference manual and notes and various Internet support links.



Reference Manual PDF file – Launch the reference manual PDF file.

Help Contents Online – Connect to the application online reference manual site.

Release Notes – Display the application release notes file.

License Agreement – Display the software license agreement.

System Information – Display the system information dialog.

Software Updates – Check the Internet for application updates and new versions.

Demenzun Media website – Connect to the software main website.

Developer blog – Connect to the developer blog site.

Discord Server – Connect to the Discord server.

Facebook Page – Connect to the software Facebook web page.

Facebook Group – Connect to the software Facebook group.

Google Asset Drive – Connect to the Google Drive that contains free asset files.

Instagram Page – Connect to the company Instagram web page.

Twitch Channel – Connect to the company Twitch channel.

Twitter Feed – Connect to the company Twitter feed.

YouTube channel – Connect to the software YouTube channel for video tutorials.

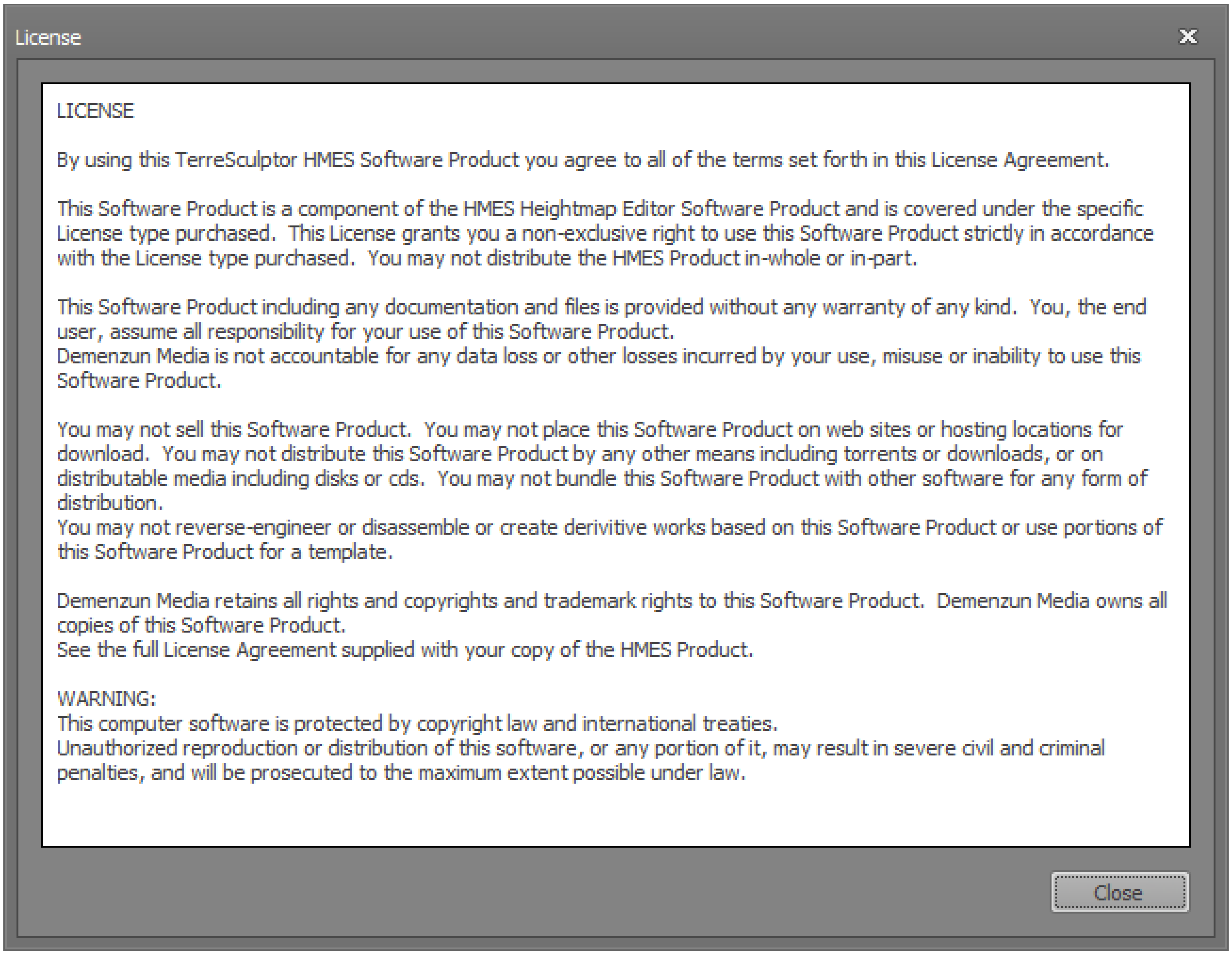
Patreon Page – Connect to the Patreon support web page.

PayPal Donations – Connect to PayPal for donations.

About TerreSculptor – Display the about and copyright dialog.

Help: License Agreement

Displays the basic software license agreement.


License

LICENSE

By using this TerreSculptor HMES Software Product you agree to all of the terms set forth in this License Agreement.

This Software Product is a component of the HMES Heightmap Editor Software Product and is covered under the specific License type purchased. This License grants you a non-exclusive right to use this Software Product strictly in accordance with the License type purchased. You may not distribute the HMES Product in-whole or in-part.

This Software Product including any documentation and files is provided without any warranty of any kind. You, the end user, assume all responsibility for your use of this Software Product.
Demenzun Media is not accountable for any data loss or other losses incurred by your use, misuse or inability to use this Software Product.

You may not sell this Software Product. You may not place this Software Product on web sites or hosting locations for download. You may not distribute this Software Product by any other means including torrents or downloads, or on distributable media including disks or cds. You may not bundle this Software Product with other software for any form of distribution.
You may not reverse-engineer or disassemble or create derivitive works based on this Software Product or use portions of this Software Product for a template.

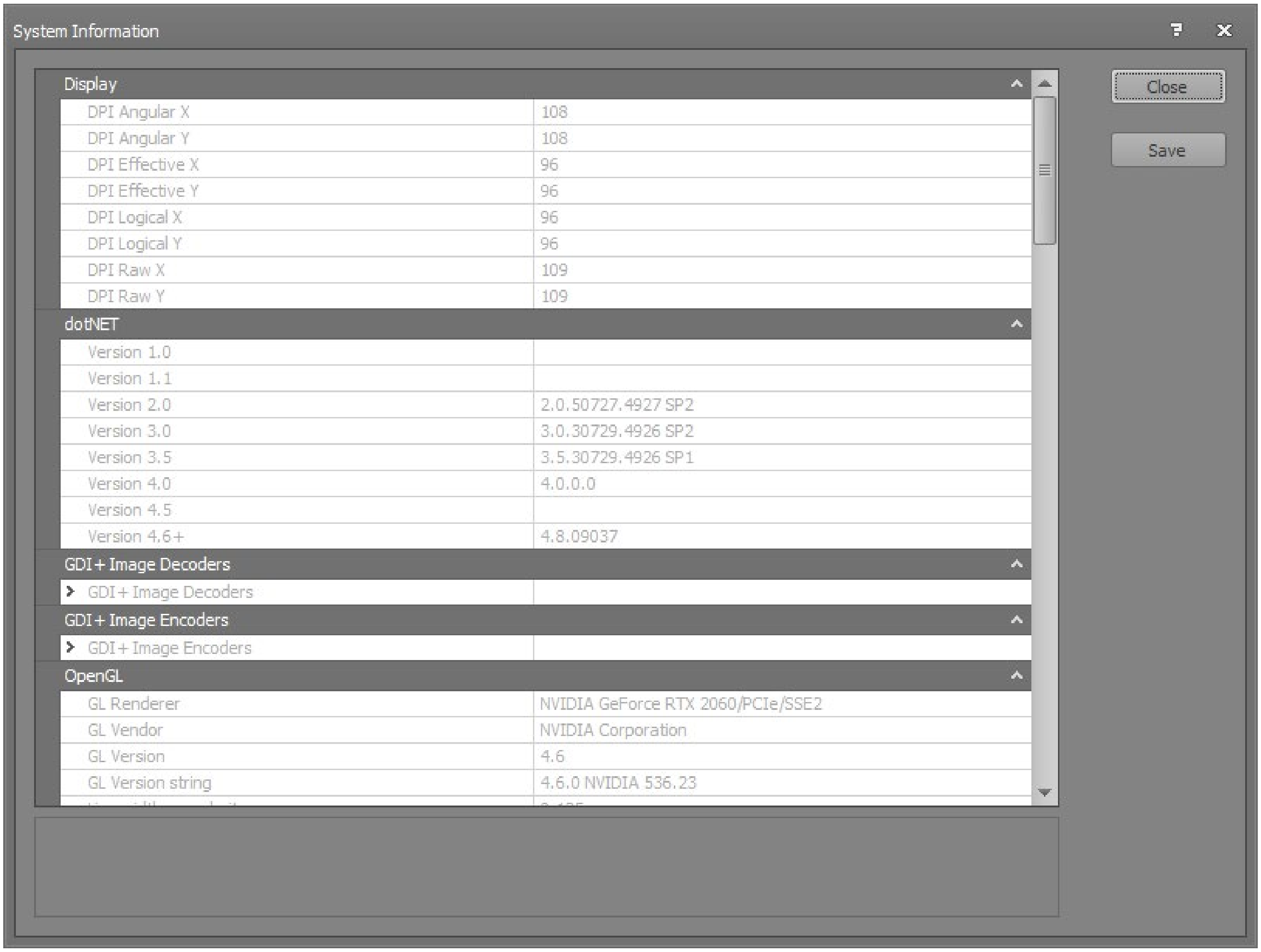
Demenzun Media retains all rights and copyrights and trademark rights to this Software Product. Demenzun Media owns all copies of this Software Product.
See the full License Agreement supplied with your copy of the HMES Product.

WARNING:
This computer software is protected by copyright law and international treaties.
Unauthorized reproduction or distribution of this software, or any portion of it, may result in severe civil and criminal penalties, and will be prosecuted to the maximum extent possible under law.

Close

Help: System Information

Displays the System Information dialog that contains information about the computer hardware and software.



Help: Software Update

TerreSculptor includes a feature for checking the Internet for updates and new versions of the software.

The software update check can be performed manually by choosing the *Software Update…* item on the Help menu, or by enabling the automatic check for updates in the application options.

Software Update Settings

The application Settings dialog includes a setting for enabling the automatic check for software updates.
The software update setting is located on the Settings dialog's General tab.

Automatic Software Update Checks

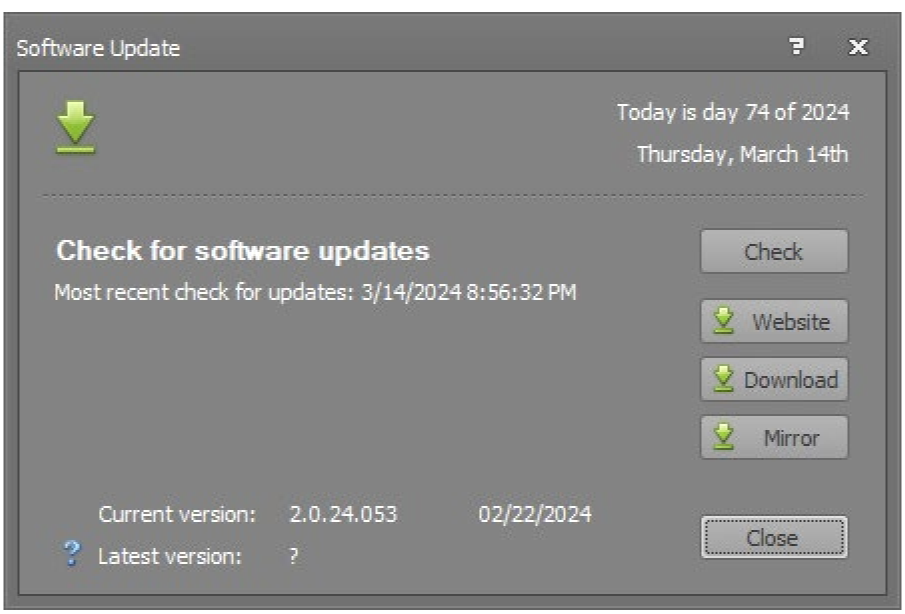
The software update checks will occur automatically if the setting has been enabled in the settings.
The first check occurs thirty seconds after the software has been launched, and then every hour after that if the software update notification icon is ignored.
If the software update notification icon is either clicked or double-clicked with the mouse, the automatic update checks are turned off until the next time TerreSculptor is ran.

 This icon will appear on the right side of the editor toolbar when a download is available.

 This icon will appear on the right side of the editor toolbar when an error occurred checking.

Software Update Dialog

The software update dialog can be displayed by choosing the *Software Update…* item on the Help menu, or by double-clicking on the automatic software update notification icon if it is visible.
Displaying this dialog does not automatically check for software updates, the Check button must be chosen.



Check Check the Internet for an update or new software version.

Website Launch the default web browser to the software download page.
Download Launch the default web browser to the main software download drive.
Mirror Launch the default web browser to the mirror software download drive.

Close Close the software update dialog.

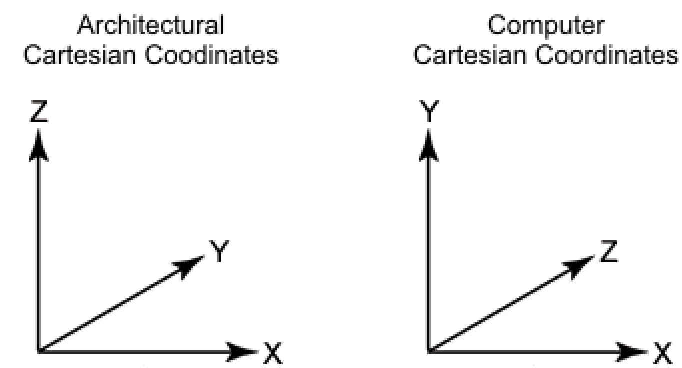
Cartesian Coordinate Systems

A Cartesian coordinate system specifies a unique point location by its numerical coordinates within a set of planes. The numerical coordinates are the signed (positive or negative) distance from the fixed plane origin to the point's location.

In a 3D coordinate system, the three mutually perpendicular planes are called the X, Y, and Z plane axes, and their point of intersection is called the origin. The origin location is at the X,Y,Z coordinate of 0,0,0, with signed (positive and negative) coordinates at distances from the origin.

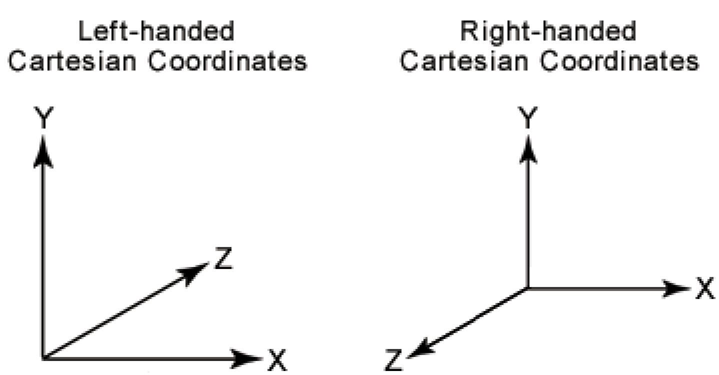
Coordinate Categories

3D Cartesian coordinate systems fall into two basic categories: architectural and computer.
The architectural coordinate system began years ago from hand-drafting where X and Y are the width and length of the paper laying flat on the drafting desk and Z is the imaginary altitude extending upward out of the paper.
The computer coordinate system began with the development of 3D rendering engines where X is across the width of the screen, Y is across the height of the screen, and Z is in and out of the screen. An easy way to remember the computer coordinate system is that the Z axis moves along the 3D renderer *Z-buffer* (depth buffer).



All 3D software applications support one or more Cartesian coordinate systems. The chosen coordinate system sometimes depends on the purpose of the software. For example, drafting software such as Autodesk AutoCAD will typically use the architectural coordinate system instead of the default computer coordinate system, since it is an architectural application that is used instead of, or in addition to, hand-drafting. Most software applications and 3D engines use the computer coordinate system.

The computer coordinate system is divided into two layouts, where the only difference is the signed positive direction of the Z axis. The layout where positive Z goes into the screen is called left-handed. DirectX uses the left-handed layout. The layout where positive Z goes out of the screen is called right-handed. OpenGL uses the right-handed layout. The "-handed" terminology comes from the fact that holding your hand in the positive X direction with the fingers curved up in the positive Y direction, then the thumb becomes the positive Z direction.

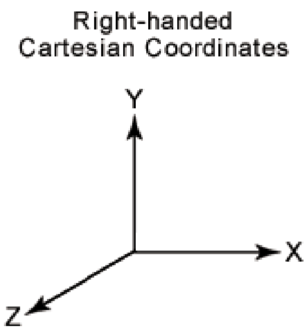


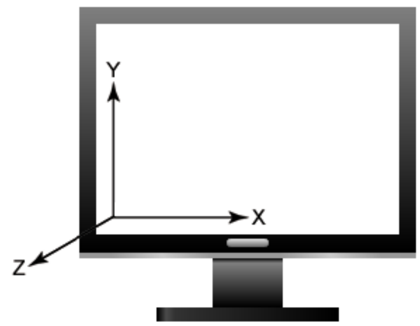
Other common 3D software coordinate default layouts include:

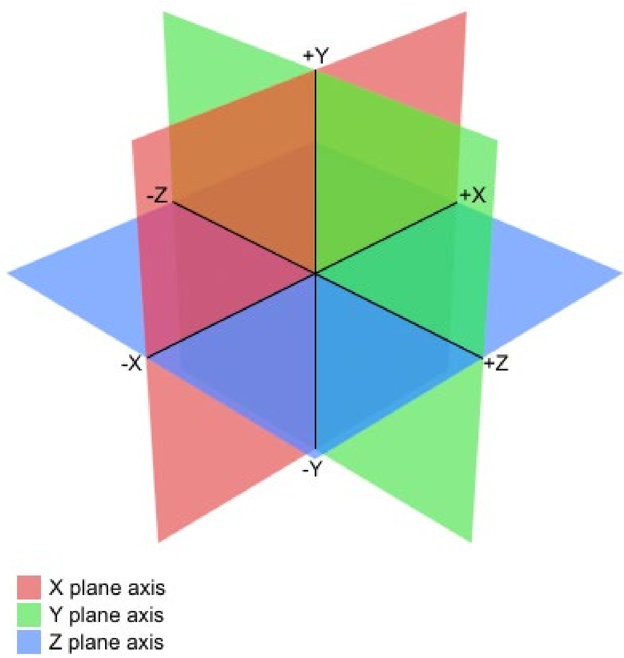
- Autodesk 3DS Max uses the architectural system with +Z up, +X right, +Y in.
- Blender uses Autodesk Max style coordinates.
- Autodesk Maya uses the OpenGL right-handed system with +Y up, +X right, +Z out.
- TerreSculptor uses the OpenGL right-handed system with +Y up, +X right, +Z out.
- Unreal Engine uses its own backwards architectural coordinate system of +Z up, +Y right, +X in, which is why meshes and heightmaps must be pre-rotated prior to import or they do not face the proper direction.

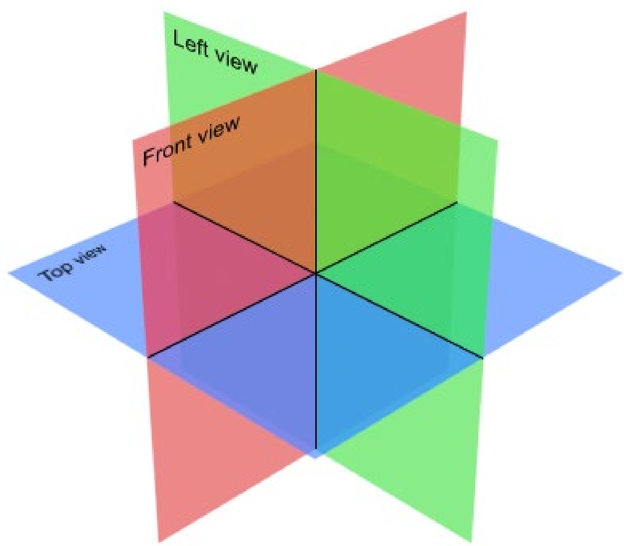
TerreSculptor's Coordinate System

TerreSculptor uses the standard OpenGL right-handed coordinate system with +Y up, +X right, and +Z out.
The X,Y,Z origin 0,0,0 is located at the intersection of the three planes.









Display Performance

TerreSculptor contains a number of features to help adjust the performance of the 2D and 3D render display output. The performance features can be set to provide a balance between visual quality and render time.

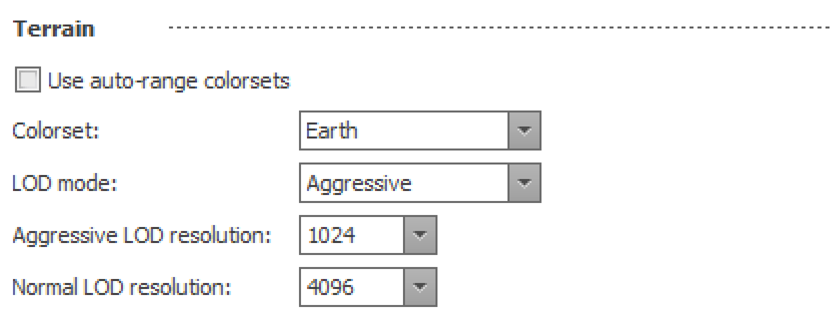
The performance features are typically set depending on the visual quality requirements and the performance level of the computer hardware.

Editor Performance Settings

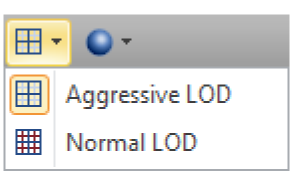
The Editor 3D scene includes performance settings for the visual quality and resolution of the rendered terrain mesh.
The terrain mesh can be set so that it is a lower resolution proxy version of the actual heightmap data, whenever the heightmap exceeds a specific resolution. This feature is called Aggressive LOD.

When the heightmap resolution exceeds the aggressive resolution value, a smaller version of the heightmap is used to render the terrain mesh. This prevents the mesh triangle count from exceeding the specified maximum, which results in better 3D rendering performance.

The aggressive LOD resolution value can be adjusted on the Settings dialog’s Scene tab in the Terrain group.
Choose the desired largest aggressive LOD resolution, and whenever a heightmap is loaded that is larger than this resolution, it will instead be rendered at this specified resolution.
For example, the default aggressive LOD resolution value of 1024 would result in a 2048×2048 or 3072×3072 or 4096×4096 heightmap being rendered at a mesh resolution of 1024×1024. This can be a significant performance savings since a 4096×4096 terrain mesh is more than 33 million triangles, while a 1024×1024 terrain mesh is only 2 million triangles, only 1/16 the amount of mesh data required to render.



The aggressive LOD resolution setting is used in conjunction with the Terrain LOD drop-down menu on the main toolbar. The available terrain LOD modes are chosen on this menu.



File Backup

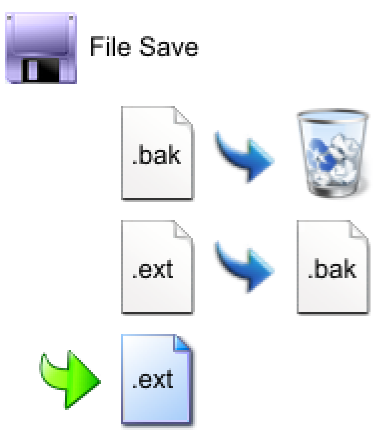
Whenever a file is saved that may cause an overwrite condition, the following actions will occur.

If the application option for *Create backup on save* is enabled, the original file will be renamed from “filename.ext” to “filename.ext.bak”. The characters .bak will be appended to the original file name. This style of action is chosen instead of replacing the original file extension in order that the original file’s format type differentiated by its extension is still obvious.

If a file already exists in the folder that is named “filename.ext.bak”, then it will be deleted, unless the *Use Recycle Bin on overwrite* option is enabled in which case the existing .bak file will be moved to the Windows Recycle Bin.

If the application option for *Create backup on save* is **not** enabled, the original file will be deleted, unless the *Use Recycle Bin on overwrite* option is enabled in which case the original file will be moved to the Windows Recycle Bin.

A flowchart for the operations of both *Use Recycle Bin on overwrite* and *Create backup on save* enabled.



Last Folder Memory

TerreSculptor maintains a memory for the last folder that was accessed for the file open and save dialogs. Whenever the software is executed it always remembers the last folders accessed, and during a session the last folder accessed is always updated to the current folder location that is browsed to.

Last folder memory is tracked independently for each of the following file areas:

Editor:

- Opening and saving a TerreSculptor World file.
- Importing and exporting a file.
- Browsing for a texture file.
- Saving a screenshot image.

Notes:

The last folder memory can be reset to the default folder locations by clicking the Reset button in the Settings.

The last folder memory is reset whenever the ini file is reset to defaults through the Settings dialog.
The last folder memory values can be modified by manually editing the ini file.

When the last folder memory for a file area is at its default ‘blank’ value, the current user account *Documents* folder is used for all files except screenshots which use the current user account *Pictures* folder.

Texture Support

TerreSculptor supports texture mapping on a number of its 3D editor scene objects. The texture image files that can be opened and applied to these scene objects include a subset of standard power-of-two sizes.

The phrase "power-of-two" is often used to specify texture dimensions. Power-of-two numbers are those that are calculated from the formula 2^*n* where *n* is any number from 1 and higher. So 2^1 = 2. 2^2 = 4. 2^3 = 8. 2^4 = 16, 2^8 = 256, 2^10 = 1024, 2^12 = 4096. etc. Common power-of-two values used for textures include 64, 128, 256, 512, 1024, 2048, 4096, 8192, and 16384. TerreSculptor supports texture dimension values of 512, 1024, 2048,4096, 8192, and 16384, as outlined below.

32-bit texture files that include an alpha channel will correctly render with alpha transparency.
If a texture file is opened that has an unsupported resolution, the texture resize dialog will appear.

The supported texture file formats include:

Windows Bitmap “.bmp”
- 8-bit palette color (also known as 256-color)
- 24-bit RGB color

Graphics Interchange Format “.gif”
- 8-bit palette color (also known as 256-color)

Joint Photographic Experts Group “.jpg”
- 8-bit palette color (also known as 256-color)
- 24-bit RGB color

Portable Network Graphics “.png”
- 8-bit palette color (also known as 256-color)
- 24-bit RGB color
- 32-bit ARGB color

Targa Image Format “.tga”
- 8-bit palette color (also known as 256-color)
- 24-bit RGB color
- 32-bit ARGB color

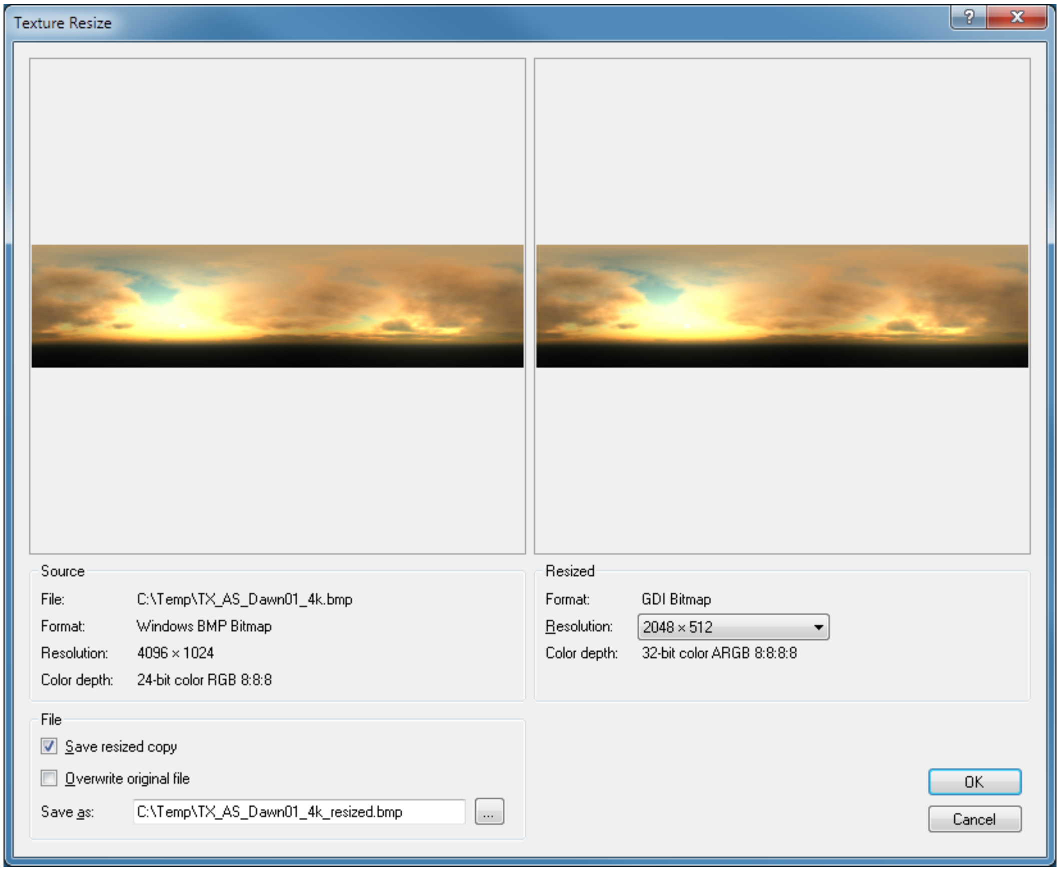
Tagged Image Format “.tif”
- 8-bit palette color (also known as 256-color)
- 24-bit RGB color
- 32-bit ARGB color

The supported texture file resolutions for each scene object are:

Backdrop Cube	512×512, 512×1024, 1024×512, 1024×1024
Backdrop Skydome	2048×512
Backdrop Skyplane	512×512, 1024×1024
Designer	512×512, 512×1024, 1024×512, 1024×1024
Water	512×512, 512×1024, 1024×512, 1024×1024

Texture Resize Dialog

The texture resize dialog supports interactive resampling of texture files that are not one of the supported texture resolutions.



Resized

Resolution – Choose one of the available supported resolutions. The supported resolutions vary by the scene object.

File

Save resized copy – Enable this to save a copy of the resized texture file. If this is not enabled, no resized copy is saved to disk, and resizing will have to be performed again if the original texture is opened at a later time.

Overwrite original file – Enable this to overwrite the original texture file with the resized version. A backup of the original file will be made if file backups is enabled in the application options.

Save as – Specifies the new name for the saved resized copy. By default the resized copy has the same file name as the original file with the word "_resized" appended to the file name.

Viewport Stats

The viewport stats display technical information regarding the current scene.

Performance Statistics

The performance statistics display the current scene render time (RT) and frame time (FT).
The render time is the amount of time spent preparing, batching and rendering the scene objects.
The frame time is the delta-time interval between subsequent calls to render the scene.

The performance statistics can be displayed in either milliseconds or frame per seconds.
Milliseconds is a more accurate statistical value as frames per second in a non-linear function.

The render engine is not a constant iterative loop method and is only updated when camera or scene changes occur. The frame time delta value is relevant only if the scene is constantly updated such as constant camera movement.

Scene Statistics

The scene statistics display information regarding the scene objects, which includes:
- The number of scene objects rendered.
- The number of terrain sections rendered.
- The number of terrain triangles rendered.

Viewport Stats Options

The viewport stats display is managed through the Options dialog Scene tab settings.
The performance statistics and scene statistics can be shown or hidden.
The performance statistics can be displayed as either milliseconds or frames per second.

Terrain Design

TerreSculptor supports creation of a wide variety of visual styles of terrain, from imported DEM digital elevation models, to complex noise generation, to mixing and masking of multiple sources. TerreSculptor utilizes the heightmap based terrain system that can visually depict hills, valleys, mountains, rivers, and roads. Plus the creation of multiple types of weightmaps for a multiple layer terrain texture system that supports real-world texture files such as dirt, rock, sand and mud. The weightmap alphamap masks determine where the textures are blended onto the terrain mesh such as on flatlands or steep mountain sides.

Terrain Use

Terrain can be used for small areas such as city lots, enclosed courtyards and even to simulate piles of debris; or the entire game map may be based on a large outdoor terrain design that incorporates a variety of geological features such as mountains and valleys.

The terrain is often used in conjunction with specifically-designed geological meshes for large boulders, buttes, cliffs, and water planes. Additional meshes are also used for the variety of foliage that may appear on the terrain, such as grass, weeds, flowers, shrubs and bushes, and trees. Video game map designs and layouts using terrain will often utilize the terrain's ability to create impassable mountains or cliffs around the circumference of the play area, in order to restrict the movement of the game player and prevent them from leaving the game area or falling out of the game world.

The terrain system essentially renders an X × Z array of mesh triangles whose vertex Y value determines the altitude of the triangles at each vertex intersection. The vertex Y values are derived from each heightmap pixel altitude or the pixel grayscale level value.

One of the challenges that video game level designers face is choosing the appropriate layout and resolution of this terrain mesh in order to provide the best visual quality versus performance setting.

Terrain Size

TerreSculptor supports a maximum world size of 1M × 1M × 1M (1048576 × 1048576 × 1048576) generic units, although terrain meshes twice this size can still be created or edited but may result in renderer distance clipping. This is equivalent to a 20.97km × 20.97km area when using the Units settings of 1 unit = 2 cm.

This maximum world size is independent of the heightmap resolution, such that a 2048 × 2048 heightmap with a Units XZ vertex spacing of 128 will result in a 256k × 256k area, while the same 2048 × 2048 heightmap with a Units XZ vertex spacing of 256 will result in a 512k × 512k area.

The Units XZ vertex spacing value determines the size of each terrain quad, along with the terrain heightmap resolution in pixels ultimately determining the total area of the terrain mesh. The total area is calculated as heightmap resolution × Units XZ vertex spacing along each dimension. Choosing the most effective set of values for heightmap resolution and vertex spacing is required to obtain the best balance between terrain detail and rendering performance.

In most cases the Units XZ vertex spacing will be 128, 192, or 256, which provide a good balance between quad size and terrain mesh density. The heightmap resolution will then be chosen to fulfill the requirement for the overall terrain size such as the area in meters or kilometers.
Care should be exercised when choosing heightmaps larger than 1024 × 1024 for both performance and file size reasons: a 2048 × 2048 heightmap is 8MB of heightmap data and a terrain mesh of 8 million triangles; a 3072 × 3072 heightmap is 18MB of heightmap data and a terrain mesh of 18 million triangles; and a 4096 × 4096 heightmap is 32MB of heightmap data and a terrain mesh of 32 million triangles.

Power-of-Two

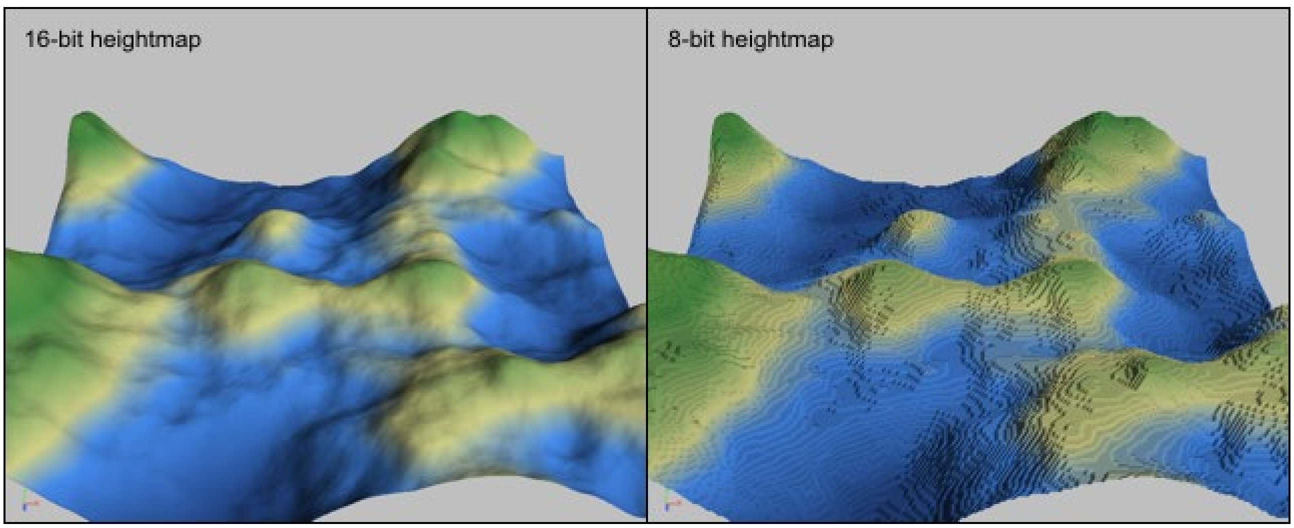
When working with heightmaps the phrase "power-of-two" is often used to specify the heightmap dimensions. Power-of-two numbers are those that are calculated from the formula 2^*n* where *n* is any number from 1 and higher. So 2^1 = 2. 2^2 = 4. 2^3 = 8. 2^4 = 16, 2^8 = 256, 2^10 = 1024, 2^12 = 4096. etc.

Common power-of-two values used for heightmaps include 64, 128, 256, 512, 1024, 2048, and 4096. Plus-half values are also commonly used, which are those half-way between a power-of-two pair, such as 384, 768, 1536, and 3072.

Heightmap Bit-depth

When developing heightmap files for use with current video game engines, be sure to always work with the proper 16-bit heightmap format and files. Choosing to work with 8-bit grayscale heightmap files for ease of support in standard paint software will result in terrains that are using only 1/256th of the available altitude range. This normally causes an undesirable stair-stepped terracing look to the terrain.

When working with heightmap files, it is not recommended to attempt to paint detail on the heightmap using standard paint software, as it can only edit and display 8-bits of grayscale on current video hardware. This means that for every single color of gray that is painted on an 8-bit display system, there are actually 256 levels of altitude that cannot be seen visually. In other words, on an 8-bit grayscale display, the value 0 (black) is actually the 16-bit values from 0 to 255; the 8-bit value 1 is actually 16-bit 256 to 511, etc. So there is no visual accuracy to the values that are being painting to.



Units Vertex Spacing

The Units vertex spacing includes individual properties for the XZ and Y directions of the terrain mesh. Units XZ are locked together to create square quads (triangle pairs) only, and affect the width and length of the terrain mesh, while Units Y affects the height (altitude range) of the terrain mesh.

Units XZ

The size of each terrain quad (triangle pair) is determined by the current Units XZ vertex spacing value.
The Units XZ value should be adjusted to modify the quad size for the required minimum visual surface resolution.

The Units XZ value chosen will depend on two factors, the desired terrain mesh detail quality, and the desired rendering performance. Higher terrain mesh detail requires a smaller Units XZ value which results in a greater number of quads for a specified terrain area, while faster rendering requires fewer quads for a specified terrain area which is accomplished with a larger Units XZ value.

Units Y

The Units Y vertex spacing value determines the granularity for each terrain mesh vertex position along the Y axis direction (altitude or up and down). The smaller the Units Y value, the finer the terrain altitude steps. The larger the Units Y value, the larger the altitude steps. Since the heightmap data is floating-point values between 0.0 and

100.0, the Units Y vertex spacing also determines the total available altitude range for the terrain.

Terrain Quad Size

The size of each terrain quad is determined by the Units XZ vertex spacing property.
This table shows the approximate size in equivalent feet and meters based on the ratio of 1 Unit XZ equals 2 centimeters.
Imperial to metric conversion is 1 inch = 2.54 cm.

Units XZ vertex spacing	Terrain mesh quad	Quad size in Meters	Quad size in Feet
64	64 units	1.28 m (128 cm)	4.20 ft (50.39 in)
80	80 units	1.60 m (160 cm)	5.25 ft (62.99 in)
96	96 units	1.92 m (192 cm)	6.30 ft (75.59 in)
112	112 units	2.24 m (224 cm)	7.35 ft (88.19 in)
128	128 units	2.56 m (256 cm)	8.40 ft (100.79 in)
160	160 units	3.20 m (320 cm)	10.50 ft (125.98 in)
192	192 units	3.84 m (384 cm)	12.60 ft (151.18 in)
224	224 units	4.48 m (448 cm)	14.70 ft (176.38 in)
256	256 units	5.12 m (512 cm)	16.80 ft (201.57 in)
288	288 units	5.76 m (576 cm)	18.90 ft (226.77 in)
320	320 units	6.40 m (640 cm)	21.00 ft (251.97 in)
352	352 units	7.04 m (704 cm)	23.10 ft (277.17 in)
384	384 units	7.68 m (768 cm)	25.50 ft (302.36 in)
512	512 units	10.24 m (1024 cm)	33.60 ft (403.15 in)

Terrain Area Size

This table lists the real-world equivalent area of the terrain for various common values of heightmap resolution and Units XZ vertex spacing.

The terrain area is calculated as:

Heightmap Resolution × Units XZ vertex spacing = total area in units
Total area in units × units type and size = total terrain area

For example: (1024 resolution × 256 units = 262144 units) × (1 unit = 2 cm) = 524288 cm = 5.24288 km

For this table data: 1 Unit XZ = 2cm. 1 foot = 30.48cm or 0.3048 meters. 1 meter = 3.280839895 feet. 1000 meters = 1 kilometer. 5280 feet = 1 mile.

To determine the total desired area for a terrain, look up the width and length from this table in meters/kilometers or feet/miles to get the required heightmap resolution and Units XZ vertex spacing.

Heightmap Res.	Units XZ	Length in Units	Meters	Feet
64	128	8192	163.84 (0.16 km)	537.532808
64	192	12288	245.76 (0.25 km)	806.299213
64	256	16384	327.68 (0.33 km)	1075.06562
128	128	16384	327.68 (0.33 km)	1075.06562
128	192	24576	491.52 (0.5 km)	1612.59843
128	256	32768	655.36 (0.66 km)	2150.13123
256	128	32768	655.36 (0.66 km)	2150.13123
256	192	49152	983.04 (0.99 km)	3225.19685
256	256	65536	1310.72 (1.3 km)	4300.26247
384	128	49152	983.04 (0.99 km)	3225.19685
384	192	73728	1474.56 (1.5 km)	4837.79528
384	256	98304	1966.08 (2.0 km)	6450.3937 (1.2mi)
512	128	65536	1310.72 (1.3 km)	4300.26247
512	192	98304	1966.08 (2.0 km)	6450.3937 (1.2mi)
512	256	131072	2621.44 (2.6 km)	8600.52493 (1.6mi)
768	128	98304	1966.08 (2.0 km)	6450.3937 (1.2mi)
768	192	147456	2949.12 (2.9 km)	9675.59055 (1.8mi)
768	256	196608	3932.16 (3.9 km)	12900.7874 (2.4mi)
1024	128	131072	2621.44 (2.6 km)	8600.52493 (1.6mi)
1024	192	196608	3932.16 (3.9 km)	12900.7874 (2.4mi)
1024	256	262144	5242.88 (5.2 km)	17201.0499 (3.3mi)
1536	128	196608	3932.16 (3.9 km)	12900.7874 (2.4mi)
1536	192	294912	5898.24 (5.9 km)	19351.1811 (3.7mi)
1536	256	393216	7864.32 (7.7 km)	25801.5748 (4.9mi)
2048	128	262144	5242.88 (5.2 km)	17201.0499 (3.3mi)
2048	192	393216	7864.32 (7.9 km)	25801.5748 (4.9mi)
2048	256	524288	10485.76 (10.5 km)	34402.0997 (6.5mi)
3072	128	393216	7864.32 (7.9 km)	25801.5748 (4.9mi)
3072	192	589824	11796.48 (11.8 km)	38702.3622 (7.3mi)
3072	256	786432	15728.64 (15.8 km)	51603.1496 (9.8mi)
4096	128	524288	10485.76 (10.5 km)	34402.0997 (6.5mi)
4096	192	786432	15728.64 (15.8 km)	51603.1496 (9.8mi)
4096	256	1048576	20971.52 (21 km)	68804.1995 (13 mi)

Creating Heightmaps for Unreal Engine 2

Performance

Unreal Engine 2 terrains perform sector frustum culling for performance. Terrains do not include any intrinsic occluding functionality, so AntiPortals should be placed beneath large hills and mountains to perform occlusion culling.

X and Y Dimensions

Each sample point in the heightmap image corresponds to a mesh vertex in the terrain. The Unreal Engine 2 TerrainInfo actor only supports power-of-two dimensions, such as 256 × 256. The number of terrain mesh quads generated will always be the dimension -1. A 256 × 256 heightmap therefore results in a 255 × 255 terrain mesh.

Altitude and TerrainScale.Z

When developing heightmaps for use in Unreal Engine 2, rarely will a heightmap utilize the entire 16-bit range of altitude values from 0 to 65535. The Unreal Engine 2 TerrainInfo actor's TerrainScale.Z determines the maximum altitude range that is available. A heightmap can use all 65536 altitude values, but it is usually easier to develop a heightmap that is using its real-world altitude layout in order to more easily visualize the terrain. In most cases, a heightmap with an altitude range that is between 10,000 and 40,000 of the available 16-bits is sufficient.

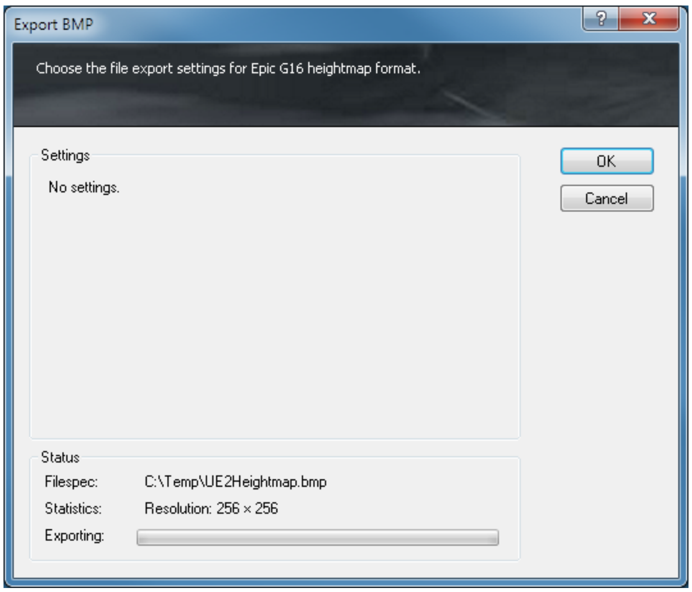
Exporting a Heightmap for Unreal Engine 2

The Unreal Engine 2 TerrainInfo actor supports heightmap importing using the 16-bit G16 format.

Unreal Engine 2 terrain is limited to power-of-two sizes, with common terrain resolutions of 64 × 64, 128 × 128, and 256 × 256. Terrains that are 512 × 512 or larger are not recommended for performance reasons. Terrains should also be square aspect.

The TerreSculptor heightmap must be the proper dimensions for one of the supported Terrain resolutions. Use the Resample tool to modify the heightmap dimensions before exporting if required.

To create a heightmap file that is compatible with the Unreal Engine 2 TerrainInfo importer, export the TerreSculptor heightmap to the Epic G16 file format. This file format has no additional export properties.



Creating Heightmaps for Unreal Engine 3 UDK

Performance

Large terrains should always be designed with sufficient intrinsic occluding capabilities to provide culling of a large portion of the terrain sections (sectors). This is accomplished by using numerous tall mountains or cliffs in the terrain design so that only a short view-distance is ever rendered in the frustum.

X and Y Dimensions

Each sample point in the heightmap image corresponds to a mesh vertex in the terrain. In order to obtain a terrain that is an even power-of-two size, such as 256 × 256 patches (quads), it is necessary to provide a heightmap that is *size+1* in dimensions. A 256 × 256 patch terrain therefore requires a 257 × 257 heightmap.

Altitude and DrawScale3D.Z

When developing heightmaps for use in Unreal Engine 3, rarely will a heightmap utilize the entire 16-bit range of altitude values from 0 to 65535. The Unreal Engine 3 Landscape/Terrain actor's DrawScale3D.Z determines the maximum altitude range that is available. A heightmap can use all 65536 altitude values, but it is usually easier to develop a heightmap that is using its real-world altitude layout in order to more easily visualize the terrain. In most cases, a heightmap with an altitude range that is between 10,000 and 40,000 of the available 16-bits is sufficient.

Heightmap Altitude Range	DrawScale3D.Z	Unreal Altitude	Altitude Range *
16384 to 49152 (= 32768)	256	65536 units (-32768 to 32768)	1310.72 m or 4300.26 ft
	128	32768 units (-16384 to 16384)	655.36 m or 2150.13 ft
	64	16384 units (-8192 to 8192)	327.68 m or 1075.06 ft
	32	8192 units (-4096 to 4096)	81.92 m or 268.77 ft
	16	4096 units (-2048 to 2048)	40.96 m or 134.38 ft
24576 to 40960 (= 16384)	256	32768 units (-16384 to 16384)	655.36 m or 2150.13 ft
	128	16384 units (-8192 to 8192)	327.68 m or 1075.06 ft
	64	8192 units (-4096 to 4096)	81.92 m or 268.77 ft
	32	4096 units (-2048 to 2048)	40.96 m or 134.38 ft
	16	2048 units (-1024 to 1024)	20.48 m or 67.19 ft

* Based on the default UE3 engine setting of 1 unreal unit = 2 cm.

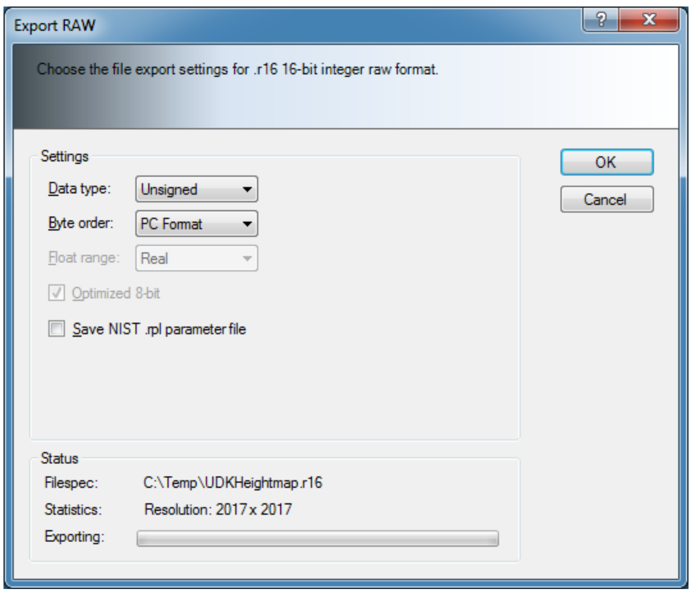
Exporting a Heightmap for UDK Landscape

The UDK Landscape actor supports heightmap importing using the 16-bit RAW .r16 format.

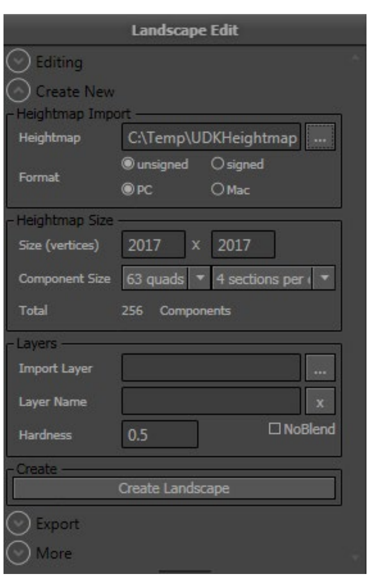
Landscape has an unintuitive method of managing the supported heightmap resolutions. There are only a limited number of resolutions that work, and even fewer that are properly optimized. It is recommended that UDK users seek help regarding this from the UDN documentation and the Epic forums, as Landscape resolution calculations will not be covered in this document.

The TerreSculptor heightmap must be the proper dimensions for one of the supported Landscape resolutions. Use the Resample tool to modify the heightmap dimensions before exporting if required.

To create a heightmap file that is compatible with the UDK Landscape importer, export the TerreSculptor heightmap to the 16-bit RAW .r16 file format using the following export properties: *Unsigned*, *PC format*. Optionally the *Signed* or *Mac Format* may also be used, just be sure to use the identical format options on the UDK Landscape Edit dialog importing.



The exported heightmap file is then imported into UDK Landscape using the Landscape Edit dialog.
In the Landscape Edit dialog's *Create New* group, browse for the .r16 file in the *Heightmap Import* group, and set the Format options accordingly: *Unsigned*, *PC*.
Choose the *Create Landscape* button to create a new Landscape with the imported heightmap.



Notes

- To match the viewport terrain rendering scale between TerreSculptor and UDK, be sure to set the TerreSculptor Units properties on the Options dialog to the UDK Units that your specific engine version is using. The default UE3 UDK Units are available in the Units Preset drop-down combobox as *Unreal Engine 3*.

- If the Landscape heightmap requires updating, the entire existing Landscape actor must be deleted and the heightmap import process repeated.

- If the Landscape is to include Layer weightmap files, they must be imported at the same time as the heightmap. If any Landscape weightmap requires updating, the entire existing Landscape actor must be deleted and the heightmap and weightmap import process repeated. See the chapter on *Exporting a Weightmap for UDK Landscape*.

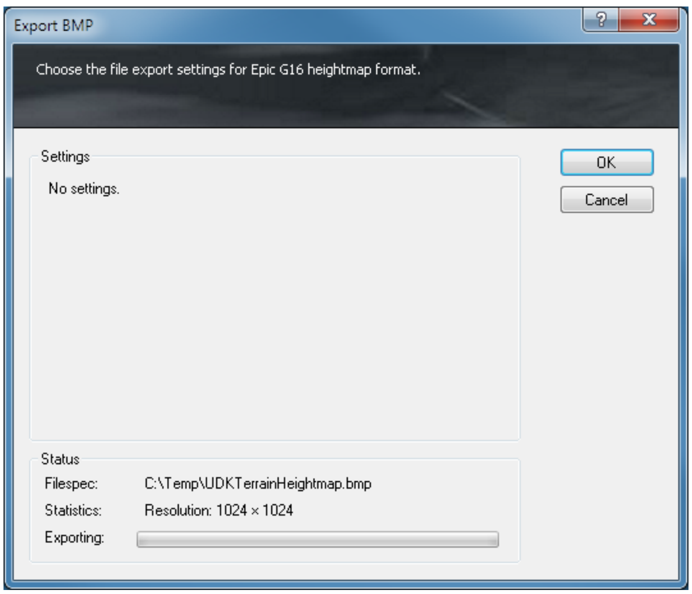
Exporting a Heightmap for UDK Terrain

The UDK Terrain actor supports heightmap importing using the Epic G16 .bmp format.

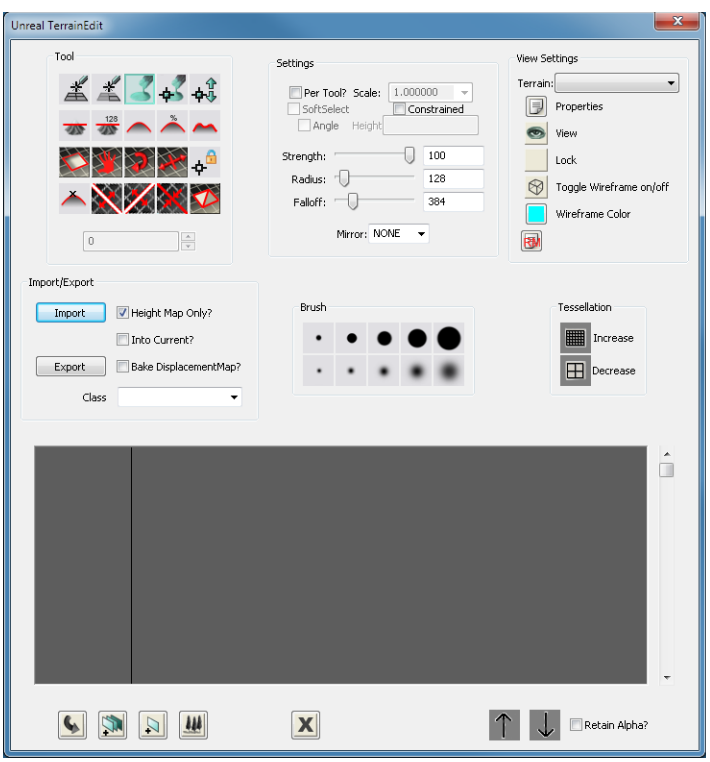
The Terrain actor supports any resolution from 2 × 2 up to 1024 × 1024. It is not recommended to use Terrain actors larger than 1024 due to performance overhead.

The TerreSculptor heightmap must be the proper dimensions for the desired Terrain actor resolution. Use the Resample tool to modify the heightmap dimensions if required before exporting.

To create a file that is compatible with UDK Terrain, export the TerreSculptor heightmap to the Epic G16 format. There are no additional property settings for this format.



The exported file is then imported into UDK Terrain using the Terrain Edit dialog.
Under the Import/Export group, enable the Height Map Only checkbox and then Import the G16 .bmp file.



Notes

- To match the viewport terrain rendering scale between TerreSculptor and UDK, be sure to set the TerreSculptor Units properties on the Options dialog to the UDK Units that your specific engine version is using. The default UE3 UDK Units are available in the Units Preset drop-down combobox as *Unreal Engine 3*.

- If the Terrain heightmap requires updating, perform the import process again with the Terrain actor selected and set the *Into Current?* option enabled.

Creating Weightmaps for Unreal Engine 3 UDK

Unreal Engine 3 weightmaps are 8-bit grayscale alphamaps used to determine the placement of texture materials on the terrain.

TerreSculptor has intrinsic functions for creating weightmaps that are fully compatible with UE3. These weightmaps can be based on limits of the terrain's altitude range, the direction that terrain triangles are facing, the terrain triangle slope, and composite weightmaps that are any combination of these.

Weightmaps based on altitude range can be used for snow-capped mountains and ocean floors. Weightmaps based on direction can be used to simulate where solar or weather effects have affected the surface. Weightmaps based on slope can be used for rock cliff edges or grass filled plains.

Each weightmap should be unique, in that its coverage should not overlap any other weightmaps.
For example, a weightmap for cliff faces would use a slope range between ~70 and 90 degrees, whereas a weightmap for grassy plains would use a slope range between 0 and ~30 degrees.

It is possible to mix algorithmically generated weightmaps with hand-painted layers. Care must be exercised when performing the hand-painting in order that the algorithmic weightmap is not inadvertently modified.

Exporting a Weightmap for UDK Landscape

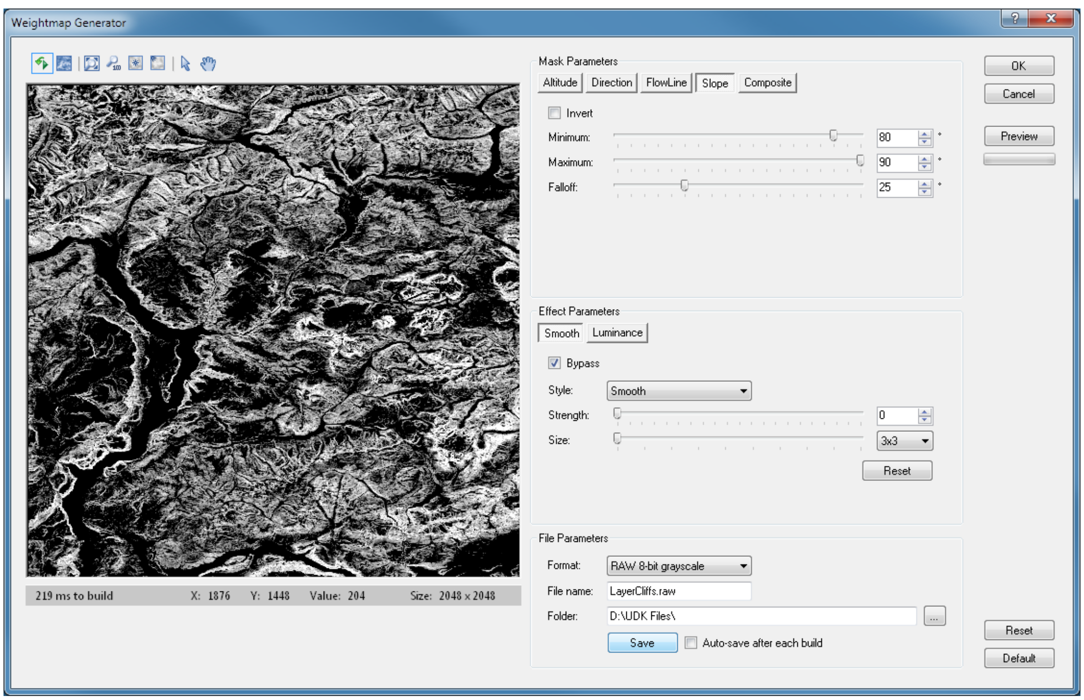
The UDK Landscape actor supports layer weightmap importing using the 8-bit RAW .r8 format.

Landscape layer weightmaps must be the same resolution as the RAW heightmap file that is imported into the Landscape Edit dialog. If the TerreSculptor heightmap was resampled prior to exporting for use in Landscape, then the weightmaps must be extracted from the resampled heightmap, or resampled manually in the Weightmap Editor (*Professional Edition Only*) or third-party paint software.

For immediate mode, choose the Weightmap Generator from the toolbar, create the desired weightmap type by choosing the appropriate dialog control properties, set the required *File Parameters*, and choose the *Save* button to save the weightmap file to disk.

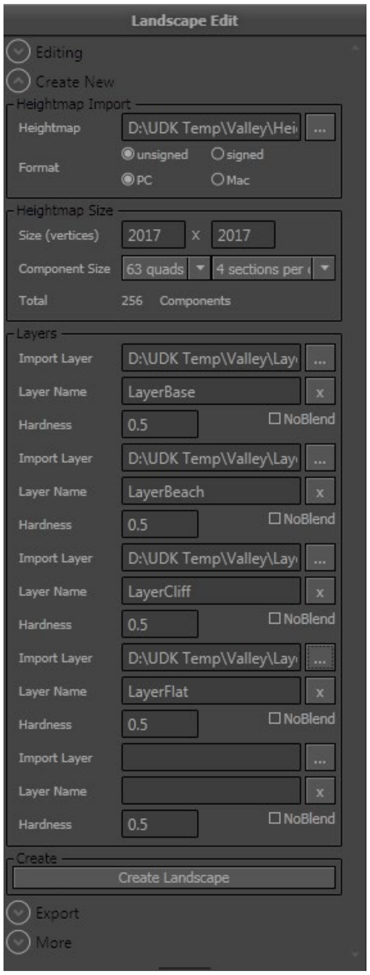
For stack mode, add a new Weightmap Generator object to the World Stack, edit the object and create the desired weightmap type by choosing the appropriate dialog control properties, set the required *File Parameters*, and choose whether to *Auto-save* the weightmap file after each build or to manually save the weightmap file by choosing the *Save* button.

To create a weightmap file that is compatible with UDK Landscape's importer, save the TerreSculptor weightmap to the 8-bit RAW .r8 file format using the Weightmap Generator dialog's File Properties:
- Format: R8 8-bit grayscale
- File name: the desired layer name which should relate to the weightmap type, eg. LayerFlatland.raw
- Folder: the folder where the UDK heightmap and weightmap project is being created



The exported weightmap file is then imported into UDK Landscape using the Landscape Edit dialog.
When importing layer weightmaps, the entire heightmap and all layer weightmaps must be imported at the same time.

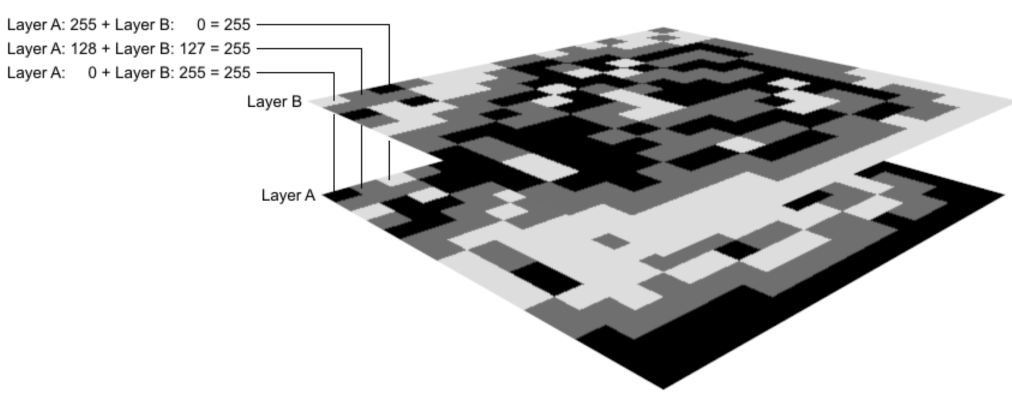
In the Landscape Edit dialog's *Create New* group, browse for the .r16 file in the *Heightmap Import* group, and set the Format options accordingly, then for each layer weightmap, browse for the .raw file in the *Layers* group, and set the layer properties as desired. The *Layer Name* property will be the weightmap file name by default. Choose the *Create Landscape* button to create a new Landscape with the imported heightmap and weightmaps.



Notes

- A proper Landscape layer weightmap setup requires that each weightmap be unique regarding its mask alphamap data. In other words, there is no weightmap layering order, and each weightmap pixel when layered one weightmap on top of each other, should add up to a value of 255 (1.0).

For example, if there are four weightmaps named A, B, C, and D, and the pixel value at XY 0,0 on weightmap A is 255, then the pixel value at XY 0,0 on weightmaps B, C, and D must be 0. If the pixel value at XY 0,1 on weightmap A is 155, then the combined pixel values at XY 0,1 on weightmaps B, C, and D must be 100.



This prerequisite for additive layer weighting in Landscape requires that the final weightmap files be modified and composited correctly using the Weightmap Editor (*Professional Edition Only*) or third-party paint software. See the chapter on *UDK Landscape Layer Compositing* for the required steps to create a proper weightmap layer set.

- The Landscape Layer weightmap files must be imported at the same time as the heightmap. If any Landscape weightmap requires updating, the entire existing Landscape actor must be deleted and the heightmap and weightmap import process repeated.

Tutorial: How to Convert a Heightmap file format

This is an *Immediate Mode* tutorial.

Converting a heightmap involves opening a file of one specific format and saving it to another format.
This is often performed when sourcing files from one application for use in a second application. For example: converting digital elevation model files for use with Unreal Engine 3 terrains.

If the heightmap is equal or smaller than the 3D Editor maximum supported dimensions, then the conversion can be performed using the editor. If the heightmap is larger than the 3D Editor maximum supported dimensions, then the Heightmap Converter dialog can be used.

Using the 3D Editor

Import the source heightmap file:

Note: imported heightmaps automatically use the Stack Base Heightmap slot and will overwrite any data there.

1. Choose the **Import** item on the File menu.
2. Select the source file format from the Import Dialog's **Files of type** drop-down list.
3. Select the desired file.
4. Select the **OK** button on the dialog.
5. Many of the file formats will include an import dialog where various format properties and options are chosen.

Export the destination heightmap file:

1. Choose the **Export** item on the File menu.
2. Select the destination file format from the Export Dialog's **Files of type** drop-down list.
3. Type in the destination file name.
4. Select the **OK** button on the dialog.
5. Many of the file formats will include an export dialog where various format properties and options are chosen.

Using the 2D Converter

Open the source heightmap file:

1. Choose the **Open** item on the File menu, or click on the Open toolbar button.
2. Select the source file format from the Open Dialog's **Files of type** drop-down list.
3. Select the desired file.
4. Select the **OK** button on the dialog.
5. Many of the file formats will include an import dialog where various format properties and options are chosen.

Save the destination heightmap file:

1. Choose the **Save As** item on the File menu, or click on the Save As toolbar button.
2. Select the destination file format from the Save Dialog's **Files of type** drop-down list.
3. Type in the destination file name.
4. Select the **OK** button on the dialog.
5. Many of the file formats will include an export dialog where various format properties and options are chosen.

Tutorial: How to Open, Edit, and Save a Heightmap file

This is an *Immediate Mode* tutorial.

Editing a heightmap is often required if the size or altitude range or other heightmap property must be adjusted.

Using the 3D Editor

Import the source heightmap file:

Note: imported heightmaps automatically use the Stack Base Heightmap slot and will overwrite any data there.

1. Choose the **Import** item on the File menu.
2. Select the source file format from the Import Dialog's **Files of type** drop-down list.
3. Select the desired file.
4. Select the **OK** button on the dialog.
5. Many of the file formats will include an import dialog where various format properties and options are chosen.

Edit the heightmap data:

1. Choose the desired editing functions on the **Adjust, Modify, Transform** menus.
   This includes transforms, altitude, filter, resample, size, etc.

Export the destination heightmap file:

1. Choose the **Export** item on the File menu.
2. Select the destination file format from the Export Dialog's **Files of type** drop-down list.
3. Type in the destination file name.
4. Select the **OK** button on the dialog.
5. Many of the file formats will include an export dialog where various format properties and options are chosen.

Using the 2D Converter

Open the source heightmap file:

1. Choose the **Open** item on the File menu, or click on the Open toolbar button.
2. Select the source file format from the Open Dialog's **Files of type** drop-down list.
3. Select the desired file.
4. Select the **OK** button on the dialog.
5. Many of the file formats will include an import dialog where various format properties and options are chosen.

Edit the heightmap data:

1. Choose the desired editing functions on the **Adjust, Modify, Transform** menus.
   This includes transforms, altitude, filter, resample, size, etc.

Save the destination heightmap file:

1. Choose the **Save As** item on the File menu, or click on the Save As toolbar button.
2. Select the destination file format from the Save Dialog's **Files of type** drop-down list.
3. Type in the destination file name.
4. Select the **OK** button on the dialog.
5. Many of the file formats will include an export dialog where various format properties and options are chosen.

Tutorial: How to create Weightmaps from an existing Heightmap file

This is an *Immediate Mode* tutorial.

Weightmaps, also called alphamaps or masks, are commonly used in video game terrain systems to define the locations of the various texture materials that cover the surface of the terrain.
Weightmaps can be algorithmically generated or hand-painted. Common algorithmically generated weightmaps include alpha selection by altitude or slope, and are used for such terrain features as rock cliff faces, grass flatlands, and lake beds. TerreSculptor supports a number of algorithmic functions and options for weightmap creation.

Open the heightmap file:

1. Choose the **Open** item on the File menu, or click on the Open toolbar button.
2. Select the source file format from the Open Dialog's **Files of type** drop-down list.
3. Select the desired file.
4. Select the **OK** button on the dialog.
5. Many of the file formats will include an import dialog where various format properties and options are chosen.

Create a weightmap:

1. Choose the Weightmap Generator button on the toolbar.
2. Choose the weightmap mask type tab button.
3. Modify the weightmap parameters as desired, using the preview as a guide.

Save the weightmap file:

The File Parameters for the weightmap generator will always default to the same folder as the imported heightmap file.

1. Choose the weightmap format in the File Parameters group.
2. Type in the weightmap destination file name.
3. Change the default weightmap file folder if desired.
4. Select the **Save** button to launch the File Save dialog and save the weightmap file to disk.

Appendix A: File Format Export and Import Options

TerreSculptor supports a wide range of file formats including digital elevation model, heightmap, image, mesh and raw data. Each file format may support a number of other exporting and importing features as outlined below.

Auto-scale

Type: Import
Applies to: image, heightmap
Settings: True or False
Description: Automatically scales the imported 8-bit data into the 0.0 to 100.0 range.

Byte Order

Type: Import and Export
Applies to: image, dem, heightmap
Settings: Intel (PC, little-endian) or Motorola (Mac, big-endian)
Description: Determines the byte-order of 16-bit and 32-bit data as per Intel or Motorola format.

Data Type

Type: Import and Export
Applies to: image, dem, heightmap
Settings: 8-bit Unsigned Byte, 16-bit Signed and Unsigned Short,
32-bit Signed and Unsigned Integer, 64-bit Signed and Unsigned Long,
32-bit Signed and Unsigned Single float, 64-bit Signed and Unsigned Double Float.
Description: Determines the data type size and Signed or Unsigned format.

Format

Type: Import and Export
Applies to: image, dem, heightmap, mesh
Settings: vary by the file type
Description: Selects a specific format type for a file, such as Grayscale or RGB, or ASCII or Binary.

Float Range

Type: Import and Export
Applies to: image, heightmap
Settings: Real (0.0…100.0) or Scaled (0.0…1.0)
Description: Determines whether the 32-bit data is stored as Real or Scaled range.

Include Object Name

Type: Export
Applies to: mesh (.obj)
Settings: True or False
Description: Determines whether the mesh information includes a Mesh Object Name.

Include Smoothing Group

Type: Export
Applies to: mesh (.obj)
Settings: True or False
Description: Determines whether the mesh information includes a Smoothing Group.

Integer Range

Type: Import and Export
Applies to: image, heightmap
Settings: 8-bit (0…255) or 16-bit (0…65535)
Description: Determines whether the float data is stored in 8-bit or 16-bit range.

Line Length

Type: Export
Applies to: dem, heightmap, mesh
Settings: up to 393216 (384k) characters per line, but usually Heightmap Width * 4 (8-bit) or * 6 (16-bit)
Description: Specifies the maximum number of text characters per line for text format files.

Optimized 8-bit

Type: Export
Applies to: image, heightmap
Settings: True or False
Description: Scales the float data into an optimized 8-bit range.

Orientation

Type: Export
Applies to: image
Settings: Left-to-Right, Right-to-Left, Top-to-Bottom, Bottom-to-Top
Description: Determines the orientation (rotation or flip) of the image data.

Reverse Vertex Order

Type: Export
Applies to: mesh
Settings: True or False
Description: Determines whether the mesh vertices are written counterclockwise (False) or clockwise (True).

Rotate Mesh Origin

Type: Import and Export
Applies to: mesh
Settings: True or False
Description: Determines whether the mesh is oriented bottom-left (False) or top-left (True).

Source (color plane)

Type: Import and Export
Applies to: image
Settings: Grayscale, Red, Green, Blue, or Alpha
Description: Determines the data color plane to read from or write to.

Text Encoding

Type: Import and Export
Applies to: dem, heightmap, mesh
Settings: ASCII, Unicode, UTF-8
Description: Determines the text character format to read from or write to.

Type Conversion

Type: Import and Export
Applies to: image, heightmap
Settings: Real, Scaled, or Auto
Description: Determines the method for conversion between data types.

Vertex Accuracy

Type: Export
Applies to: mesh
Settings: 1…6
Description: Determines the number of decimal places of accuracy for the mesh vertices.

Vertex Spacing

Type: Export
Applies to: mesh
Settings: 1…65536
Description: Determines the number of units spacing along the X and Y between each mesh vertex.

Void Fill

Type: Import
Applies to: dem
Settings: Fill Style, Flag Value, Fill Value
Description: Fills voids, which are missing sample point data, in a digital elevation model data set.

Write Header

Type: Export
Applies to: dem, heightmap
Settings: True or False
Description: Writes a header or parameter file for those file types that have optional headers.

Z offset

Type: Export
Applies to: mesh
Settings: Absolute, Altitude Center, Heightmap Midpoint
Description: Determines the mesh location along the Z axis.

Z scale

Type: Export
Applies to: mesh
Settings: 0.01% … 1000.00%
Description: Scales the heightmap altitude range values by the specified percentage.

Appendix B: Export and Import Type Conversion

Exporting to and importing from file formats that contain a different data type than the internal heightmap format will go through a type conversion process. The following table outlines the conversion for all supported data types.

Export Type Conversion

Export to 8-bit Unsigned Byte

Data range:	0 … 255
Real:	>> 8 (shift right 8 bits to 8-bit data type)
Scaled:	>> 8 (shift right 8 bits to 8-bit data type)
Auto:	scaled to fit the heightmap altitude into the full 8-bit range 0 … 255 (Optimized 8-bit)

Export to 16-bit Signed Short

Data range:	-32768 … 32767
Real:	-32768 to convert to signed (-32768 … 32767 range)
Scaled:	-32768 to convert to signed (-32768 … 32767 range)
Auto:	-32768 to convert to signed (-32768 … 32767 range)

Export to 16-bit Unsigned Short

Data range:	0 … 65535
Real:	as is
Scaled:	as is
Auto:	as is

Export to 32-bit Signed Integer

Data range:	-2,147,483,648 ... +2,147,483,647
Real:	-32768 to convert to signed (-32768 … 32767 range)
Scaled:	-32768 to convert to signed, << 16 (shift left 16 bits to 32-bit data type)
Auto:	-32768 to convert to signed, << 16 (shift left 16 bits to 32-bit data type)

Export to 32-bit Unsigned Integer

Data range:	0 ... 4,294,967,295
Real:	as is
Scaled:	<< 16 (shift left 16 bits to 32-bit data type)
Auto:	<< 16 (shift left 16 bits to 32-bit data type)

Export to 64-bit Signed Long

Data range:	-9,223,372,036,854,775,808 ... +9,223,372,036,854,775,807
Real:	-32768 to convert to signed (-32768 … 32767 range)
Scaled:	-32768 to convert to signed, << 48 (shift left 48 bits to 64-bit data type)
Auto:	-32768 to convert to signed, << 48 (shift left 48 bits to 64-bit data type)

Export to 64-bit Unsigned Long

Data range:	0 ... 18,446,744,073,709,551,615
Real:	as is
Scaled:	<< 48 (shift left 48 bits to 64-bit data type)
Auto:	<< 48 (shift left 48 bits to 64-bit data type)

Export to 32-bit Signed Single-Precision Floating-Point

Data range:	$\pm 1.5 \times 10^{-45}$ … $\pm 3.4 \times 10^{38}$
Real:	-32768 to convert to signed (-32768 … 32767 range)
Scaled:	convert range to -1.0 … 1.0
Auto:	-32768 to convert to signed (-32768 … 32767 range)

Export to 32-bit Unsigned Single-Precision Floating-Point

Data range:	$\pm 1.5 \times 10^{-45}$ … $\pm 3.4 \times 10^{38}$
Real:	as is
Scaled:	convert range to 0.0 … 1.0
Auto:	as is

Export to 64-bit Signed Double-Precision Floating-Point

Data range:	$\pm 5.0 \times 10^{-324}$ … $\pm 1.7 \times 10^{308}$
Real:	-32768 to convert to signed (-32768 … 32767 range)
Scaled:	convert range to -1.0 … 1.0
Auto:	-32768 to convert to signed (-32768 … 32767 range)

Export to 64-bit Unsigned Double-Precision Floating-Point

Data range:	$\pm 5.0 \times 10^{-324}$ … $\pm 1.7 \times 10^{308}$
Real:	as is
Scaled:	convert range to 0.0 … 1.0
Auto:	as is

Import Type Conversion

Import from 8-bit Unsigned Byte

Data range:	0 … 255
Real:	as is 0 … 255
Scaled:	<< 8 (shift left 8 bits to 16-bit data type)
Auto:	scaled to fit into the full 16-bit range 0 … 65535

Import from 16-bit Signed Short

Data range:	-32768 … 32767
Real:	+32768 to convert to unsigned
Scaled:	+32768 to convert to unsigned
Auto:	scaled to fit into the full 16-bit range 0 … 65535

Import from 16-bit Unsigned Short

Data range:	0 … 65535
Real:	as is
Scaled:	as is
Auto:	scaled to fit into the full 16-bit range 0 … 65535

Import from 32-bit Signed Integer

Data range:	-2,147,483,648 ... +2,147,483,647
Real:	clamped to assumed range of -32768 … 32767, +32768 to convert to unsigned
Scaled:	>> 16 (shift right 16 bits to 16-bit data type), +32768 to convert to unsigned
Auto:	scaled to fit into the full 16-bit range 0 … 65535

Import from 32-bit Unsigned Integer

Data range: 0 ... 4,294,967,295
Real: clamped to assumed range of 0 … 65535
Scaled: >> 16 (shift right 16 bits to 16-bit data type)
Auto: scaled to fit into the full 16-bit range 0 … 65535

Import from 64-bit Signed Long

Data range: -9,223,372,036,854,775,808 ... +9,223,372,036,854,775,807
Real: clamped to assumed range of -32768 … 32767, +32768 to convert to unsigned
Scaled: >> 48 (shift right 48 bits to 16-bit data type), +32768 to convert to unsigned
Auto: scaled to fit into the full 16-bit range 0 … 65535

Import from 64-bit Unsigned Long

Data range: 0 ... 18,446,744,073,709,551,615
Real: clamped to assumed range of 0 … 65535
Scaled: >> 48 (shift right 48 bits to 16-bit data type)
Auto: scaled to fit into the full 16-bit range 0 … 65535

Import from 32-bit Signed Single-Precision Floating-Point

Data range: $\pm 1.5 \times 10^{-45}$ … $\pm 3.4 \times 10^{38}$
Real: clamped to assumed range of -32768 … 32767, +32768 to convert to unsigned
Scaled: clamped to assumed range of -1.0 … 1.0, convert to unsigned, scaled to 0 … 65535
Auto: scaled to fit into the full 16-bit range 0 … 65535

Import from 32-bit Unsigned Single-Precision Floating-Point

Data range: $\pm 1.5 \times 10^{-45}$ … $\pm 3.4 \times 10^{38}$
Real: clamped to assumed range of 0 … 65535
Scaled: clamped to assumed range of 0.0 … 1.0, scaled to 0 … 65535
Auto: scaled to fit into the full 16-bit range 0 … 65535

Import from 64-bit Signed Double-Precision Floating-Point

Data range: $\pm 5.0 \times 10^{-324}$ … $\pm 1.7 \times 10^{308}$
Real: clamped to assumed range of -32768 … 32767, +32768 to convert to unsigned
Scaled: clamped to assumed range of -1.0 … 1.0, convert to unsigned, scaled to 0 … 65535
Auto: scaled to fit into the full 16-bit range 0 … 65535

Import from 64-bit Unsigned Double-Precision Floating-Point

Data range: $\pm 5.0 \times 10^{-324}$ … $\pm 1.7 \times 10^{308}$
Real: clamped to assumed range of 0 … 65535
Scaled: clamped to assumed range of 0.0 … 1.0, scaled to 0 … 65535
Auto: scaled to fit into the full 16-bit range 0 … 65535

Appendix C: File Formats

TerreSculptor supports a wide range of file formats including digital elevation model, heightmap, image, mesh and raw data. Each file format may support a number of additional importing and exporting features and sub-formats.

There are currently 28 file formats supported, in a total of 87 data formats.

Note that not all file formats support the large width and height dimensions supported by TerreSculptor.

Ext.	Description	Type	Data Formats
.3ds	Autodesk 3D Studio	mesh	1
.ase	Autodesk 3D Studio ASCII	mesh	1
.bil	band interleaved by line	digital elevation model	9
.bmp	Windows Bitmap	image	4
.bmp	Epic Unreal G16 Heightmap	heightmap	1
.bt	Binary Terrain	heightmap	3
.csv	comma separated value	heightmap	1
.dem	VistaPro 4 binary DEM	digital elevation model	2
.flt	GridFloat DEM	digital elevation model	2
.gif	Graphics Interchange Format	image	2
.hgt	SRTM height	digital elevation model	1
.obj	Alias Object	mesh	1
.pam	Portable AnyMap	image or heightmap	3
.pgm	Portable GrayMap	image or heightmap	4
.png	Portable Network Graphics	image	4
.r8	raw binary 8-bit	heightmap	2
.r16	raw binary 16-bit	heightmap	4
.r32	raw binary 32-bit	heightmap	4
.raw	raw binary	heightmap	21
.stl	Stereolitho	mesh	2
.t3d	Epic 3D Text	heightmap	1
.tab	tab separated value	heightmap	1
.ter	Terragen Terrain	heightmap	1
.tga	Truevision TARGA	image	5
.tif	Tagged Image Format	image	4
.tsv	tab separated value	heightmap	1
.txt	space separated value	heightmap	1
.txt	Vista Pro 4 ASCII DEM	digital elevation model	1

.3ds – Autodesk 3DS Max mesh

Format

Total format types: 1

Autodesk 3D Studio and Max mesh format.
Only a single plane XY grid mesh is supported. Importing other mesh shapes will result in an unspecified heightmap shape.
Files that contain multiple objects will present an object list where one object may be chosen.

Import Options

na

Export Options

Vertex spacing
Z offset
Z scale
Reverse vertex order
Rotate mesh origin
Include smoothing group

Notes

The 3DS file format only supports objects with a maximum of 65536 faces (triangles), which limits the heightmap mesh to a maximum square resolution of 181x181. A future version will allow exporting the entire terrain as multiple triangle strip objects.

When importing mesh formats, the mesh object being imported must be a square or rectangular grid plane with constant and equidistant XY vertex spacing. The mesh grid plane will be converted into a 16-bit heightmap.

.ase – Autodesk ASCII Scene Export

Format

Total format types: 1

Autodesk mesh format.
Only a single plane XY grid mesh is supported. Importing other mesh shapes will result in an unspecified heightmap shape.
Files that contain multiple objects will present an object list where one object may be chosen.

Import Options

na

Export Options

Vertex spacing
Z offset
Z scale
Accuracy
Reverse vertex order
Rotate mesh origin
Include smoothing group

Notes

ASE is a text format file type. Text format files are typically much larger than binary format files.

When importing mesh formats, the mesh object being imported must be a square or rectangular grid plane with constant and equidistant XY vertex spacing. The mesh grid plane will be converted into a 16-bit heightmap.

.bil – Band Interleaved by Line DEM

Format

Total format types: 9

ArcView and United States Geological Survey (USGS) National Elevation Dataset (NED) Digital Elevation Model.
Only BIL Single-Band (one heightmap in file) binary format data files are supported.
The following data types are supported in either Motorola or Intel Byte Order: 8-bit Unsigned Byte, 16-bit Signed and Unsigned Short Integer, 32-bit Signed and Unsigned Floating Point.
The default format if no header file is included is: Intel 16-bit Signed Short Integer with Skip Bytes = 0.
A .hdr Header properties file should be included to specify the binary file properties.

Description

The USGS NED BIL files contain elevation data tiles of the earth at various resolutions. The tiles are available from a number of sources and usually include an .hdr Header properties file, and may also include a .prj Projection properties file. The Projection file is ignored by HMES.

These files are commonly available in 10 meter (⅓ arc-second), 30 meter (1 arc-second), 90 meter (3 arc-second), and 300 meter (10 arc-second) resolutions.

The tile data supports an elevation range from -32767 to +32767 meters. An elevation value of -32768 signifies a void (missing data sample). When imported into HMES, this range is converted to 1 to 65535, with a value of 0 signifying a void flag value.

Header Properties File

Varying tile Width and Height values, and various bit-depth data types, are supported through an .hdr Header file that contains a set of property values for the BIL file. The Header file is a multi-line ASCII text file that contains the following supported properties. Additional properties supported by the BIL .hdr file format that are not shown in this list are ignored by HMES.
Each property is the upper-case name followed by white-space (one or more tabs, or one or more spaces) and the property value. HMES ignores the case and will properly load lower-case, upper-case or mixed-case.

BYTEORDER	see note below	Intel or Motorola byte order
LAYOUT	BIL	must be "BIL"
NCOLS	<tile width>	eg: 1200
NROWS	<tile height>	eg: 1200
NBANDS	1	must be "1", files whose value is greater than 1 are not supported
NBITS	8 or 16 or 32	number of bits per data sample: 8-bit byte, 16-bit short, or 32-bit float
PIXELTYPE	see note below	the data sample type, typically absent when NBITS = 8
SAMPLETYPE	see note below	the data sample type, our custom HMES property
SKIPBYTES	0 to n	the number of bytes to skip to get to the sample data, typically 0
XDIM	<x arc-seconds>	eg: 3.000000000000, optional
YDIM	<y arc-seconds>	eg: 3.000000000000, optional

BYTEORDER may be one of the following: M or MOTOROLA or MSBFIRST, or, I or INTEL or LSBFIRST.
I, INTEL, LSBFIRST are for PC format files, and M, MOTOROLA, MSBFIRST are for Mac format files. HMES supports both types. 8-bit byte data (NBITS = 8) will ignore the BYTEORDER property entry.

PIXELTYPE may be one of the following: SIGNEDINT, UNSIGNEDINT, FLOAT, or FLOATINGPOINT.
INT entries are for 16-bit Short Integer data type, and FLOAT entries are for 32-bit Floating Point data type.
8-bit byte data (NBITS = 8) will ignore the PIXELTYPE property entry.

The SAMPLETYPE entry is our own custom property that supersedes both of the ambiguous NBITS and PIXELTYPE entries. NBITS and PIXELTYPE are supported for compatibility with other software, however, HMES will give SAMPLETYPE higher precedence if it is present in the header. SAMPLETYPE must be one of the following:
UNSIGNEDBYTE, SIGNEDSHORT, UNSIGNEDSHORT, SIGNEDSINGLE, UNSIGNEDSINGLE.

Unsupported Header Entries

The following header entries are not supported and are ignored by HMES.

BANDROWBYTES	the number of columns times the number of bytes per pixel, when NBANDS > 1.
TOTALROWBYTES	the number of columns times the number of bytes per pixel, when NBANDS > 1.
BANDGAPBYTES	must be 0 for single band images.
ULXMAP	.
ULYMAP	.
XLLCENTER	x center.
YLLCENTER	y center.
CELLSIZE	.
NODATA	the altitude value for DEM voids, typically -32768.

Import Options

Width
Height
Byte order
Data type
Type conversion
File offset

Export Options

Byte order
Data type
Type conversion
Write header
Header type

Notes

The optional XDIM and YDIM are read on import strictly for informational purposes, and are converted to meters.

.bmp – Windows Bitmap

Format

Total format types: 4+1

The Windows Bitmap format is very popular for storing standard grayscale and color images.

The following BMP formats are supported for import and export:

8-bit Grayscale	with a 24-bit RGB palette
8-bit Paletted	with a 24-bit RGB palette
16-bit Grayscale	the Epic Unreal G16 heightmap format
24-bit RGB Color	
32-bit ARGB Color	

Import Options

Source: Grayscale, Red, Green, Blue, Alpha
Auto-scale to 16-bit

Export Options

Format
Source: Grayscale, Red, Green, Blue, Alpha
Optimized 8-bit
Orientation

Supported Orientations

Left to right, Top to bottom
Left to right, Bottom to top

Notes

Only the uncompressed format is supported at this time.
The .bmp 16-bit Grayscale format is the Epic G16 format.
HMES can read and write to the 32-bit format Alpha Channel which is not supported on most other software.

.bt – Binary Terrain

Format

Total format types: 3

VTP Binary Terrain digital elevation model file format supported by numerous open-source and retail heightmap, terrain, and GIS applications for saving and transferring of digital elevation model data.

The following data types are supported: 16-bit Integer, 32-bit Integer, and 32-bit Floating-Point.

TerreSculptor supports importing and exporting all four BT file format versions from 1.0 (1997) through 1.3 (2007).

Import Options

Type conversion

Export Options

File version
Data type
Type conversion

Notes

The following BT properties are ignored by TerreSculptor:
- UTM Zone
- Datum
- Horizontal and Vertical Units (scale)
- Extents (Left, Right, Top, bottom)
- Internal Projection
- External Projection

.csv .tab .tsv .txt – Delimited ASCII Text and Vista Pro 4 ASCII DEM

Format

Total format types: 1+1+1+1+1

This is the standard ASCII delimited formats.
The supported delimiters include comma (.csv), tab (.tab and .tsv), and space (.txt).
Each heightmap row is written to an individual line as multiple fields separated by the delimiter.
Each numeric value is prefixed with the number of required 0's to be either three digits 000...255 for 8-bit range or five digits 00000...65535 for 16-bit range. This allows for easier reading in text editors that use a fixed font as all columns are aligned.
Each heightmap row line is terminated by a CRLF.

Import Options

Auto-scale to 16-bit

Export Options

Encoding: ASCII (default) or Unicode or UTF-8
Integer range: 8-bit or 16-bit
Optimized 8-bit
Orientation
Write header

Supported Orientations

Left to right, Top to bottom
Left to right, Bottom to top

Notes

Only ASCII format is currently supported for importing.

Heightmaps saved for Vista Pro 4 ASCII DEM format must be saved in ASCII encoding, 16-bit range, LRBT orientation, no Header, to be compatible with Vista Pro 4.

It is not recommended to use Unicode encoding formats to save heightmap files since the file size can become extremely large. For example, an 8192x8192 16-bit heightmap saved as UTF-32 will result in a text file larger than 1.6GB.

Unicode files will have to be converted to ASCII prior to importing using Notepad or another compatible text editor. An attempt is made to recognize common Unicode format text files and provide a warning to convert the file to ASCII before importing. This is only possible if the text file contains the Unicode preamble or BOM (byte order marking) information at the start of the file.

.dem – VistaPro 4 binary DEM

Format

Total format types: 2

VistaPro version 4 binary digital elevation model.

File import supports both compressed and uncompressed formats.
File export supports uncompressed format.

During file import, the DEM altitude data is automatically scaled and centered.

During file export, the following limitations are imposed:
- The DEM data is always 258x258 samples.
  Heightmap resolutions other than this will be resampled to 258x258.
- The DEM data altitude range is 0 to 16000.
  Heightmap ranges greater than 16000 will be scaled to 0 to 16000.

Import Options

None.

Export Options

Name
Comment

Notes

The Colormap data is ignored.
The DEM data is assumed by VistaPro 4 to be 30 meter sample spacing and 1 meter altitude spacing.

.flt – GridFloat DEM

Format

Total format types: 2

ArcGIS GridFloat binary digital elevation model.

The ancillary files are ignored and only the .flt file that contains the actual altitude float values is used for heightmap information.

Import Options

Width override
Length override
Byte order

Export Options

Byte order
Save .hdr header properties file

.gif – Graphics Interchange Format

Format

Total format types: 2

The GIF format is one of the image standards for Internet and image transfer. GIF supports a paletted image of up to 256 gray-levels or 256 colors.

The following GIF formats are supported for import and export:

8-bit Grayscale	with a 24-bit grayscale palette
8-bit Paletted	with a 24-bit RGB palette

Import Options

Source: Grayscale, Red, Green, Blue
Auto-scale to 16-bit

Export Options

Source: Grayscale, Red, Green, Blue
Optimized 8-bit

Notes

The heightmap data is saved as an 8-bit grayscale palette image.

.hgt – SRTM DEM Heightmap

Format

Total format types: 1

Shuttle Radar Topology Mission Digital Elevation Model.

Typically available in 30 meter (1 arc-second) and 90 meter (3 arc-second).
All SRTM formats are supported.
SRTM HGT files are normally 16-bit signed big-endian with a left-to-right top-to-bottom format.

Description

The Shuttle Radar Topology Mission HGT files contain elevation data tiles of the earth at various resolutions. The tiles are available from a number of sources and usually have the following file naming convention:

<latitude><longitude>.hgt

The file name is the latitude and longitude of the bottom-left corner sample point of the SRTM file. For example, a file named N36W005.hgt would be North 36:00:00 latitude and West 5:00:00 longitude.

The tile data supports an elevation range from -32767 to +32767 meters. An elevation value of -32768 signifies a void (missing data sample). When imported into HMES, this range is converted to 1 to 65535, with a value of 0 signifying a void flag value.

HGT files are a square aspect ratio whose dimensions vary depending on the source resolution. 90 meter files are commonly 1201x1201 with a file size of 2.75MB (2,884,802 bytes), while 30 meter files are commonly 3601x3601 with a file size of 24.7MB (25,934,402 bytes).
Non-square-aspect files cannot be imported unless a Header properties file is supplied along with the HGT file. The Header file is custom for HMES and normally unsupported by other SRTM software.

The Width and Height are pre-determined by the file size, or the optional Header properties, and cannot be modified.

Header Properties File

The optional Header properties file contains a set of property values for the HGT file. The Header file is a multi-line ASCII text file with the same file name as the HDR file with a file extension of .hgp, and contains the following supported properties. Each line is terminated with a CRLF. Any line cannot be longer than 80 characters not including the CRLF line terminator. There is a single space character between each property and value pair. Case is not strict and can be upper or lower or mixed. A Resolution value of 0 is "unknown".

<comment>	SRTM HGT N38W112	normally SRTM HGT followed by the HGT's file name
Width <value>	Width 3601	x sample points, supports 1 to 65536
Height <value>	Height 3601	y sample points, supports 1 to 65536
Resolution <value>	Resolution 30	spatial resolution in meters, supports 5, 10, 30, 60, 90, 300

Import Options

Void fill style
Void flag value
Void fill value

Export Options

Write header

.obj – Alias Object ASCII Mesh

Format

Total format types: 1

Only a single plane XY grid mesh is supported. Importing other mesh shapes will result in an unspecified heightmap shape.
Files that contain multiple objects will present an object list where one object may be chosen.

Import Options

na

Export Options

Vertex spacing
Z offset
Z scale
Vertex Accuracy
Reverse vertex order
Rotate mesh origin

Notes

Autodesk 3DS Max requires that the vertex order be reversed to render the face normals in the upward direction.

When importing mesh formats, the mesh object being imported must be a square or rectangular grid plane with constant and equidistant XY vertex spacing. The mesh grid plane will be converted into a 16-bit heightmap.

.pam – Portable AnyMap Binary Image or Heightmap

Format

Total format types: 3

PAM files are always unsigned big-endian format.

The following PAM formats are supported for import and export:

P7 - 8-bit Grayscale
P7 - 16-bit Grayscale
P7 - 24-bit RGB Color

Import Options

Auto-scale to 16-bit
Source: Grayscale, Red, Green, Blue

Export Options

Format
Integer Range
Source: Grayscale, Red, Green, Blue
Optimized 8-bit

.pgm – Portable GrayMap ASCII and Binary Image or Heightmap

Format

Total format types: 4

PGM files are always unsigned big-endian format.

The following PGM formats are supported for import and export:

P2 - 8-bit ASCII Grayscale
P2 - 16-bit ASCII Grayscale
P5 - 8-bit Binary Grayscale
P5 - 16-bit Binary Grayscale

Import Options

Auto-scale to 16-bit
Source: Grayscale, Red, Green, Blue

Export Options

Format
Integer Range
Source: Grayscale, Red, Green, Blue
Optimized 8-bit

.png – Portable Network Graphics

Format

Total format types: 4

The PNG format is one of the image standards for Internet and image transfer. PNG supports a wide range of image formats including grayscale, paletted and planar, and up to 48-bit color plus alpha channel.

The following PNG formats are supported for import:

8-bit Grayscale	
8-bit Paletted	with a 24-bit RGB palette
24-bit RGB	
32-bit RGB with alpha	

The following PNG formats are supported for export:

8-bit Paletted	with a 24-bit RGB palette
24-bit RGB	

Import Options

Source: Grayscale, Red, Green, Blue
Auto-scale to 16-bit

Export Options

Source: Grayscale, Red, Green, Blue
Optimized 8-bit

Notes

The heightmap data is saved as an 8-bit grayscale palette image when 8-bit Paletted format is chosen.

.r8, .r16, .r32, .raw – RAW Heightmap

Format

Total format types: 21

Essentially twenty-one different RAW formats are supported, including 8-bit byte, 16-bit short integer, 32-bit integer, 64-bit long integer, 32-bit single-precision floating point, and 64-bit double-precision floating point; in Intel and Motorola byte order where applicable, and in signed and unsigned where applicable.
The floating point formats also support real-number or scaled 0.0-to-1.0 ranges.

The raw data is assumed to be an X×Y grid of heightmap sample point altitudes.

The RAW Format property and file extension is used to determine the data contents of the file:

.r8	8-bit unsigned byte
.r16	16-bit short integer, signed or unsigned, Intel or Motorola byte order
.r32	32-bit single-precision float, signed or unsigned, real or scaled, Intel or Motorola byte order
.raw	can be any of the following:
	8-bit unsigned byte,
	16-bit short integer in signed or unsigned and Intel or Motorola,
	32-bit integer in signed or unsigned and Intel or Motorola,
	64-bit long integer in signed or unsigned and Intel or Motorola,
	32-bit single-precision floating point in signed or unsigned and real or scaled and Intel or Motorola,
	64-bit double-precision floating point in signed or unsigned and real or scaled and Intel or Motorola

RPL RAW Parameter List Properties File

RAW file properties are supported through a RAW Parameter List .rpl file that contains a set of property values that define the contents of the RAW binary data file.
The RPL file is a multi-line ASCII text file that contains the following supported properties. Additional properties supported by the RAW RPL file format are ignored by HMES.
Each property entry is the lower-case property name followed by white-space (one or more tabs, or one or more spaces) and the property value. Any line that begins with a semicolon (;) is regarded as a comment and is ignored. The line with "key" and "value" must be present in an RPL file but is ignored by HMES.

The “sample-type” entry is our custom property that is used to alleviate the ambiguous meanings and missing data types with the default RPL data-length and data-type entries. This entry is not supported by most other software.

;comment	comment	;HMES Heightmap Raw Parameter List	* optional
key	value	key value	* ignored
width	<raw width>	eg: 256	
height	<raw height>	eg: 256	
depth	<number of raw blocks>	must be 1 if present	* optional
offset	<file offset to data>	must be between 0 and the file length -1 if present	* optional
data-length	<bytes per raw sample>	must be 1 for 8-bit, 2 for 16-bit, 4 for 32-bit, 8 for 64-bit	
data-type	<raw data type>	must be "signed", "unsigned", or "float"	
		8-bit is always "unsigned"	
byte-order	<raw data byte order>	must be "big-endian", "little-endian", or "dont-care"	
		big-endian = Motorola, little-endian = Intel	
		8-bit is always "dont-care"	
record-by	<raw, image or vector>	must be "dont-care" if present	* optional
sample-type	<data type>	must be one of the following:	* optional
		unsigned-byte,	
		signed-short, unsigned-short,	
		signed-integer, unsigned-integer,	
		signed-long, unsigned-long,	
		signed-single, unsigned-single,	
		signed-double, unsigned-double	

Import Options

Format (r8, r16, r32, raw)
Width
Height
Data type
Type conversion
Byte order
File offset

Export Options

Format (r8, r16, r32, raw)
Write header (write a RPL parameter file)
Data type
Type conversion
Byte order
File offset

Notes

The Format property values of r8, r16, and r32 determine whether the RAW file written is fixed as an 8-bit unsigned byte, 16-bit short integer, or 32-bit single-precision floating point data format.

The File Offset property allows for importing a chunk of binary data that is located at virtually any location within a file. This allows the use of the RAW importer to import additional unsupported file types through the proper use of the import properties, where the chunk dimensions are specified along with the number of file header bytes to skip over.

.stl – StereoLitho ASCII and Binary Mesh

Format

Total format types: 2

Both ASCII and Binary formats are supported.
Only a single plane XY grid mesh is supported. Importing other mesh shapes will result in an unspecified heightmap shape.
There is no support for multiple objects, all vertices are assumed to be a single plane mesh.

Import Options

na

Export Options

Format
Vertex spacing
Z offset
Z scale
Vertex Accuracy
Reverse vertex order
Rotate mesh origin

Notes

Autodesk 3DS Max requires that the vertex order be reversed to render the face normals in the upward direction.

When importing mesh formats, the mesh object being imported must be a square or rectangular grid plane with constant and equidistant XY vertex spacing. The mesh grid plane will be converted into a 16-bit heightmap.

.t3d – Epic 3D Text

Format

Total format types: 1

Unreal Engine 3 3D ASCII Text Terrain format.

Supports the Terrain Actor only.

Import Options

none

Export Options

none

.tab – TAB Delimited ASCII Text

See .csv .tab .tsv .txt - Delimited ASCII Text and Vista Pro 4 ASCII DEM

.ter – Terragen Terrain

Format

Total format types: 1

HMES supports the Terragen Classic (1.0) file format properties relevant to the heightmap data.
Heightmap sizes from 2x2 up to the HMES maximum heightmap dimensions are supported.
Both square and rectangular heightmaps are supported for both import and export.
HMES supports the Terragen file format properties (chunks) for SIZE, XPTS and YPTS, ALTW, and EOF.
HMES ignores the file format properties (chunks) for CRAD (curve radius), CRVM (curve mode), and SCAL (terrain scale in meters).
HMES always writes out the optional XPTS and YPTS chunks even if the heightmap is square.

“TERRAGEN”
“TERRAIN “
“SIZE” n-1 (if the heightmap is rectangular then SIZE is the shorter dimension -1)
“XPTS” width
“YPTS” length
“ALTW” HeightScale, BaseHeight, heightmap data width*length signed shorts
“EOF “

Import Options

none

Export Options

none

Notes

TerreSculptor imports and exports Terragen Terrain files flipped vertically (Left-Right Bottom-Top) so that the terrain orientation within TerreSculptor matches the Terragen Classic top-down preview.

Terragen Terrain format files created with World Machine have an n+1 resolution. In other words, a 1024×1024 World Machine heightmap is exported as a 1025×1025 Terragen file.

.tga – Truevision TARGA

Format

Total format types: 5

The following TGA formats are supported for import and export:

8-bit Grayscale
8-bit Paletted with a 24-bit RGB Palette
16-bit Grayscale
24-bit RGB Color
32-bit ARGB Color

Import Options

Source: Grayscale, Red, Green, Blue, Alpha
Auto-scale to 16-bit

Export Options

Format
Source: Grayscale, Red, Green, Blue, Alpha
Optimized 8-bit
Orientation
Enhanced Format

Supported Orientations

Left to right, Top to bottom
Left to right, Bottom to top
Right to left, Top to bottom
Right to left, Bottom to top

Notes

Normal and Enhanced (Extended) TGA Format is supported.
Only the uncompressed format is supported.
Only the non-scanline-interleave format is supported.
Not all software supports the 16-bit Grayscale format.
Not all software supports Right-to-Left orientation.

.tif – Tagged Image Format

Format

Total format types: 4

The following TIF formats are supported for import and export:

8-bit Grayscale	with a 24-bit RGB palette
8-bit Paletted	with a 24-bit RGB palette
16-bit Grayscale	
24-bit RGB Color	

Import Options

Source: Grayscale, Red, Green, Blue, Alpha
Auto-scale to 16-bit

Export Options

Format
Source: Grayscale, Red, Green, Blue, Alpha
Optimized 8-bit

Supported Orientations

Left to right, Top to bottom

Notes

Only the uncompressed format is supported at this time.

.tsv – TAB Delimited ASCII Text

See .csv .tab .tsv .txt - Delimited ASCII Text and Vista Pro 4 ASCII DEM

.txt – Space Delimited ASCII Text and Vista Pro 4 ASCII DEM

See .csv .tab .tsv .txt - Delimited ASCII Text and Vista Pro 4 ASCII DEM

Appendix D: Obtaining DEM Data

A DEM or Digital Elevation Model is a file that contains real altitude information gathered from areas of the earth or other planets in our solar system. The DEM data is typically collected by orbiting a satellite, the shuttle, or an airplane around the planet and performing altitude distance measurements using radar or other means. These stripes of altitude distance measurements are then converted and compiled into files based on planetary latitude and longitude values. The final DEM data is often available at no charge from a variety of websites, typically operated by organizations or governments.

For use as typical heightmaps in video games and 3D rendering, DEM data should be at least 10 meter or higher resolution, 16-bit or greater bit-depth, with an altitude range of more than 1000 samples.

DEM Sample Spacing

DEM data is normally measured in meters between sample points, but may be using one of the additional equivalent scales. The meters value is only approximate, the arc-seconds value is typically accurate.
Meters and arc-seconds for terrestrial DEM data are shown in the table below.

Meters	Arc Seconds
1 meter	1/27th (0.037) arc-second
3 meter	1/9th (0.111) arc-second
5 meter	1/6th (0.167) arc-second
10 meter	1/3rd (0.334) arc-second
30 meter	1 arc-second
60 meter	2 arc-seconds
90 meter (100 meter)	3 arc-seconds
300 meter	10 arc-seconds

DEM Spacing to Engine Units

DEM data is typically provided in meters, whereas TerreSculptor and many video game engines are scaled in centimeters, such as TerreSculptor's default 1 cm unit scaling and the Epic UDK's 1 unreal unit = 2 cm scaling.

To determine the proper terrain vertex spacing within TerreSculptor or a video game engine so that the DEM data is scaled correctly, simply convert the DEM sample spacing to the equivalent engine units.

TerreSculptor example:
A 5 meter DEM is 5 meter spacing between sample points. 5 meters is 500 centimeters.
The engine scale is 1 unit = 1 cm.
Therefore, a terrain units XZ spacing of 500 is 5 meters (500 cm / 1 cm = 500).

UDK example:
A 5 meter DEM is 5 meter spacing between sample points, 5 meters is 500 centimeters.
The engine scale is 1 unit = 2cm.
Therefore, a DrawScale3D.X/Y spacing of 250 is 5 meters (500 cm / 2 cm = 250).

DEM Properties Files

Some of the DEM file formats are headerless raw binary data files and therefore support an additional ASCII text file that contains the DEM properties.
These properties typically include the data samples width, data samples length, data bit-depth (bits per sample such as 16-bit), data endian (Intel/PC or Motorola/Mac), data integer sign (signed or unsigned), etc.

When working with DEMs, if the properties file is not included by the source supplier, it can be advantageous to create the properties file in order that TerreSculptor has the correct file information for importing.

DEM Dataset Links

For current up-to-date links and file format support information, visit the TerreSculptor Wiki web site.

Appendix D: Keyboard Shortcuts

To be completed.

-eof-