

# michi84o's Planet Generator

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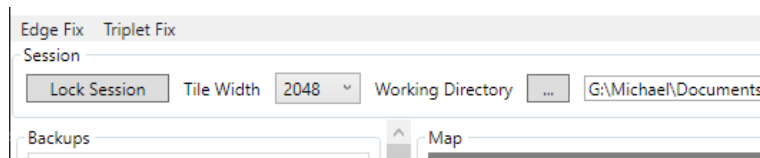
<https://github.com/michi84o/SpaceEngineersTools>

## Background

I made this generator to replace the height maps of the Alien planet in Space Engineers. The original uses the exact same height maps as Earthlike, which means it has the exact same landscape formations. If you explored Earthlike there would be no reason to explore Alien.

## Workflow

First you need to set a working directory where the files will be created. Then set the tile width you want to work with. The default and recommended width is 2048.



Once you're done, click "Lock Session" to lock these values. After that you can choose several actions in the left panel.

## Edge Fix

The menu options "Edge Fix" and "Triplet Fix" are independent from the session.

"Edge Fix" allows you to make a set of 6 height map tiles seamless.

"Triplet Fix" only applies a fix at the corners where 3 tiles meet.

If the edges of height maps are not properly aligned you will get issues like this:



## Backups

This section shows the backup folders in your working directory. All backups must start with "Backup\_" and end with the backup name. Enter a new name in the text box and click "Save" to create a new backup folder. You can load a backup by selecting it from the list and clicking "Load Backup".

## Preview Mode

The preview mode can be used to apply the effects to only one tile. This allows you to quickly check the results.

If "Limited Preview Area" is checked, the effect will only be applied to a limited sub area of that tile for even faster results.

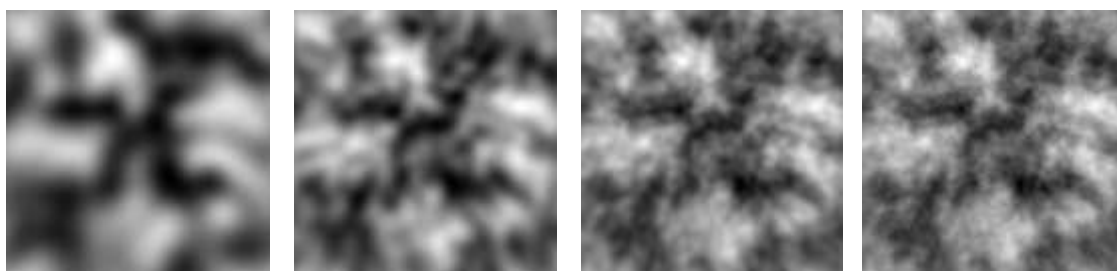
You can select the tile you want to use with the "Preview Tile" option.

Some effects might ignore Preview mode.

## Simplex Noise Generator

This rewrites the height maps by using Simplex noise. It is similar to Perlin noise but avoids 45° angled edges that appear with Perlin.

The seed is used to initialize the random number generator. Use the same value if you want to create the same height maps each time. The noise scale is used to scale the noise map, basically a zoom in/out. The number of octaves defines how many different frequencies of noise maps should be overlaid. The more octaves, the more detail the map will have. Values above 10 don't seem to have any visible effect. The following example shows octave values of 1 to 4.



You can adjust the persistence, which controls how quickly the amplitude decreases between octaves. Similarly you can adjust the lacunarity which controls how quickly the frequency increases between octaves.

The Ridged option changes the noise algorithm to produce ridged noise. If you only want ridged noise for a certain octave, write the octave number into the text box below. You can also enter multiple numbers, separated by comma.

The ridged noise changes the simplex values like this:  $\text{ridged} = (1 - |\text{simplex}|)$ .

This means that the value is 1 minus the absolute value of the simplex noise.

Backups

AutoBackup

original

water

x1

↕

Load Backup

New

Save

Preview Mode

Enable Preview Mode ☐

Limit Preview Area ☐

Preview Tile 

Back

Simplex Noise Generator

Seed

Noise Scale

Octaves 

6

Persistence 

0.50

Lacunarity 

2.00

Ridged ☒ Enable

R. Octaves

Fill Map

## Worley Noise Generator

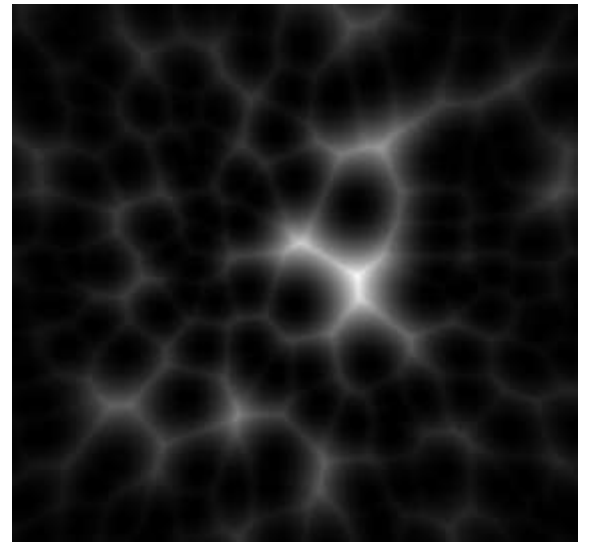
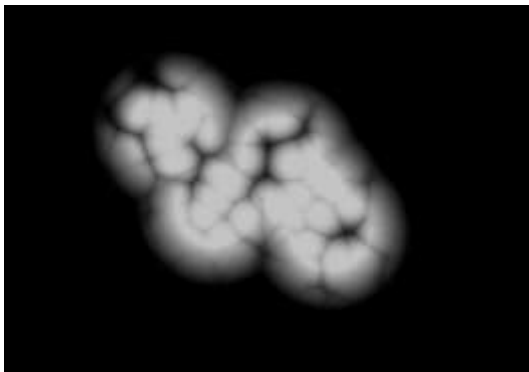
As an alternative to Simplex noise there is also a Worley noise generator. You can use this if you want more alien looking planets.

You can enter a number of cells. The more cells you enter the finer the structure will be. Be aware that high cell numbers significantly increase the processing time!

Click “Invert Noise” if you want the output colors inverted.

There is also an option to add freckles of Worley noise to an existing height map. You can define how many freckles per tile should be added. To avoid round blobs, the region of the freckles will consist of multiple circles. You can define the radius and the number of these circles. The number right of “Add Freckles” is a seed. Change the seed if you want to add freckles multiple times.

The freckles will use inverted Worley noise by default and look like this:



Worley Noise Generator (Very Slow!)

Number of Cells  10

Invert Noise ☐

Freckles per Tile  6

Freckle Segment Radius  40

Freckle Segment Count  6

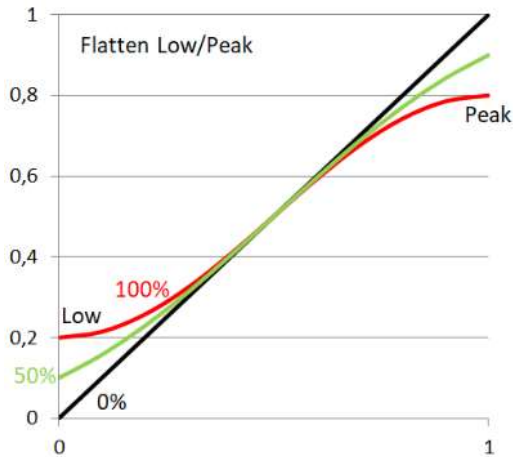
These structures look similar to eroded sand stone. And look similar as the Red Rocks from Utah.

If you create freckles the generator will create additional “\*\_worley.png” files to help you locate where the freckles were placed. These can be used if you want to use different materials in the material map. The red value in these files is 76.

## Histogram Manipulation

Here you can modify the histogram of the height maps.

If you click “Flatten” the “Flatten Lows” and “Flatten Peaks” values will be used to apply an S-Curve to the histogram:



Histogram Manipulation

Flatten Lows
100%

Flatten Peaks
100%

Flatten

Exp. Factor
1.4

Equator Width
10%
☐

Flatten Exponential

Stretch Min
0

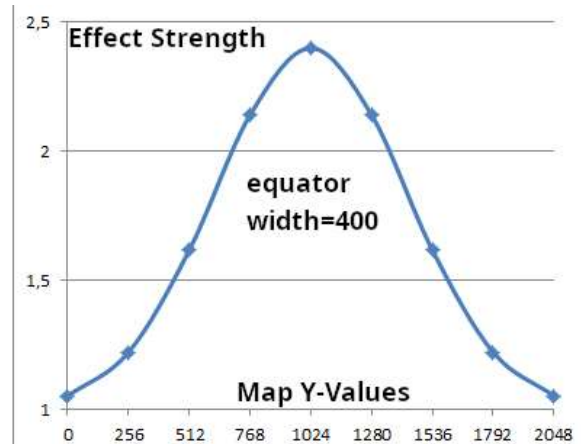
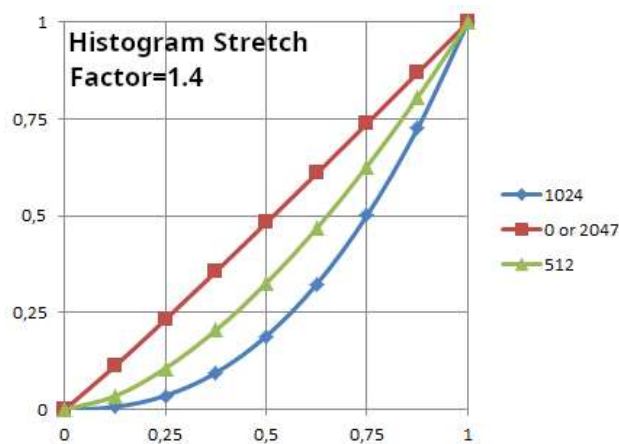
Stretch Max
1

Stretch Histogram

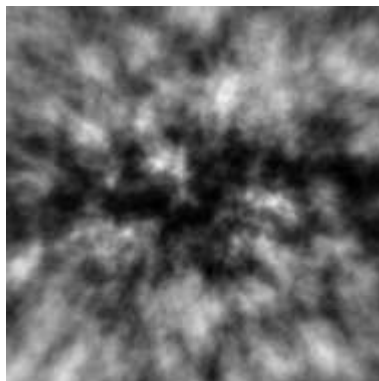
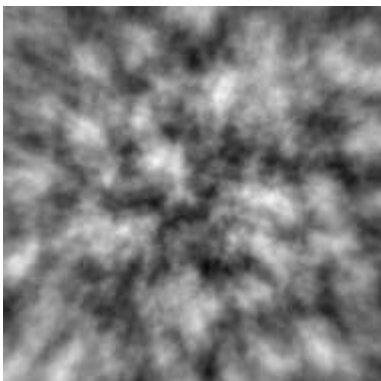
Invert

Lower values will be shifted up and higher values will be shifted down. This will flatten terrain in low valleys or flatten the peaks of the highest mountain tops.

“Flatten Exponential” will make valleys flatter and mountains steeper by applying an exponential curve to the histogram. If enabled, this effect will be limited to the equator region. You can define a width around the equator where the effect is applied.



The right one of the following pictures shows the exponential stretch with default values.



This effect could be used to create flat desert regions at the equator.

“Stretch Histogram” will squeeze the histogram to the minimum and maximum pixel values you specified.

The “Invert” button will invert the colors of the height maps.

## Sediment Layers

This is an experimental feature. It splits the height maps into the specified amount of plates. Each plate will get a different set of sediment layers. The unique amount of sediment layer configurations can be set with the slider.

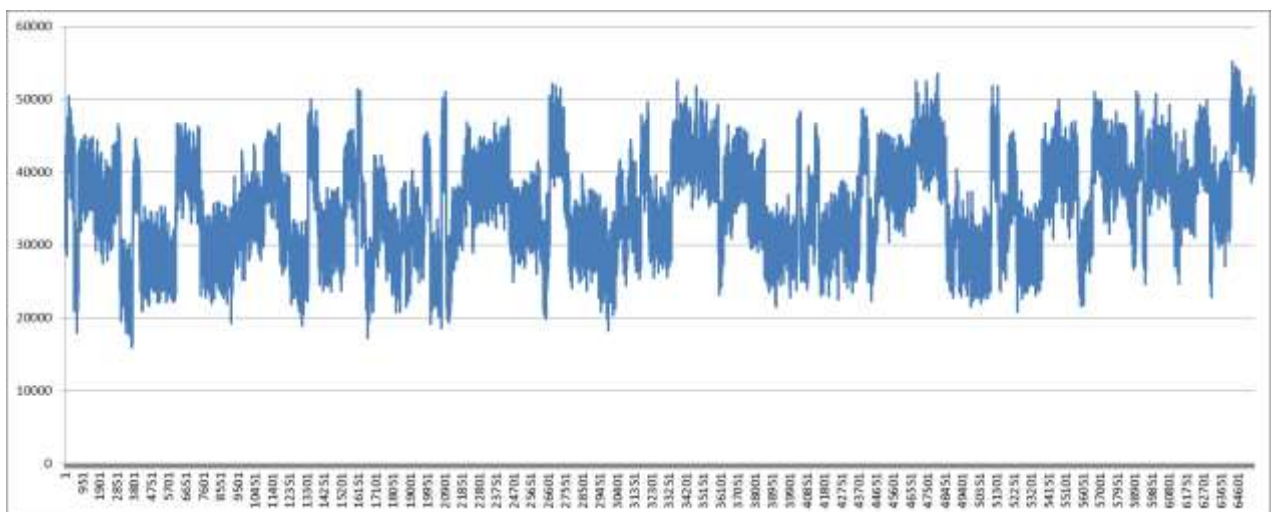
Sediment Layers

Total Sed. Plates

Sediment Sets  64

By default there are 64 sediment layer sets. Each plate will randomly use one of these sets. Each set has 65535 sediment layers of different hardness. Harder layers are harder to erode. The hydraulic erosion system can use the sediment layer definitions to get more unique erosion patterns.

Each layer set has different regions where the hardness is roughly the same. There can be sudden jumps, so called phase transitions, where the average value changes:



The default hardness is 32768.

Warning !!! Creating the sediment layers takes a lot of time !!!

You probably only want to create them once.

Here is an example how the plates look: Each color represents a different sediment layer set.



## Hydraulic Erosion

Let's come to the good part. Hydraulic erosion is what makes height maps look realistic.

To get more realistic looking landscapes we simulate droplets of water which grind down the stone and deposit material where the water stops and also along the way.

The "Iterations" option defines the number of simulated water droplets.

The positions of these droplets are random. Be aware that we have 6 height map files with 2048\*2028 pixels. That makes 25.165.824 pixels! If you want the droplets to hit nearly every pixel you must enter at least that number, but it will take a lot of processing time to simulate all droplets!

| Hydraulic Erosion                    |                                      |
|--------------------------------------|--------------------------------------|
| Iterations                           | <input type="text" value="2500000"/> |
| Droplet Lifetime                     | <input type="text" value="100"/>     |
| Inertia                              | <input type="text" value="0.01"/>    |
| Sediment Cap. Factor                 | <input type="text" value="35"/>      |
| Erode Speed                          | <input type="text" value="0.3"/>     |
| Deposit Speed                        | <input type="text" value="0.1"/>     |
| Erode Brush Radius                   | <input type="text" value="2"/>       |
| Deposit Brush Radius                 | <input type="text" value="2"/>       |
| Brush Pointiness                     | <input type="text" value="0.25"/>    |
| Gravity                              | <input type="text" value="10"/>      |
| Evaporate Speed                      | <input type="text" value="0.01"/>    |
| Use Sediments                        | <input type="checkbox"/>             |
| <input type="button" value="Erode"/> |                                      |

The default value 2.500.000 drops a droplet roughly at every 10th pixel.

The "Droplet Lifetime" option defines how many iterations of the droplet movement should be simulated. It's size is changed so that it has fully evaporated when the life time is reached.

Lower "Inertia" values will cause the water droplets to change their direction faster if there is an obstacle in the way.



“Sediment capacity Factor” defines how much sediment a droplet can take. The capacity is higher when the droplet has more speed, e.g. steep mountains.

“Erode speed” defines how much sediment a droplet can take at each iteration.

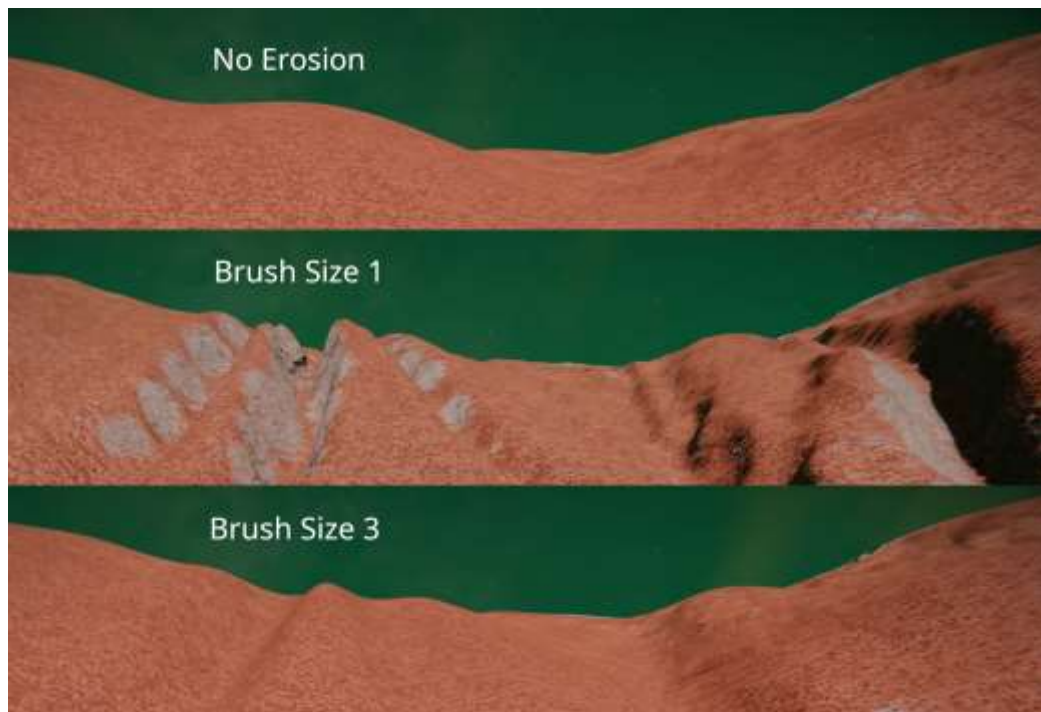
“Deposit speed” defines how fast sediment is removed from the droplet.

“Erode Brush Radius” and “Deposit Brush Radius” define the area that is affected by a droplet. It is basically the droplets size.

“Gravity” will influence how fast a droplet accelerates downhill.

Evaporate speed defines how much of the droplet evaporates at each iteration.

Careful: High Erode speeds and sediment capacities will carve canyons. Also consider using a wider brush than 1 or 2 but be aware that larger brushes take more processing time.



- Change the pointiness of the brush if you want to change the weights based on the distance from the middle.

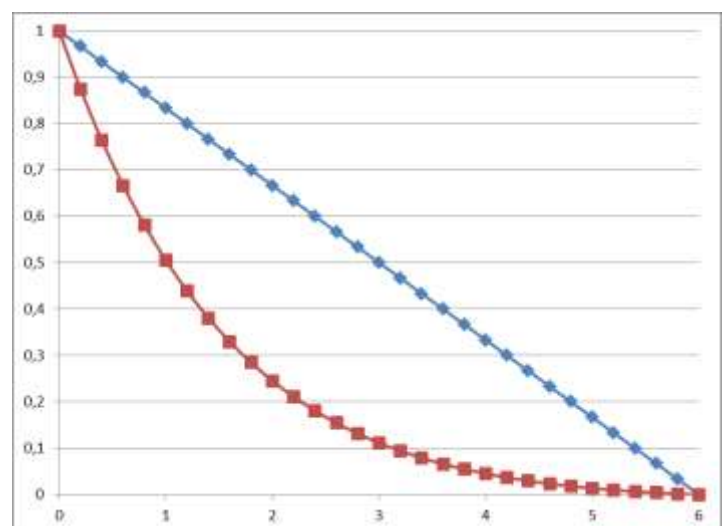
Formula:

$$weight = e^{(-p*x)} * (1 - \frac{x}{x_{max}})$$

x=Distance from center

Pointiness 0 results in the blue line.

The red curve shows pointiness 0.5.



## Lake Generation

This feature simulates droplets again but with the goal of finding spots where water accumulates. These spots will be turned into lakes.

“Lakes per Tile” influences the number of generated lakes.

“Lake Area Multiplier” will make the lakes larger. The target size is 3000 pixels for a factor of 1. You can enter floating point numbers.

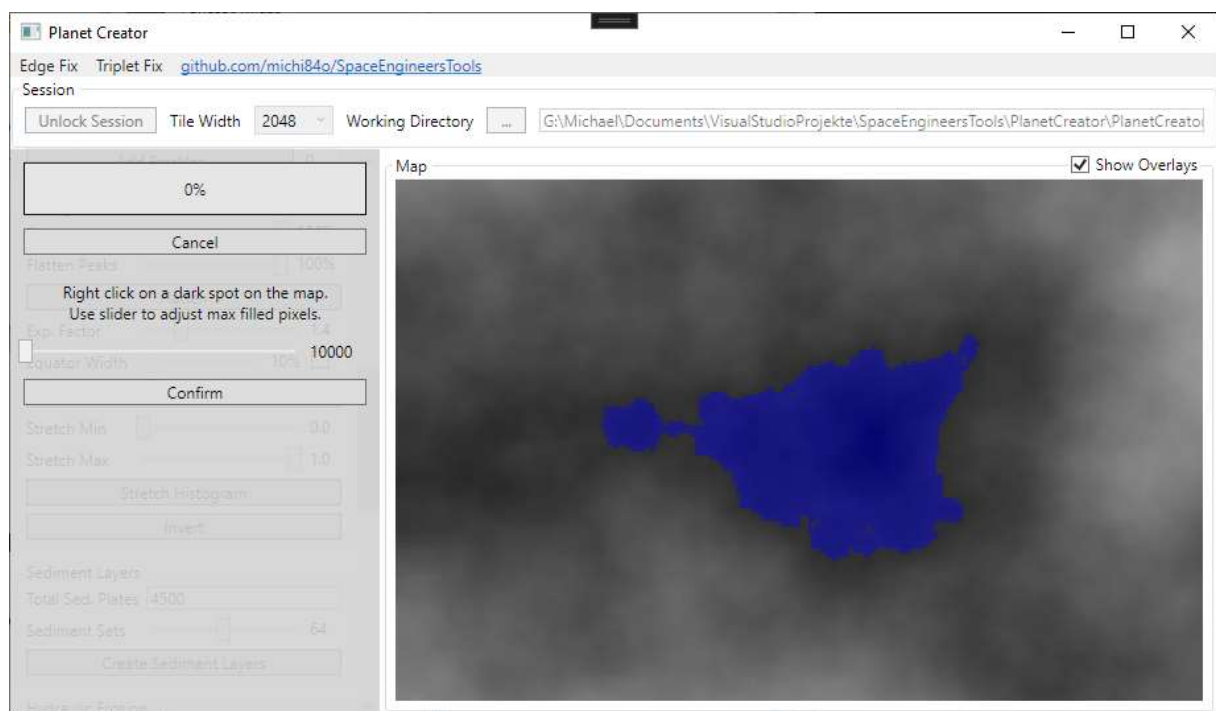
“Material Source” should point to a preexisting planet folder. Material files from that folder will be taken to generate lake material files. The red value will be as specified in “Mat. Map Value”.

|                         |  |
|-------------------------|--|
| Lakes                   |  |
| Lakes per Tile          | 40   |
| Lake Area Multi.        | 1  |
| Mat. Source             | Enter Source PNG Folder  |
| Stamp Depth             | 100  |
| Mat. Map Value          | 82   |
| Mode                    | <input checked="" type="radio"/> Replace <input type="radio"/> Add |
| Add Lakes Automatically |  |
| Add Lake by Right Click |  |

You can define a stamp depth in height units to shift the lake bed height lower. This will create more naturally looking transitions between ground and lake.

“Add Lake by Right Click” will allow you to place lakes manually. After entering this mode, you can click on any point on the map to create a lake. It should be dark spots or otherwise the lake will overflow and you will see an error message.

Click the “Confirm” button if you want to place the previewed lake.



After confirmation, the material map and height map will be updated. The height map will have a flat area for the lake bed.



