

# michi84o's Planet Generator

## 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.

## Planet Generation

The height maps are generated using several steps:

- Create 3D noise pattern and map it to cubemap.
- Scale height maps
- Hydraulic erosion
- Lake generation
- Make edges seamless

## Noise Pattern

The noise pattern is created by a 3D simplex noise algorithm. The noise is generated in different resolutions and overlaid on top of each other to generate more detail.

- Use the "Octaves" option to tweak the amount of detail.
- Use the "Noise Scale" option to scale the size of the noise patterns.

## Scaling of Height Maps

The histogram is stretched using a S-curve to flatten out plains and mountain tops. This also results in steeper mountains.

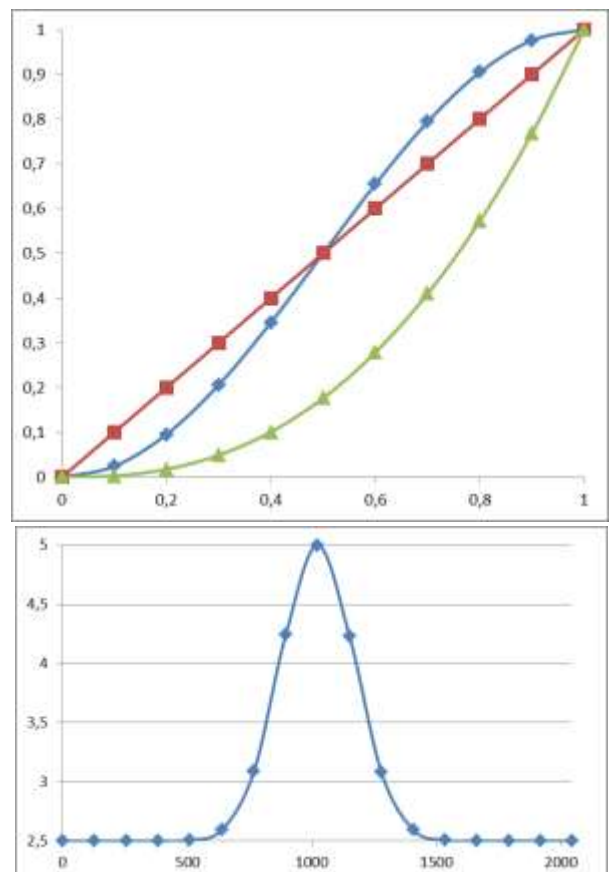
- Set "Flatten Factor" to 0 if you want to disable this effect.
- Set "Flatten Factor" to 100 to maximize this effect.

As a next step we take the height map value and replace it with its power of 2.5.

$$v = v^{2.5}$$

This is represented by the green line in the diagram. Plains will be flattened even more by this while the flattening of mountain tops from the S-curve is reversed.

The strength of the exponential function can be increased around the equator to achieve flat deserts like in the original EarthLike/Alien height maps. An exponent of 5 will be applied at the equator which goes down to 2.5 at the edges. The width can be adjusted. Yes that curve is a Gauss curve. Math, yay!



- Enable “Flatten Equator” and set an “Eq. Flatten Width” value to specify the width of the flattened area around the equator.

### Hydraulic Erosion

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

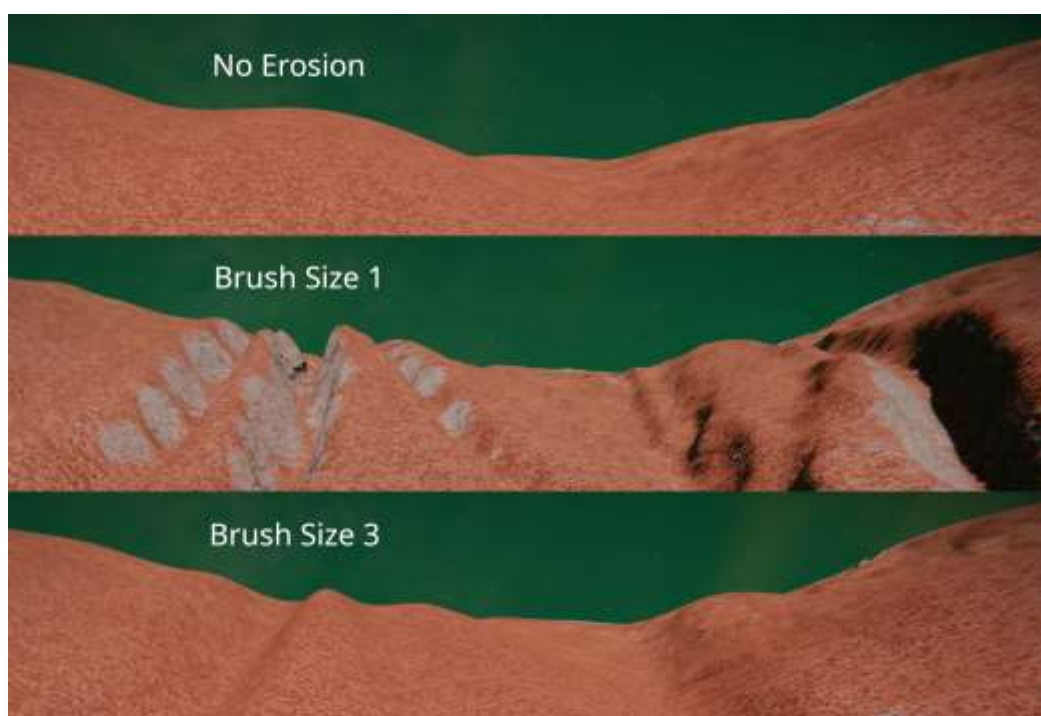
- The “Iterations” option defines the number of simulated water droplets.

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.

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.
- 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.

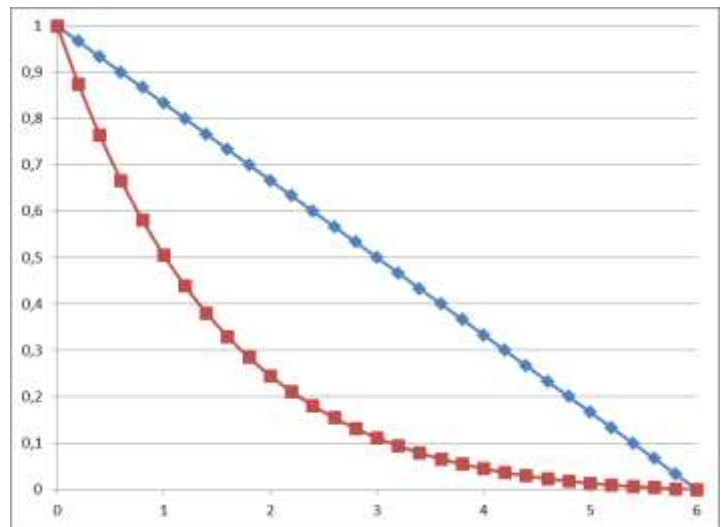
Formula:

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

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 Volume Multiplier” will make the lakes larger.
- “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 82.