

Tectonic Tools

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1 Introduction

Hi blender artists community. I am currently working on a research project for the University of Sydney on algorithms for procedural tectonics based terrain generation. I decided to write my code in the form of a blender add-on, but apart from that I was fairly new to blender, and this is my first time reaching out to the community to see what you guys think.

In this post I just wanted to introduce myself and my project and see what you guys think. Also, I will start to begin a tutorial series in a blog post style, partially as a way to document my code, and as a way to spread the knowledge about these algorithms.

My current code tries to emulate how mountains grow over time due to tectonic uplift, which occurs when two tectonic plates are colliding into each other. It starts with a spherical planet with some low amplitude initial noise already on it, then the mesh is split into tectonic plates and each plate has a direction of travel along the sphere. Mountains grow when a continental plate is colliding into some other plate. Eventually as the mountains grow too high, they begin to collapse under their own weight, forming a plateau and the mountain range spreads out. So far, my code seems to produce plateaus quite well, although to make the mountains even more realistic I may add some other geological phenomena in the future.

This is still very much a work in progress, and I am aware that there are some bugs and issues here and there. This project is inspired by a paper by Y. Cortial & Al. [1], where they described methods for generating terrains based plate tectonics. Apart from their work and mine, I believe there is no other code out there that tries to model how mountains grow over time due to tectonics, which is why I am beginning to write this blog tutorial series.

Since noise based algorithms are already well researched and widely implemented, I will not attempt to replicate those, but will instead focus more on geological phenomena. As such I have used the official blender add on *A.N.T. Landscape* to generate the initial noise map that my algorithm then works from.

2 Installation

To install Tectonic Tools, the official blender add-on "A.N.T.Landscape" must be installed. To make sure A.N.T Landscape is installed:

- Open blender and click Edit → preferences and navigate to the Add-Ons tab in the new window that pops up
- In the search box, search for "A.N.T.Landscape", and make sure the check box next to "Add Mesh: A.N.T.Landscape" is checked.
- Once installed successfully, a new tab on the sidebar named "Create" should appear.

To then run tectonic tools:

- Open new blender project with an empty scene
- In the *Scripting* tab, copy and paste code and press *Run Script*
- In the *Modeling* tab, click *View* and make sure *Sidebar* is checked
- On the right, open the *Tools* tab which should open the Terrain Generator

3 Usage

All properties and operators have descriptions which will display when hovering the mouse over it.

3.1 Main Operators

Once tectonic tools is successfully installed, the menu should look like that in figure 1. The minimum steps require to run the tectonic simulation is to click *Initiate Terrain*, then click *Auto Create Plates*, and then click *Move Tectonic Plates* a few times, each time the simulation will run for a few steps. Note that the first time running the *Move Tectonic Plates* operator will be significantly slower compared to the subsequent runs.

3.2 Initial World Properties

This sub-menu allows the user to specify the initial world properties. These must be set before the operator *Initiate Terrain* is called, and include properties such as the *Mesh Subdivisions* and *Initial Noise Frequency*.

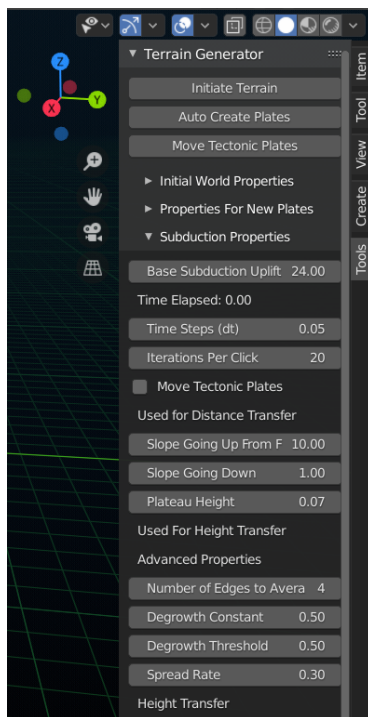


Figure 1: Screenshot of tectonic tools

3.3 Properties for New Plates

Here the user may choose whether they want their tectonic plates to be automatically generated based on voronoi tessellation, or be manually defined by the user. Depending on which mode the user chooses, the rest of the menu will be different.

If *Auto Create Plates* is on, then the user may specify how many plates they wish to generate, and customize some noise properties which will be used to define the plate boundaries.

If *Auto Create Plates* is off, then the user may draw the plates by selecting vertices using the lasso tool while in EDIT mode. The properties *Plate Rotation Axis* may then be used to define which the axis that each plate moves about, and the plate speed may also be specified. Once a plate is drawn, and its properties defined, click *Create Plate* to register the newly defined plate.

3.4 Simulation Properties

Here the user may specify the properties that are used while the simulation is running. Feel free to play around with those, although messing around with these values too much can really quickly result in glitches and unintended un-

realistic looking landscapes.

The most notable parameters are *Base Uplift*, which determines how fast a mountain will grow per iteration. And *Iterations Per Click* determines how long the simulation will run for internally per click before changes are registered and displayed back to blender.

References

- [1] Y. Cortial, A. Peytavie, E. Galin and E. Guérin *Procedural Tectonic Planets*, LIRIS-CNRS INSA de Lyon