General Information

Please note that this application is currently under development. Should you encounter any bugs, such as crashes or issues with reading files, please contact me at either Kindrat.Beregovyi@unh.edu or kberegovyi@ccom.unh.edu.

Before you can start working with our application, you will need to have a 3D model of your object of interest, be it coral, a dive site, or another subject. 3D models can be created from a collection of photos or videos using a program like Reality Capture (https://www.capturingreality.com/realitycapture).

Load Your Model

Our application currently only supports the .OBJ and .RUG file format for 3D models. There are two ways to load your model:

- Drag and drop your file onto the application window.
- Use the main menu: File -> Load…

After the file is loaded, your model will appear in the center of the window(Figure 1).

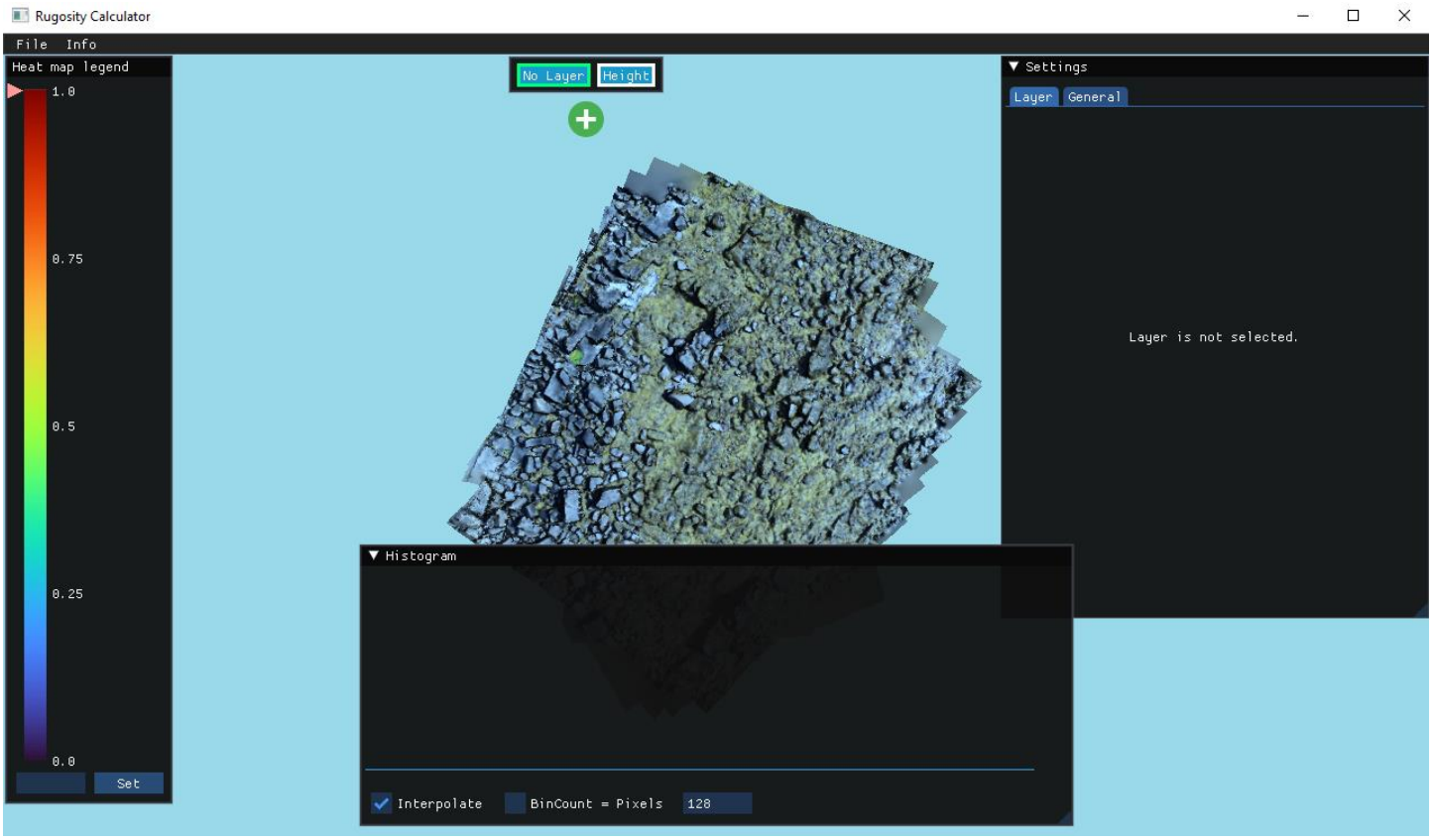

Figure 1: Application after model was loaded.

Examining the Model

You can rotate the model by pressing and holding the right mouse button. If you require more camera movement freedom to examine specific details of the model from various angles, you'll need to disable the "Model Camera" mode. You can do this by unchecking the "Model Camera" box found in the "General" tab of the Settings window(Figure 2).

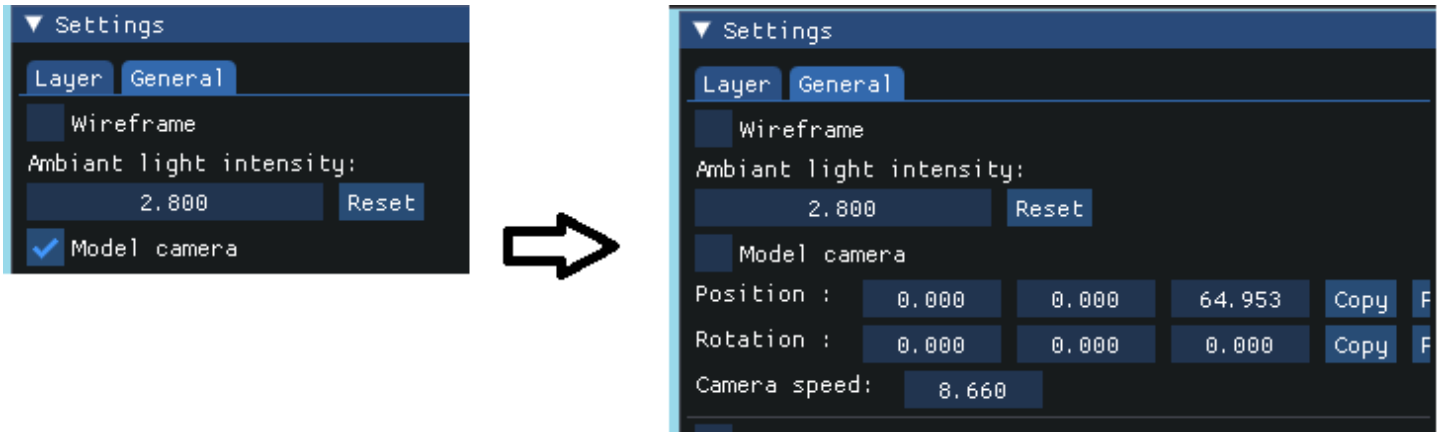

Figure 2: Enabling more flexible camera.

Once you have disabled the "Model Camera" mode, you can move the camera freely. Press and hold the right mouse button, then use the W, A, S, D keys in conjunction with mouse movement to navigate.

Creating and Using Layers

Our application utilizes layers to represent various types of information, such as complexity metrics. Once a model is loaded, you can find the layer tabs at the top middle of the application window:

Figure 3: Layer tabs.

The first two tabs, "No Layer" and "Height", have straightforward functions. "No Layer" displays the raw model with a solid color, or RGB colors if the model includes these. "Height" stores information about the relative heights of parts of the model.

To perform rugosity or other calculations, you will need to add a new layer. To do this, press the green circle with the white cross symbol (refer to Figure 3). A new window will appear, in which you should select the type of new layer to add (see Figure 4).

Figure 4: New layer window.

In the dropdown list labeled "Type of Layer," you will have these options:

- Height: A slope-independent height map.
- Rugosity: A complexity metric.
- Compare Layers: This layer visualizes the differences between user-specified layers of interest.
- Triangle Area/Edges: Aids in understanding the model's complexity and the artifacts of its creation.
- Vector Dispersion: An alternative complexity metric.
- Fractal Dimension: Another alternative complexity metric.

Standard Deviation: This layer is automatically generated after rugosity calculations. It visualizes the standard deviation based on all jitters (different samples taken to suppress outlier values and to produce a smoother result). Essentially, it highlights areas most susceptible to variations in voxelization parameters.

If you choose one of the complexity metrics, corresponding settings will be displayed. Some options may vary between complexity metrics, but all three will include a setting for the grid cell (or voxel) size, as shown in Figure 5.

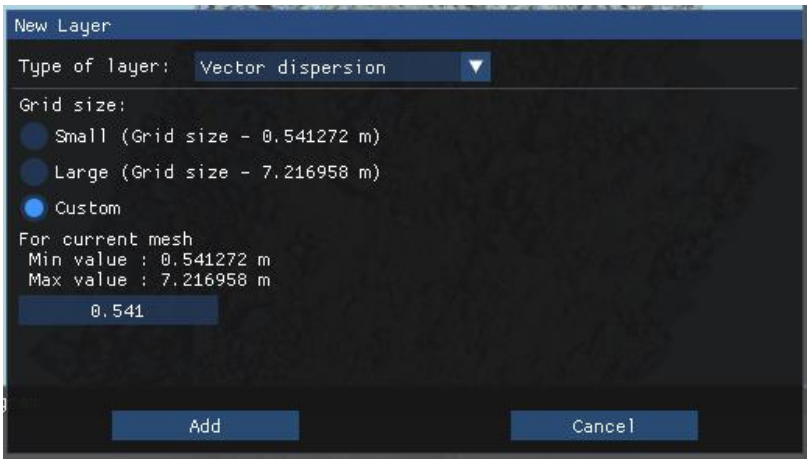

Figure 5: Grid size - crucial for accurate complexity measurement results.

The choice of voxel size significantly impacts our rugosity calculations, and unfortunately, there isn't a single correct size applicable to every model. The voxel size should be determined based on both the model resolution and its contents, specifically the size of the features of interest. For larger models, the voxel size may be limited by the available computing resources, such as RAM and CPU time.

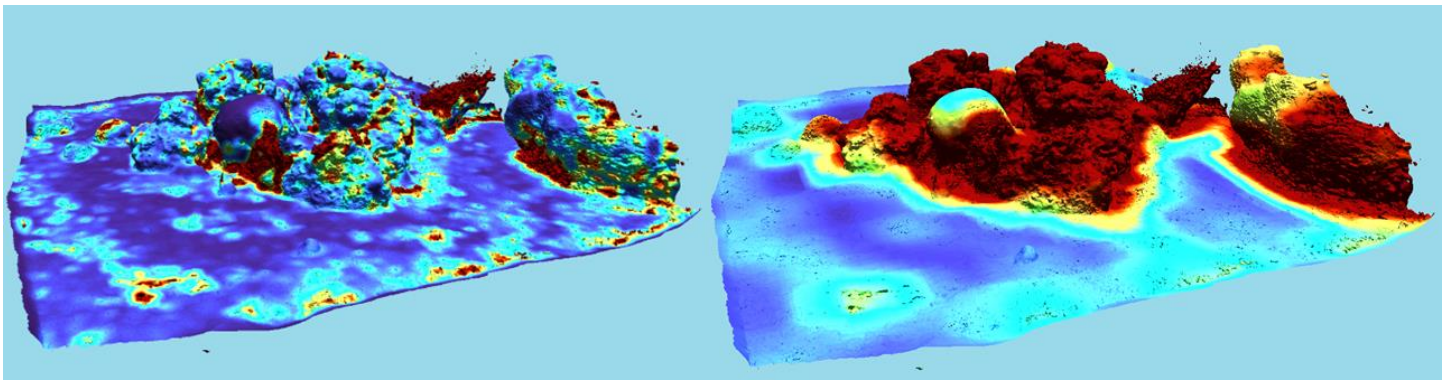

Figure 6: The same model with different grid (voxel) sizes - small on the left, large on the right.

When layer (except "No Layer") is activated by clicking on it, additional information will be displayed in the heat map legend (1), histogram (2), and settings/layer tab (3):

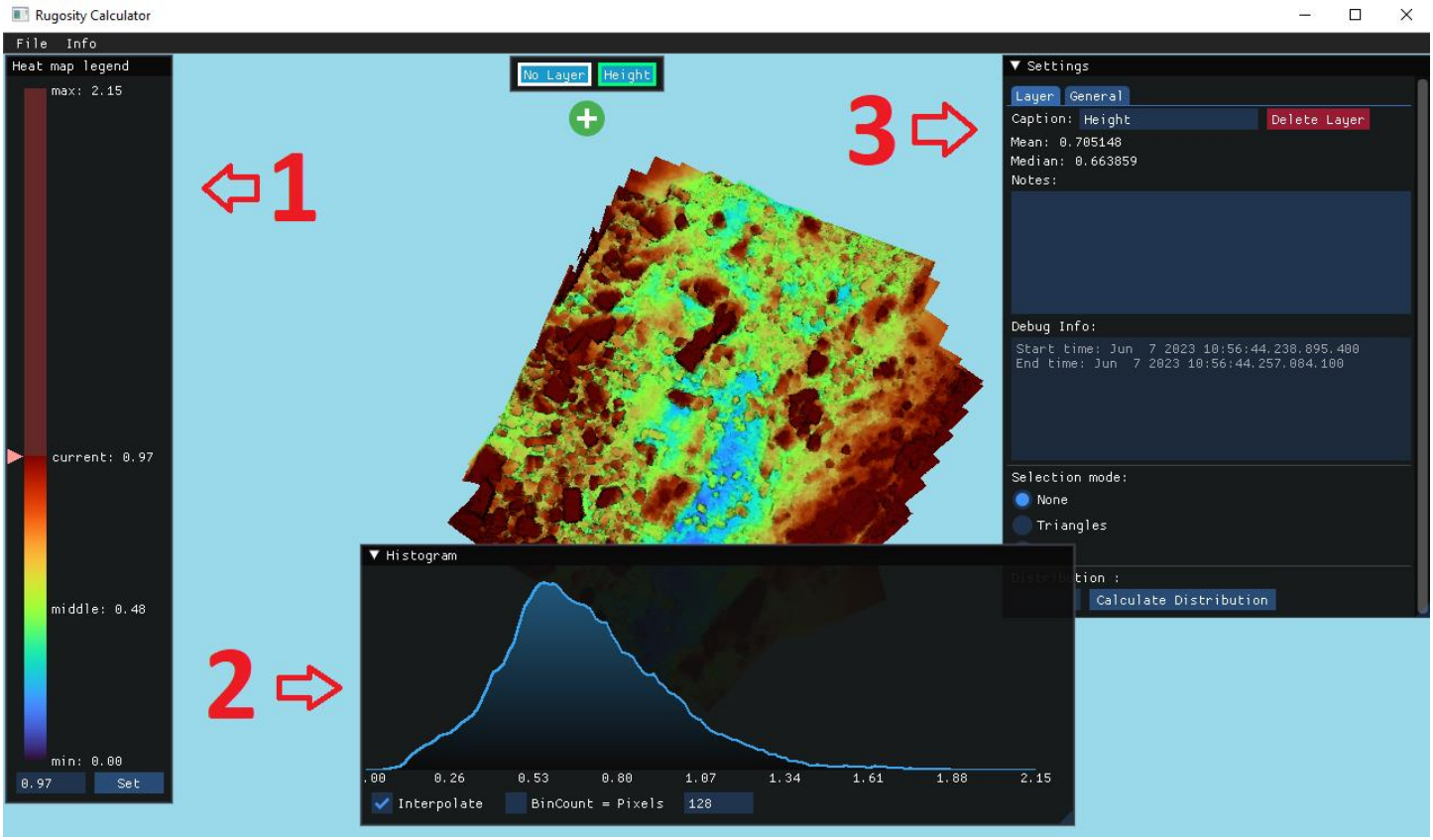

Figure 7: Overview of sub windows of application.

The heat map legend displays the maximum and minimum values for the current layer. For instance, these could be the minimum and maximum height or rugosity values for the model. The "Current" value, which can be adjusted by dragging the arrow dial or entering a number in the input field at the bottom of the window, determines what value (and above) is considered as "red" on the model's heat map. By adjusting this value, the user can alter the heat map visualization. This can sometimes help highlight features that are of particular interest. This setting also could be called “sensitivity” of heat map. After calculation we would recommend tweaking this value to find the best value for your needs. The screenshot below demonstrates different heat map settings on the same model (Figure 8).

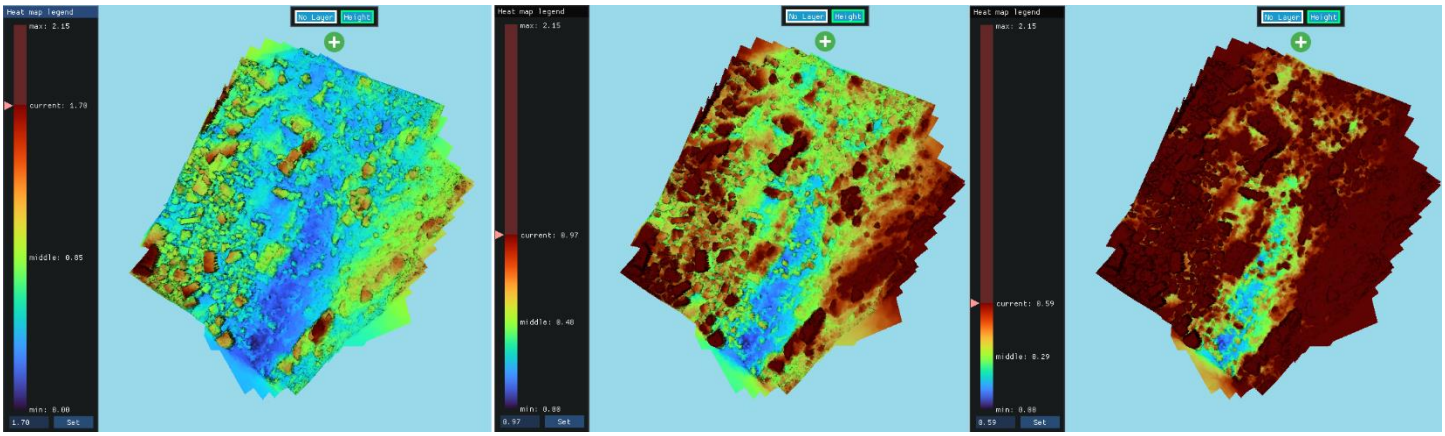

Figure 8: Different “sensitivity” of heat map.

The histogram window (refer to Figure 7, item 2) provides valuable insights into the distribution of rugosity or other metrics across the model. By examining the histogram, users can quickly understand the uniformity of the selected metric's distribution within the current model. For example, in Figure 9, the histogram features two peaks that represent areas with low complexity (sea floor) and high complexity (coral).

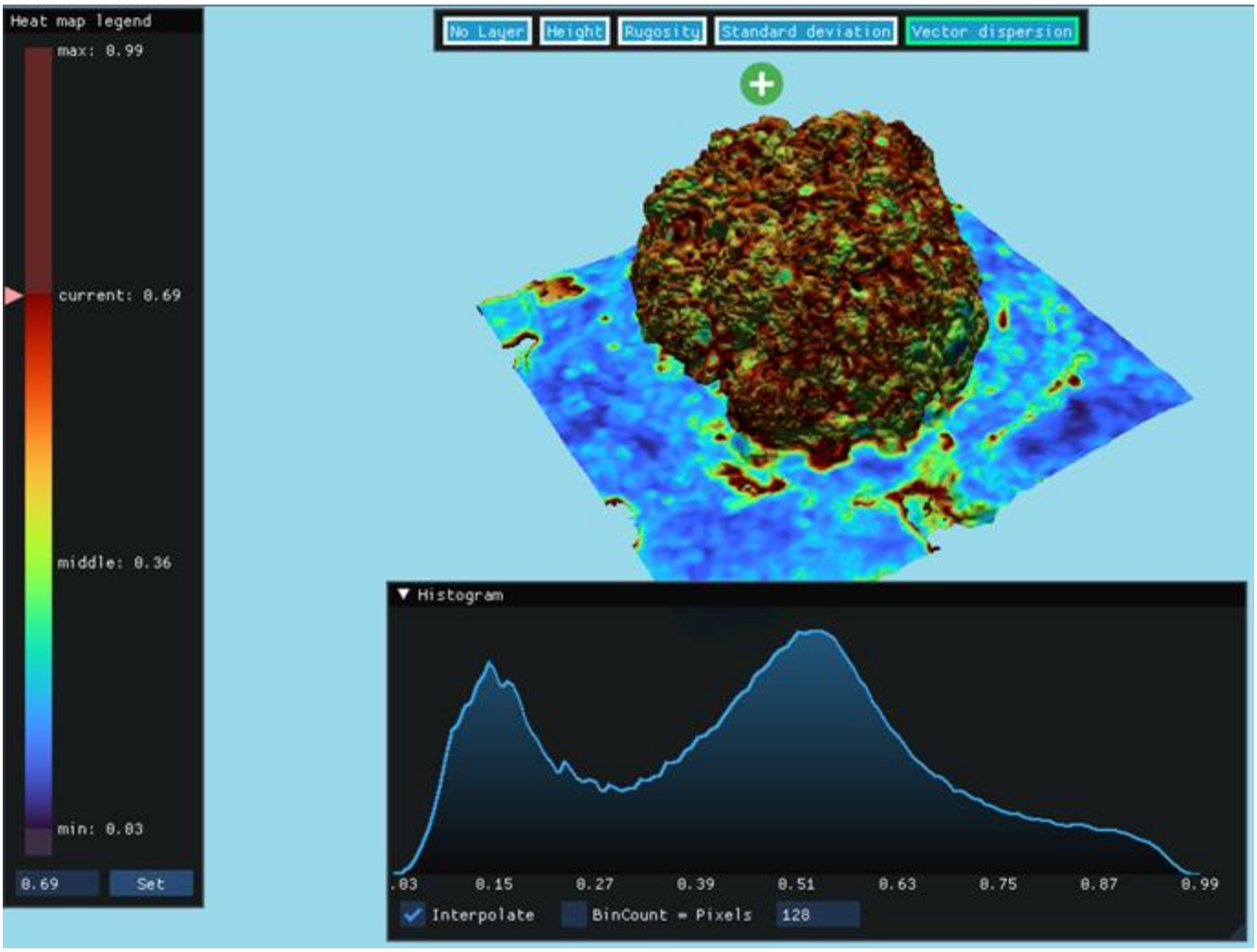

Figure 9: Histogram demonstrating two distinct value peaks, illustrating its utility in understanding your data..

The settings window (refer to Figure 7, item 3) tab, labeled "Layer," provides information about the currently selected layer. This tab also includes a selection tool, which can be used to query the value of the current data layer either by triangle or by area(Figure 10).

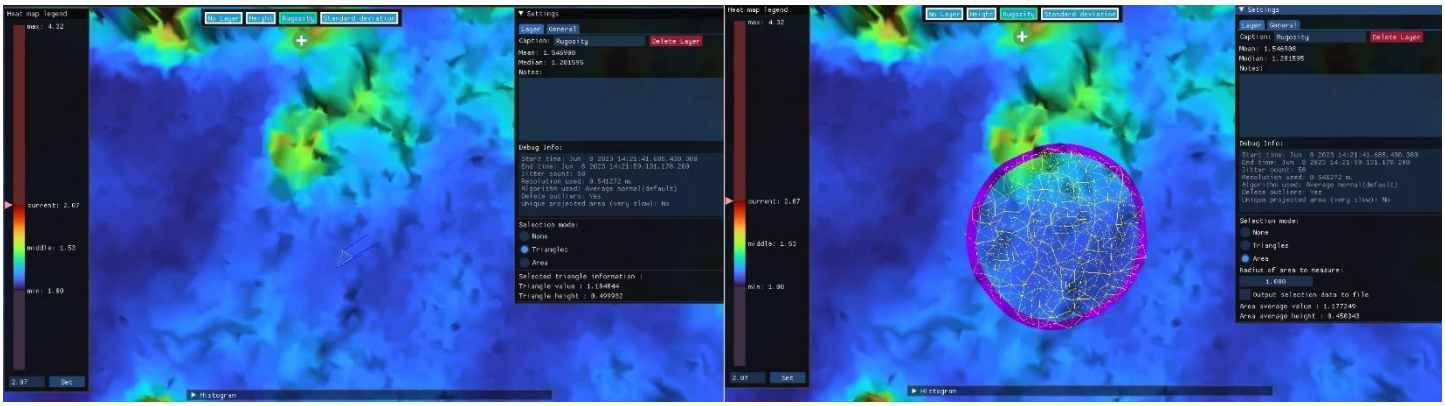

Figure 10: Selection tool usage.

Users have the option to save the model and all of its layers into the .RUG file format. This allows for quicker loading of the information in future sessions, and .RUG files will also occupy less storage space on the PC. To save your work, use the main menu: File -> Save...

In future releases, we will add additional export options.