

## CA155 Supplementary Notes

### Hand sculpting an FT3 world

These Supplementary Notes cover the process of creating your own hand sculpted world in FT3, and were written in response to questions raised on this subject when this issue of the 2019 Cartographer's Annual was first mentioned in the Profantasy community.



If you already have a world map that you would like to redraw in FT3 you will need to generate a bitmap copy of your map that is fitted or cropped to a rectangle of 5,000 x 2,500 pixels. The actual size can be smaller, but the proportions must be the same - twice as wide as it is tall. This is because the MDR file used to transfer data between FT3 and Wilbur ports world maps as equirectangular projections, and while you can change the projection in either app it is easier to keep the same projection throughout the process.

The image on the left is a screen shot from the world of Helena, which is used as the example in these notes.

Helena took 6 days to sculpt, but only an hour to erode in Wilbur.

Due to the size of the maximum resolution files, which can be collectively measured as several GB, Helena's Fractal Terrain files were not included in this annual, though the final MDR file resulting from the Wilbur erosion process is included, and can be used to regenerate the final Fractal Terrain file.

Don't worry about the *World Seed* when you are adjusting the settings, but the *Highest Peak* and *Lowest Depth* should be the default values of + and - 30,000ft.

The default *Circumference* is the same as the Earth. You can change that figure if you wish, though it will not have any effect on the processes contained in these notes.

## 1 - Creating a blank world for sculpting

Start a new world in FT3 and pick the *Flat World* option.

Click *Next*.

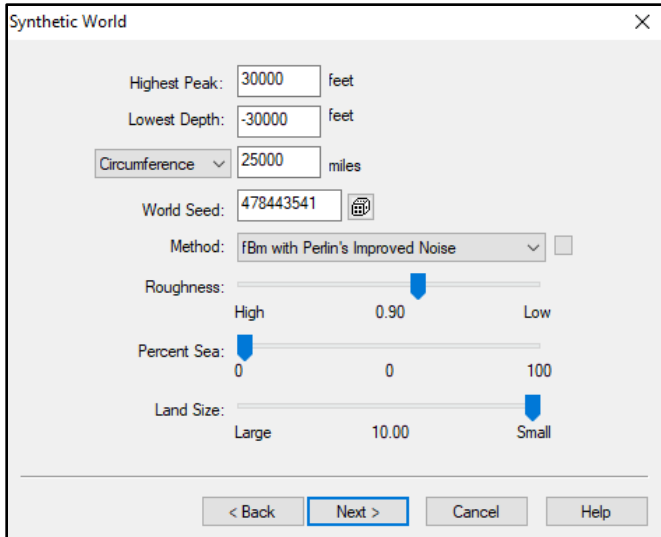
In the second dialog it's important that you pick the *Method* called; *fBm with Perlin's Improved Noise*.

Move the *Percent Sea* slider to zero.

Move the *Land Size* slider to the smallest setting.

Set the *Roughness* to around 0.90. This would be quite a low figure for a synthetic world, but your new world will be harder to sculpt if it is as rough as a synthetic world.

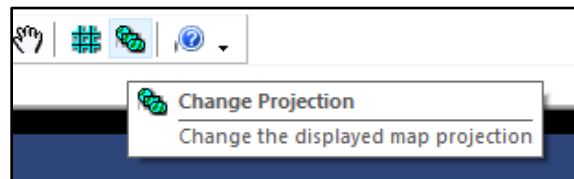
Click *Next*, and then in the final dialog click *Finish*.

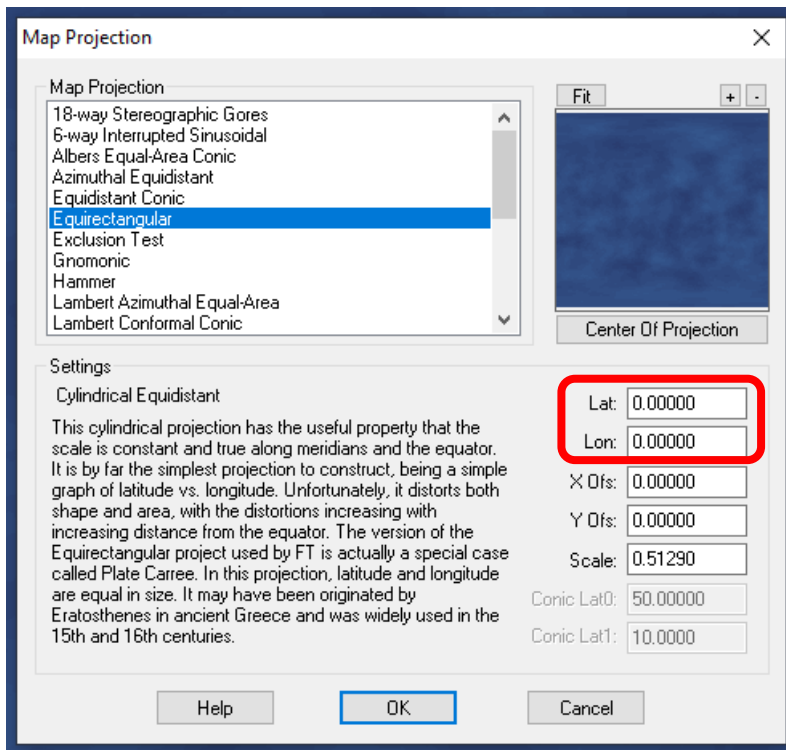


## 2 – Setting up

Although your world is blank at this point, you should be aware that there is a synthetic fractal world hiding in the background that will be providing the basic roughness to help you with your sculpting. While this background fractal is of little or no other consequence to your world, you need to be sure that the 180° meridian (the date line) is properly aligned with the east and west edges of the map before you start to make sure that you don't end up with any sculpting anomalies.

Click the *Change Projection* button on the *Map Tools* tool bar to open the *Map Projection* dialog box (shown below)





Ensure that the *Lat:* and *Lon:* values (ringed in red on the left) are both set to zero and click OK.

The values below them relate to the view on your screen, and may vary from those shown here, depending on your zoom and view.

It is important that you know these two things:

Adjusting the position of the 180° meridian at any point *after* you start sculpting will damage your work, so it is really important that you do this now.

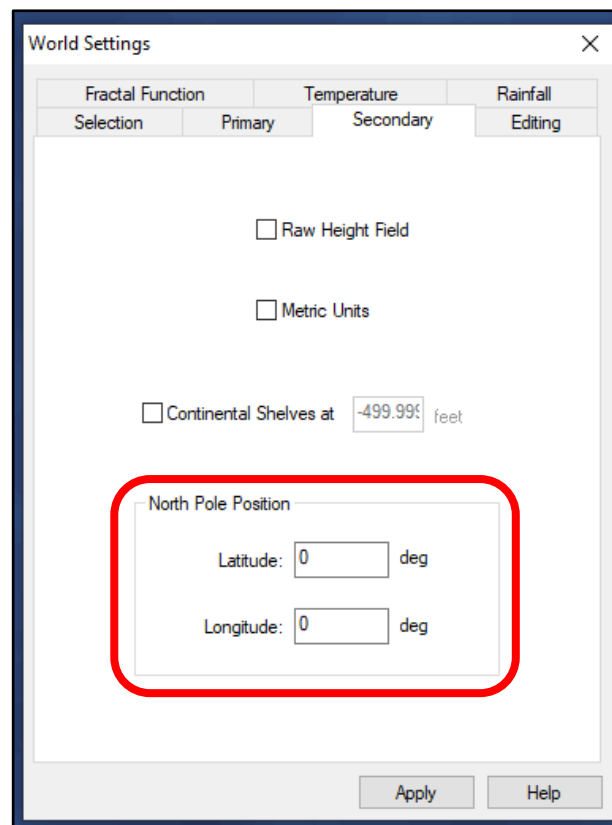
You should avoid using the move tool in combination with the SHIFT key at any point in the process, since this will move the centre of projection and cause the 180° meridian to drift back into the map.

If you make a mistake and move the meridian by accident, you can correct it immediately after you've done it by resetting the Lat and Lon in the Map Projection box (shown left).

Next, open the *World Settings* dialog and go to the *Secondary* tab, where you will see two coordinate boxes in a panel called *North Pole Position*.

Set both of these values to zero and click the *Apply* button.

These two actions should have ensured that the 180° meridian lies exactly on the east and west edges of the map, where it will be nicely out of your way.



Notice the size of the file you are creating. Be prepared to store several copies on a semi-permanent basis so that you can go back a stage if you wish.

The settings being made at this point are important if you want your world to perform in the same way that Helena does.

The *CA155 - FT3 HC Gamut* palette has been designed as a sculpting aid. There are 62 defined contours above and below sea level so that you can see exactly what you are doing to the nearest 968 feet.

The topmost and bottommost contours of this color scheme are colored markers (red and white) that will warn you if you are about to exceed the gamut of available altitudes in either direction. They are referred to throughout these notes as 'gamut markers'.

When you are editing try to stay within the gamut markers. The reason for this will become apparent during the Wilbur part of the process.

While you still have the *World settings* dialog open, go to the *Editing* tab, pick *Custom* and set the resolution to 8,000.

Check the *Allow Prescale Offset Editing* box and *Apply* it.

In the *Fractal Function* tab make sure that both the *Flip...* boxes are unchecked, and *Apply*.

In the *Secondary* tab set all values to zero and uncheck all the boxes.

Click *Apply* and close the dialog.

Check your work and save your file.

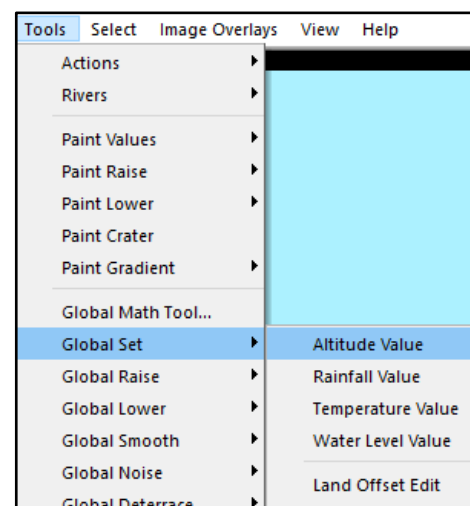
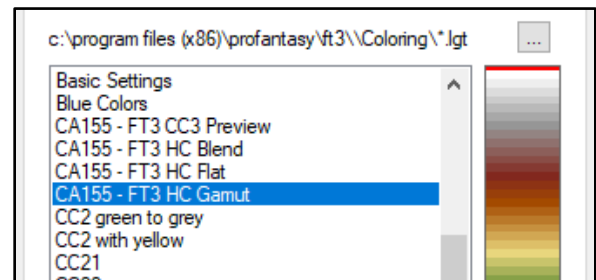
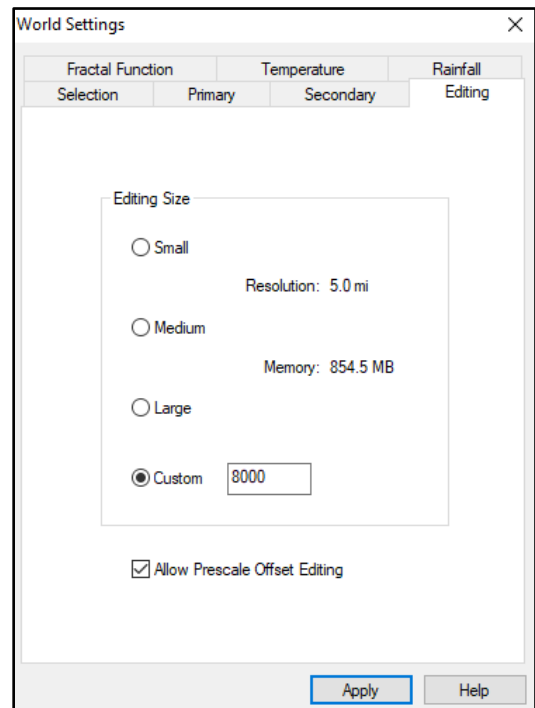
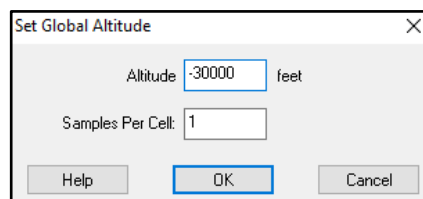
Open the *Lighting and Color* dialog.

From the list of options in the *Select Coloring Scheme* tab, pick:

*CA155 - FT3 HC Gamut*.

Click the *Load* button and then the *Apply* button and close the dialog.

From the *Tools* menu, pick *Global Set -> Altitude Value*, and set the altitude to -30,000 feet. This will result in a completely white map, since you have set the entire world to an altitude at the very bottom of the lowest gamut marker.





From the *Tools* menu, pick *Global Set* -> *Land Roughness Edit*, and set the *Value* to 0.3.

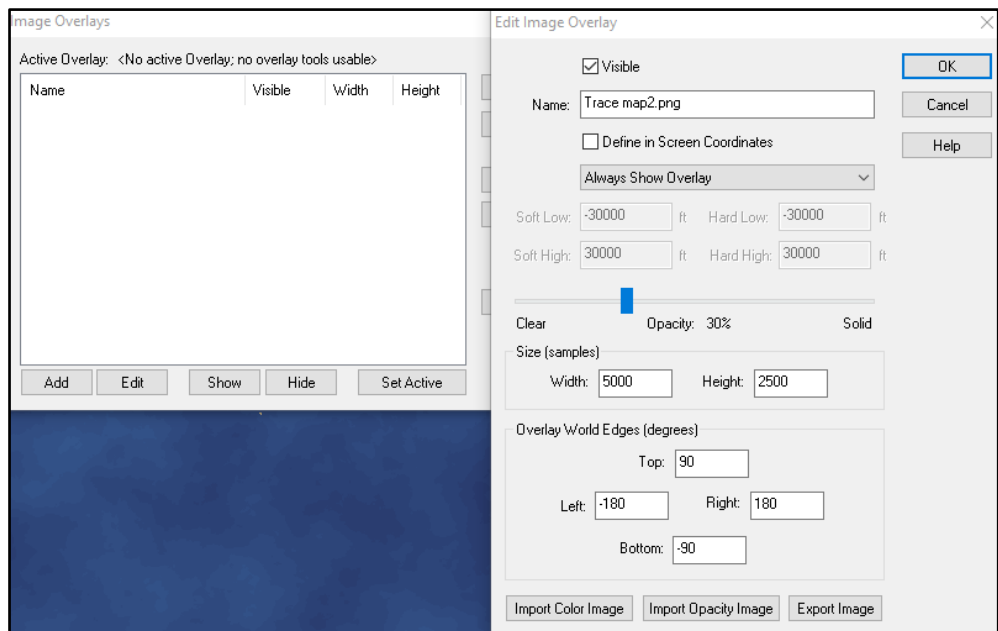
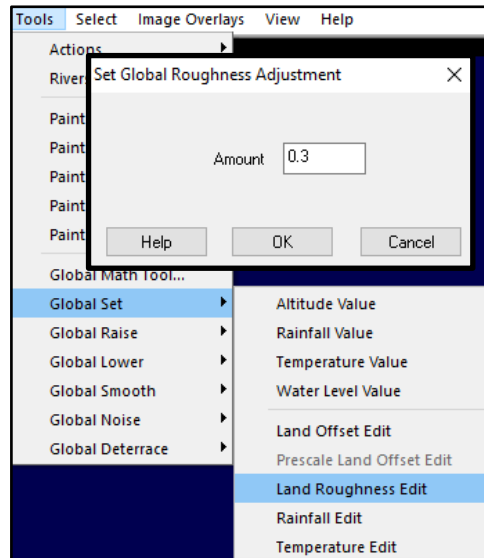
Most of the world should now be showing the darkest blues of the bathymetry (the ocean contours), but some parts may remain white. These are the deepest parts of the ocean and will be within 968 feet of the lower altitude limit.

The fractal function you used to create this file is one of the better-behaved fractals of those available in FT3. It tends to stay within the altitude limits set in the *World Settings* dialog. None of the values in the visible white bits should be any lower than -30,000 ft. However, if you find these odd white patches distracting just dab them away with a single click of the brush once you start to edit.

Save this file as a blank master file which you can use again for other worlds, and then save a second copy of it to work on now.

## 2 – Raising the land

If you have a map you wish to trace that has been cropped to fit the 5000 x 2500 template size mentioned at the outset, *Show Overlay Window* from the *Image Overlay* menu, click the *Add* button and pick your image file. Set the *Opacity* to 30%, and click OK.

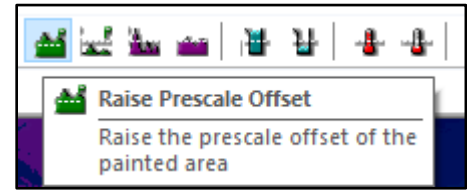


Prescale Offset brushes are very powerful. 0.5 is a high value setting for such a brush, but you will need it to be that powerful to make raising the land from the bottom of a 30,000ft ocean easier.

You will be using both of the green Prescale Offset brushes throughout the project (this and its green partner, the Lower Prescale Offset brush, or LPO). Do not use any of the other brushes – particularly not those which affect roughness.

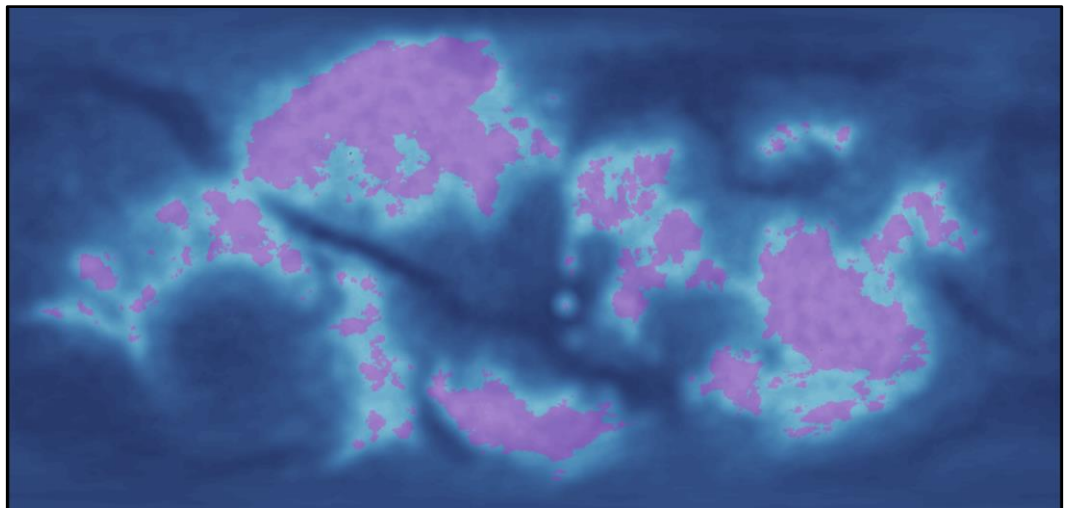
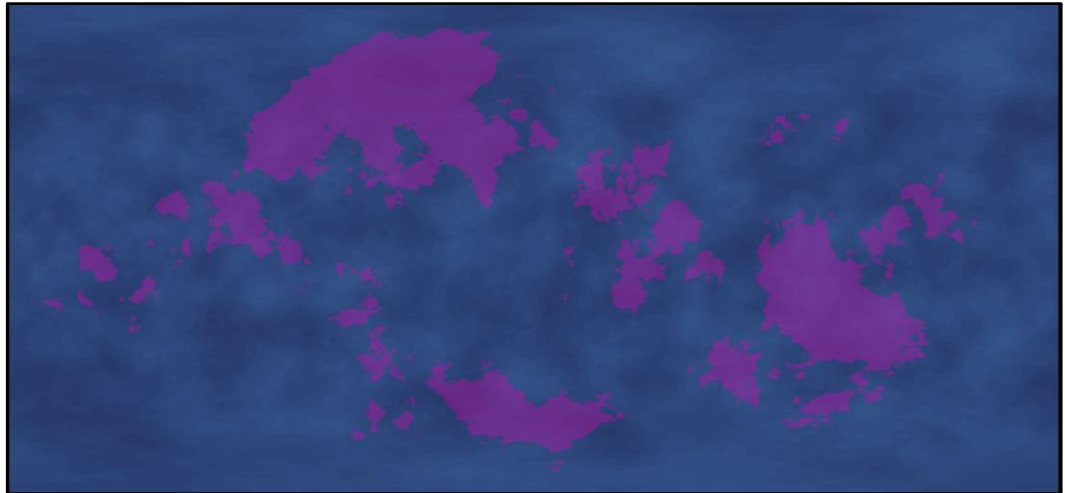
Using just the RPO and LPO brushes helps to maintain a consistent texture across the surface and ensures a better result in Wilbur.

Click the Green *Raise Prescale Offset* brush (RPO) and in the *Tool Properties* panel set the *Height* and *Width* of the brush to 500. Set the *Value* to 0.5.

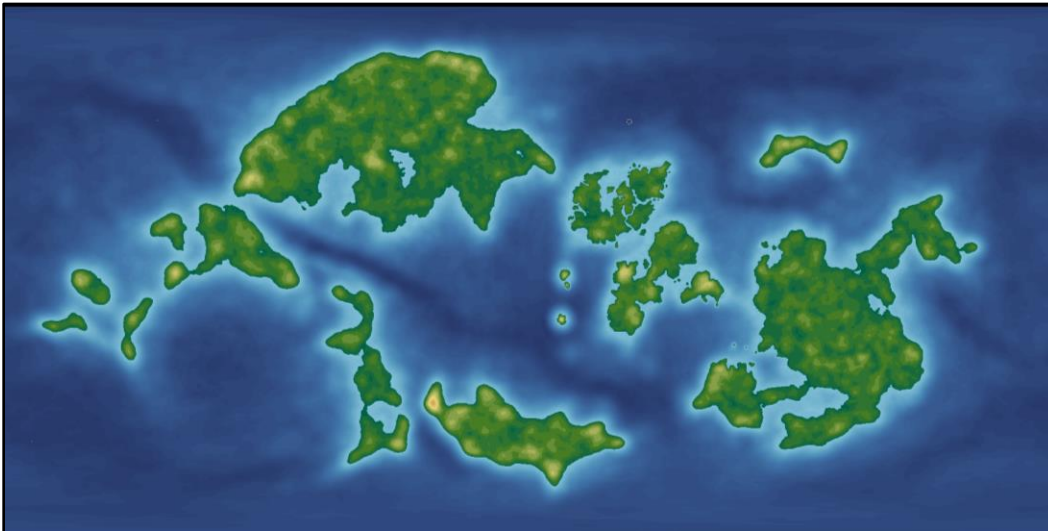


The new world has been created with a basic texture or roughness in the background to give you a head start with your sculpting. It is easier to work from than a blank flat background. Even so, raising the land from these depths without any further shaping of the ocean floor will cause distinct and rather artificial looking lumps, so it is best to do some basic sculpting of the ocean floor before you fully raise the land.

Here are the 'before' and 'after' images of the ocean sculpting carried out on Helena that formed her continental shelves.



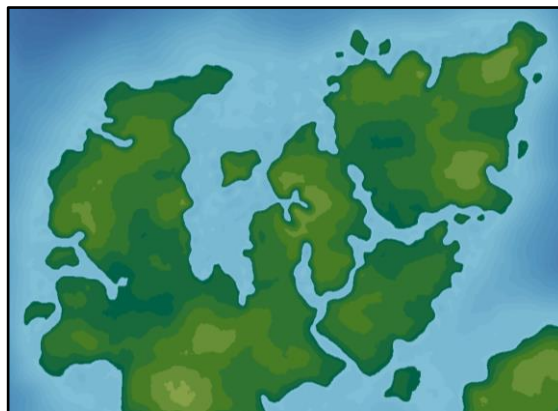
When you are happy with the ocean floor reduce the value of the brush to 0.05, and raise the land from the continental shelves.



Do not waste countless hours trying to raise the land to exactly match the outline of your overlay map all in one go. You can trim the excess using the Lower Prescale Offset brush, set to a very low value.

### Healing the Continental Shelf

You can see that the result of trimming the land around the coast can sometimes leave sculpting scars on the surface of the continental shelf. While a real continental shelf is rarely smooth, yours will look wrong compared with the equally smooth ocean surrounding it if it isn't repaired to a comparable state before the erosion process takes place.



Fill the visible holes with a small RPO and LPO brushes set to values of 0.005 (or less) until the inlets are evenly expressed as the topmost contour color of the ocean. This is probably the most time-consuming part of the project, but in the end you will see that the benefits outweigh the cost.

The invisible sculpting scars that exist within that single contour (where altitudes may still vary by as much as 968 ft without showing up), can be levelled by selecting everything between - 1000ft and 0ft, using *Select -> Altitude Range...* and setting the whole area to the lowest altitude in the selected range.

Before you set the altitude, however, check for holes in the selection where the initial repair work failed to lift patches of the continental shelf far enough to be included in the selection. These patches can be added using the freehand select tool and drawing around them while holding the SHIFT key down.

Once everything that is part of the continental shelf is selected, the selected area should be set to the lowest altitude in the initially selected range (1000 ft), using *Tools -> Global Set -> Altitude Value*.

You have just created a perfect continental shelf, but it has also created an artificial drop of 1000 ft at the coastline.

Fortunately, the drop will be filled in during the Wilbur process, so don't be overly concerned about it for now.



Deselect the continental shelf and save this file as the first in a string of versions before you go onto the next stage.

### 3 - Shaping the land

Most of the surface of an Earth-like world would be covered in relatively flat land – plains, lowland hills and river valleys.

Depending on which articles you read, and how land use is defined in each case, approximately 20% of the Earth's land surface is generally considered to be 'mountainous'. This includes mountains that are relatively small like Ben Nevis (the highest mountain in the UK, at 4,413 ft), as well as Everest (29,030 ft) and K2 (28,250 ft).

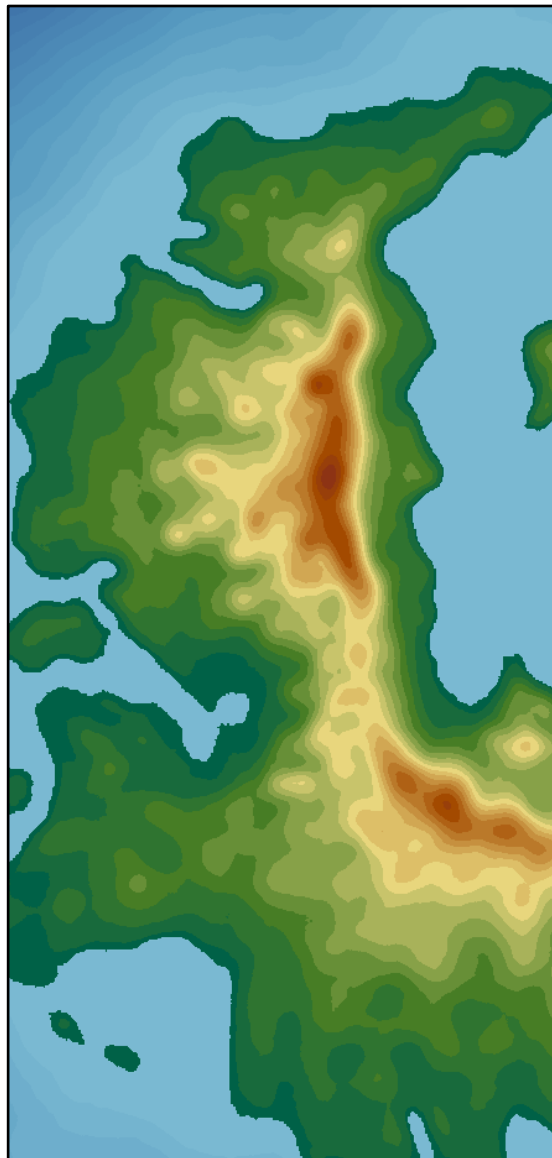


There are no rules that say you can't cover your world in mountain ranges of such epic proportions that they make the Himalayas look like foothills, but the 20% statistic is something worth considering while you work.

Think also of the profiles you will be creating. Where the contours are far apart the land will slope gently. Closer together is steep, and nearly right on top of one another is a cliff.

Pick the RPO brush again and set the *Value* to 0.01. Use it at sizes ranging between 150 and 50, and raise the base level of the land wherever you want there to be mountains, high level plains and plateaus.

Towards the end of this process start to add the mountains with a brush that decreases in size the higher you go.



The smallest brush size used in the Helena map was 20 x 20.

#### Lakes and inland seas

It has already been mentioned in the Mapping Guide that Wilbur will drain rivers to the closest point on the world where the altitude is equal to or less than zero, whether that is the global ocean or a tiny pinprick hole in the landmass. If you wish to have large lakes in your world you can, but make sure that they are large enough to absorb all the runoff from the land around them or you may end up with the Amazon draining into a very small lake instead of the sea.

Helena has a large inland sea, but it is roughly the same size as the Caspian Sea and more than able to absorb the volume of the rivers running into it.



#### 4 – To Wilbur and back again

This process is very similar to the one previously covered in the main *Mapping Guide* for eroding the surface of a modified synthetic world. There are, however, a sufficient number of differences for it to be worth writing a separate set of instructions in these notes.

This method assumes that you have previously read the *Mapping Guide*, where you will find instructions on where to find Wilbur and how to download and install it, and that you may have had time to try some of the tutorials written by Joseph Slayton, which are referenced at the end of the *Mapping Guide*.

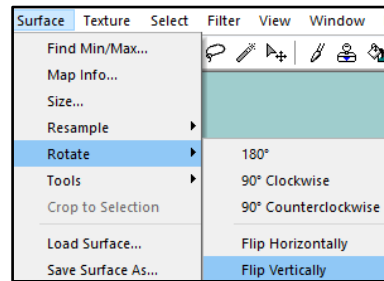
Before you save the final copy of your sculpted world in FT3 go to the *Tools* menu and pick *Actions* -> *Normalize Data*. Manually sculpting an entire world can cause outlying values that are far above or below the 60,000 ft range you have been working within. If any of these outliers are NAN (not a number) *Normalize Data* will get rid of them. The outliers that are numbers will be dealt with in Wilbur.

Save your world as a *Special MDR* file with the full resolution of 8192. Do *not* check the *16-bit Integer Output* box.

These errors can be as tiny as a single data point in several million data points, but each of them may cause significant issues in Wilbur.

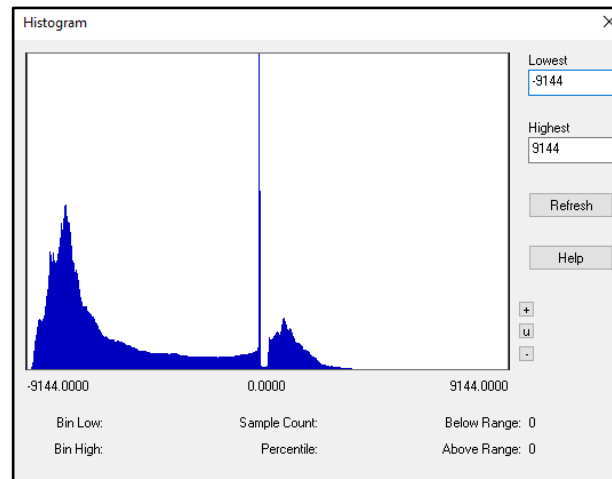
Open Wilbur, and open the MDR file. Remember that you will need to change the file type Wilbur is looking for before you can see the MDR file.

If it is upside-down when you open it, turn it the right way up using *Surface -> Rotate -> Flip Vertically*.



From the *Window* menu, run *Histogram*.

You should see a nice distribution graph showing the number of data points by altitude, but if you can only see a single very fine blue line, or the bars of the graph are concentrated in just one place with large white sections on one or both sides, then there is at least one outlier somewhere outside the expected altitude range.



The majority of hand sculpted worlds will have at least some outliers.

Outliers need to be trimmed away before we start the Wilbur process.

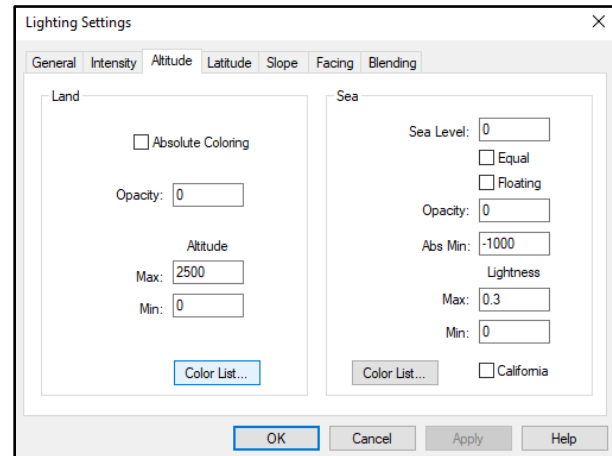
From the *Filter* menu pick *Height Clip...* and set the min and max values to -9144 and 9144 respectively. (Wilbur works in meters, not feet, and 9144 m = 30,000 ft). When you check the histogram again you should see a marked improvement.

This one (above) is from Helena just after the height clip. That tall bar in the middle represents the levelled continental shelf, and the short gap to the right of it represents the altitudes between -1000 ft and 0 ft that were leveled down to -1000 ft.

From the *Texture* menu, pick *Shader Setup...*

On the *Altitude* tab click the *Color List...* button on the *Land* panel side.

In the *Edit Color List* dialog that appears, click the *Load* button and navigate to the CA155 folder, where you will find a subfolder called *Wilbur Color Schemes*.

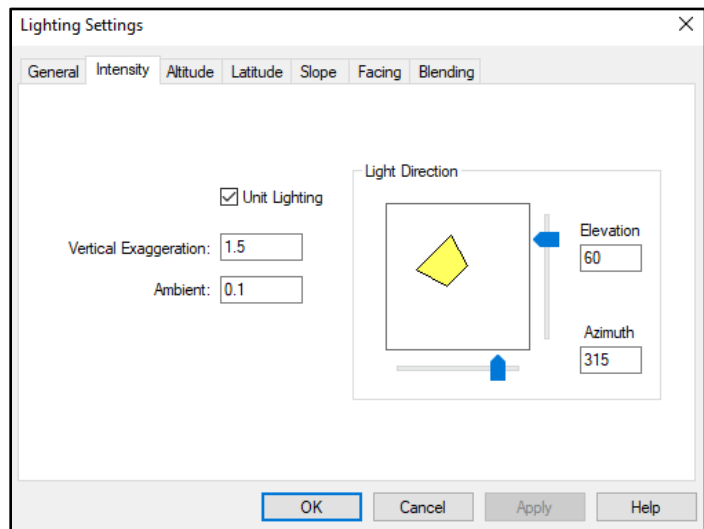


Inside that folder there are a number of color schemes you can use to render maps directly from Wilbur, but the one you want right now is called *CA155 Wilbur HC Blend – land*.

There is another color scheme by the same name in that folder which ends with 'sea' instead of 'land'. This is the color scheme you should pick using the *Color List...* button on the *Sea* panel. On that same panel set the *Lightness Max* value to zero.

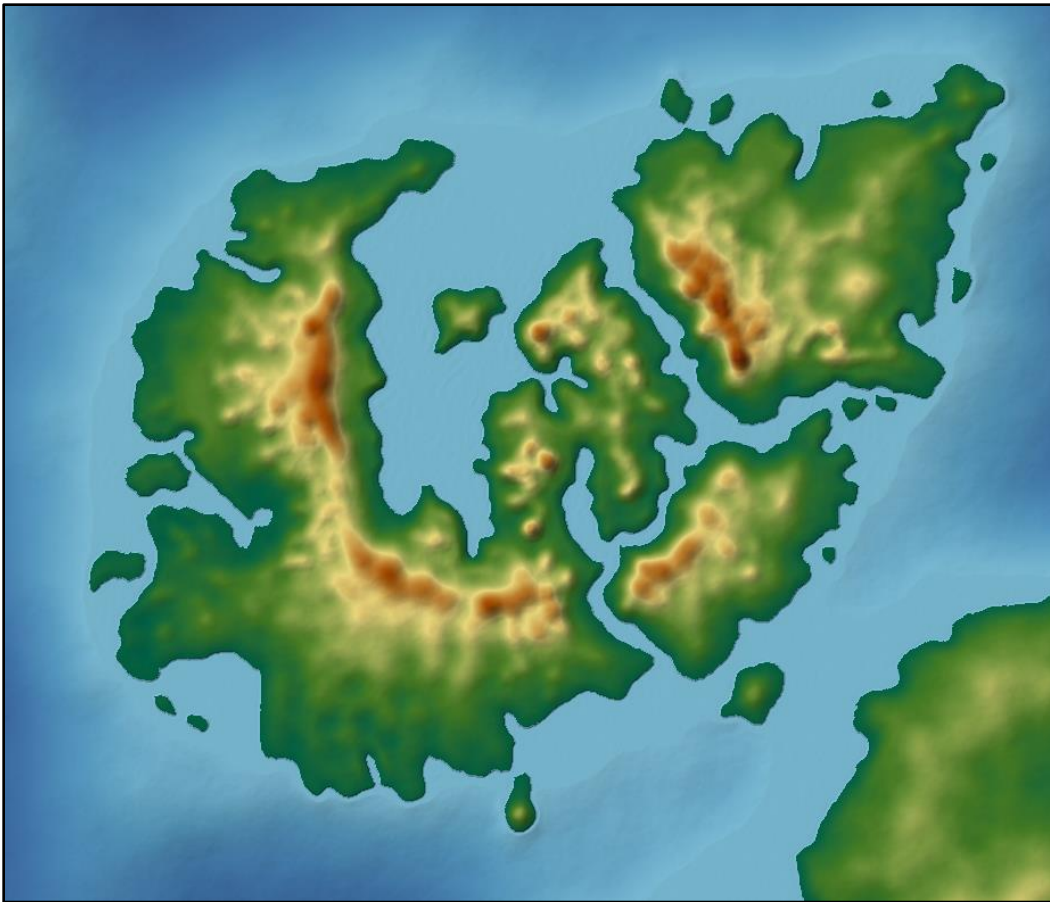
Go to the *Intensity* tab and adjust the settings to match those shown on the right and OK your changes.

Now that you have corrected the outliers and swapped the color scheme your world, should closely resemble the familiar FT3 view.



This (below) is a small continent of Helena that is approximately 2,000 miles wide. It is by no means a full representation of the world, but you will be able to see what happens at each stage more clearly if we stay focussed at this spot and zoomed in relatively close.



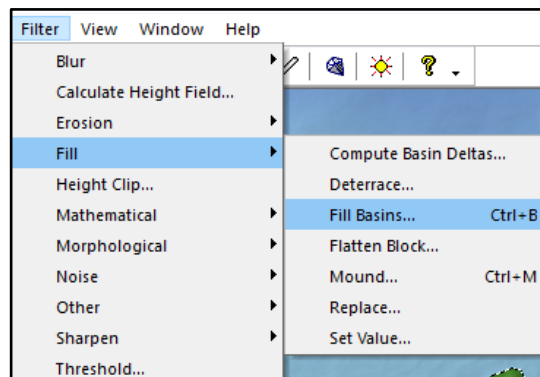


From the *Select* menu pick *From Terrain -> Height Range...* and set the range from zero to 9144 to select the land.

Some worlds may not have reached their full altitude potential and the mountains may be considerably less than 30,000ft at their maximum altitude, so unless it is your intention to have a relatively flat world pick *Mathematical -> Span...* from the *Filter* menu, and set the span from zero to 9144.

From the *Filter* menu, again, use *Fill -> Fill Basins...*

The flashing selection line will freeze while Wilbur is busy. When it starts to move again you will see small differences in the topography of your map where depressions that

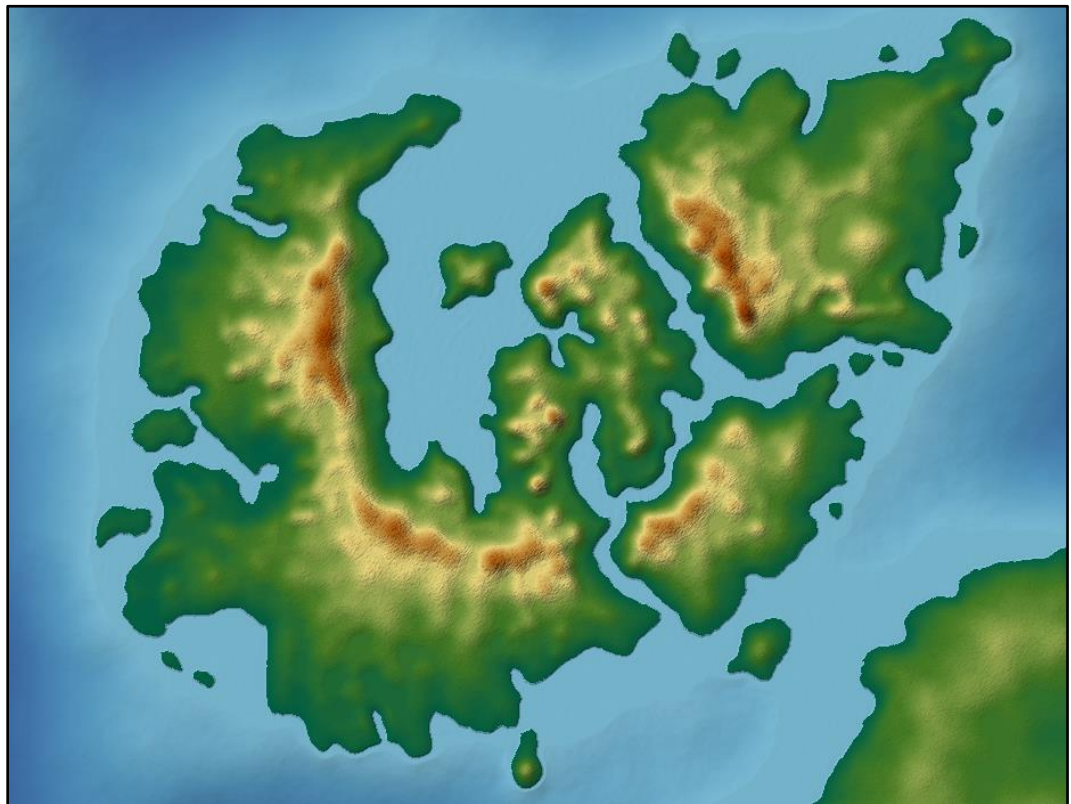


might have been lakes in a real world have been filled.

From the *Filter* menu, use *Noise -> Percentage Noise...*, and add 5% noise to your world. The result will make the map look roughened – more so at higher altitudes.

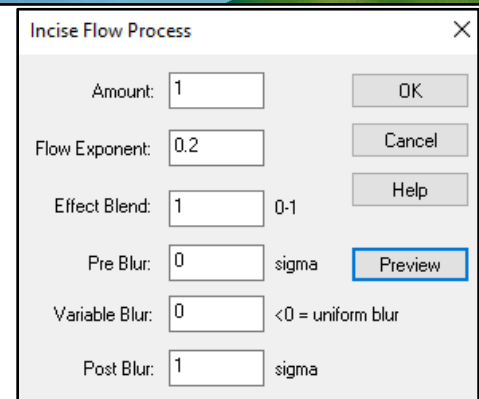
Repeat *Fill Basins* and *Add Noise* a further two times, and finish with a final *Fill Basins* process.

You should now have something that looks a bit like this. (The selection has been temporarily deselected for this screen shot. Please leave yours as it is)



From the *Filter* menu, run *Erosion -> Incise Flow...*

This will freeze the selection mask for some considerable time. When it unfreezes you will see a dialog that offers you the chance to modify the default settings. Adjust them to match these (right) and click OK.



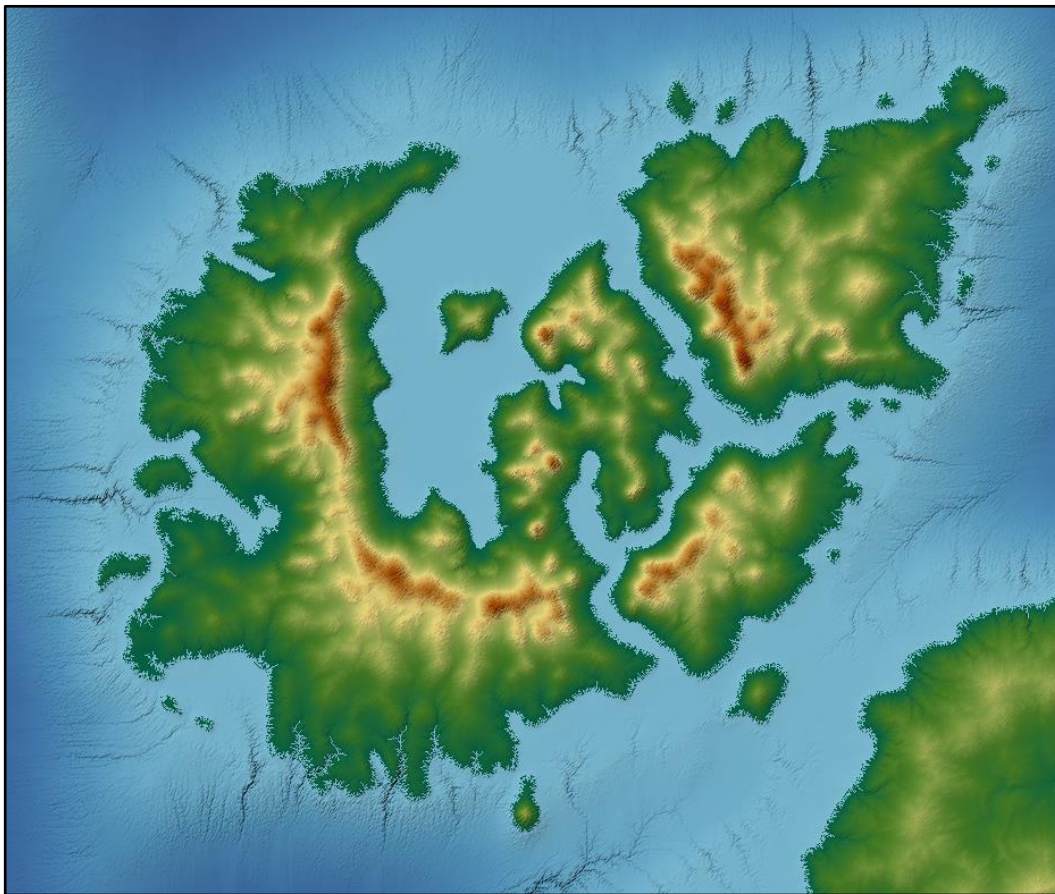
Correct the altitude span as before and *Deselect* the land from the *Select* menu.

From the *Filter* menu pick *Erosion -> Precipitation based...*

Leave the settings at default values, but increase the number of passes to 5.

This process will take several minutes.

The first pass of the precipitation based erosion may sometimes cause land elevations to snap to a much wider range. While the reason for this is unclear, it is more of an accidental improvement than a problem.



As you can see, precipitation based erosion continues below the water line, so in one move you have given your world sediment-filled valleys and a more believable continental shelf texture. However, the coast has become rather ragged. To cure this problem pick *Blur -> Gaussian Blur...* from the *Filter* menu and use



it set to a value of 0.5, three times over. There are more blurs towards the end of the Wilbur process which will finish the job of tidying the coastline.

Select the land the same way as before (*Select -> From Terrain -> Height Range...*) and correct the span again.



While you may be thinking that this is looking good, and that you are surely finished already, this is not the case. The precipitation based erosion filled in the river beds with sediment, so it is necessary to repeat the Incise Flow process to rediscover them.

Fill the basins and repeat the add noise process as before, but this time add only 1% noise three times, *not* 5%. The reason you don't have to add so much noise this time around is that even though the surface looks smooth, there will still be quite a lot of noise remaining from the first noise cycle. Adding any more than necessary in this final stage will lead to bumpiness in the finished FT3 world.



Make sure the last thing you did was fill the basins at the end of the noise cycle, then run *Incise Flow* again. When you are presented with the options set them to the values shown on the right. Your target is to produce a fine tracery of rivers to fit the existing valleys.

Incise Flow Process		×
Amount:	<input type="text" value=".5"/>	OK
Flow Exponent:	<input type="text" value="0.1"/>	Cancel
Effect Blend:	<input type="text" value="1"/> 0-1	Help
Pre Blur:	<input type="text" value="0"/> sigma	Preview
Variable Blur:	<input type="text" value="0"/> <0 = uniform blur	
Post Blur:	<input type="text" value=".5"/> sigma	

Adjust the altitude span of the land as before.

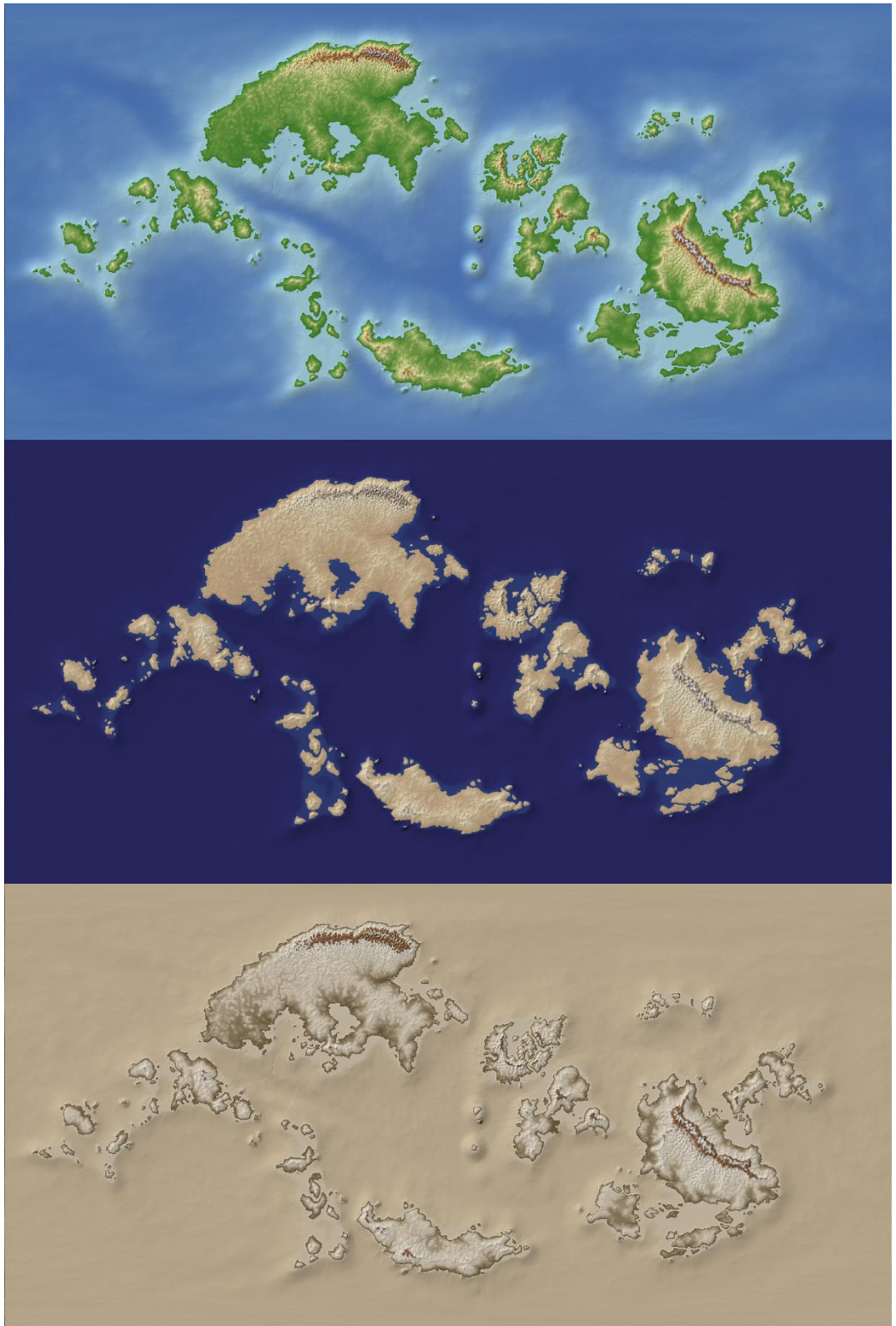
From the *Select* menu pick *Inverse* and set the ocean span from a minimum of -9144 to a maximum of -1.

*Deselect* and use Gaussian blur at a value of 0.5 three times on the resulting landscape.



From this point you can rejoin the main *Mapping Guide*, at the beginning of Stage 3.

Below: A few renders from Wilbur with different color schemes.



PREMIUM CREATIVE CONTENT

# Cartographer's Annual 2019

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While the FT3 files for Helena are too big to be included in the annual, there is an MDR file of the finished world, and both versions of FCW end results available in the Helena folder.