

# **FRACTAL TERRAINS**

## Tips and Tricks

With Frequently Asked Questions

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## Resources

Profantasy Home Page <http://www.profantasy.com>  
 Wilbur Home Page <http://www.ridgenet.net/~jslayton/software.html>  
 Blue Mars Page <http://www.ridgenet.net/~jslayton/mars/index.html>

## Demo Version

> *Will there be a downloadable demo of FT?*

There should be one available for download from the ProFantasy web site soon.

## Recreating a Specific World

### *Using existing CC2 files with FT*

> *Are there any plans to update FT to be able to read CC2 files? As a long time user of CC, it would be useful to be able to run FT on existing maps (at minimum the continent outlines).*

The current version does not import CC2 files. The first or second update should be able to handle very simple importing (importing some paths for coastlines and possibly some existing contours).

It *is* possible to do an import of an existing CC2 file using the current version, but it takes a fair amount of work and the results may not be as good as you expect. The concept is simple: output your map as a binary file and use the binary import feature of FT to load the map.

To create the binary file:

    For each contour level

        Hide all layers but the contour level (or hide everything except the entities you want at a specific altitude level).

        Output a PNG file (JPEG is probably a bad idea) of the map. Take note of the size that you're using.

    End For (pass 1)

    Start up a program like Photoshop or PSP.

    Create a grayscale image the size of the output images.

    For each output image (from coastline up)

        Load the image file into something like Photoshop or PSP

Convert to grayscale, preferably with the non-interesting areas black and the interesting ones as a dark gray (value 10 or so on a 0-255 scale)

Optional: blur the image slightly.

Add the current contour interval to the growing image

End For (pass 2)

Save the file as a 256-color Window bitmap (BMP) file.

Use Wilbur (included on the FT CD) to open the bitmap as a surface (File->Open:8-bit BMP Surface)

Scale the altitudes to the desired level (Surface->Point Process->Scale:To Range)

Save the image as a Muse DTED file (a 16-bit binary format)

To load the binary file in FT:

Use File>>New:Binary File. Select the DTE file you created and set the Per-sample info to 2-byte, LSB First, Signed, Header Length=1024, Line Width to image width\*2, Width and Height to the image width and height, and Map Edges to the locations on the globe where you want the map to be placed.

That's it. Your map should be present in the FT display.

### ***Using current CC2 files***

*> I have a very specific coast line that I need to created. Is it possible to recreate an existing coast line in CC2 within FT? I'm after the realistic look you get with FT but also the customizability of CC2...*

If you can create your coastline with a paint program, you can create it in FT. FT will not directly import a CC2 file at this point, however. It also does not provide selections or vector drawing tools.

### ***Painting to get an existing world***

*> I have an existing world map. I guess the only way to get this map into FT is to start with a "flat map" and paint the oceans into it, is that right?*

That's one way to go about it. Another way is to explore a number of worlds until you get one that's generally in your desired configuration and then use the editing tools to submerge the parts you don't want.

Another option is to take any world, use Tools>>Global Set>>Land Roughness to 0.5 in order to flatten out the land a bit and use Tools>>Global Set>>Land Offset to push most of the land underwater. The painting tools can then be used to finish the land shaping. If you've already done some editing, use the Global Raise tools instead of the Global Set ones.

### **Importing terrain from bitmap files**

*> Can you explain that comment a bit more? Even if FT doesn't import a file from CC2, can it import coastlines (and perhaps other things) from .BMP files?*

FT has a binary import feature. If you can generate a grayscale bitmap that represents your information, it should be possible to read this bitmap and use the info as part of the surface. The initial release probably won't work in quite the way you want in this regard, though. It does have basic painting tools (raise/lower, roughen/smooth) and a grid, but not a bitmap overlay feature for the basic world type.

## ***Background images***

> *Can you put a background pic in FT and trace over it?*

The first update should be able to import an image as a texture map for the surface. A little drawing and it should give you the desired coastline. It got missed in the first release, though, so the version in the box won't do this directly.

## **Wilbur and FT**

### **Compatibility**

> *If I use Wilbur to generate a world map, is there a way to use it with FT when it comes out or would I be stuck starting from scratch?*

The world definition files generated by Wilbur will not generate the same world if used with FT. However, a binary file generated by Wilbur can be used with FT.

### ***Why is Wilbur included?***

> *If the files are not going to be compatible, why is Profantasy including Wilbur on the FT CD?*

Even though the world definition files aren't compatible, FT can generate a binary file type that Wilbur can read and Wilbur can convert lots of file types into something that FT can read. In short: Wilbur does I/O better but FT does basic world-building, map projections, and CC2 export better. The two of them together make it possible to handle many of the existing data sets out there.

### **Performance**

> *I have an older machine and am concerned about how well FT will perform on it.*

I find FT runs just a bit slower than I'd like on a P2/450 but is still usable on a P2/333. I'm not sure how it would run on a system with less than 64 MB of RAM, but it should run, albeit somewhat more slowly. In either case, however, it's much faster than trying to do the same things by hand. (And, BTW, using a smaller window makes it run faster - use a 24-bit or 32-bit color mode if possible for maximum speed).

### **Brush Sizes**

> *I am trying to modify the existing elevation data from a generate world in FT, and it seems like only a brush size of 2 or greater does anything. I would like to use a size of 1 to do really fine detail. Is this possible? If not is there another way of doing it?*

You're usually better off using a higher-resolution editing system (World Settings >>

Advanced.Editing Setup) than you are trying to use a brush with a 1 pixel size. The value entered in the brush size is only an approximation of the actual size; the brushes in this version must be created internally with an odd size. The correspondence between values you enter and the actual brush size is given below:

Entered Size	Created Size
0, 1	0 (no effect)
2, 3	1 editing pixel
4, 5	3 editing pixel
6, 7	5 editing pixel (odd shape)
... the pattern should be obvious	

## **Installation**

*> I know there's an order that needs to be installed when I install CC2 and its upgrades/addons. Where does FT fit into the list?*

Where you install FT in the sequence (before, during, after) doesn't matter one bit. Generally I've found that the best solution is to install the original CC2, FR Atlas, and then the add-ons with the newest one installed last to get the most recent update.

## **Current View Export**

*> Is there a way to get FT to export a small section of a map to CC2, without going through the multiple files export?*

Zoom to the section you want and then "Save CC2 File". The command saves the current view as the CC2 file.

## **Dialog Defaults**

*> I played with the tool settings and now I can't get them back the way they were? What do I do?*

The pictures of the dialogs in the manual should all show the default Settings for all dialogs.

## **Multi-maps**

*> I generated multiple maps down to three levels. Now I'd like to add a fourth sublevel of maps. Can I just have FT generate a fourth level or does it have to generate all of the other levels again?*

FT needs to generate all of the map information in order to get correct sublevels so all of the map levels would be regenerated.

## **Other Programs**

### ***Using World Builder data***

*> I built a map using World Builder because I like the way it does tectonics. Can I import this world into FT?*

World Builder maps can be imported into FT by passing through Wilbur. Load the WB map in Wilbur (which unprojects it), then save as a Muse DTED file and open that file in FT as a binary file (1024 byte header, 2 bytes/sample, width and height as you saved them in Wilbur).

### ***Using Bryce for 3D Views***

*> Does it have the ability to save output in a format that Bryce can understand? (I would like to be able to create 3d pictures of the mapped terrain).*

Not directly. It can, however, output to a format the Wilbur can understand and Wilbur can output into Bryce 2 and Bryce 3D format. Wilbur is included on the CD-ROM for your convenience.

## **Heightfields**

*> You mention heightfields in the documentation and online discussions. Can you elaborate?*

Height fields are (usually rectangular) grids of points. Every X,Y point has a corresponding Z value. FT uses height fields internally to store the intermediate calculations as well as for storing

all user editing. In the case of FT, it's a spherical height field (every latitude, longitude position has a radial offset from a perfect sphere - subject to the editing resolution, of course).

### **Spin Animations**

> *What would be really great is for Profantasy to release something that can make the spin animation, and then be able to display it in CC2 \*grin\**

Including GIF files in new development is a very expensive proposition due to the Unisys patent licensing situation. The cost for FT would increase substantially if GIF encoding were included. Similarly, providing a facility in CC2 to display GIFs would incur another licensing fee. Because of the licensing issue, I recommend a program such as ImageReady from Adobe (<http://www.adobe.com>) or Animation Shop from Jasc (<http://www.jasc.com>).

### **World Setup**

#### ***How customizable is the sea setting?***

> *I understand that I can set the land/water ratio, but how much further customization is possible? Can I (for example) specify that my world will have only 10% water and that I want it all in one ocean? or that I want the same ratio of water but in many small oceans? or maybe all in one huge "river" that spans the world flowing from place to place? (Like the world in "The Seventh Sword, if any of you know it)?*

FT will generate an approximate percentage of water, but you have no direct control over where the water will be placed during the initial generation process. However, it is possible to edit the generated data just like with a paint program to lower land sections into the ocean or scuff up mountains where you want them.

#### ***Lakes and Rivers***

> *Will FT have a function for mapping out low points for lakes and rivers or will we still have to be pseudo-geologists and figure this one out on our own?*

FT does not provide automatic calculation of lakes and rivers.

#### ***Climate Overrides***

> *Can I override the climate information that FT generates? I may, for example, want to arbitrarily decide that in my world the rivers all flow up mountains and it rains mostly in the desert(s) (where large cacti absorb the water, which is why the land itself is a desert). Easy? Hard?*

Any future algorithm for river placement is not likely to allow customization for rivers flowing the wrong way (uphill). It is possible to paint any desired climate onto the map (except, of course, for oceans - they stay oceans.).

#### ***Hot worlds***

> *What about an extremely hot world, where most of the water is likely to be concentrated in polar oceans, with massive rivers running to the oceans from hotter areas, and strictly desertous terrain at the equator? How hard would something like this (which pretty much describes the world I have been building) be to create?*

Again, no river plotting, sorry. Heat and polar oceans are no problem with the editing tools, though.

### ***Setting the base temperature***

> *Also, although I can control the sunlight, greenhouse, and reflectivity of the planet, and the temperature RANGE, I don't seem to be able to specify the base temperature i.e. how hot or cold the planet is (because it's closer to or farther from it's planet than Earth is to the sun).*

Those three parameters do in fact control the temperature of the planet. They combine to get the base temperature. There is no direct way to enter a numeric value for temperature at this time, however. The relation between these is parameters is  $T=374G(1-A)I^{0.25}$ , though, so setting Albedo(A) to 0, I(lighting) to 1 will enable the temperature to be controlled by G(greenhouse effect). Simply take your desired temperature (in Kelvins), divide by 374 and enter that value as G. For example, to get a temperature of 0 degrees Celsius (273.15K) as the base temperature for the planet, enter  $273.15/374(0.73034759358ish)$  into the Greenhouse field, 0 into Albedo, and 1 into lighting.

### ***Stringy Worlds***

> *I was playing with FT and changed the settings around a lot to see what I could do. One thing I found was that with a high water percentage and "small" land blocks (rather than one continent) I would get these weird worlds with long "finger" continents spanning the planet and usually connecting together at points. I was trying to get an "Archipelago" world with lots of ocean and spotted islands around the place, but I didn't seem to be able to manage this. Any ideas?*

Play with the roughness parameter (move it more towards "high"). Due to the way that FT calculates worlds, they become more extreme in altitude as the size of the continents is decreased. That is to say, the odds of a given point being closer to one of the extreme altitudes goes up. One way to work around this problem and get chains of islands is to globally lower the land level, which has the effect of raising sea level.

### ***Massive World Tweaking***

> *I want to create a very hot world, with a desertous equator and temperate poles, which should lead to the main distribution of the surface water appearing in polar oceans. Now, if I could set the temperature of the planet manually, and crank it up, this would presumably force the polar oceans and desertous equator (and I'm guessing tropical rainforest in a thick band between them) but there doesn't seem to be a setting for this. Have I just missed it?*

Tools>>Global Raise>>Temperature should do what you want without having to fiddle with many other parameters. Unless the rainfall is reduced, you'll never get rainfall in an area, no matter how hot it is. Check the manual for the section on climate computation. The assumption in FT is that a hot, wet area will have some form of jungle, not desert.

### **Real-World Data**

#### **Multiple GTOPO30 tiles**

> *Is it also possible (either in Wilbur or in FT) to load multiple GTOPO files at once, to build up a bigger picture?*

Check the tutorials section on the Wilbur web site at

<http://www.ridgenet.net/~jslayton/tutorials.pdf> for the section "Stitching together multiple binary files", which details how to combine GTOPO30 data tiles (and any other binary data source as well).

## **Terrainbase and GTOPO30**

*> In Wilbur, it's possible to combine the terrainbase and GTOPO30 data into one image. Is it possible to then get that image into FT?*

Save the file from Wilbur as a Must DTED file. The file format is a 16-bit LSB-format raster data file with a 1024 byte header. Note the width and height of the data that you save and use those as inputs to FT's binary file import feature.

## **Binary Files**

*> I created a binary map and now it gives me a General Protection Fault error message every time I try to open the .FTW file. Help!*

The binary file world type uses the binary data on disk as the source of its data. It currently does not import the binary image data into FT. If you move or delete the binary file, you will get GPFs instead of something more useful like an error message.

## **Unexpected Behaviors**

### **Metric Units not saved across sessions**

*> FT resets the metric units flag every session. How can I get the setting to stick between session?*

The metric units flag is saved in a saved data file (.FTW file). FT reloads the prior data file by default and should restore that flag.

### **Last saved file doesn't automatically reload**

*> FT is not loading the last world saved, but a completely new, untitled appears at start up each time.*

FT should be loading the last .FTW file you saved (using Save or Save As). Some people are reporting that their copy doesn't, but so far it's not possible to say why this is only happening to a few.

### **Saved maps not coming up the same.**

*> I loaded a map that I saved and it came up completely different, land all over the place. I exited that map and reloaded it and it came up fine. Then I edited some more to produce the second continent in my world, no problem. I saved again. When I loaded the map again however I get the same problem, much more land than I ever had on this map before, and now I can't fix it. What happened? Can I get my saved map back to the state it was in when I saved it?*

This appears to be a bug with the software that does not have a fix at this time.

### **Generated worlds seem to to really screwy**

*> Occasionally (well, quite often actually) when I generate a world, or reload a saved world, it has ice sheets all over it - with altitudes exceeding 60Km (!) and temperatures approaching absolute zero at the extremes. And yet there are little pockets of reasonably liveable terrain (at sensible altitudes) scattered about.*

This problem is related to the prior bug. It's not certain when it will be addressed because the developer can't reproduce it yet.

### **Zoom Window only fits horizontally**

> *The zoom window seems to always zoom to fit the horizontal axis of the window you select, even if the vertical range you boxed will not fit at that zoom.*

The behavior described is the designed behavior of the software. It may be changed in the future.

### **World doesn't match settings**

> *Sometimes a generated world does not seem to have the % sea that I set. I have had generated worlds set to 80% water that looked to be half and half, and others that should have been half and half that appeared to be mostly water, any thoughts?*

The way that the amount of ocean is placed (actually the zero point of the altitudes) is that FT generates a low-resolution version of the world and searches through that one to get the land statistics. If the roughness is high and/or the land size small, the statistics can be a poor approximation to the actual land information and sea level will be off.

### **Altitude Key on wrong Layer**

> *I found that when I chose the "Full Monty" as the CC2 export option that the Altitude Key got placed on the wrong layer on every map. Fortunately it was relatively easy to correct once I discovered the layer it was on (which was the Scale bar layer). Is it supposed to do that?*

It's a genuine bug when you use an output format based on the Advanced contour type. Seems one line of code was on the wrong side of an if statement. It'll end up on the prior layer. This problem has been corrected in the code base and the fix will be available in the first release.

### **Finding just the right spot**

> *I want to set the map window to show a specific part of the world. How do I go about performing this action?*

The Map Projection dialog has three basic sets of parameters:

**Projection Center** (lat, lon) is the center of projection for the map type. Changing the lat doesn't do anything unless the projection is an azimuthal one like Orthographic.

**View Offset** (X, Y) is the offset from the Projection center to the center of the area of interest.

The view space is defined on the range -1 to +1 in X and Y. It is also flipped top to bottom and left to right. A small table of values for X and Y in the equirectangular projection with projection center at 0,0 might help:

<u>X</u>	<u>Y</u>	<u>Screen Center (Projection Center at 0,0)</u>
-1.0	0.0	Right Edge, Centered top to bottom (0, 180)
0.0	0.0	Center of projection (0,0 lat/lon for our example)
+1.0	0.0	Left Edge, Centered top to bottom (0, -180)
-1.0	-0.5	Top Right corner (90, 180)
0.0	-0.5	Top Edge, Centered left to right (90, 0)
+1.0	-0.5	Top Left corner (90, -180)
-1.0	+0.5	Bottom Right corner (90, 180)
0.0	+0.5	Bottom Edge, Centered left to right (-90, 0)
+1.0	+0.5	Bottom Left corner (90, -180)

So (for the equirectangular projection only - others have different formulae), placing a given point at the center of the screen means placing the projection center to 0,0 and the view offset to [x=-lon/180, y=-lat/180].

**Scale** values are computed as  $1/\text{zoom}$ . Scale value of 1.0 will place the entire map onto the view space (the imaginary -1 to +1 screen defined above under View Offset). In the case of infinite projections such as Gnomonic, Stereographic or Mercator, it will place a reasonable amount of information in the view. Adjusting the current factor by 2x will zoom out by a factor of two (which is actually what the zoom out button does). Adjusting by a factor of 0.5 zooms in by a factor of two ( $1/2$  – just like the zoom in button). The quick table:

<u>Scale</u>	<u>Zoom Level</u>
0.25	4x
0.50	2x
1.00	1x
2.00	1/2x
4.00	1/4x

To zoom in on a particular area on the equirectangular projection (again, other projections are more complex), use the formula:

$$\text{scale} = \text{width}/360$$

For example, I want to zoom in on the location lat35, lon -117 (my home area) and I want to see about a 1 degree area in the equirectangular projection. We're assuming GTOPO30 here, but any data set works.

Lat: 0

Lon: 0

X Ofs:  $-(-117/180) = 0.65000$

Y Ofs:  $-(35/180) = 0.19444$

Scale:  $1/360 = 0.00278$

## Esoterica

> *Fractal Terrains uses a number of esoteric values to generate worlds, and I could do with guidelines on how to assign these reasonably. I'm planning to use FT to design both earth-like and non-earthlike worlds (though I'm guessing it'll be somewhat limited on very un-earthlike worlds - ones without an atmosphere for example), but I'd like to stay at least semi-reasonable, so I'd appreciate any advice on reasonable ranges of the following values.*

A word of warning: some of those values (usually the ones labeled "Base", "Random" or "Variance") are fairly arbitrary fudge factors placed only to make the worlds look a little more realistic without having to spend hours waiting for a climate model to calculate.

> *Albedo, Greenhouse Effect, Variance: what kind of values are reasonable both for earth-like and non-earthlike worlds (Mars, Titan and Venus, for example).*

The defaults (and the values shown on the dialog) are for an earthlike world. The three parameters given combine to form the basic temperature at that orbit (the world's base temperature). as described in the "A Tiny Bit of Theory" section of the manual. Venus has a high albedo and an enormous greenhouse effect combined with being closer to the sun. Actual

values can be computed with a solar system atlas. Titan is COLD, as is Mars. The climate model is intended for earthlike worlds. Mars and Titan will show up as ice balls (-lots temp and 0 rainfall), while Venus will show as desert (+lots of temp and 0 rainfall).

> *Light (#suns): how do I work this out, given the stars luminosity and planets orbital radius?*

Taking the luminosity of the sun as 1, the luminosity of a star is given by

$$L = 2.52^{(4.85 - M)}$$

where M is the absolute magnitude of the star (4.85 is the absolute magnitude of the sun).

\*\* means "raised to the power"

Calculate absolute magnitude from

$$M = m + 5 - 5 \cdot \log(p)$$

where m is the apparent magnitude of the star and p is the distance to the star in parsecs.

log is the base 10 logarithm; a parsec is 3.26 light years.

The final value to plug into FT for the light parameter (I) is:

$$I = L / (R \cdot R)$$

where R is given in AU (1 AU = distance from the sun to the earth)

> *Continental Shelves, Min Depth and Max Elevation: should these be related to the size of the world and/or gravity or other factors? What kind of relationship if any?*

Your world, you place them. For example, Venus seems not to have much in the way of recognizable continental shelves and mountains many kilometers high. Mars also has big mountains (different kind) and again nothing much like continental shelves. The maximum/minimum values will be based on what you want and are referenced to a mythical "surface" which is also where the world size is measured.

In general, the lower the gravity, the easier it is to have mountains that are large relative to the size of the world. On an asteroid, for example, the "mountains" can be half as large or larger as the body on which they are found. Mountains on a neutron star are likely to be no more than a few centimeters high. Also, dry rocks are much stronger than wet rocks (mountains on Venus vs. mountains on Earth despite very similar gravity).

In general, I'd say don't have continental shelves unless you have ocean AND plate tectonics.

> *The "Random" quantities on Rainfall and Temperature: what sort of ranges should these be in? Are they purely random, or do they represent some other difficult-to-define quality?*

They represent the amount of interest in the rain and heat patterns. That is to say, with Random values of 0, temperature has straight bands (adjusted for latitude and altitude only) while rainfall is constant except for adjustments for altitude and temperature.

> *Rainfall: what sort of numbers for "rainfall" do other planets in our solar system experience, if any?*

0 (water, at least). Most planets don't have enough atmosphere (Mercury, Mars, Pluto) or liquid water (Venus and the rest) to support rain. The gas giants Jupiter and Saturn likely have lots of rain, but no real surface to fall on. Some moons (Titan and Io) may have rains of methane or sulfur.

> *What's the typical rainfall over the Amazon, and over a typical desert or Antarctica?*

Many rain forests get 4+ meters of rain a year; parts of some deserts get rainfall only every few years. Near where I am (in the American Southwest) is a place that's gotten 0.4 inches of rain in the last three years. Some deserts get little or no rainfall but support some of their sparse life on fog and clouds (the Namib desert, for instance). A desert is really isn't defined by how much rain it gets, but by how much evaporation it gets. If there's substantially more evaporation than rainfall then it's likely to be a desert. Places that can form clouds from their evaporation are likely to be marginal grasslands. In deserts, it just blows away.

> *I have seen other (free) software available on the web which, after developing the terrain for a world, can suggest weather patterns, determine where major rivers and lakes would lie, which regions would be desertous and so on. Has FT got this kind of capability?*

FT has the ability to do rough estimates of topography, rainfall, and temperature (and from those parameters, a climate or biome). It does not do rivers or lakes.

> *What exactly is roughness? In the generation settings it's slider seems to control how mountainous the world is, but when editing that would be an altitude issue.*

Roughness corresponds roughly to fractal dimension. Basically it's a measure of how close the surface is to filling 3D space. A smooth value will approach a flat plane; a rough value will approach filling space (lots of little spikes all over at all scales).