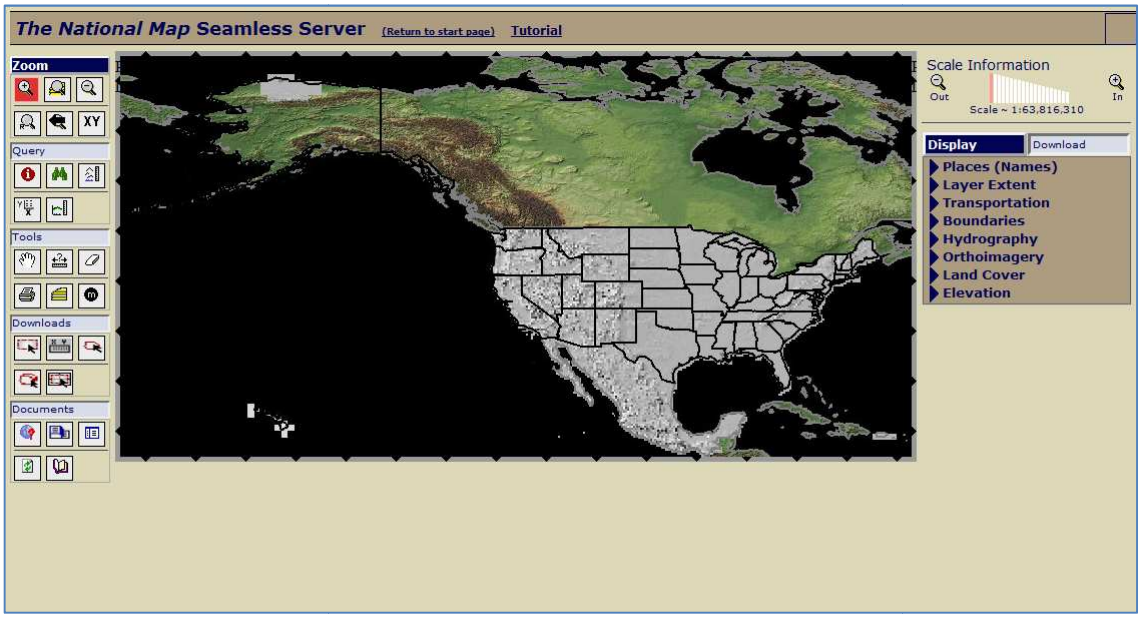
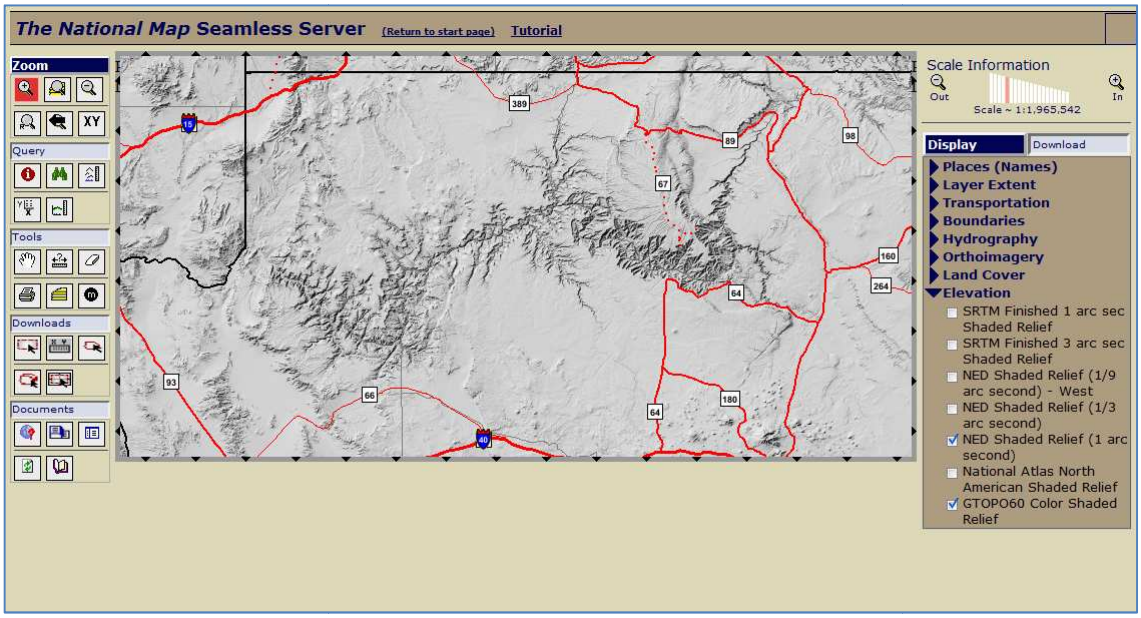
Tutorial how to create real Terrains for BlitzTiles

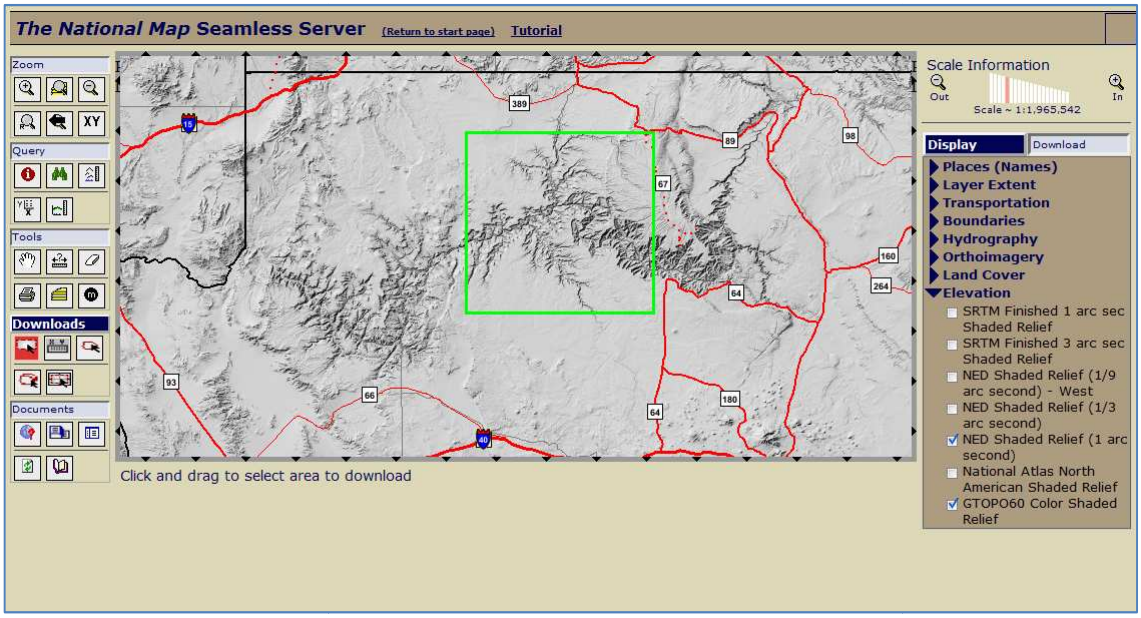
- Go to USGS website (http://seamless.usgs.gov/website/seamless/viewer.htm)



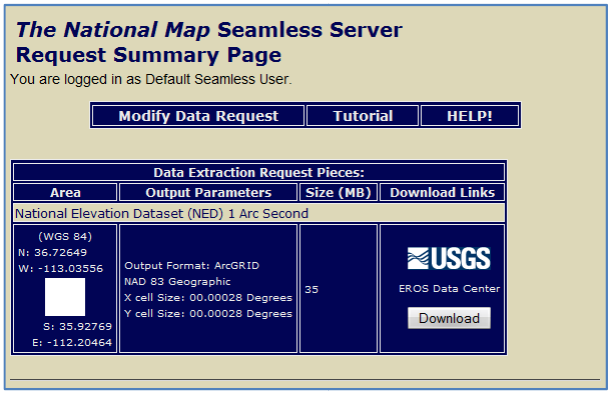
- Zoom to the desired area (Zoom is already activated by default). Here we go to the upper left corner of Arizona to grab a part of the Grand Canyon.



- Now select an area to download, click the upper left icon below „Downloads“ on the left hand and select a rectangle (ideally square format and a little bit larger than you want to process):

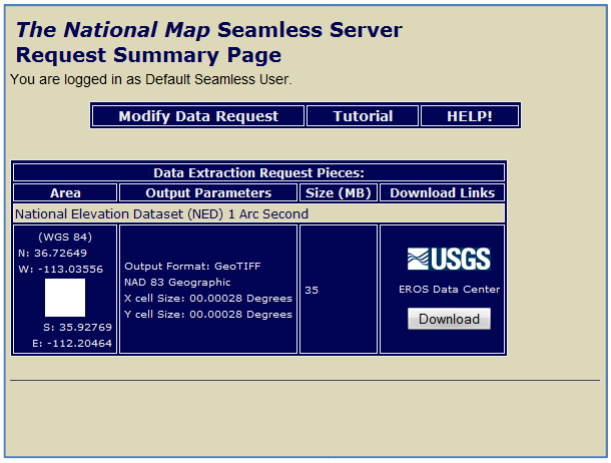


- A new window appears (be sure your popup blocker is offline). By default the „ARCGRID“ format is offered but we need to switch to GEOTIFF format first, so click on „**Modify request**“ at the top.

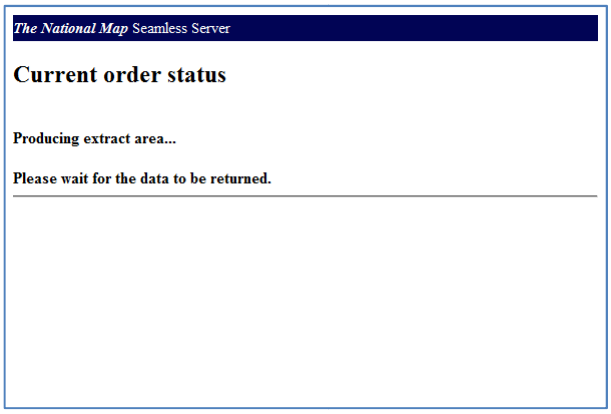


- Now ONLY select the „National **Elevation Dataset (NED) 1 Arc Second**“ and switch the **ARCGRID** format to **GEOTIFF**, leave ZIP and HTML untouched, click „**Save Changes and return to summary**“

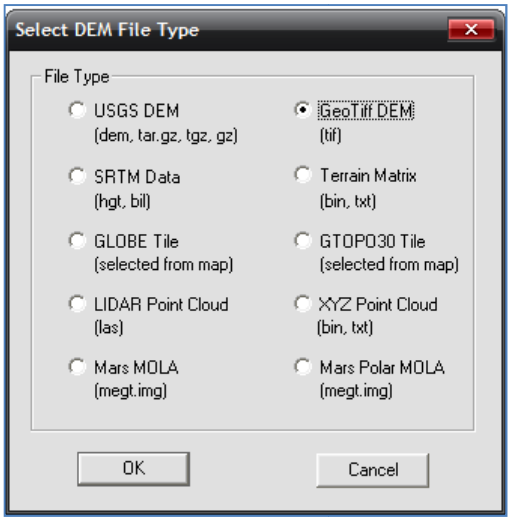
- The overview page appears again, this time with GEOTIFF format (here 35MB now). Click „**Download**“ to get the file



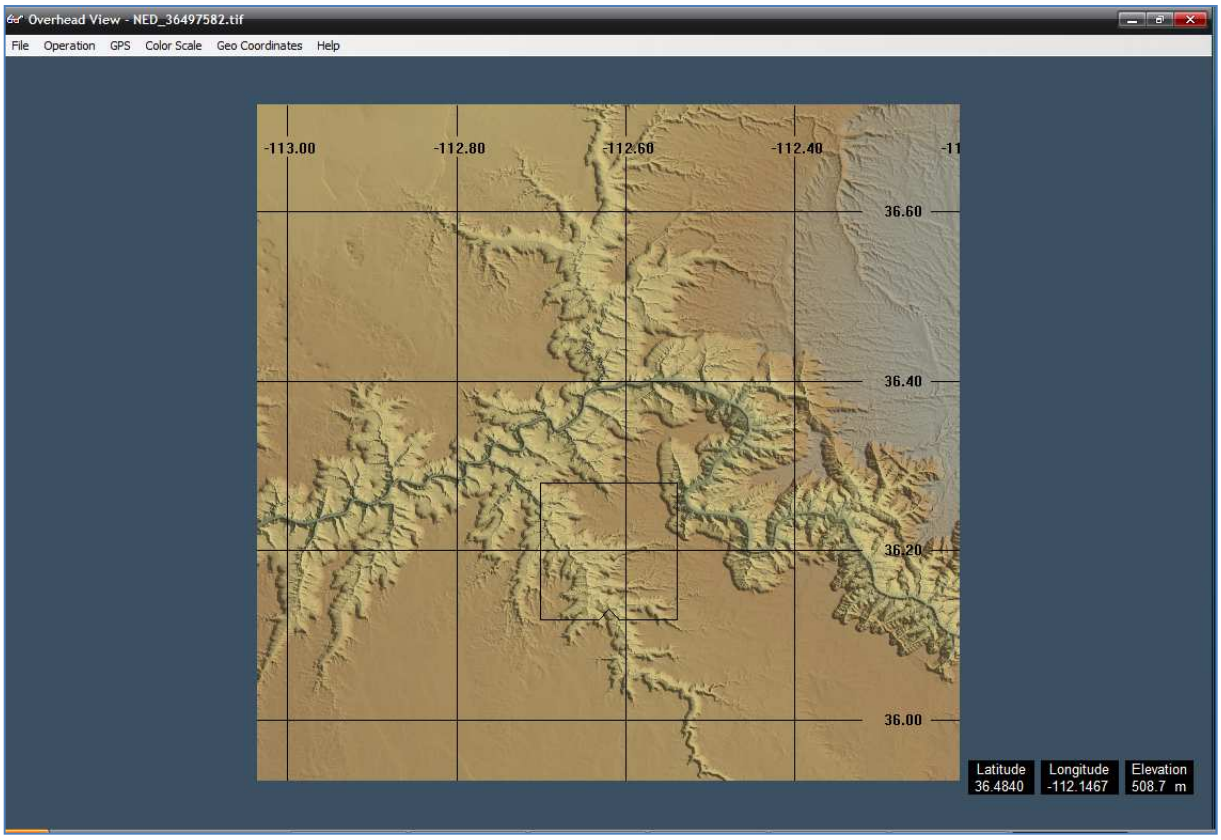
- Now your request will be processed by the USGS server, this can take some seconds to minutes, depending on the area size and the current server load. Finally you will get a download window with the ZIP file (mine is named NED_36497582.zip, it‘s random).



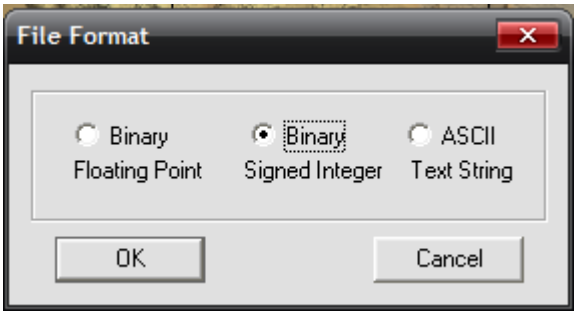
- Open the ZIP and extract only the TIF file – this is not an image, it is in GEOTIFF format so we need the program 3DEM to convert it. Grab it here: http://www.hangsim.com/3dem/ (unfortunately the original site at http://www.visualizationsoftware.com has been closed and 3DEM is discontinued but the Version 20.6 there is sufficient for our needs). Now open the extracted file in 3DEM as a **GEOTIFF DEM**:



- You should see the terrain nicely colored like here



- Export it: go to Menu File > Save Terrain Matrix and choose „Binary Matrix“, name it „grandcanyon“ or what you want:



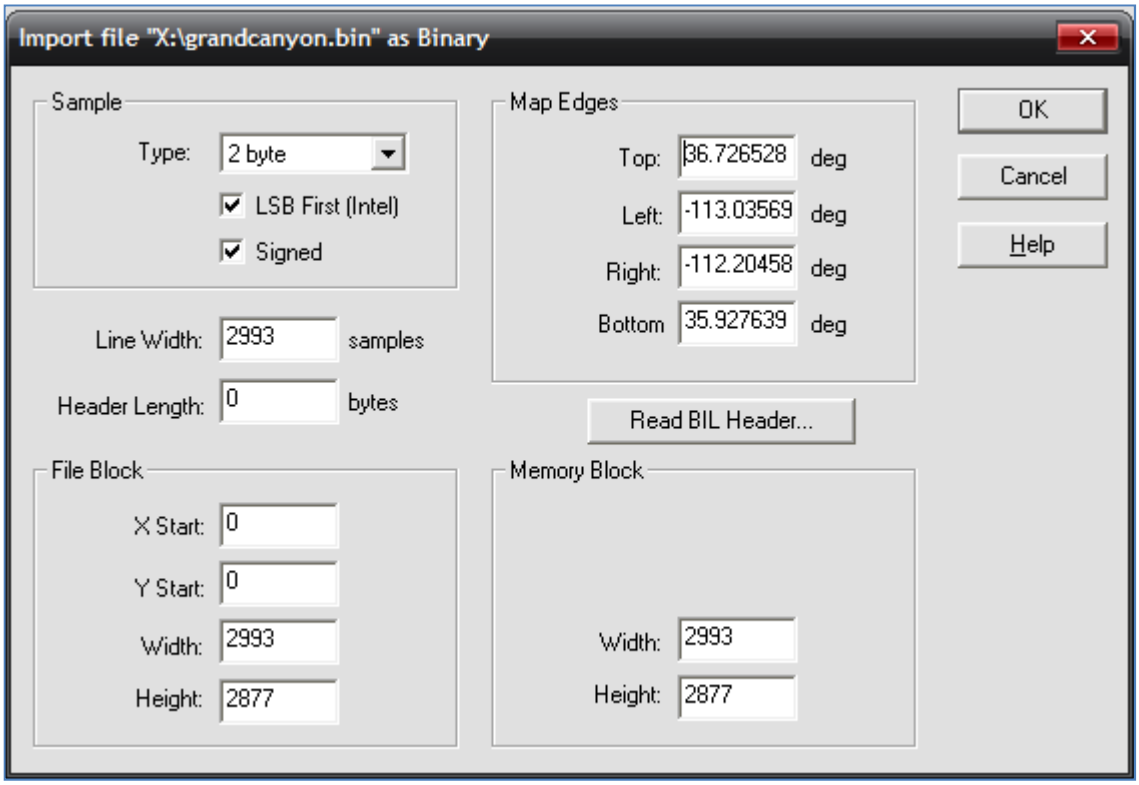
- Now there are two files, the binary terrain data in „**grandcanyon.bin**“ and very important: a „**grandcanyon.hdr**“ file, looking like that (important informations about the binary matrix):

```
file_title              = grandcanyon
data_format             = int16
map_projection          = Lat/Lon
left_map_x              = -113.035690
lower_map_y             = 35.927639
right_map_x             = -112.204582
upper_map_y             = 36.726528
number_of_rows          = 2877
number_of_columns       = 2993
elev_m_unit             = meters
elev_m_minimum          = 508
elev_m_maximum          = 2714
elev_m_missing_flag     = -9999
```

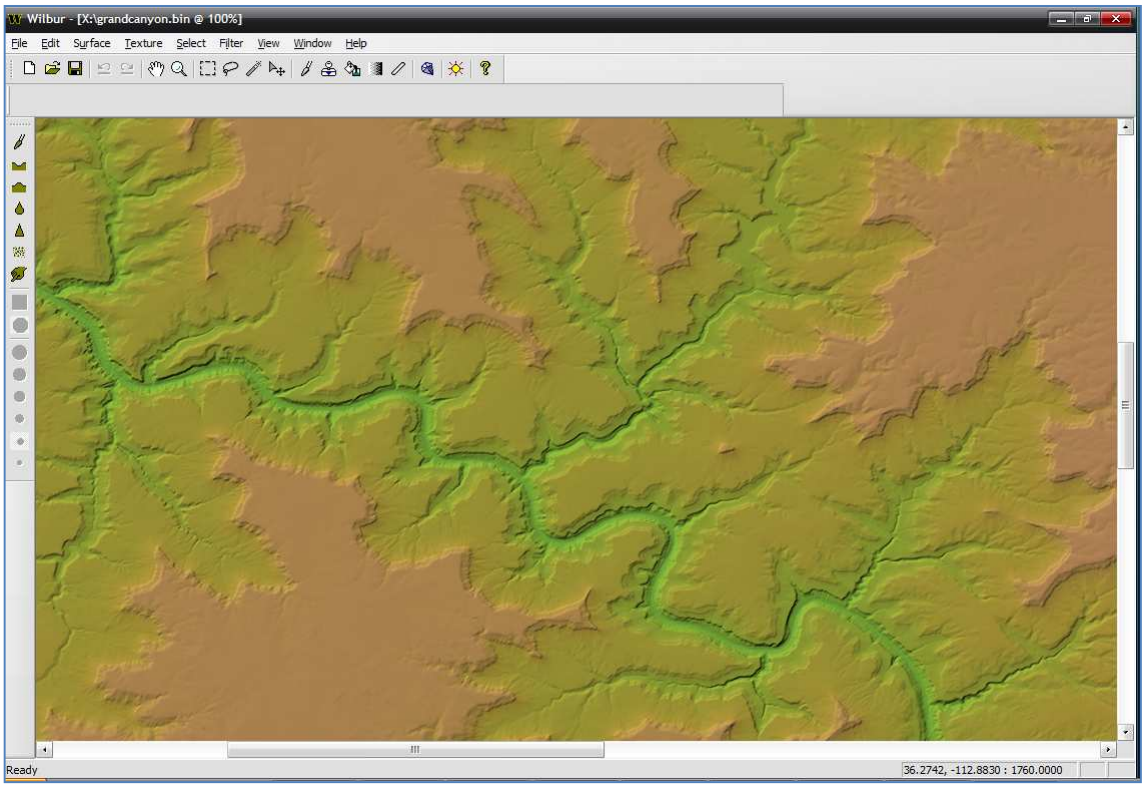
- Now go get Wilbur at http://www.ridgenet.net/~jslayton/wilbur.html. Go to File > Open and choose as format „**Binary Surface (*.bin)**“ at the very end of the file formats list. A new window will appear where we must provide some of the data provided by the „**grandcanyon.hdr**“ file. Here is the correct data conversions:

number of columns	=	width
number of rows	=	height
Top	=	upper_map_y
Left	=	left_map_x
Right	=	right_map_x
Bottom	=	lower_map_y

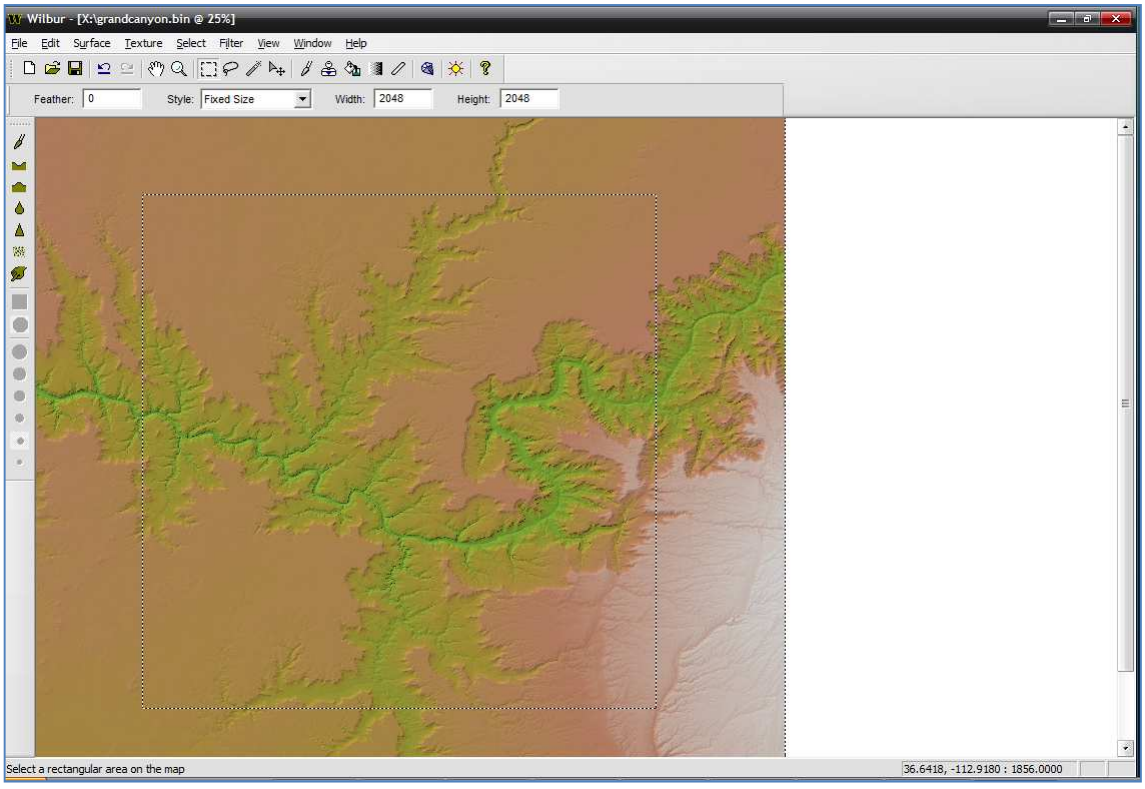
It should look like that, if so press OK to import. It is important to provide the LAT/LON dimensions that the real dimensions don't get lost:



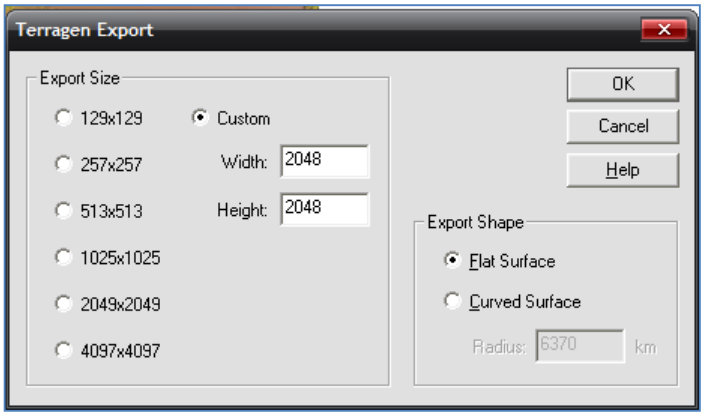
- And here we go: the terrain in ultra high resolution with 16bit precision:



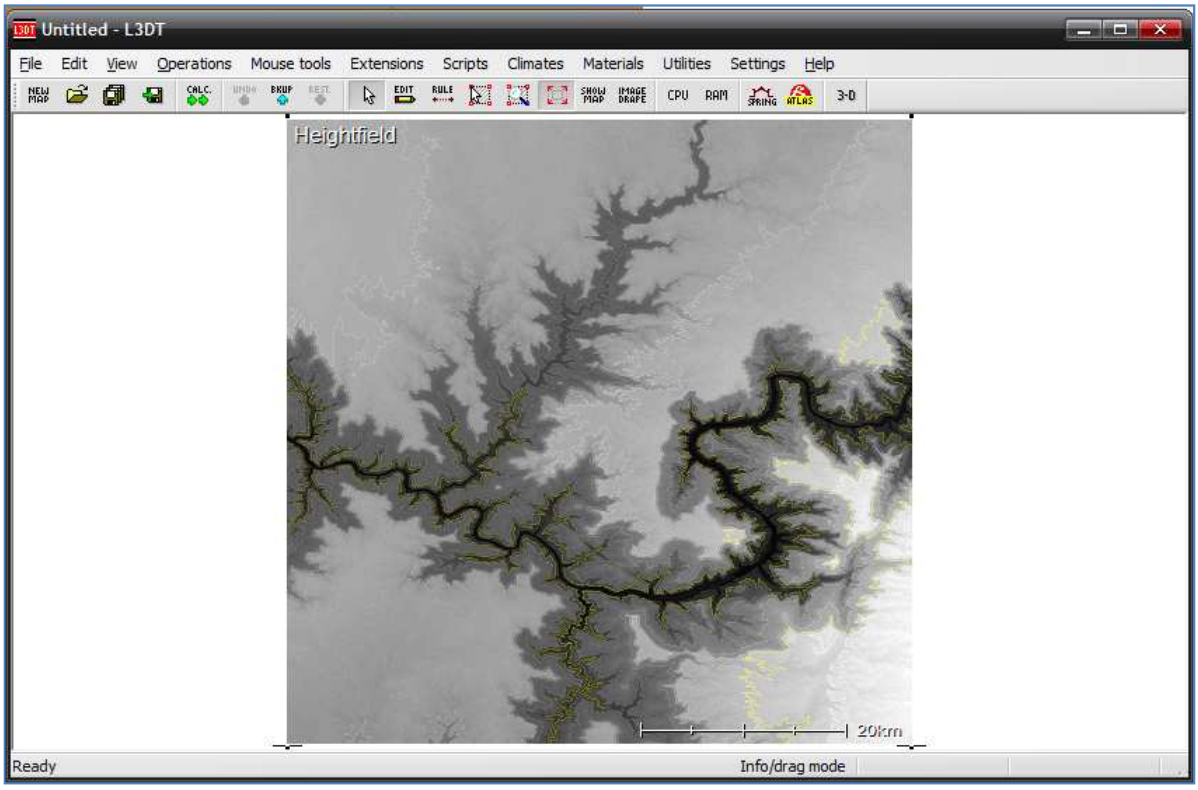
- You can manipulate the terrain now in many ways but for the moment the map is fine but upside down, so first go to **Surface > Rotate > Flip vertically**. After that we zoom out a little bit and crop a square area for further processing in L3DT. Click the rectangle selection tool right to the magnifier icon, select style „**fixed size**“ and use a value of 2^n, here my map is large enough to cut a 2048x2048 map out of it, go to **Surface > Crop to Selection**:



- Now we can export the map in Terragen format, go to **File > Save as** and save it in „**Terragen Surface (*.ter)**“ format. Remember the size of your selection? Select „**Custom**“ and fill in these values, press OK:

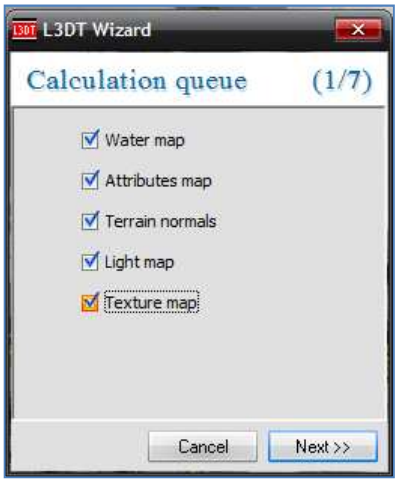


- Now get a trial version or buy right now L3DT at http://www.bundysoft.com/L3DT/. The Trial version only allows terrains up to 1024x1024 and textures up to 1024x1024 as far as I remember (I’m a very satisfied customer for years now ☺). So my screens show the Professional version. First, import the Terragen heightmap at „File > Import > Heightfield“ and the heightmap should appear in greyscale:

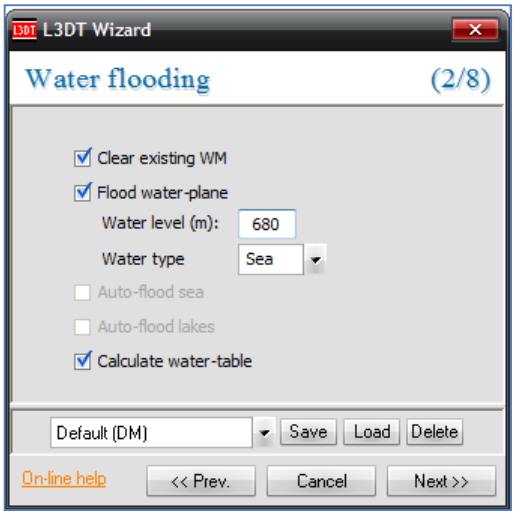


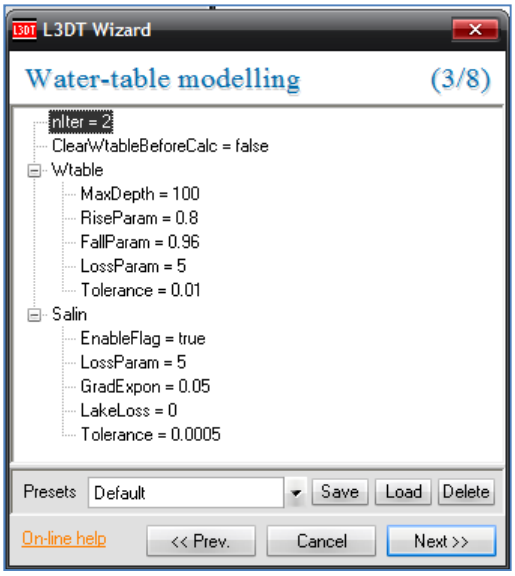
First you should check the water level – unfortunately the Grand Canyon is not a flat lake so we have different heights in the map, you should approximate the water level – just move the mouse over the areas and remember the maximum height, here it is about 680 to 545 meters, so my water level will be 680 meters. This will be important later in BlitzTiles so write the value down, we must change this in the grandcanyon.ini later!

- A hint about heightmaps and how to get more quality textures: they should be as large as possible, we can downsample them later. It will increase the quality of the texture dramatically! In my example we will render a 4096x4096 texture, you can render higher sizes and reduce them later which looks a little bit nicer then. Now go to **Operations > Calc Wizard** and check all options, click Next:

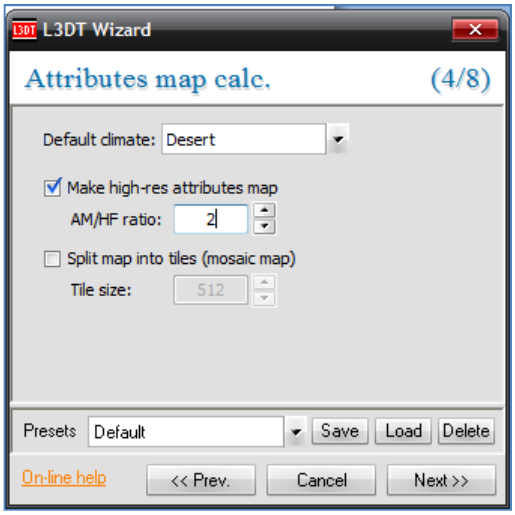


- Set the water level you calculated before, it was 680 in my example, click Next and leave the next screen like it is:

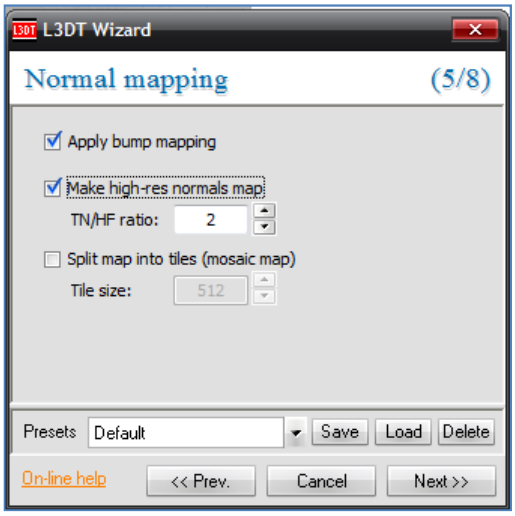




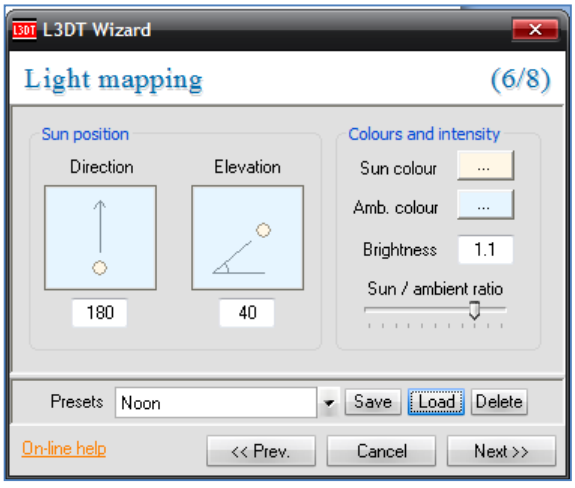
- Now choose the climate. The Grand Canyon is desert-style so switch to desert, set the attributes ratio to 2 which will result in a 4096x4096 attributes map, click Next:



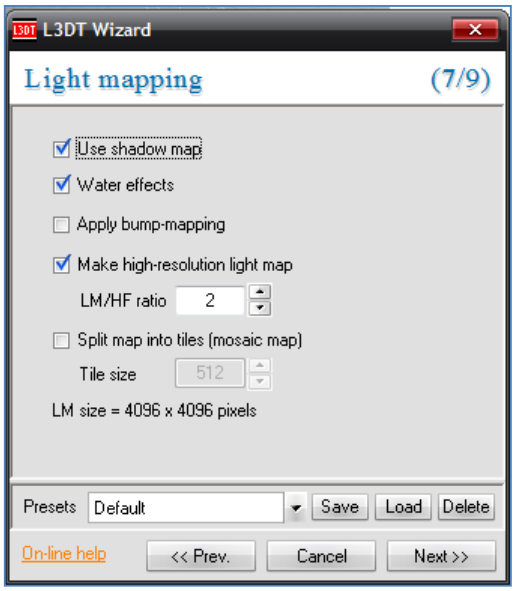
- Leave the next screen as L3DT already chose a ratio of 2 for the normal map, click Next:



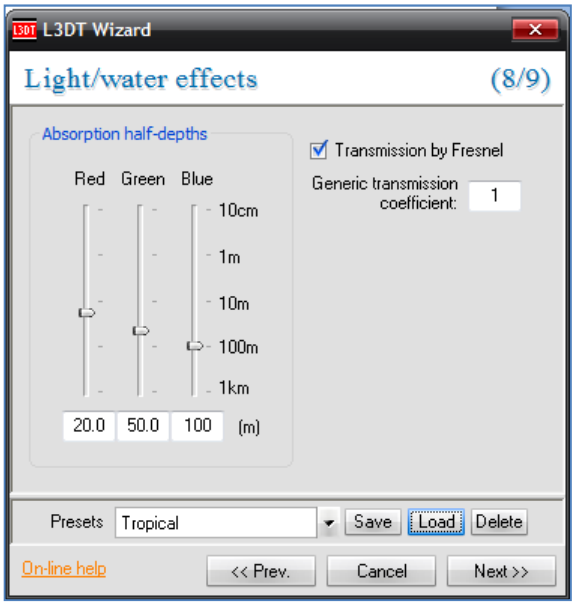
- Now comes the light. I figured out that the Preset „**Noon**“ ist he best one, so choose it and click „**Load**“ at the right side. This makes the sunlight coming from the south in a decent angle, click Next:



- For the light mapping leave everything, click Next:

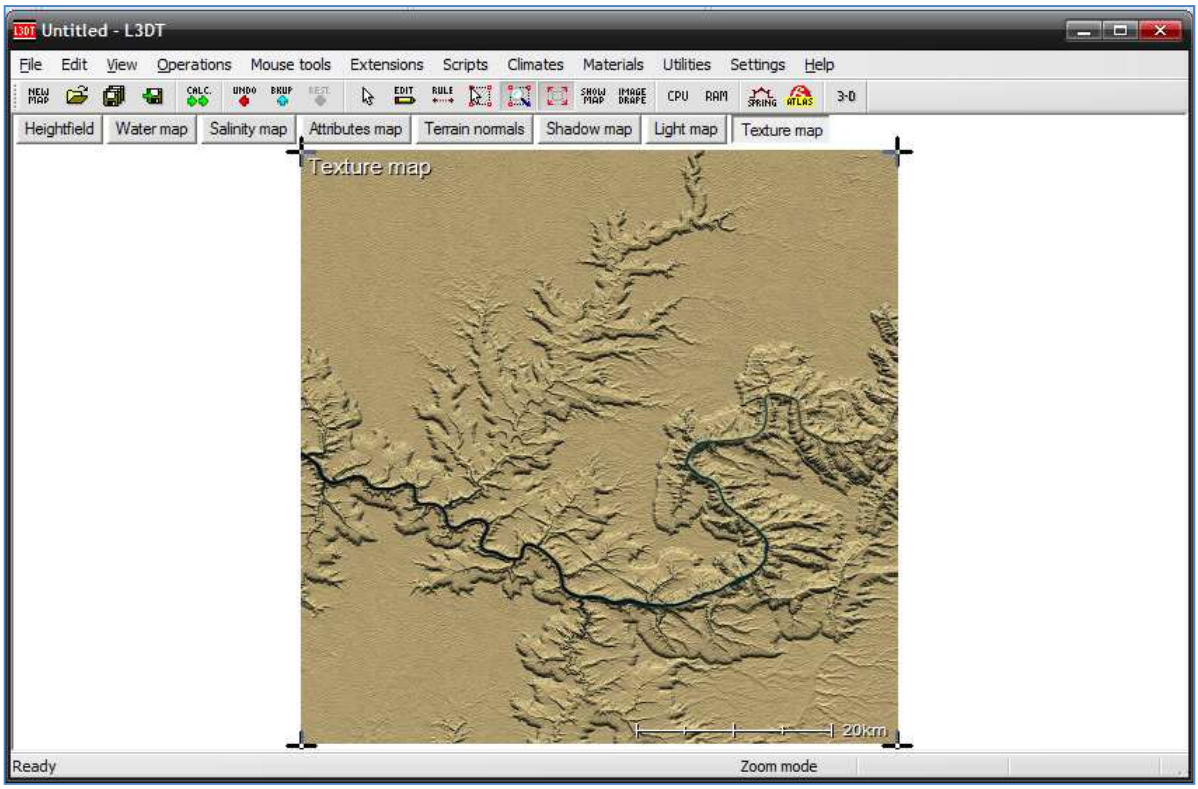


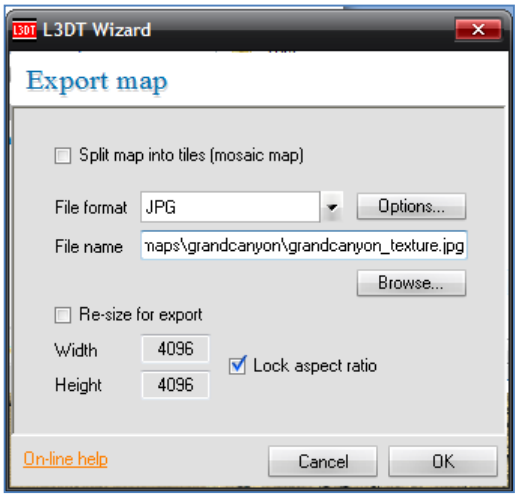
- I love tropical water because it is in a nice blue tone, so load the Preset „Tropical“ and click „Load“, then click Next:



- Now the final setting, here you can experiment with the antialiasing parameter, we leave it for faster rendering at „2x“. When you click „OK“ the rendering starts and the time depends on the power of your computer. Lean back and watch L3DT doing the work (can take up to 10 Minutes now).

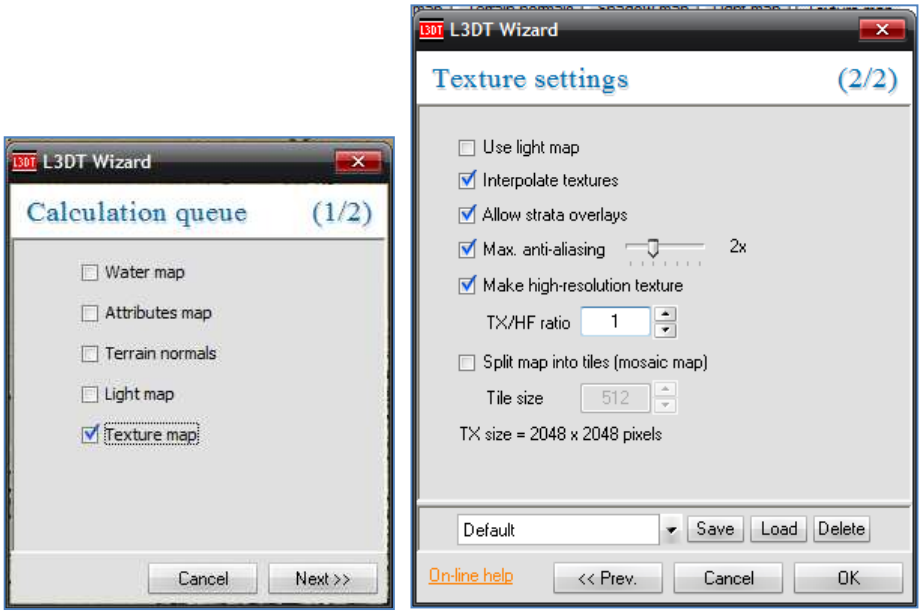
- The result should look like that. Now we can export our first map, go to **File > Export > Active Map** and click at „**Browse**“. Did you already create a new „**grandcanyon**“ subfolder in BlitzTiles maps folder? If not then this is the right moment. Call the file like the folder **grandcanyon_texture.jpg**.



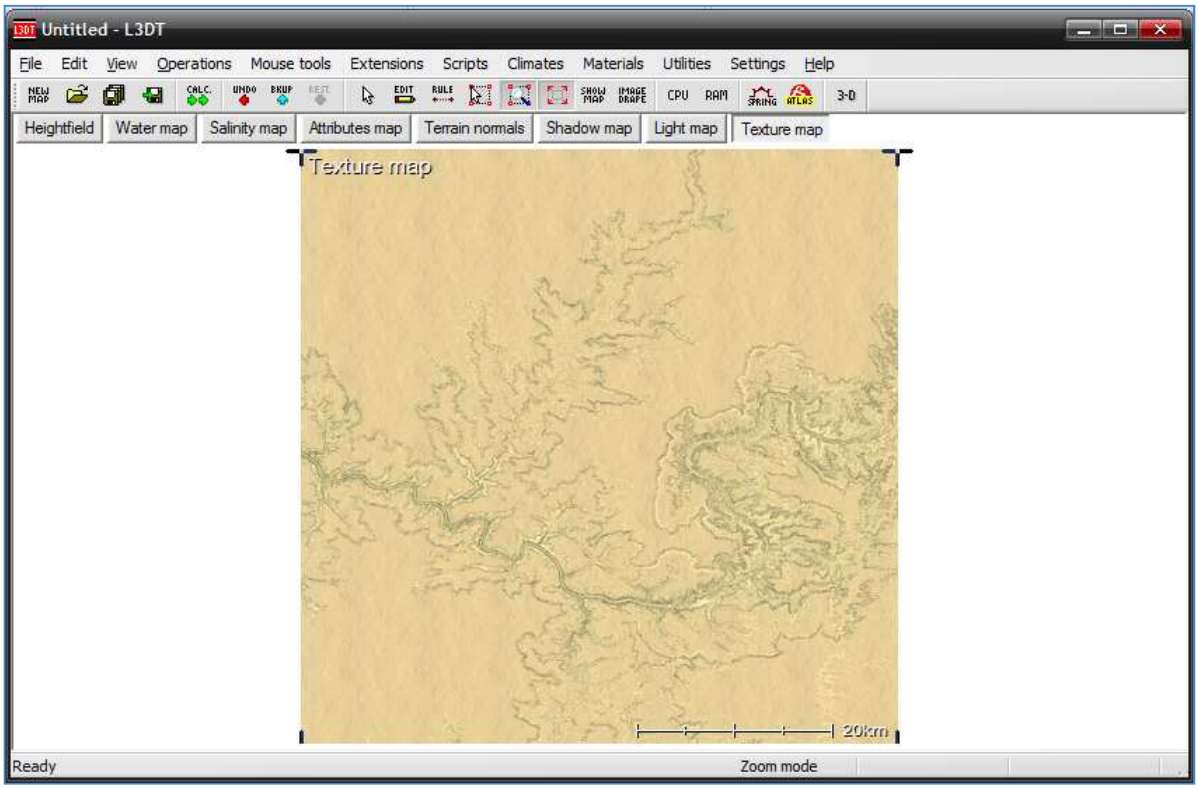


- Now we need a colormap – it is the same texture but without light informations and matches the terragen size. Go to **Operations > Calc Wizard** and just check „**Texture map**“ this time, click

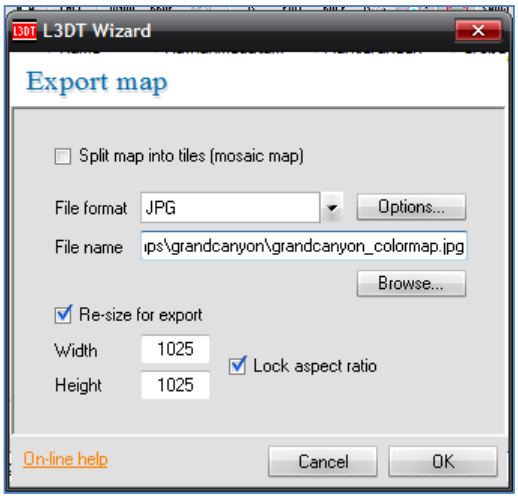
OK, uncheck the „**Use light map**“ in the next screen and set the ratio to 1:



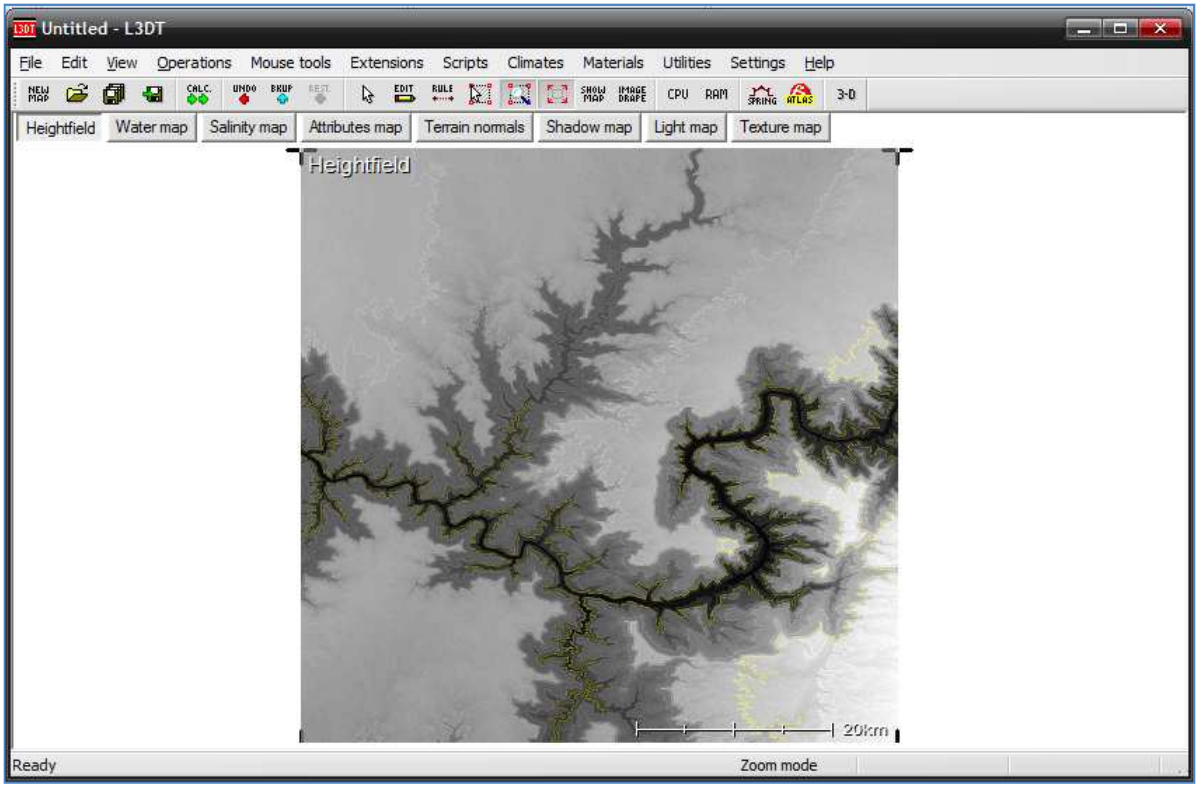
- The result should look like that:



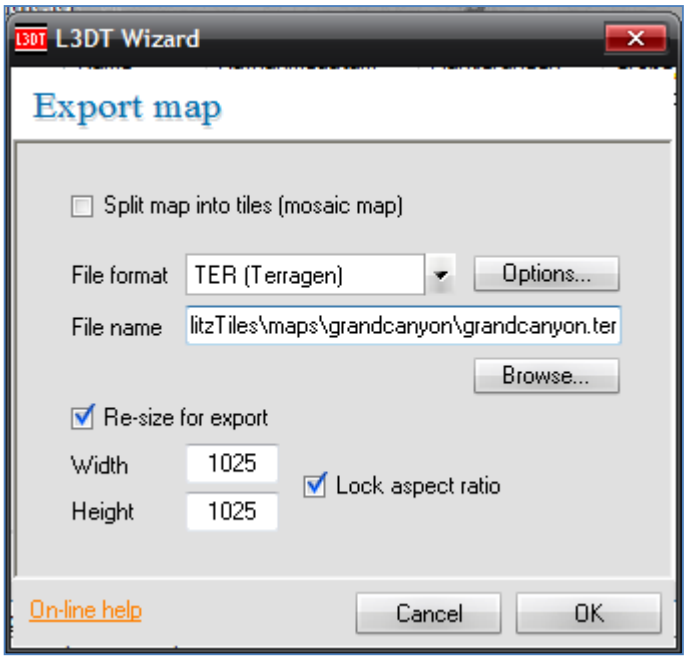
- Now export this map, too with **File > Export > Active Map**, but this time we resize the map to 1025x1025 and name it „**grandcanyon_colormap.jpg**“, put it in the maps folder again like the map before.



- Now we must export the Terragen map. Click at the top at the button „Heightfield“ so that we go back to the heightfield.



- Now comes the tricky part: we'll resize the terrain and must resize some parameters according to it. Take my hand: Go to **Operations > Heightfield > Resize heightfield** and resize it to 1024x1024. In the next step, we must increase the horizontal range by the factor 2 (because we reduced the number of horiziontal pixels by 50%). Go to **Operations > Heightfield > Change horiz. Scale** and increase it from 30 to 60. Now each pixel represents 60 meters in reality. If you don't do that, the vertical map scale gets to big and you will get peaks instead of mountains… Now export the map, go to File > Export > Export active map, choose File Format „TER (Terragen)“, set the size to 1025x1025 (because BlitzTiles needs a file mit 2^n+1) and save it with the name „grandcanyon“ to the maps folder, too.



- If you want to check the landscape in a preview, re-import the Terragen file as a heightmap and go to **Operations > Heightfield > Edit heightfield in 3D** and check if the dimensions are correct. If not adjust the horizontal scale again until it fits.

- Now we need two additional files in the maps folder: the INI and the preview. Just copy the two files from another map to the grandcanyon folder and rename them:

  zillertal_preview.jpg to grandcanyon_preview.jpg
  zillertal_ini to grandcanyon.ini

  We can create a nice preview later. Now edit the grandcanyon.ini and replace all „zillertal“ text with „grandcanyon“. After that, edit the blitztiles.ini and set the scene to „grandcanyon“. Now you can run the map and finetune it. And don’t forget to set the water level to 680 in the INI!

  And thats it, folks! Here some additional useful informations I found out so far:

  - A map with 1 arcsecond means: The earth has a circumfence at the equator of about 40,075.02 km, which is 40,075,020 million meters. 1 Arcsecond is 1/60 of 1 Arcminute is 1/60 of 1 degree. So one pixel in a map with a 1 arcsecond resolution is **40,075,020 / (360*60*60) = 30.922 meters**. This is approximate the value of the horizontal scale of 30 used in Terragen. If you use other resolutions than 1 arcsecond recalculate the resolution again to get a realisitic dimension of your map!

  - You should always prefer the NED data over the SRTM data, because SRTM data ist faulty sometimes (the Grand Canyon for example has many gaps in SRTM data)

  - Dont use too large areas with too low resolution (ex. San Francisco Bay Area with a scale of over 200km packed into a „small“ 1024x1024 Terragen map. It won’t look good so dont even try it. Either increase the map size (which will lead to FPS drops) or only use parts of it.