Preparing Binary Planetary Data

Mars MOLA data can be extracted and visualised by 3DEM and then exported as Floating Point Binary data. The exported data has to be prepared to be of use in Bryce.

Preamble

There is still no better free program available to visualise MOLA and GTOP data than 3DEM. It cannot export these data sets as GeoTIFF (64-bit monochrome reals), but the raw data can be exported as 32-bit monochrome reals. The binary (BIN) file is written and additionally a header file (HDR), which is a text file describing the data in the BIN file. There is some work involved to make the data ready to be used as a terrain in Bryce.

3DEM

Open the image data available, e.g. MarsMOLA128 or GTOP030. In the *Area Selection*, use *Lat/Long* (spherical) and select the part desired. You have to navigate to the data set. GTOPs are tar-gzip-ed files with DEM and header data, Mars MOLA are unzipped raw image file (IMG) and label (LBL) files in text format describing the data.

Once the tile is displayed, the colour representation with the coordinate grid can be saved (*File > Save Map Image*). This image can be used in Bryce to drape over the terrain. Best if the camera looking straight down.

The image data can be saved as *Binary, Floating Point* (*File > Save Terrain matrix*). There is also a *Binary Signed Integer* option but it only saves the data as 16-bit integers. As signed integers, they cannot be used in Bryce without adjustments, Bryce wants unsigned ones.

The floating point binary data are also signed but are 32-bit and have a much better resolution. If the data has to be processed to make it Bryce compatible anyway, using the higher resolution makes more sense.

The data file `myfile.bin` contains the data, the file `myfile.hdr` (not a radiance hdr file) the information about the data. In case of Mars, the tile is 3840 x 3840 pixels. It would be possible to generate an Image File Directory (IFD) with the tags describing the data, put it in front of the data and call it a TIFF. Using HDRShop seems to be the easier way.

HDRShop

HDRShop can open, read and interpret many raw — or pure data — formats. *File > Import RAW Data File* prompts for a file to access and opens a dialog. Enter the *Width* and *Height* as found in the header file; keep *Header Size* at 0, then select *32 Bit Floating Point* and *Monochrome*.

Once the image appears, adjust F-Stops so that the image can be seen and measure the pixel values. HDRShop flips the negative pixel values to positive for display. Deep trenches or craters are suddenly high mountains. If this image is saved as HDR or Floating Point TIFF, the negative values stay flipped. Using the Absolute function in the Calculate menu does not help.

What must be done is to add an image with positive pixel values at least as big as the most negative value. If the most negative value in the image is -4478, the new image should have all pixel values at 4478, or better 4480 or 4500. Note that the monochrome 32-bit image is automatically converted to a 96-bit colour image when loaded into HDRShop.

Create a new image *File > New*. Scale this image to the same dimensions as the loaded one, e.g. 3840 x 3840 (*Image > Size > Arbitrary Size*). This may take a while. Once a black image with pixel values 0.000 appears set the pixel values to the absolute of the lowest value in the loaded image. *Image > Pixels > Clear* and enter that value, e.g. 4480.

Add the loaded and created image: *Image > Calculate*. Maybe only a white image results but the pixel values are really high. Just divide all pixel values to a more sensible value. In the example, the values go nearly as high as 4500 so dividing the values by 1000 is sensible.

Dividing as such is not possible, but multiplying by 0.001 is the same: *Image > Pixels > Scale*. With adjusting Stops ([-] or [+]) the low parts are now darker, lower, not brighter, higher.

Looking at the result shows that it is upside down and needs to be flipped vertical: *Image > Transform > Flip Vertical* (or [V]). This is the 96-bit representation of the initial binary data file. If desired it can be rescaled to 4096 (*Image > Size > Arbitrary Size*). Finally, save it as either Radiance HDR or Floating Point TIFF.

TIFF 4816 or MANY216U

Open the saved 96-bit HDR or TIFF file and convert it to 16-bit unsigned integer. The resulting image can be loaded into the Terrain Editor in Bryce.

Observation: There is a small difference whether the image is saved as Radiance or TIFF and then converted to 16-bit greyscale. The TIFF file is probably more accurate. The difference can be seen when the images are subtracted from each other, or when stacked in Bryce.
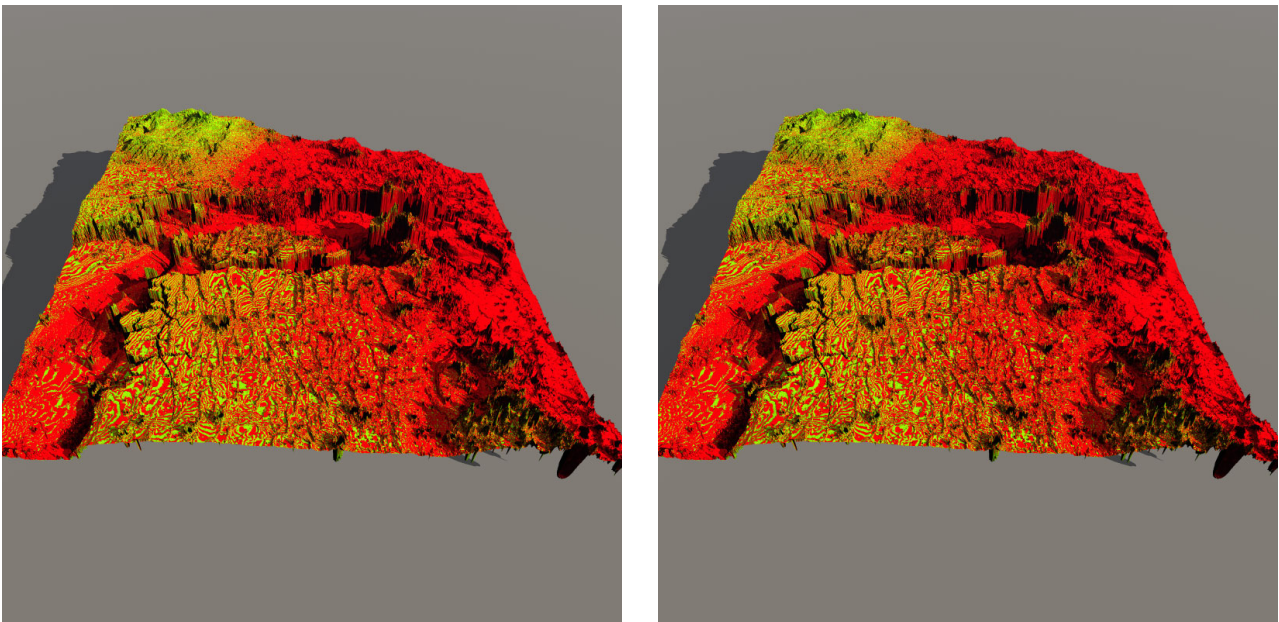
Red the HDR saved image, green the TIFF saved. At left, both terrains with *Smooth* enabled in the Terrain Editor, at right with *Smooth* disabled.

Software

3DEM original site discontinued, available here: http://www.visualizationsoftware.com/3dem

TIFF4816: https://www.horo.ch/docs/progs/zip/TIFF4816.zip

HDRShop 1.03 is not available anymore. V3 is $200 and available from: http://www.hdrshop.com/