Satellite images in 3D (with or without reception) HRPTReader, GroundMap and 3DEM

Here some lines – without claiming to be other than an initial aid – to try to explain as simply as possible the operation of the program 3DEM, starting from HRPT images of the NOAA satellites. The numerical data can either be received directly or downloaded from the Internet at the following address:

http://www.class.noaa.gov

where they are freely available after registering (Login). The process is described here:

http://perso.wanadoo.fr/f6bek/nouveau_fichier10.html

After having decoded the numerical data thanks to the program 'HRPTReader', available on the site of David Taylor:

http://www.david-taylor.pwp.blueyonder.co.uk/software/hrpt.htm

It is essential to process them in order to make them usable with a projection and a dimension adapted to 3DEM. This will be the subject of a treatment in the GroundMap software:
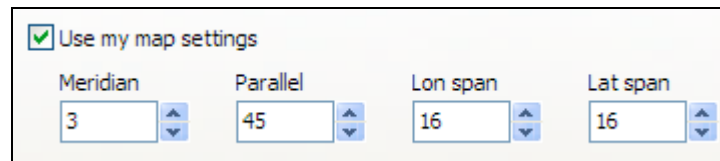
http://www.david-taylor.pwp.blueyonder.co.uk/software/groundmap.htm

First of all, let us consider the data after their processing with HRPT Reader. The images must be saved without borders nor names of cities etc… (these additions do not form part of the image and would give at the very least unexpected results in 3D). They must be saved with the function 'Save displayed image' because this method generates, at the same time, a file of extension 'lcn' comprising information of a geographical nature which will be essential later.

Choose an easily remembered location for your files. Personally I chose to create a folder named 'satellite images' on the Windows desktop.

It is now that Ground Map comes into play. It should be specified that the operations which follow, call upon advanced functions requiring the **registered** version of the software.

Open 'GroundMap' and to choose the following options in Menu/Options/Setup:

- Output size 'Giant-3600 X 2700'
- Location 'User'
- Map projection 'Cylindrical equidistant (zoomed)'
- In Setup, select 'Uses my map settings' and to fill as follows: 3-45-16-16.

In the 'Files' menu is a function 'Open mapping list…'. You must use it now. The file in question, named 'Map_list.mpl', is generally in the GroundMap folder. It is advisable, for greater convenience, to store a copy in your work folder.

Open this file.

In the 'Files' menu, choose 'Open location data…' and in the window which appears, open the folder in which you saved your images and select the one you require. It has an extension 'lcn'.

GroundMap works and produces an image with characteristics that you have selected. You must now save it using the function 'File/save image…'
Choose to save, preferably, in the same folder as before.

There is no reason now why you cannot—within the limits of good taste—give this image a little more colour or adjust the brightness/contrast using your favourite image processing software.

Now the program '3DEM' comes into play. It is free, and can be downloaded from:

http://www.visualizationsoftware.com/3dem.html

This software makes it possible (inter alia) to superimpose your satellite images over terrain models. This implies that for the two files to make a perfect superposition, they must **possess absolutely identical** geographical coordinates.
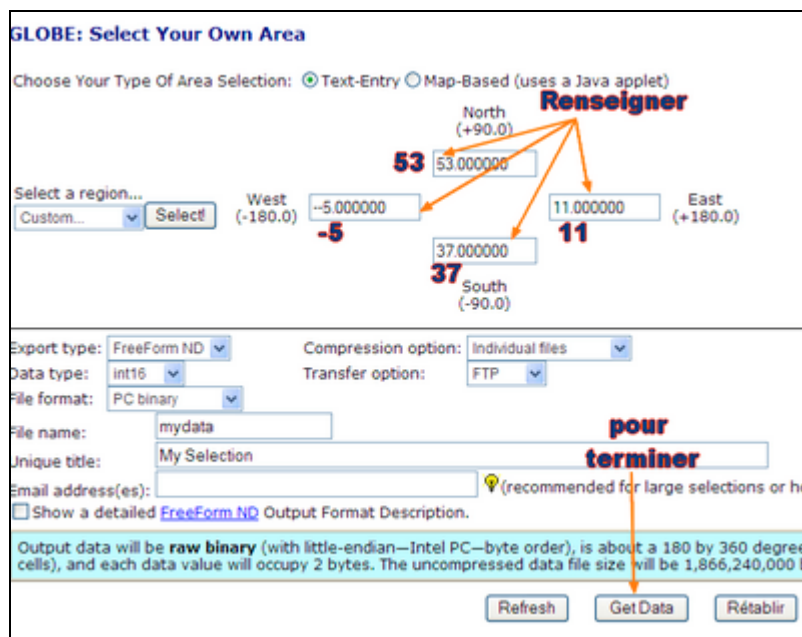
The image has already been created and saved.
You now need a terrain model. This can be downloaded gratis from:

http://www.ngdc.noaa.gov/mgg/topo/globeget.html

Unfortunately, the function 'Premade parts of the world' is difficult to use for our regions because the portion that interests us is located exactly on the intersection of 4 rectangles. We will therefore have to make use of the option 'Select your own area using the same geographical area that you used in the GroundMap image (see image below).

This is important to make it correspondence with the location used by GroundMap.

You thus open another window from which you are able to download the selected files.

The following image shows the window in question.
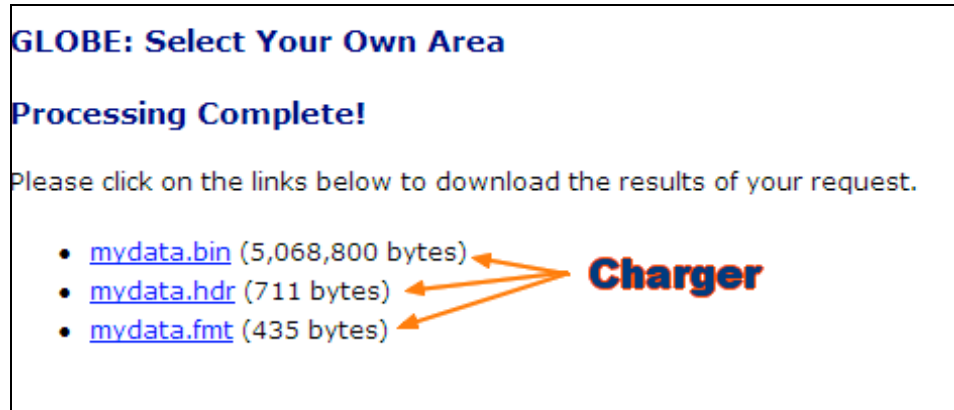
If any of the downloaded files have an extra extension '. txt', remove this. So 'mydata.hdr.txt' would be edited to 'mydata.hdr' etc.

Note well: I would prefer to download a larger region which would correspond more closely with our geographic situation, but the site prevents download of files above a certain size.

Open then the software 3DEM.

- File/Load terrain model
- Choose 'Terrain matrix (bin, txt) as indicated below
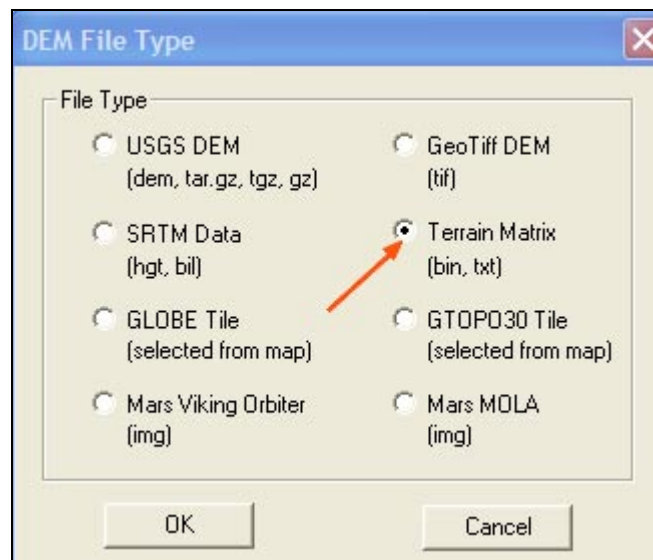
Locate the folder containing your recent downloads and select 'mydata.bin' (using whatever name you selected to download them)

An image centred on France then appears – your terrain model.
If you have followed all the steps in GroundMap correctly, your image will have the same geographic coordinates as the terrain model.

It is therefore ready to be 'overlapped' with the terrain model.

To achieve this, choose in the menu:

- Operation/F4 Apply/Remove Map Overlay
- Click on 'No' in the warning window that appears.
- In the following window, (Apply Map Overlay) click on 'Load'.
- Load your GroundMap image. This image is called 'remapped.jpg' by default.
- Click 'OK' in the notice that now appears on the screen
- Your satellite image now appears in the loading frame - validate using 'Accept'
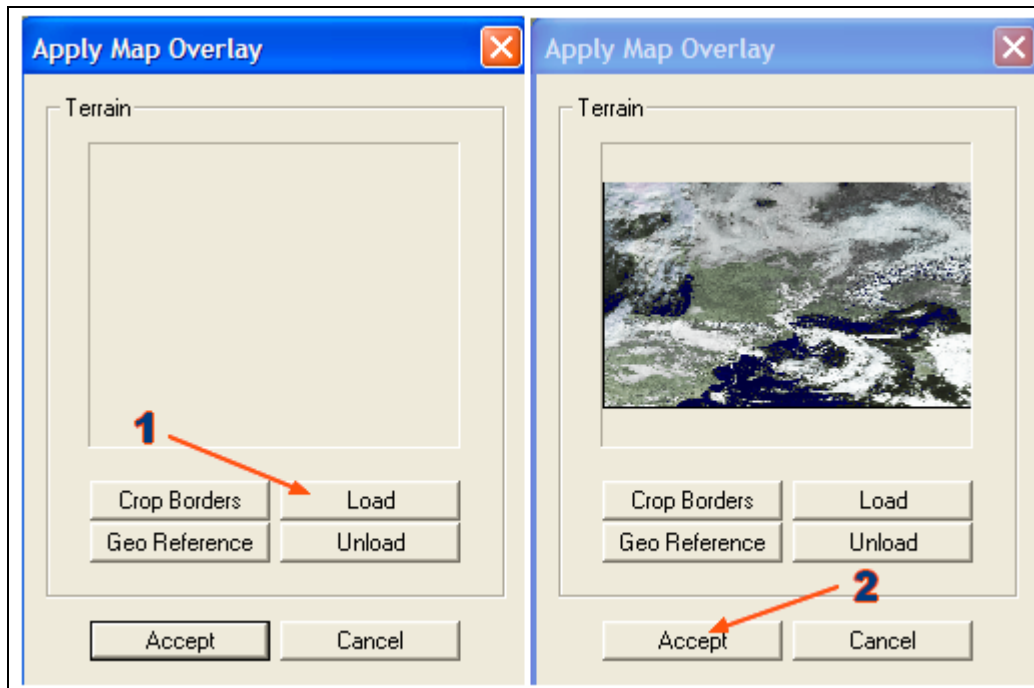

The satellite image becomes available on the working screen, covering the terrain model. You can see on this screen a black square which you have without doubt already noticed when loaded the terrain model. This zone of limitation comprises one side with a notched part in the middle.

This square is mobile and redimensionable. You must:

- place the notched part in the **from which** you wish to observe the image
- Move the opposite edge at the point in the direction towards which you wish to observe
- Increase the size of the visualisation zone as required

The image immediately following shows the square sized to allow a view of a fairly large section of the Alps in the direction southeast.
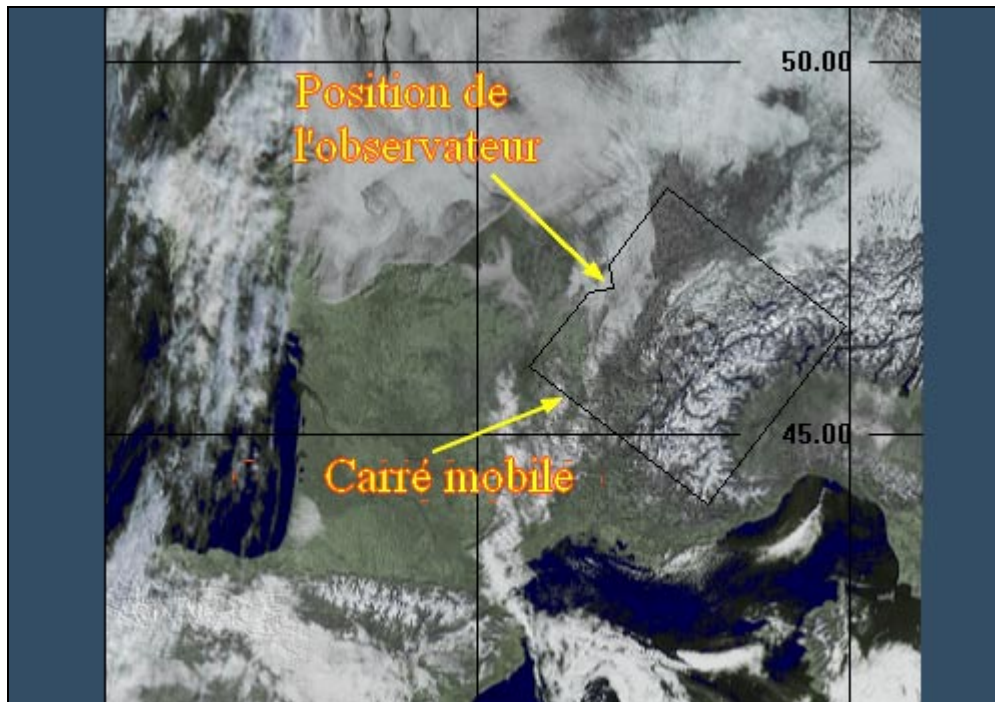
The following operation will allow generation of the image in 3D.

Choose in the Menu
- 'Operation/F2 3D Scene'

A new window appears. It is shown on the next page, and the **principal** functions are described immediately below:

1. Legend – the title, which will appears at the top of the image
2. Dimensions chosen for the image.
3. Observer's altitude (only if 'Background' is selected in point 6 below).
4. Co-ordinates and elevation of the sun, to be modified according to the hour of acquisition of the image.
5. Terrain vertical magnitude (%) (lack of realism so important).
6. Terrain position – foreground or background.
7. Terrain resolution, min or max (honestly, I haven't seen any difference).
8. Terrain type.

This last point is of particular use to adjust the image to the terrain model. I recommend starting with a 3D image and selecting a region containing part of the coast. The function 'Island/Ocean' ????? the image thus generated appear clearly (if it exists) a ????? between the terrain model and the image itself.

It will be then easy to rectify this using the function 'Adjust Overlay'. It is appropriate at this stage to proceed by very small movements.

Return now to the 'Mountain/Plain' adjustment.
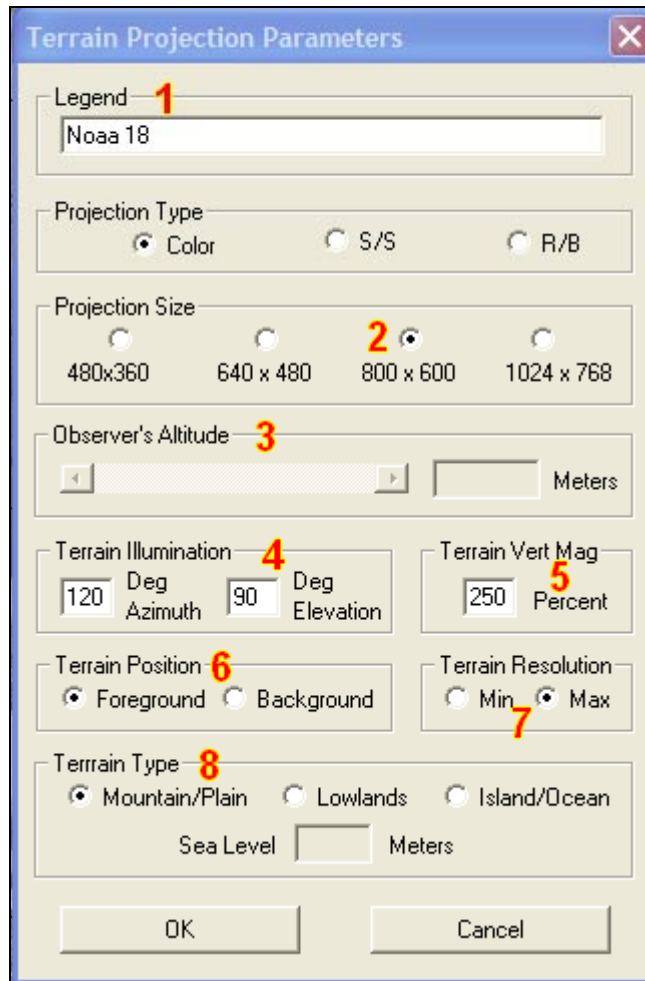
While clicking on 'OK' your final image will appear. There are strong chances so that you
Will not be immediately satisfied with it. The program possesses all the tools to allow you
to proceed with the modifications which you wish.

The image that you come to create is presented in a new window which contains the two following
buttons:
- File
- Operation

The first will be very useful to you for saving your work.

The second will allow you respectively:

- F1 - to return to the positioning of the observation square.
- F2 - to modify the scene while reconsidering the choices of the window above.
- F3 - to modify the colours of the terrain model and text.
- F4 - to load a different image.
- F5 - to adjust the terrain model in proportion with the image (as explained above) and to modify
  the position of the observer.

After this, it is recommended to carry out numerous tests to become completely familiar with the
program.

Here in are some additional sites where you can find more information.
One of them allows you to download numerous terrain as well as high-definition satellite images.


http://www.suissegeo.ch/didacticiels_dossiers.php?page=3DEM
http://ailexhere.free.fr/index.php?p=http://ailexhere.free.fr/volvirt11.php
http://perso.wanadoo.fr/darthmagus/3dem.html

All the above sites are in Frenc.- for more, try looking for '3DEM' in your search engine. You will be surprised.

By clicking over part of an image with the **right** mouse button you can obtain a graph of elevation of the journey
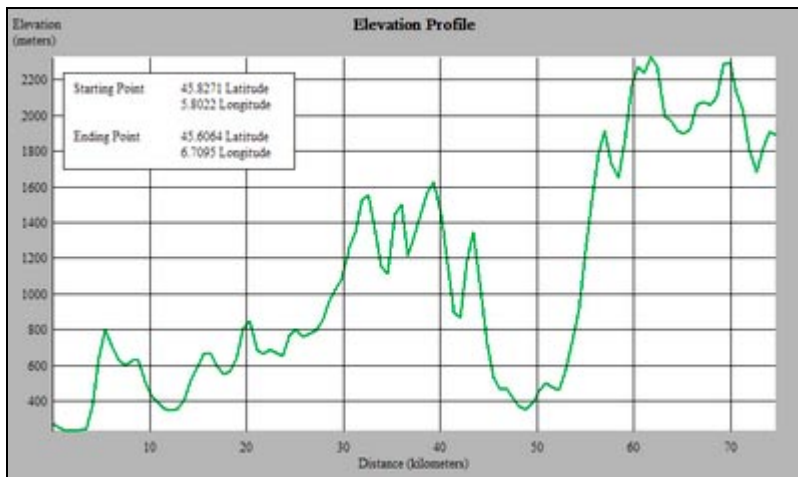
Some words on the flyover mode of the program.

- Open the option 'GPS/GPS Points by mouse'.
- Indicate on the chart, with the mouse, each point of passage of your itinerary.
- Finish with 'OK' in the 'GPS PointEntry' window (the number of points traced must appear there).
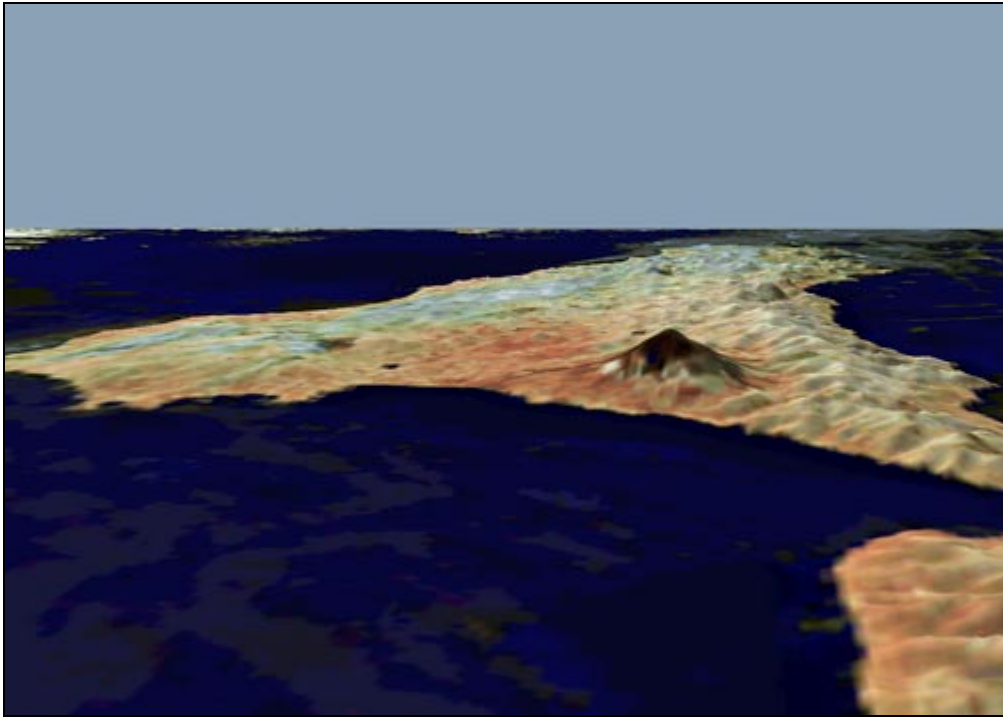- Use 'Operation/View Flyby' and select 'GPS' in 'Flyby Type'

Click on 'OK' to begin your trip on the chart on the selected itinerary and the altitude, speed etc. – defined in the 'Flyby projection parameters' window (ask a reasonable speed in connection with your itinerary).
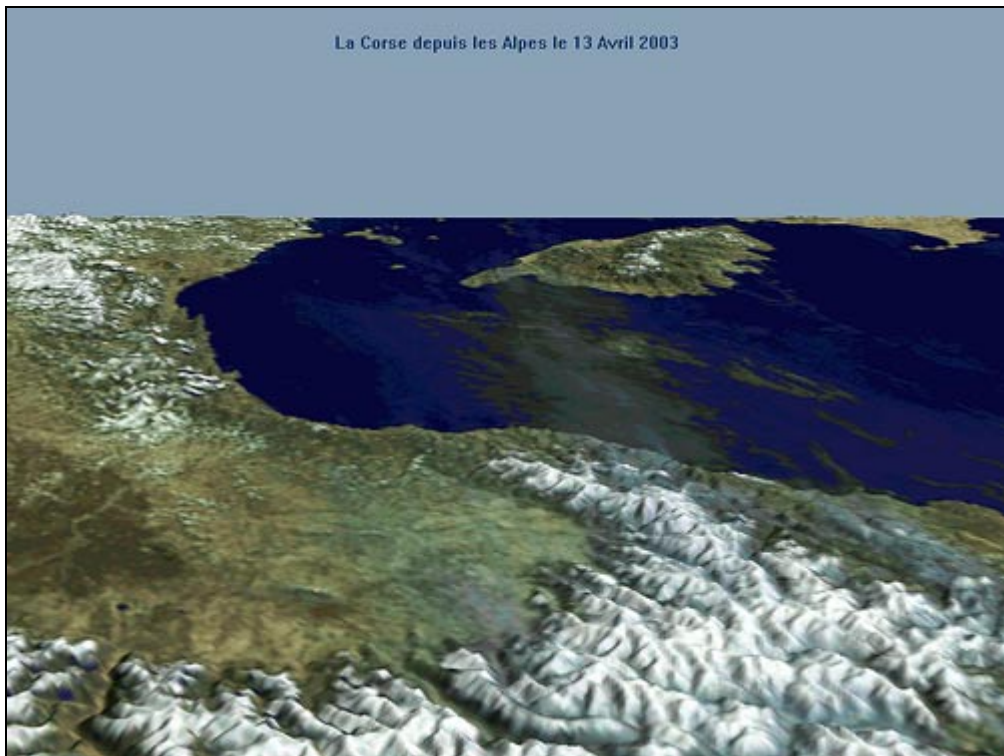

Many tests are necessary to master this.

To save this animation, in AVI or MPEG, use the 'Operation/Animate Flyby' function.

Finally, here are some examples obtained from HRPT images received from NOAA satellites.

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Sicily and Mount Etna

La Corse depuis les Alpes le 13 Avril 2003

The southern Alps and Corsica