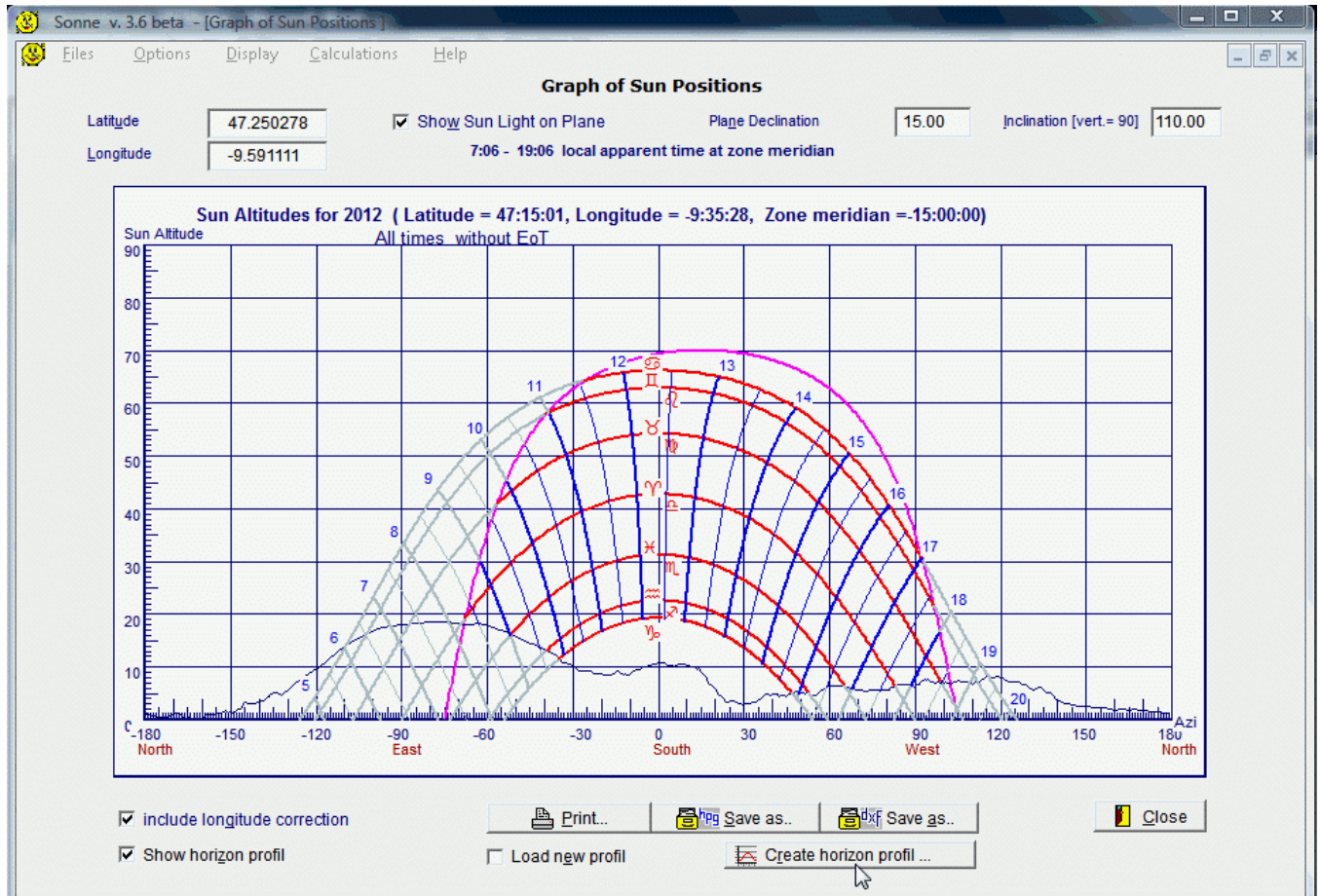# I. Generation of Horizon Profiles (Skylines) with Software SONNE

For generation of horizon profiles (see screenshot below) you have to download the local digital elevation data (DEM or SRTM) from the web (see page 3ff). Afterwards do the following steps:

After start of SONNE select menu *„Calculations / Graph of Sun Positions"* :

1.   After click on button *„Create horizon profile …"* (see arrow in the image above) you get:
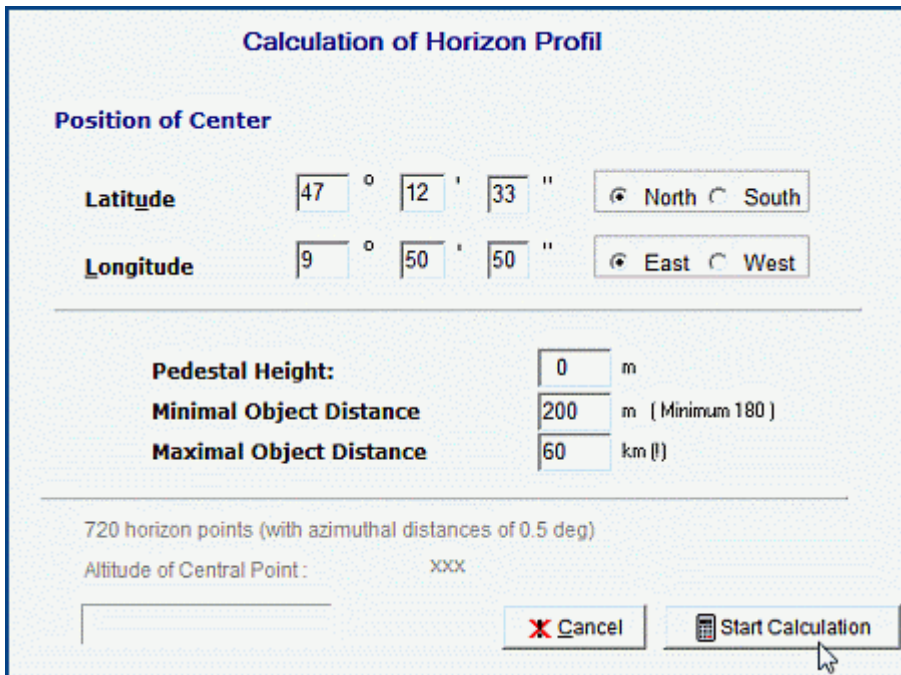

Now you can input or correct the different data displayed:

a) longitude and latitude of your location of interest.

b) *„Pedestal Height"* = height of observer above the local ground.

c) The calculation includes only objects (hills, ..) further away than the *„Minimal Object Distance"* in m(!), 180 m at least and nearer than the *„Maximal Object Distance"* in km (!).

After input of all data click button *„Start Calculation"*

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2. Now the digital elevation data must be loaded (format arcInfo ASCII). Here „srtm_38_03.asc" will be loaded (about 140 MB):
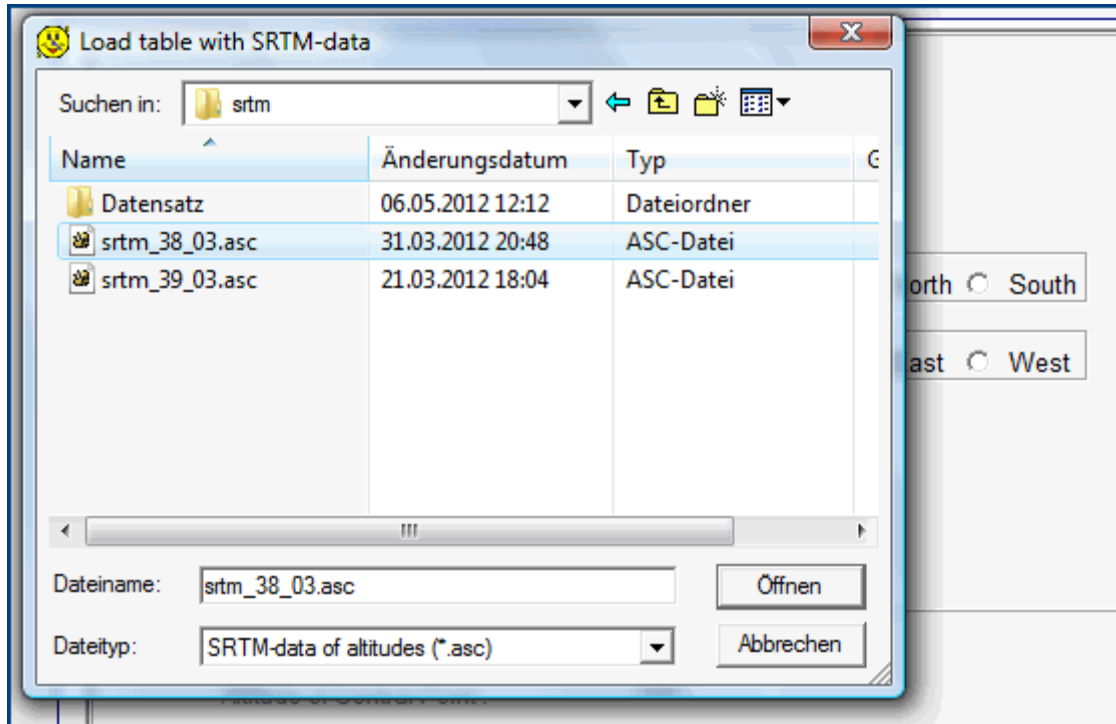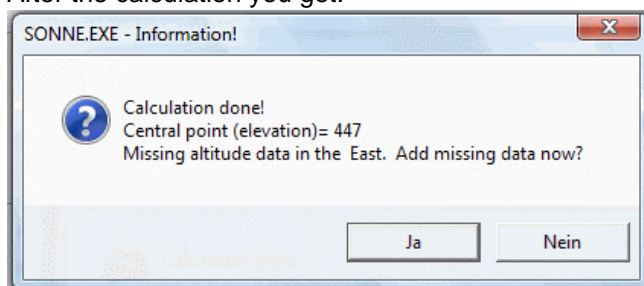

3. If your location is rather near one edge of the loaded table area then an information is given and loading of the neighboured data file is offered later on.
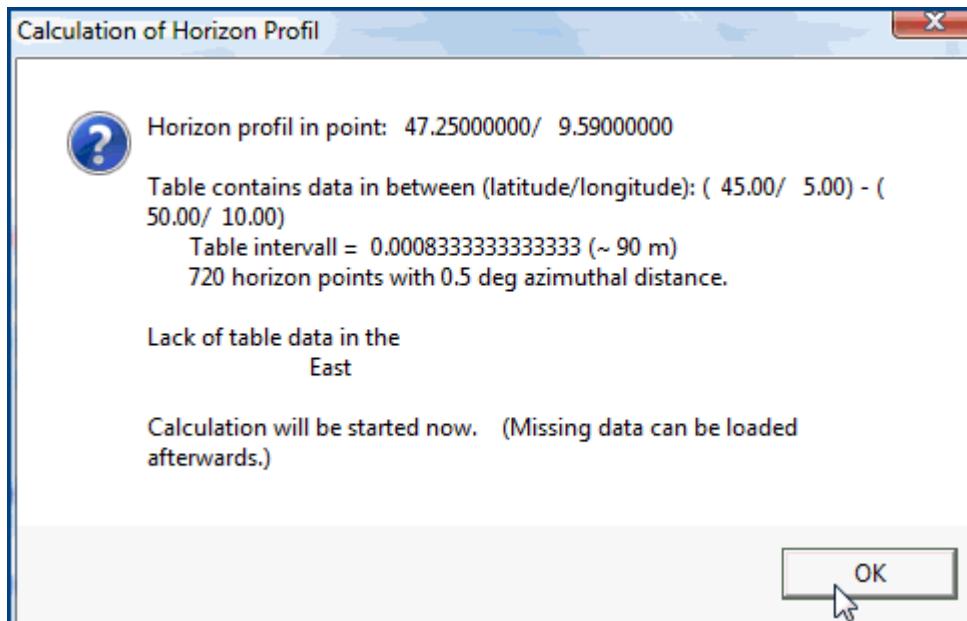
If your location of interest is near a corner of the table area, then succesive upload of all neighboured data tables can be done later on.

4. After the calculation you get:


To add data of the neighbour table(s) select „yes"

Select „no" if you decide to add no more data. Then a dialog offers the possibility to save the so far calculated horizon profile.

Always, at the end of the calculations a dialog is offered to save the calculated horizon profile (with extension*.ele). You need not include all "missing" data tables.
If it is useful or necessary to include further data depends on the the area !

To include a calculated horizon profile in the graph of Sun positions you have to load a saved horizon profile with extension "ele". This is started with click on checkbox *„Load new profile"* (right red arrow in image below). Then the selection of the horizon profile is offered. Maybe you have to click a second time onto the checkbox to start the upload.

If a horizon profile is loaded then the program also corrects the latitutude and longitude of the graph of Sun positions to latitude and longitude of the loaded ele-file.

After upload the horizon profile is included in the graph of Sun positions automatically.
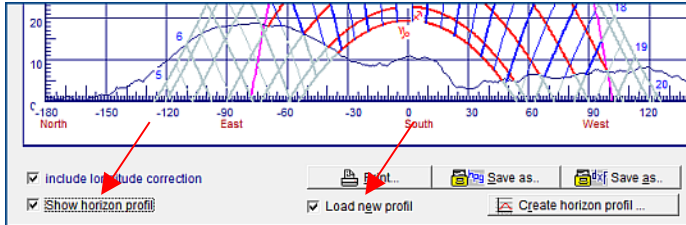
6. Now you can switch on/off the horizon profile with mouseclick on checkbox *"Show horizon profile"* (left red arrow above).

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II. Download Elevation Data SRTM-3

Software SONNE needs digital data elevation tables to calculate horizon profiles.
1. Download of such date tables is possible on web page

http://srtm.csi.cgiar.org/srtmdata/

Sroll down to the map on this website.
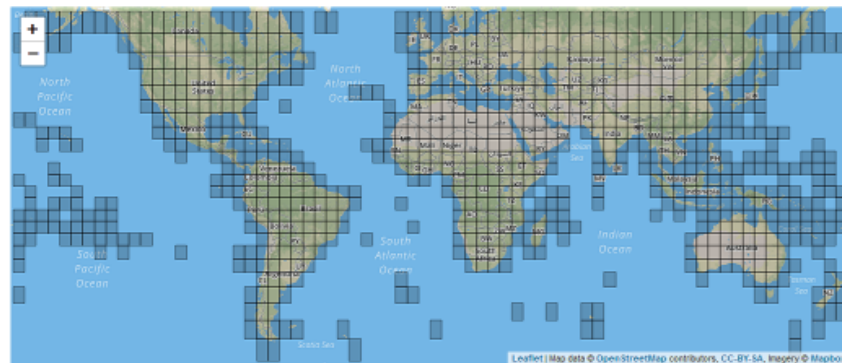
Fist select Tile Size 5 x 5 degree and Format EsriASCII. Afterward mark the area of your interest and click to `search'. You get the following window.

If all is correct press 'Download' SRTM. After a short time the downlad of the zip-file should start (about 40 MB).

The unpacked *.ASC-file needs about 140 MB. It contains a grid of about 36 Mill. altitude data. Software SONNE extracts all needed data from such data files and calculates the horizon profile of any location situated within one of the downloaded tables.

Download from the address below (which is nearly the same) leads to the same start page
http://srtm.csi.cgiar.org/SELECTION/inputCoord.asp

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3. Information on Elevation Data SRTM-3

SRTM-data vers. 4.1 are reengineered and adapted to system WGS84.

The offered data tables are Public Domain.

The area of these srtm-data-tables is 5° latitidue x 5° longitude (SRTM-3). For USA also data tables exist with 1" grid with and area of 1° latitude x 1° longitude (SRTM-1).

Comon data grid within 60° N and 60° S has grid width of 3" (in latitude and longitude). For USA grid width 1" is available.

The absolute elevatIon error (90%-error) for Eurasia is ± m, the relative error (which seems to be more important for local horizon profiles) is about ±8 m.

The grid with the elevation data is world-wide 3" x 3" (SRTM-3), which equals a distance of about 90 m x 90 m at latitude 0°. For USA (and Canada ?) also tables with grid 1" x 1" (SRTM-1) are offered which equal a distance of about 30 m .

Eastern longitudes in SRTM-3 are positive**. On the contrary Eastern is** negative in software SONNE**.** Therefore your input of Western longitudes must be positive in SONNE but, no changes are necessary in the downloaded tables.

Annotation on Possible Errors

Of course this method to calculate horizon profiles is not fully precisely. This because the data set is a grid and we know nothing about elevations in between this grid points. For instance peaks of mountains are often to low, because the peak itself is not exactly identic with a prticular grid point. In the 3" resolution of the dataset a mountain peak could have a distance up to about 60 m from the nearest grid point! As a consequence often the elevation angle of a mountain is often a bit to low but never to high.

The Structure of Format ArcInfo ASCII

The first 6 lines inform on the structure of the data file. In srtm-3 files you get:

ncols	6000	….. number of columns
nrows	6000	….. number of rows
xllcorner	5	….. longitude of most left first columc (her 5° Eastern longitude)
yllcorner	45	….. latitude of the last row
cellsize	0.00083333333333333	….. grid width in deg (here for 3")
NODATA_value	-9999	….. value for unknown elevation

If the latitude of the last data row is 45 deg then the latitude of the first data row (after the 6 start rows) is
45 deg + 5999*cellsize [=0.0008333333333333] which is a bit less than 50 deg.

Analogical, the longitude of the last data column is not 10 deg but
5 deg + 5999*cellsize   which is a bit less than 10 deg.
Of course 5 deg+6000*cellsize = 10 deg but, this is already the longitude of the first column in the neigboured Eastern data file.

Here a note on data quality:

Andy Jarvis[1], Jorge Rubiano[2], Andy Nelson[3], Andrew Farrow[4] and Mark Mulligan[5]: Practical use of SRTM data in the tropics – Comparisons with digital elevation models generated from cartographic data.

"Perhaps the most important message is that SRTM-derived DEMs provide greater accuracy than TOPO DEMs, but do not necessarily contain more detail. Cartography at scales of 1:25,000 and below (i.e., 1:10,000) contains topographic features not captured with the 3-arc second SRTM DEMs. However, if only cartography with scales above 1:25,000 (i.e., 1:50,000 and 1:100,000) is available, it is better to use the SRTM DEMs. This statement holds for use of SRTM DEMs for terrain derivatives (slope, aspect, landscape classifications, etc.) as well as pure elevation. For hydrological modeling, SRTM 3-arc second DEMs perform well, but are on the margin of usability. If good quality cartography of scale 1:25,000 and below is available, better results may be expected through digitizing and interpolating the cartographic data."(p. 33)

Bibliography :
Gianpiero Casalegno: Il profilo dell'orizzonte: calcolo e utilizzo negli orologi solari. In: Gnomonica Italiana, Nr. 24-25 (2011), S. 40-47.
Web Sites:
          http://www.viewfinderpanoramas.org/dem3.html - 3dem
 "SRTM_paper.pdf " from SRTM-Web Site: http://www2.jpl.nasa.gov/srtm/srtmBibliography.html
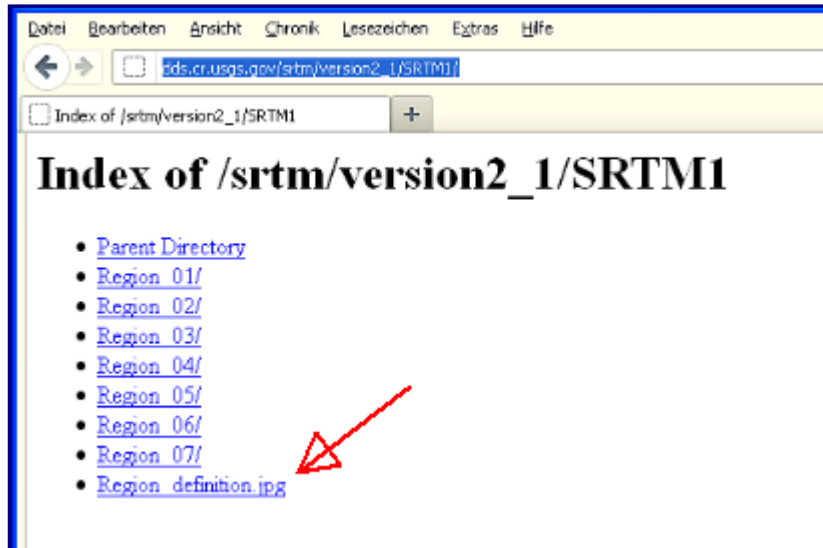
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III. Download of SRTM1 – Data for U.S.

SRTM1 (for the U.S. and its territories and possessions) are data sampled at one arc-second intervals in latitude and longitude. They are offered in tiles of 1 degree in latitude and longitude.

1. One possible download address is:

http://dds.cr.usgs.gov/srtm/version2_1/SRTM1/
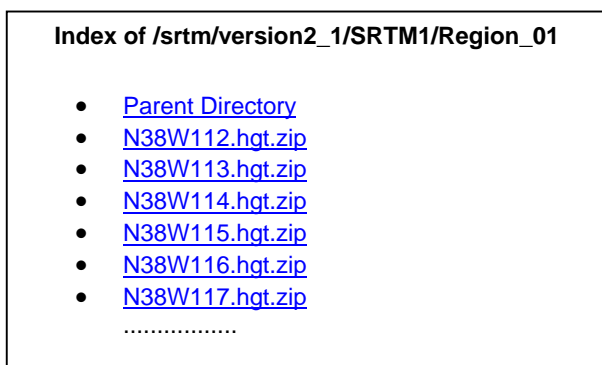

http://earthexplorer.usgs.gov/ is another website, where you can download srtm1 data by selection of "Datasets / Digital Elevation / SRTM" and   "Additional Criteria / Resolution / 1 ARC (US Coverage) ". For Download you have to register and login. As a difference to the here described method, graphical data selection is possible.

2. To find out your region of interest select "Region definition.jpg".
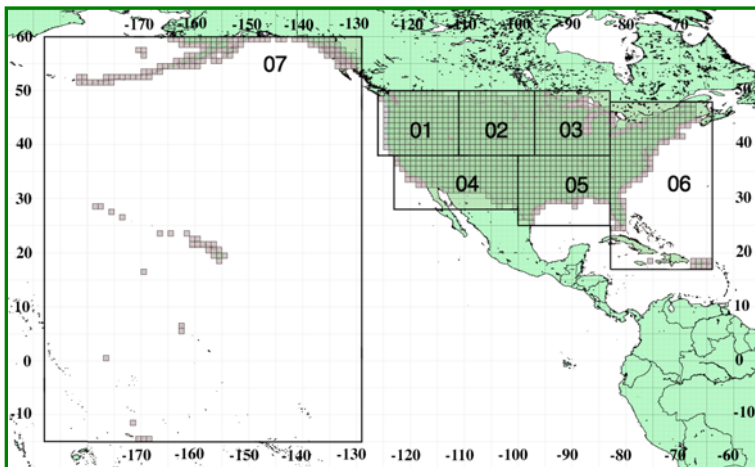
This image shows all U.S. regions but, the displayed regions are not linked to the the page where all elevation files of this region are offered. So you have to go back to the previous view.

3. When you are back on the previous view then select "your" region to see all the height files of this region.

Index of /srtm/version2_1/SRTM1/Region_01

- Parent Directory
- N38W112.hgt.zip
- N38W113.hgt.zip
- N38W114.hgt.zip
- N38W115.hgt.zip
- N38W116.hgt.zip
- N38W117.hgt.zip
  ....

Now out of all the files belonging to the chosen region you must select your files of interest.

The offered file names refer to the latitude and longitude of the lower left corner of the tile - e.g. "N38W112.hgt.zip" has its lower left corner at 38 degrees North latitude and 112 degrees West longitude. The height files have the extension *.HGT where every height is represented in two byte integers. NoValue heights are assigned as value -32768.

To get better horizon profiles you also should download the "neighbour data files" in the North, North-East, East, South-East, South,…of your selected location.

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4. If you want to use these downloaded data in software SONNE for calculation of a skyline (horizon profile) you have to *convert the hgt-files to ArcInfo-ASCII-format.* This can be done with the free software ("Open Source") "VTBuilder" . **Download of "VTBuilder"** from http://vterrain.org/Notify/ . Select "Binary Distribution"!

Windows Vista: It's strongly recommended to *avoid Vista if at all possible*. Many compatibility problems have been reported with it. If you must install on Vista, do **not** install to the default location of C:\Program Files\VTP. Instead, pick another location like C:\VTP. That has been reported to reduce problems (see http://vterrain.org/Download/Binaries.html). And this seems to work fine for our conversion problem.

5. For conversion of hgt to ArcInfo ASCII start VTBuilder:
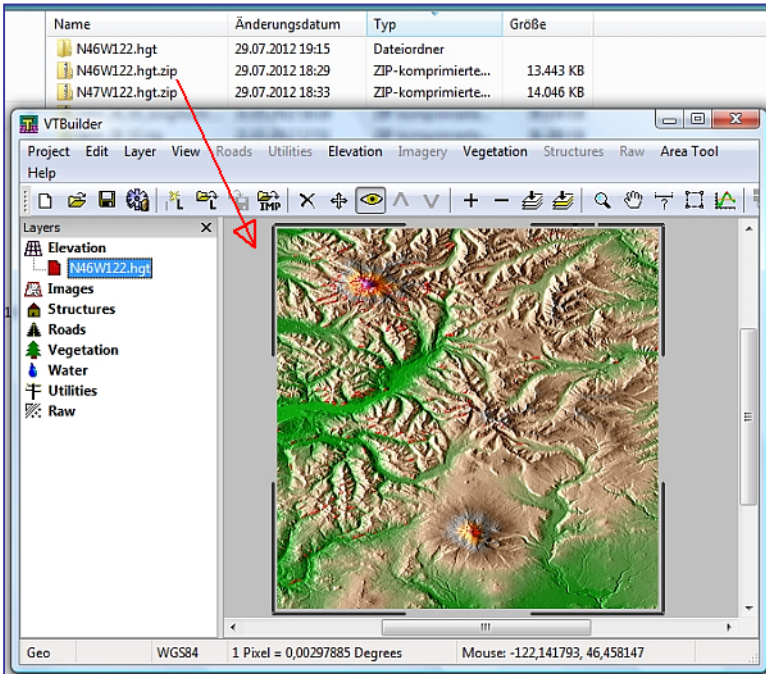
After start of VTBuilder you have to load the hgt-file. The easiest way is to pull and drag the unpacked (!) hgt-file (here N46W122.hgt.zip) into the window of VTBuilder.

After successful data import the elevation data are displayed automatically (see image left).
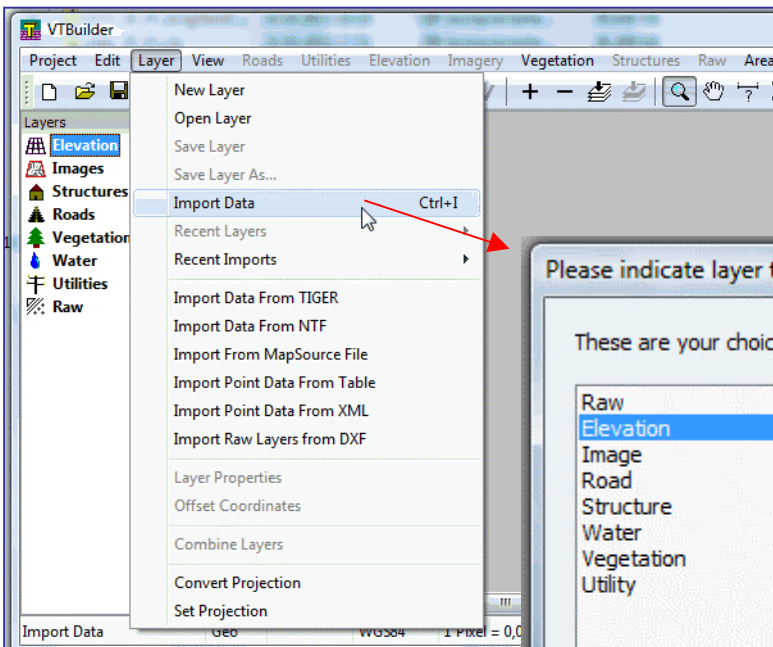
As a second way to load the elevation data file select menu *"Layer / Import Data"*. In the following window select layer type "*Elevation*". After *< Ok >* you select the unpacked hgt-file for import, not the packed zip-file. This seems to work with Vista too.
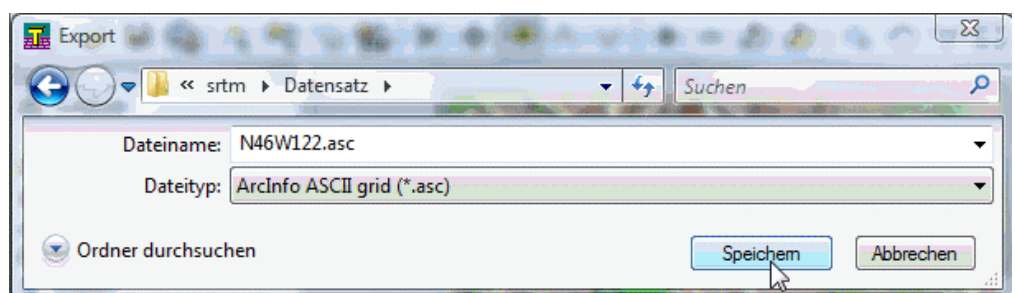
6. Generation of the ArcInfo ASCII File
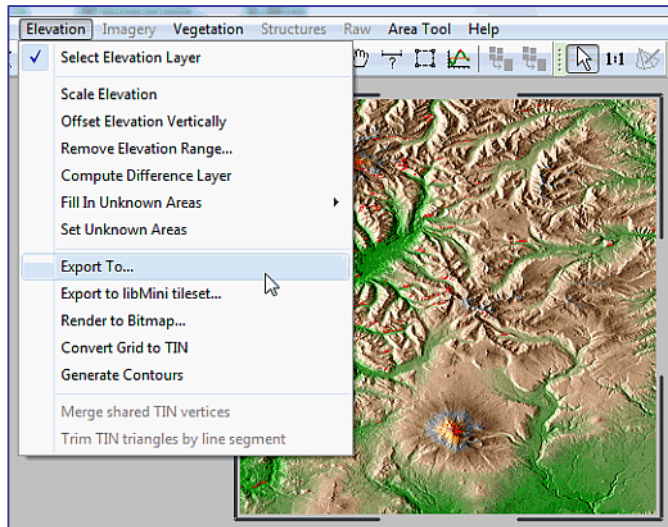
Elevation data are saved in ArcInfo-ASCII-format
by selection of menu *"Elevation / Export to … "*

In the following window select option *"ArcInfo ASCII Grid":*
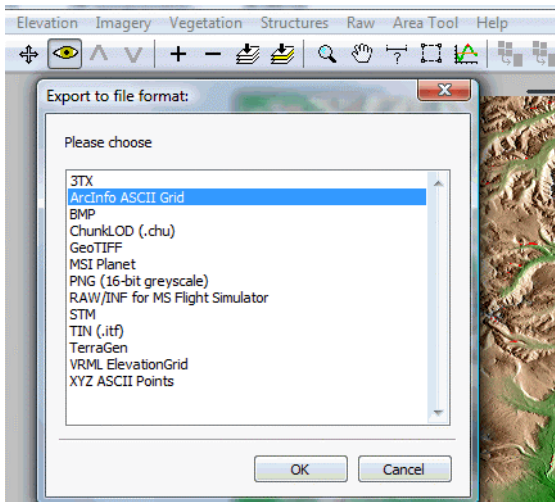
Click on button *< Ok >*
saves the elevation data
(see right image).

Now this data file is ready for further use in software SONNE.

Another website which offers 1 arcsecond elevation data for many areas in the world is
         „DIGITAL ELEVATION DATA" (http://www.viewfinderpanoramas.org/dem3.html - 3dem
The data files are of exactly the same type as the 1 arcsecond data files for the U.S.

Bibliography :
Gianpiero Casalegno: Il profilo dell'orizzonte: calcolo e utilizzo negli orologi solari. In: Gnomonica Italiana, Nr. 24-25
(2011), S. 40-47.

"SRTM_paper.pdf " from SRTM-Web Site: http://www2.jpl.nasa.gov/srtm/srtmBibliography.html

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