University of Gothenburg
Department of Earth Sciences

Exercise 8 - Raster data and terrain models

In this exercise, we will learn to work with raster data. You will create an elevation database using an interpolation tool in QGIS. A term often used in GIS instead of height database is the Digital Elevation Model (DEM). You should also create a number of terrain models with the help of your raster data. A terrain model is a product of any kind of analysis or calculation that you performed on your DEM.

What is raster?

Raster data describes an area that is divided into a measured grid. Each cell location is identified by the row and column numbers in the grid. Moreover each cell/grid has one or more numerical values indicating any property, for example, ID number or height for the position the cell represents. These cells are usually called image points or pixels. Raster grids are spatial, continuous data. In other words; there are no gaps in a raster grid.

Unlike in vector data where each point/line/polygon can have many attributes (e.g. name, code, area/length, category etc.), each pixel in a raster has **only one value**. To show two values – e.g. elevation and mean annual air temperature, you need two rasters.

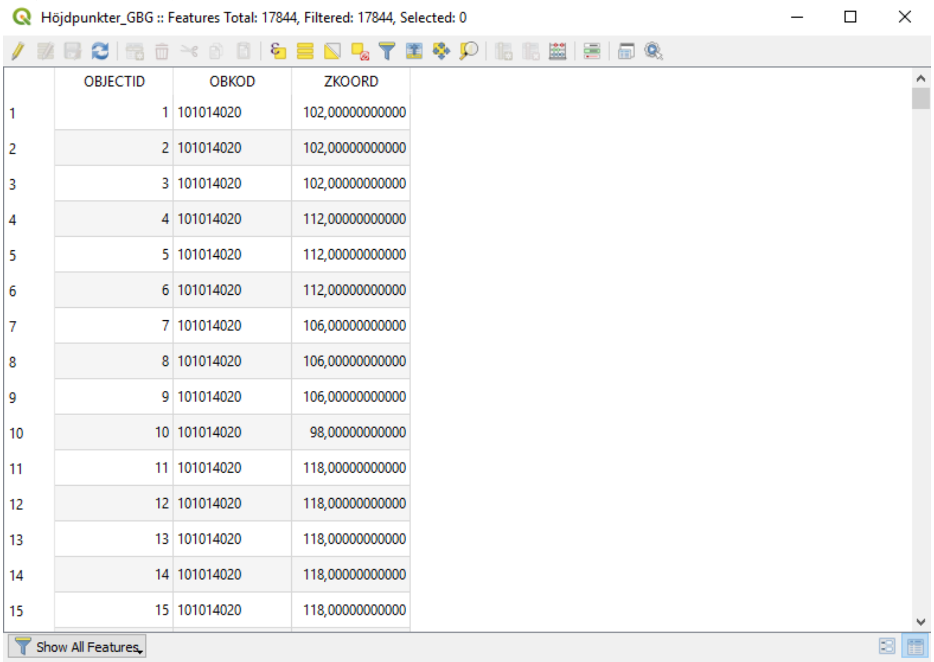
Hand in: You must send in a screenshot (print screen) on your "aspect-layer" that shows all of the south slopes of the area (see the example on the next page). Paste your image in a normal Word document and send in a PDF-copy to Canvas.

1. Preparations

As in previous exercises, you need to create a new project. You will need the shapefile **Höjdpunkter_GBG.shp** which is a point vector layer containing a number of highlights somewhere in northwestern Gothenburg.

2. Create a grid

Open Höjdpunkter_GBG and open the attribute table. Here you see that every point has a height value (ZKOORD).


Höjdpunkter_GBG :: Features Total: 17844, Filtered: 17844, Selected: 0

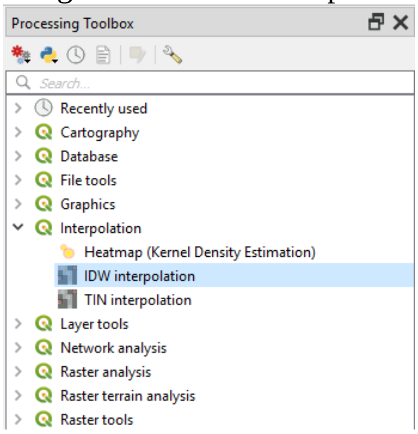
	OBJECTID	OBKOD	ZKOORD
1	1	101014020	102,00000000000
2	2	101014020	102,00000000000
3	3	101014020	102,00000000000
4	4	101014020	112,00000000000
5	5	101014020	112,00000000000
6	6	101014020	112,00000000000
7	7	101014020	106,00000000000
8	8	101014020	106,00000000000
9	9	101014020	106,00000000000
10	10	101014020	98,00000000000
11	11	101014020	118,00000000000
12	12	101014020	118,00000000000
13	13	101014020	118,00000000000
14	14	101014020	118,00000000000
15	15	101014020	118,00000000000

Show All Features

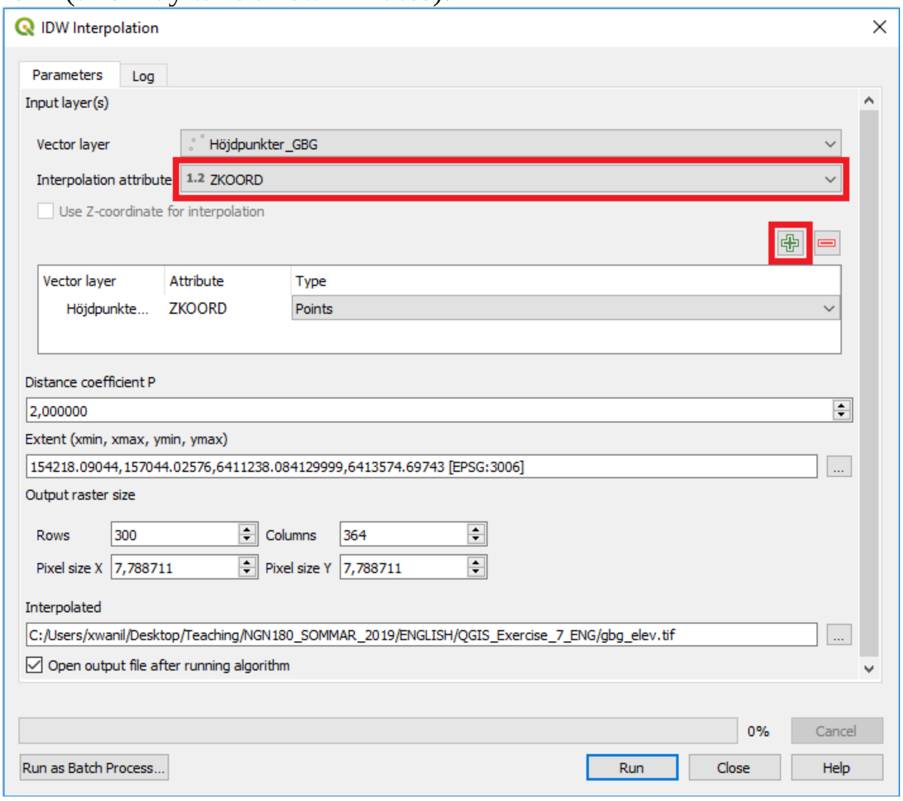
To create a raster grid that shows the height of the area, we need to estimate heights between the points. This is called interpolation. There are a number of different interpolation methods to use. The one we will try is called the **Inverse Distance Weighted** (IDW). Briefly, one can say that IDW estimates the value of a pixel depending on the distances to nearby points. If you want to know more about IDW method, you can read about it (and other methods) in the textbook. You can also read more about IDW here:

http://docs.qgis.org/testing/en/docs/gentle_gis_introduction/spatial_analysis_interpolation.html

IDW will be found in the Processing toolbox under Interpolation, as shown below:



We will use the settings shown in the figure below. A raster name cannot be longer than 13 characters and does not contain the letters å, ä or ö. As a suggestion, you can call it **gbg_elev**. Enter ZKOORD as **Interpolation attribute** which represent height values for each grid box. **Set the extent to same as Höjdpunkter_GBG and number of Rows to 300 and Columns to 364** (probably automatically after setting rows). After entering the new name for the new raster, press **OK** (this may take a few minutes).

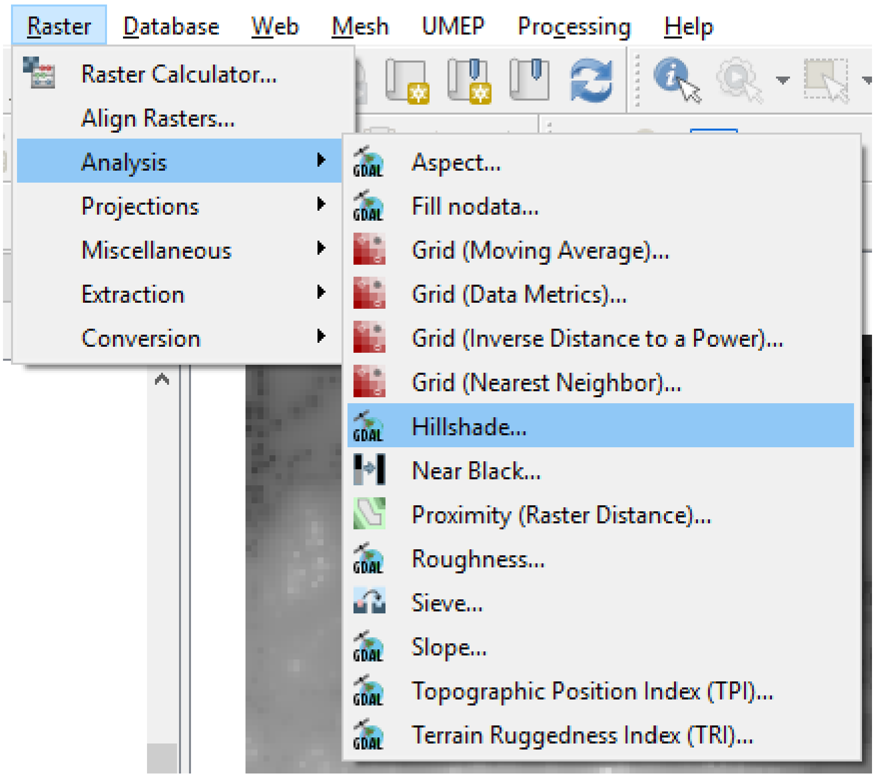


You have now created your first raster. Turn off the **Höjdpunkter_GBG** layer to get a clearer picture of your DEM.

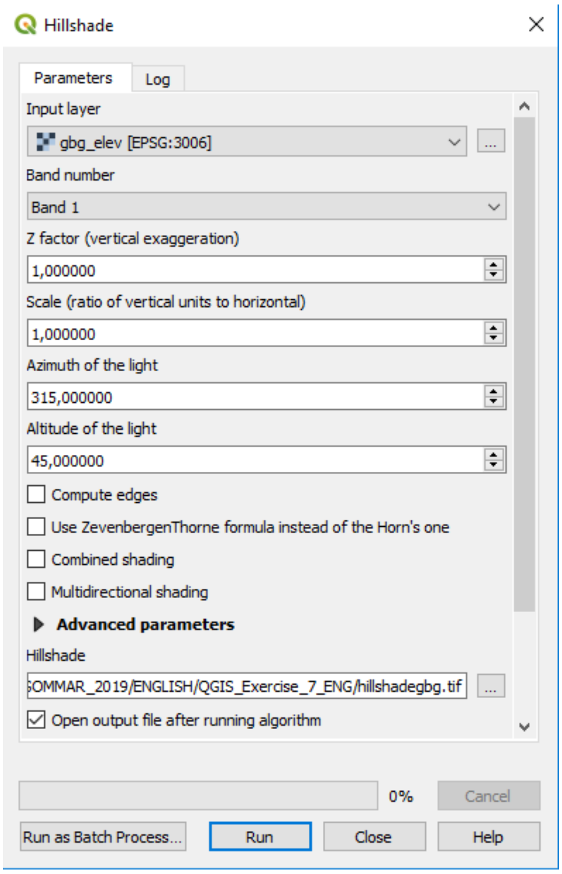
3. DEM (Digital Elevation Model) and Terrain Shading

We will now go ahead and create a number of terrain models based on our height database.

First we create a so-called **Hillshade** model. One such model is primarily used for clarifying and visualizing elevation data. **Hillshade** can be found as shown below, under DEM:



Use the preset settings as shown below. Save your terrain model at any location. For example call it **hillshadegbg**.



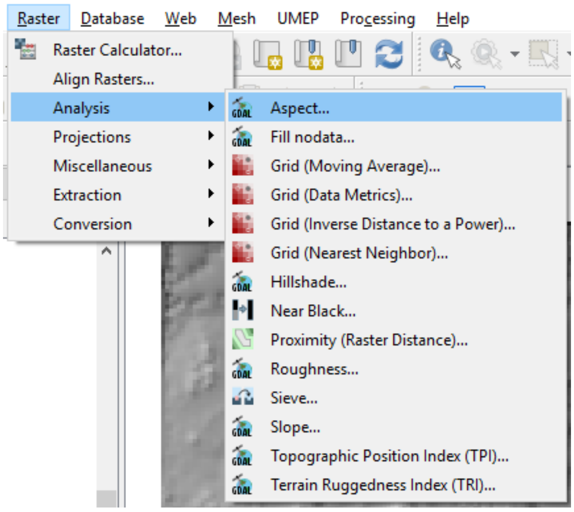
The result looks like shade patterns where you clearly can see variations in the terrain. You would get the best results if you mix up the height data (elevation data) with the hillshade model.

Right-click on the layer **hillshadegbg** and select Properties from the pop-up menu. Scroll to "Transparency". Change the value of Overall Transparency to 50%. Press **OK**. Now we can see "through" the terrain model and the height data (elevation data).

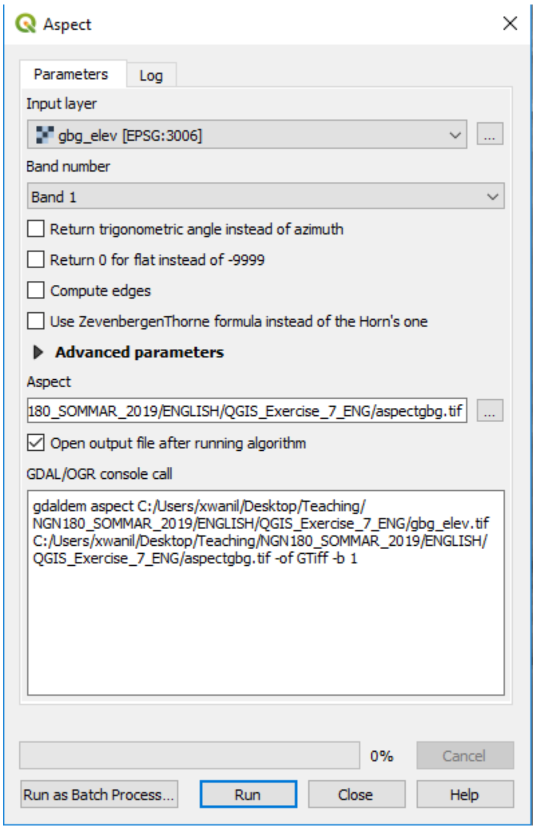
4. Aspect and classification

National Heritage Board want to conduct an inventory of old farms in the area. A clue to where to look, they were mainly located on the southern slopes. Raster-analysis in GIS is an excellent tool for finding these areas.

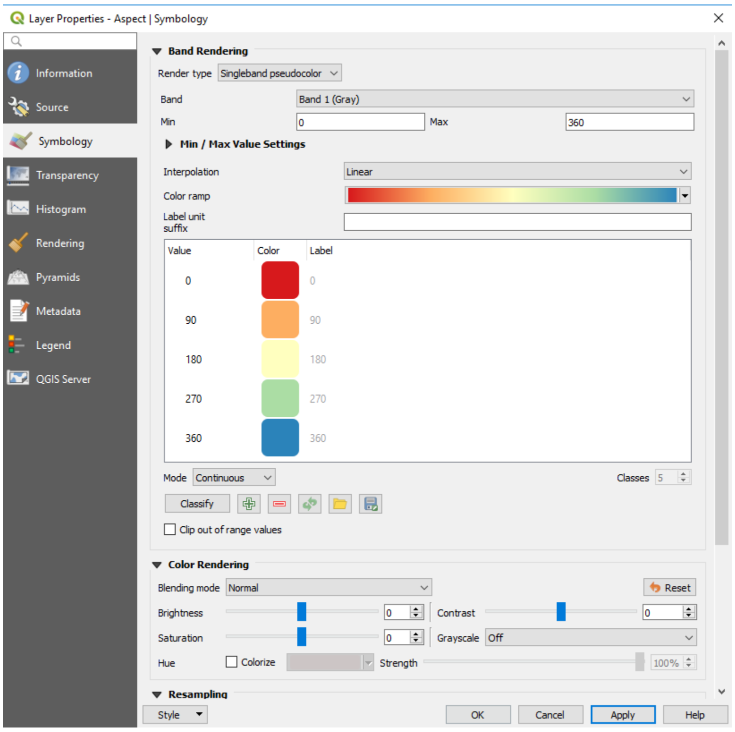
We will now make use of a tool called **Aspect**. With this tool, you can obtain the direction in which it leans to each pixel in the height database. The values counted corresponds to the direction of the number of degrees on a protractor with north in 0°, east in 90°, south in 180° and west in 270°. There is a related tool, **slope**, which calculates how much it leans instead of in which direction. Where to find the **aspect**-tool:



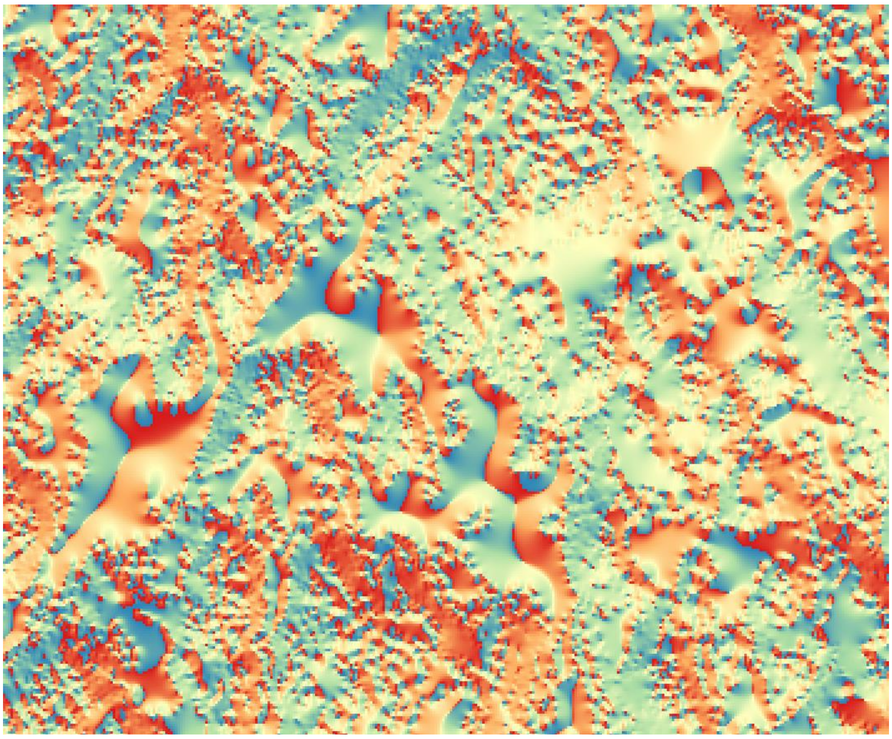
All you have to do here is to set the Input layer to gbg_elev. Name your new raster file **aspectgbg** or something similar.



To change the appearance of **aspectgbg**, right-click on the layer and press the Properties tab then **Symbology**. There, change the Render Type to **Singleband pseudocolor** and then click on classify, execute and finally click **ok**.

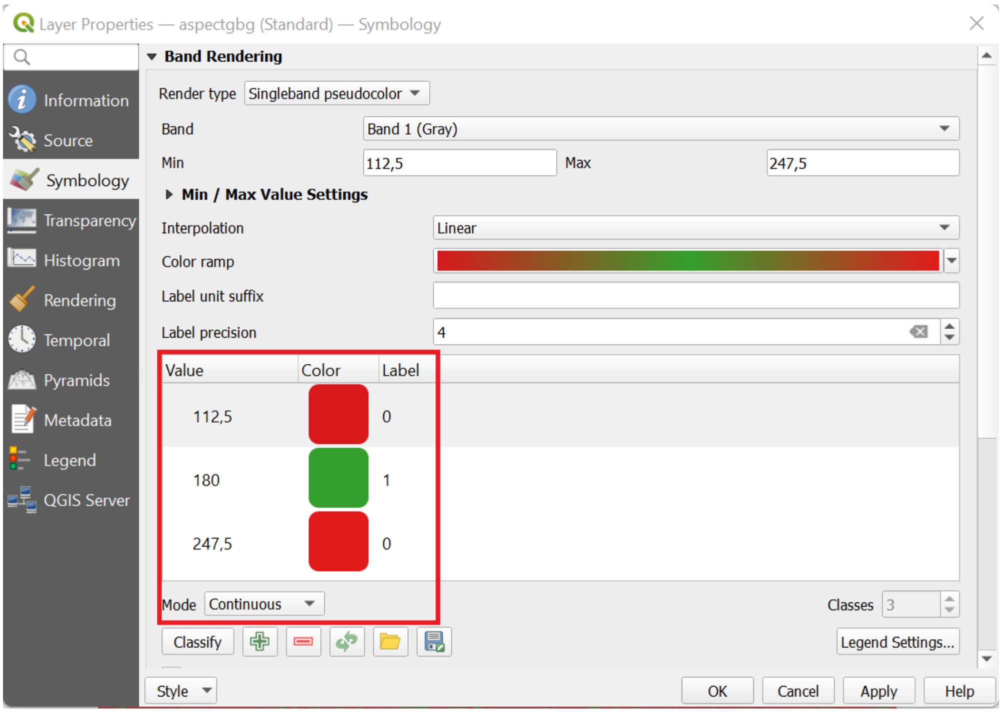


The figure shows the terrain model created by the aspect tool based on height data base **hojdatagbg.**



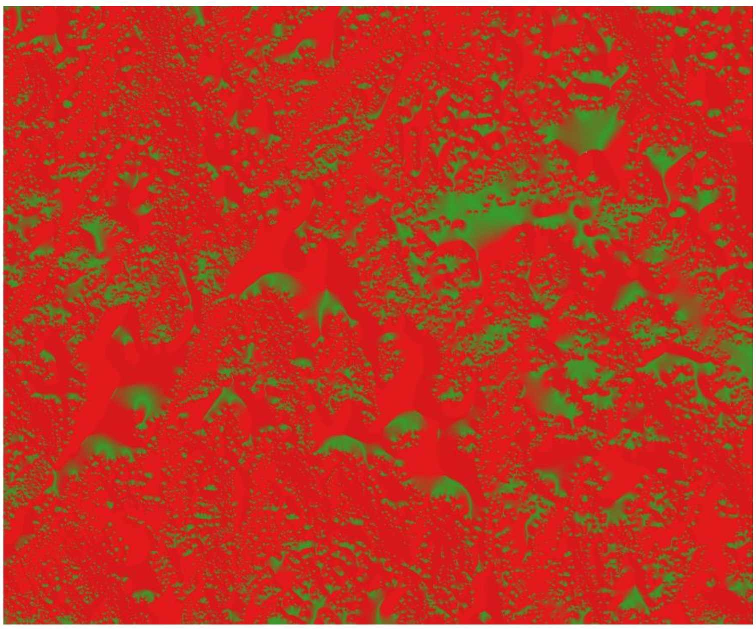
The raster emerging from the aspect tool can be difficult to interpret because of how it is presented. Each color represents a directional range of 90 degrees. To make it easy to find the areas that lean to the south you will now create a Boolean image. A Boolean image is made up of ones (true) and zeros (false). In your case, if a pixel is in a southern slope, the assigned value should be 1. If a pixel is located in any other direction it shall be assigned with the value 0.

To select these slopes, you can open **Properties** and use **classify**. Change the settings as shown below. Start by selecting a value and press the minus sign until only three values are remaining. To change to the desired values of the three remaining values double-click the value and type in the new values as shown below. Change the color of the different values as shown, and finally change the labels.



Note that these values are break values between the cardinal directions, aspect values between 112.5 and 247.5 (south west to south east) will be colored green, the rest will be red.

Now, your raster image should look like the one below. The green areas represent appropriate slopes, and will be easier to interpret after the classification.



In this exercise you have used a few tools to analyze raster data. In exercise 9 we will continue to work with raster data and familiarize ourselves with more tools. Do not forget to submit your screenshot of the aspect layer showing all southern slopes in the area, saved as **PDF** on Canvas.

End of Exercise 8!