Solution Exercise 1

March 4, 2025

LTE, EPFL, Switzerland

Question 1

The minimum elevation is 193 meters and the maximum elevation is 4554.18 meters.

Question 2

The minimum value in the legend is 0-10 and the maximum value is >3000. They represent the annual average precipitation in mm. When looking at the exact values (either on the map or in the Properties - Information tab) we can see that the true minimum value is 500-700 mm (corresponding to the category #2). The maximum is >3000mm (category #11). Note that the rainfall categories in the legend are indexed starting at 0.

Question 3

Both are raster data files. dem.tif contains the elevation data of Switzerland. The legend is continuous and represents every value with a slightly different hue. rain_clim.tif contains the climatological distribution of annual precipitation in Switzerland and shows a categorical legend. All data within one category are represented by the same color in the legend.

Question 4

Geneva: 900-1100mm
Lausanne: 900-1100 mm
Basel: 799-900 mm

Question 5

The position of the cursor in the units of the coordinate system are shown.

Question 6

The lowest elevation is the altitude of Lago Maggiore. As the entire lake surface is at equal altitude, there is a relatively large number of values at precisely this altitude. The

same can be seen for other large waterbodies at larger altitudes, e.g. lakes Geneva (372 m) and Constance (395 m).

Question 7

The value of the pixel at the selected point is shown.

Question 8

Vector layers consists of points, lines and polygons. Therefore, they are used to represent locations, boundaries, networks, trajectories or complex geographic features (i.e. river, lakes, house parcels, urban zones, ...). Each object has its own topological properties (i.e. length and position for lines). Vector layers offers high geographic accuracy at a fraction of the cost required by raster layers, which precision depends on the grid resolution. Vector manipulation algorithms can be quite complex and computationally expensive to run, and unfortunately, they are not well adapted to represent continuous spatial fields. On the other hand, rasters are made up of pixels (grid cells), often regularly-spaced and squared, which processing is generally fast and easy to perform with simple matrix operations. Each raster layer pixel is associated to one value. Values can be discrete (i.e. to represent a class or a category) or continuous (i.e. the radiance measured by a sensor). Rasters are the natural choice for storing information from remote-sensing sensors. The raster resolution increase as the grid-cell size (pixel area) decreases. High accuracy requires high resolutions, but this implies large data volumes and increased processing time. QGIS offers tools to convert between raster and vector and vice-versa:
Rasterization (vector to raster): Raster $\Rightarrow$ Conversion $\Rightarrow$ Rasterize
Polygonalization (Raster to polygons): Raster $\Rightarrow$ Conversion $\Rightarrow$ Polygonize

Question 9

Increasing the vertical exaggeration can be useful to emphasize the topography in relatively flat regions. It can also be useful when looking at large areas. E.g. in comparison to the horizontal extent of Switzerland ($\sim$ 300 km), the vertical extent ($\sim$ 4 km) is very small.