Exercise 2: Open Data and Methods

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Exercise 1 Data methods and gathering

1. Write down the temperature for each station at 2018-10-01 01:00.

|  |  |  |
| --- | --- | --- |
| Station | Datum | Temperatur |
| „Heidelberg“ | 2018-10-01 01:00 | 11.3°C |
| „Karlsruhe-Nordwest“ | 2018-10-01 01:00 | 12.2°C |
| „Mannheim-Nord“ | 2018-10-01 01:00 | 11.6°C |

1. Search the location for each of those stations (...) and write the coordinates in WGS84.

|  |  |
| --- | --- |
| Station | Coordinates in WGS84 |
| „Heidelberg“ | Lat: 49.419546° N Long: 8.676645° E |
| „Karlsruhe-Nordwest“ | Lat: 49.028580° N Long: 8.355635° E |
| „Mannheim-Nord“ | Lat: 49.544066° N Long: 8.465269° E |

1. What is the original coordinate system?

The original coordinate system is the “Gauss–Krüger coordinate system”.

1. Load the data into QGIS as a delimited text layer.

QGIS > add layer > add delimited text layer > chose file, chose coordinates, … > chose coordinate system

1. Visualize the position of each station over a map of the “Regierungsbezirk Karlsruhe in Baden-Württemberg/Germany”. (...) Make a screenshot.
2. What level of Open Data is the LUBW data set and how could it be made to level 4?

According to 5 star open data, the Open Data from LUBW is Level 2. “*The data is accessible on the Web in a structured way (that is machine-readable), however, the data is still locked-up in a document (Excel).*” (<https://5stardata.info/en/>).

To make it level 3, the data needs additionally to be published in a format that can be accessed without proprietary software package. For example in the .cvs format.

To make it level 4, the data needs additionally to level 3 to be made accessible as part of the web with a Uniform Resource Identifier (URI), for example in a RDF schema.

Exercise 2 Define the study area

1. Download the “Municipalities(LAU2)” from <https://www.stat.si/gis/Baza.aspx?lang=en>.

Downloaded

1. Extract the file and load Obcine.shp into QGIS. If the layer is not displayed properly, open the layer properties and change the coordinate reference system (CRS) to EPSG:3787.

Layer > add layer > add vector layer

1. Select the municipalities “Izola” and “Piran”. Save the selected features in a new shapefile called “studyarea.shp” with EPSG:3787.

Open attribute table > Select by expressions

> "IME" IS 'IZOLA/ISOLA' OR "IME" IS 'PIRAN/PIRANO'

> save feature as > save only selected features

1. Upload the new shapefile to your GitHub repository.

git status # check status

Output:

*Untracked files:*

*(use "git add <file>..." to include in what will be committed)*

*studyarea.dbf*

*studyarea.prj*

*studyarea.qpj*

*studyarea.shp*

*studyarea.shx*

git add studyarea.shp # added .shp file to be included for the next commit

git commit –m “aoe created” # creates the commit with a description

Output:

*1 file changed, 0 insertions(+), 0 deletions(-)*

*create mode 100644 studyarea.shp*

git push # upload the commit to the remote repository

Exercise 3 Data and Methods research

1. Why do they use the TWI instead of a hydrological model to derive flood prone areas?

Hydrodynamic models are expensive and time-consuming, so they can’t be developed fast when needed. The Topographic Wetness Index (TWI) instead can be implemented easily and applied very fast.

1. How is the TWI related to flood probability?

The TWI quantifies the effect of local topography on the runoff generation, which is the factor that controls hydrological processes in their first phase. More precisely, the TWI describes the water trend accumulating at a given point. Also it shows long-term moisture availability in a landscape.

1. What are the limitations of using the TWI to map flood prone areas?

* Soil transmissibility which is an influencing parameter was not included in the original form of the TWI.
* The calculation of slope in the original form of the TWI might not adequately represent the local drainage impedance. Distances should be taken into account also due to the influence of soil permeability.
* Also the DEM resolution is an important parameter to be taken into account.
* Additional the algorithm needs to be adapted when used in low-relief areas.

1. Search for implementations of the TWI. List two possibilities and answer the following questions for each method. Provide your information sources.

Possibility 1: SAGA Wetness Index

The 'SAGA Wetness Index' is, as the name says, similar to the 'Topographic Wetness Index' (TWI), but it is based on a modified catchment area calculation ('Modified Catchment Area'), which does not think of the flow as very thin film. As result it predicts for cells situated in valley floors with a small vertical distance to a channel a more realistic, higher potential soil moisture compared to the standard TWI calculation. ([www.saga-gis.org](http://www.saga-gis.org))

Possibility 2: Topographic Wetness Index (TWI)

Calculation of the slope and specific catchment area (SCA) based Topographic Wetness Index (TWI). ([www.saga-gis.org](http://www.saga-gis.org))

Possibility 3: Generating Wetness Indices for Watersheds in GRASS (<https://gracilis.carleton.ca/CUOSGwiki/index.php/Generating_Wetness_Indices_for_Watersheds_in_GRASS#Generating_Wetness_Indices>)

* 1. What kind of input data is required and which parameters need to be specified?
* Necessary Input for Possibility 1: Digital Elevation Model (DEM)
* Necessary Input for Possibility 2: Slope (which can be calculated from a DEM) and the catchment area.
* Necessary Input for Possibility 3: Digital Elevation Model (DEM)
  1. How easy is it to run? Is it already part of QGIS or do you need to install something?

The SAGA as well as GRASS functions are both already included in QGIS.

1. Which method would you choose and why?

I would choose (given that we examine an area with identical properties) the SAGA Wetness Index function. Pourali et al (2014) compared different WTI and came to the conclusion that “SAGA-GIS modelled reality better than the other TWI results …”.

1. After reading the documentation of some of the TWI modules you should have found out that all of them require a Digital Elevation Model (DEM) as input. Do an online search for open (free) DEM data sets that cover our study area. List two potential data sets and answer the following questions for each of them:
   1. What is the resolution in meters?
   2. How accurate is it? Is there information about potential errors in the dataset?
   3. What is the coverage? Is it only locally available or is there a global coverage?

Exercise 4 Calculate the TWI

Exercise 5 Analyse and verify your results

Bonus Exercise: