TARGET data preparation

This pdf gives an overview on how to prepare the input data. If you find faster or easier methods, it would be nice to share them with the other students and the TAs :)

1. Meteorological data

The meteorological data provided in Moodle needs to be prepared before it can be used as input in TARGET. First, you need to decide which data you want to use. At the stations in Lausanne and Pully, no incoming longwave radiation is measured. Thus, you will need to combine the data of Lausanne/Pully with the radiation measured in Aigle/Payerne.

For TARGET, the meteorological data should ideally be from an open area. As the station in Lausanne is not located in an open area but Pully is farther away from your study site, it is your choice to which one to use. Same goes for the radiation data from Aigle and Payerne. Make sure to explain your choice in the report. In the “readme” file on Moodle, additional information on each station is provided.

The meteorological data is provided with a 10 min interval. You can choose a lower temporal resolution to obtain a higher computational efficiency. The temporal resolution needs to be specified in the controlfile (see section 3) and your input data should only contain the data of your chosen resolution (e.g. only the rows of every 30min).

The simulation should be performed for data of a heat wave event, ideally without any precipitation. Search online for heat waves in summer 2023 (e.g. MeteoSwiss website) and chose a suited time interval (at least 3 days) for your simulations. Check/plot the meteorological data of the chosen interval. The interval needs to be specified in the controlfile (see section 3).

While preparing the meteorological data, make sure to have an output file that corresponds to the structure of the example data (see screenshot):

- The values should be separated by a comma (csv format)
- No quotes (“ “) should be in the data
- The format of the datetime column should be: 1/7/2023 00:00

```
datetime,Ta,RH,WS,P,Kd,Ld
1/1/2011 0:00,20.4,81,0.555555556,1011.2,0,331.45
1/1/2011 0:30,20,81,1.111111111,1011.1,0,334.73
1/1/2011 1:00,19.9,77,1.388888889,1010.9,0,335.03
1/1/2011 1:30,19.6,78,0,1010.6,0,339.27
1/1/2011 2:00,19.2,82,0.555555556,1010.8,0,338.56
1/1/2011 2:30,19.5,78,0,1010.3,0,339.48
1/1/2011 3:00,19.2,78,1.388888889,1010.6,0,336.58
1/1/2011 3:30,18.9,80,0,1011,0,331.36
1/1/2011 4:00,18.8,75,0.555555556,1010.8,0,330.04
1/1/2011 4:30,18.6,69,2.5,1012.2,0,340.36
1/1/2011 5:00,18.3,73,1.111111111,1011.6,2.01,334.76
1/1/2011 5:30,18.5,73,1.388888889,1011.3,24.61,348.78
1/1/2011 6:00,18.6,71,1.111111111,1011.7,58.19,361.7
1/1/2011 6:30,18.9,73,1.111111111,1011.9,103.12,364.38
1/1/2011 7:00,19.3,76,2.222222222,1011.6,117.58,367.18
1/1/2011 7:30,20.2,72,1.111111111,1012.2,192.21,364.44
1/1/2011 8:00,20.5,73,2.5,1013,251.21,343.94
```

If you use R, you can adjust the datetime column by doing (install and library the packages tidyverse and dplyr):

```
#formats a date column with slashes and removes the seconds
data$date <- format(as_datetime(data$datetime), "%d/%m/%Y %H:%M")

#removes the 0 before day, month and hour
data$date<- as.character(data$date)

a<- str_replace(data$date,"09/01", "9/1")

a<- str_remove(data$date,"^0") %>% str_replace("/0", "/")

#creates formatted datetime column
data$datetime <- a

#removes the date column, as you don't need it anymore
data <- data %>% select(-date)
```

To export your data as a csv without quotes and row names, you can use the following command:

```
write.csv(data, "meteo_campus.csv", row.names=F, quote = F)
```

2. Landcover data

General remarks on the shape files and raster files:

Each **shapefile** is a composition of different features, that indicate the different data sources of the polygons. Like this, you can select a specific building of the “buildings” shapefile, or you can select only the asphalt that was defined as “place” if you wish to modify very specific areas for your scenarios.

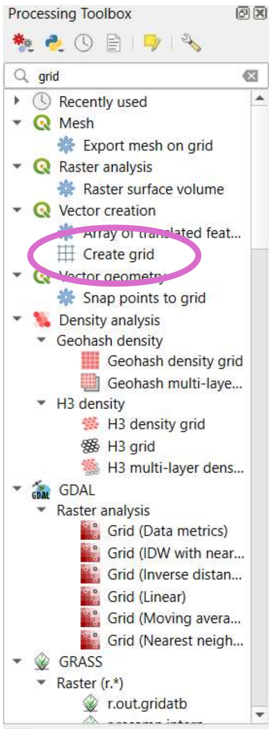
Raster data for street width and building height: The street width only corresponds to width of asphalted streets and thus does not represent the canyon width, as this should as well account for grass areas between buildings. You can still use the provided street width for your calculations. If you want, you can discuss this inconsistency in the report or try to estimate the urban canyon width yourself.

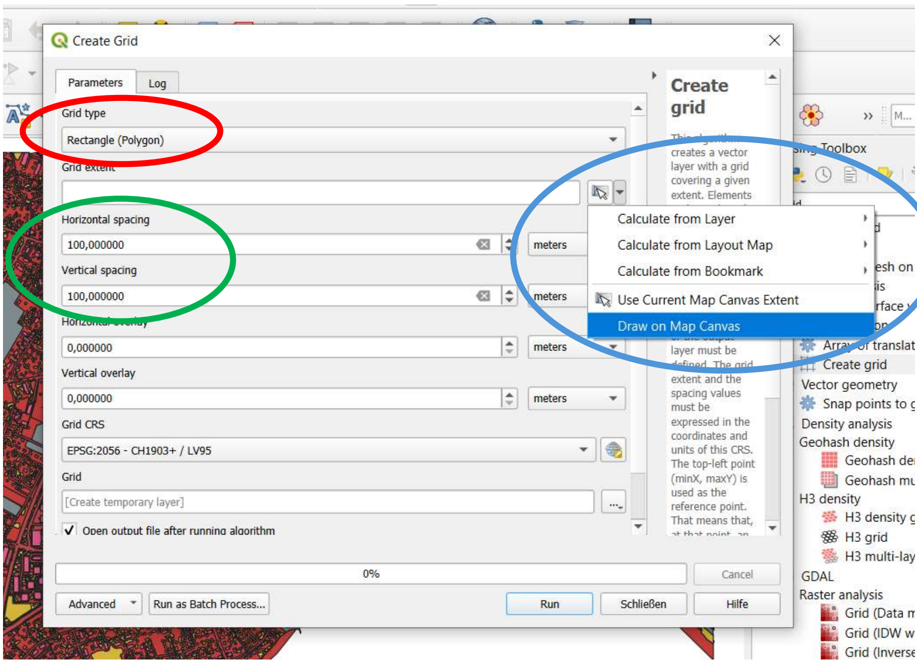
More information on the original data sources of the landcover data are provided in the “readme” file on Moodle.

Create the landcover grid in QGIS

(1) Insert the shapefiles (.shp) and rasterfiles in QGIS. The coordinate reference system (CRS) should be: ESPG 2056 (bottom right corner in QGIS)

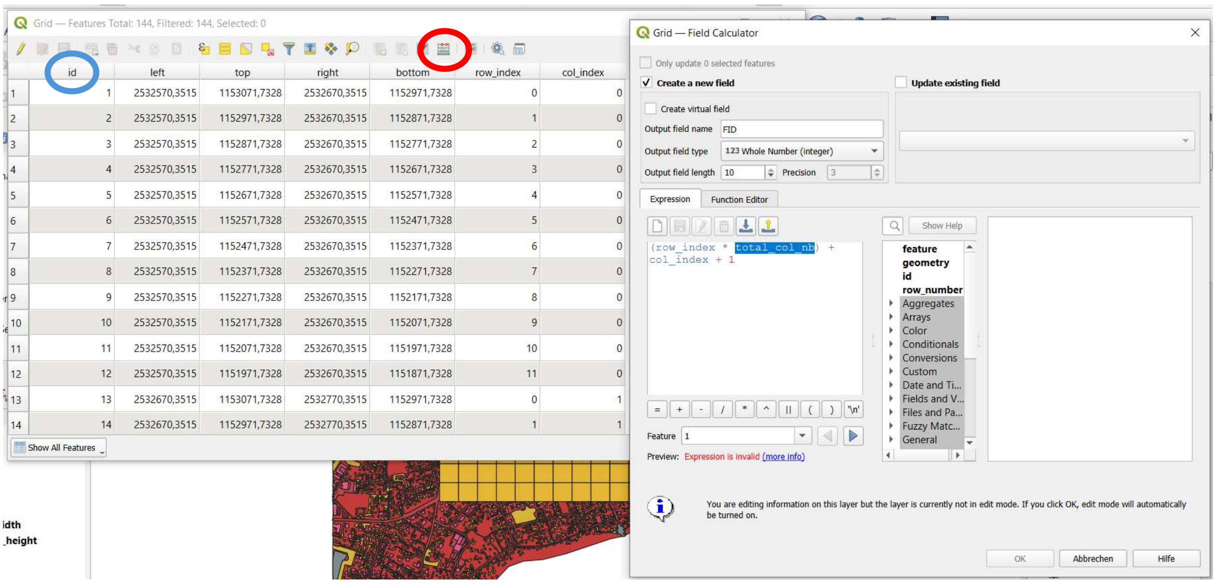
(2) Create grid by using the processing tool “Create grid”. Make sure to select “Rectangle” as Grid type, chose the horizontal and vertical spacing according to your desired spatial resolution and select a grid extent matching your study area, for example by drawing it on the map canvas:





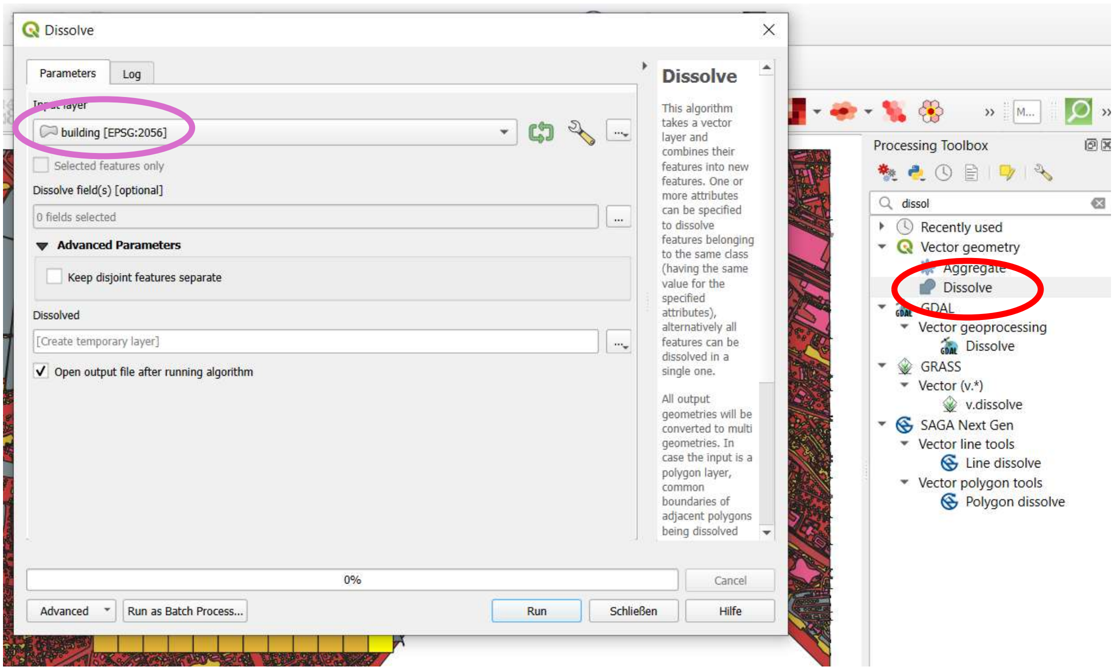
After running this process, a new layer should appear on your canvas.

(3) Make sure to have a field id (FID) column, that corresponds to the numeration as illustrated in the TARGET user manual. When you open the attribute table of your grid, an “id” column exists. But usually, this ID counts the grid cells per per column and not per row as needed for TARGET. With the field calculator, you can create an FID column with the desired numeration using the row and column indices. You can use the formula below and replace “total_col_nb” with the number of columns of your grid (the col_index starts counting with zero!).
(row_index * total_col_nb) + col_index + 1



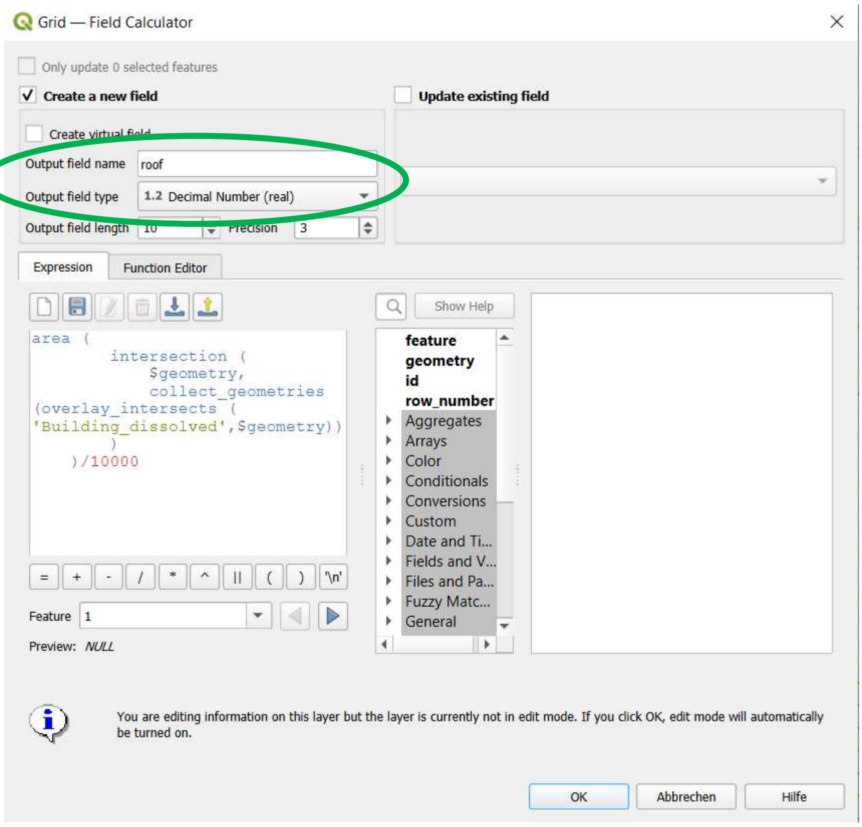
After running the calculation, a new field should appear in the attribute table of your grid. Verify that the calculate ID is correct by selecting and checking them on the canvas.

(4) Before calculating the area of each landcover class per grid cell, each landcover class shapefile should be processed using the “Dissolve” tool. In this process, all features of one shapefile are combined to one by creating a new layer. Using the dissolved layers in (5) significantly accelerates the calculation and avoids inconsistencies due to overlapping of different features of the same class/shapefile.



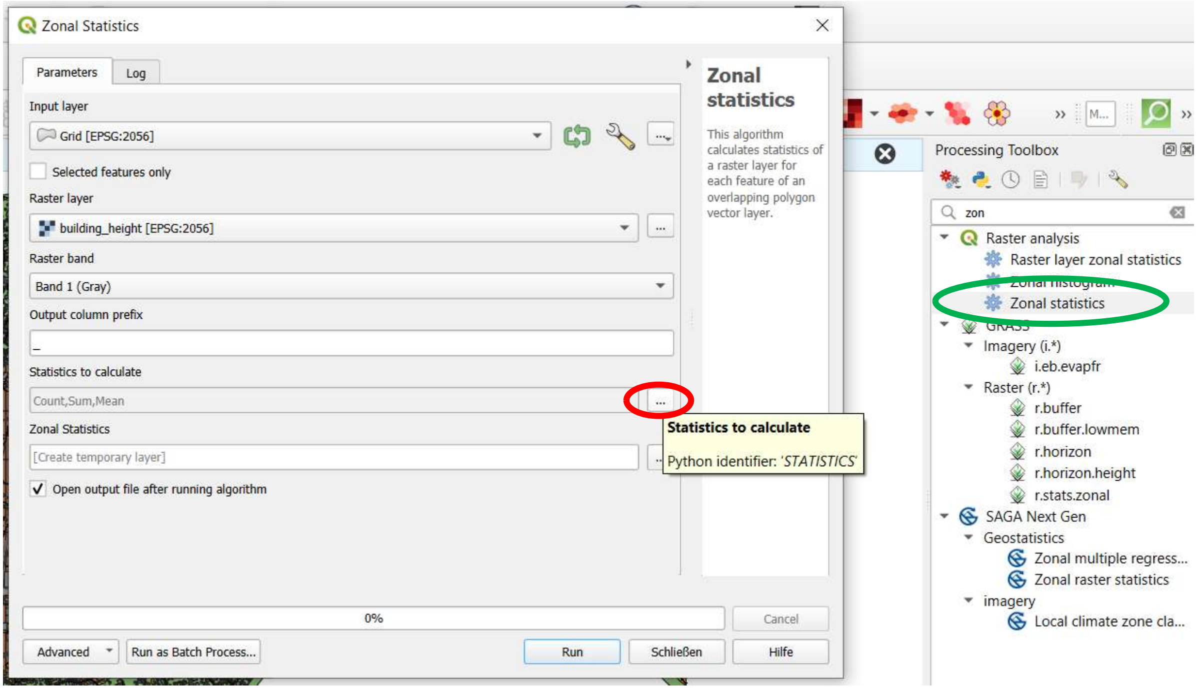
(5) To calculate the percentage of each landcover class per grid cell, open the attribute table of your grid and then the field calculator. Use the formula below to create a new column of your grid and replace “layer name” with the dissolved landcover class layer. You can directly calculate the percentage (as decimal number) by dividing it with the cell_area of your grid.

```
area (
    intersection (
      $geometry,
      collect_geometries (overlay_intersects ('layer_name',$geometry))
    )
  )/cell_area
```

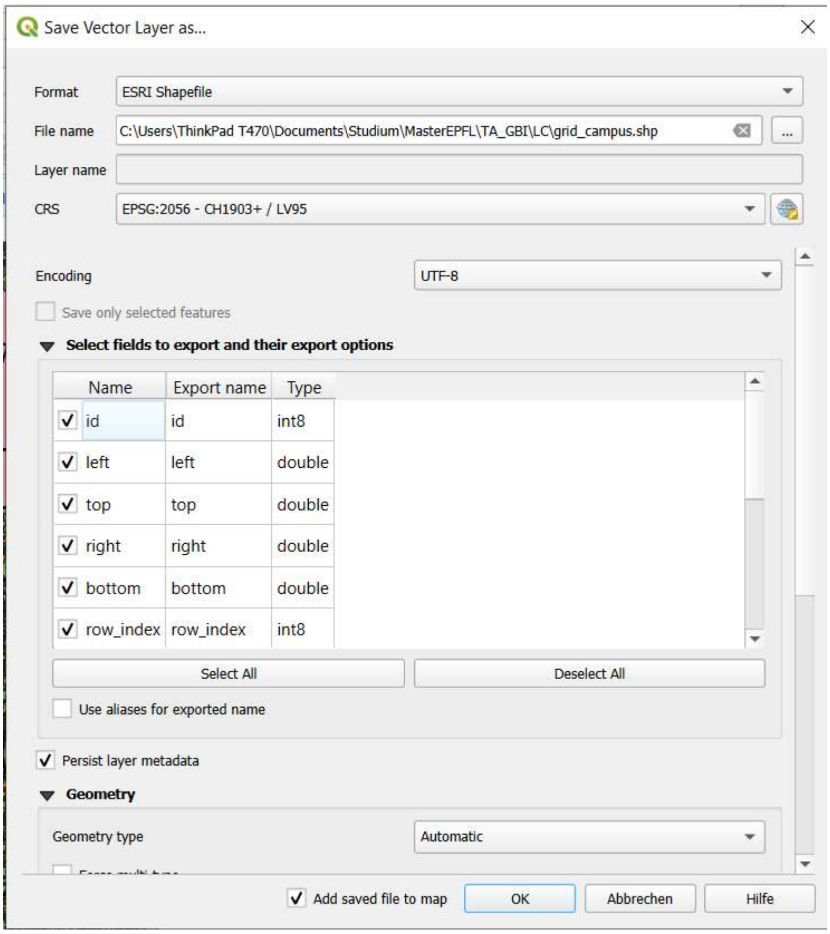


Repeat this for each land cover class and make sure to adjust the output field name and type. Ideally, you can directly choose the same column names as in the TARGET example landcover data.

(6) The mean street width and building height are provided as raster files. To calculate the mean per grid cell, use the zonal statistics processing tool. Select your grid as input layer and your raster as raster layer. In statistics to calculate, you can specify that it is only the mean you want to have added to your grid attribute table.
This will generate a new grid which includes your calculated mean, thus you need to keep working with the new grid layer.



(7) Export your grid as csv by rightclicking on your grid – export – save features as...
In the opened window, you can specify the file format as csv and you need to enter the path and name of your file. You can also deselect fields that you don't wish to export.



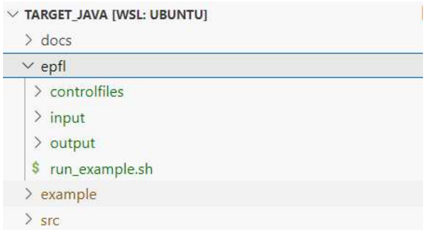
Before you can use this data as input for TARGET, fill the “NULL” or “NA” entries of your landcover classes with zeros and add a column for concrete filled with zeros (as we only do have asphalt). You can fill the “NULL” or “NA” entries of building height and street width with the overall average height/width.

If you have grid cells that cover the lake, you can try to fill them with zeros or 100% water (I don’t know what works better). As TARGET cannot account for lager waterbodies like the Léman, you don’t need to include them in your final analysis of the simulated data.

Make sure to use the same column names and structure as the example data, and that the rows are ordered by your calculated FID.

3. Run TARGET with your data

To keep a clear folder structure, it is recommended to create a new folder like the "example" folder (same structure) for the campus data. Like this, you need to replace the input data with the one you created and adjust a controlfile accordingly.



Adjust the control file:

(1) Paths of input and output
(2) Name of the run/simulation (this will be the name of the output file)
(3) Simulation period and interval
(4) Coordinates and spatial resolution in degrees
latEdge and lonEdge are the coordinates of the topleft grid cell edge (see TARGET user manual). To get the coordinates of the grid in degrees, you need to export your grid as a shapefile with another coordinate reference system that is in degrees (e.g. ESPG 4326). The you can open a new QGIS project and when add the exported shapefile, it should be showing the coordinates in degrees. This allows you to calculate/measure the resolution and coordinates in degrees.
(5) Domain dimensions (number of grid rows and columns)

```
#--------------------------------------------------------------------------------------------
####### EPFL Main Control File #######
#-------------------------------------------------------------------------------------------
####### INPUTS #######
site_name=epfl              # site name (string)
run_name=epfl_100m                          # run name (string)
inpt_met_file=/home/rosa/target_java/epfl/input/epfl_in/MET/meteo_epfl.csv  # input meteorolgical file (i.e. fo
inpt_lc_file=/home/rosa/target_java/epfl/input/epfl_in/LC/LC_epfl.csv              #  input land cove
output_dir=/home/rosa/target_java/epfl/output/epfl_out                   # directory output will be saved in
date_fmt=%d/%m/%Y %H:%M                              # format of datetime in input met files
timestep=1800S                                       # define in seconds
include roofs=Y                                      # turn roofs on and off to affect Tac
#-------------------------------------------------------------------------------------------
# dates
#--------------------------------------------------------------------------------------------
SpinUp=2023,8,18,0             # year,month,day,hour   #start date for simulation (should be a minimum of
StartDate =2023,8,19,0             # year,month,day,hour   ## the date/time for period of interest (i.e. b
EndDate =2023,8,23,0               # year,month,day,hour   # end date for validation period
######################

mod_ldwn=N             # use modelled ldown
lat=46.5
domainDim=138,112
latEdge=6.5767372
lonEdge=46.526257
latResolution=0.00013
lonResolution=0.00009
### disabled output options are Fid,Utb,TsurfWall,TsurfCan,TsurfHorz,Ucan,Utb,Tsurfwall,TsurfCan,TsurfHorz,Ucan
disableOutput=Fid,Utb,TsurfWall,TsurfCan,TsurfHorz,Ucan,Pet
```

Run the simulation by specifying the path of your campus controlfile in the Terminal:

```
java -cp ../netcdfAll-4.6.11.jar:. Target.RunToolkit ../epfl/controlfiles/epflExample/controlfile.txt
```