Podrobné modelování teplot v závislosti na nadmořské výšce a vzdálenosti od vodního rezervoáru

aneb

informace pro zemědělce s využitím meteorologických předpovědních služeb

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EUXDAT

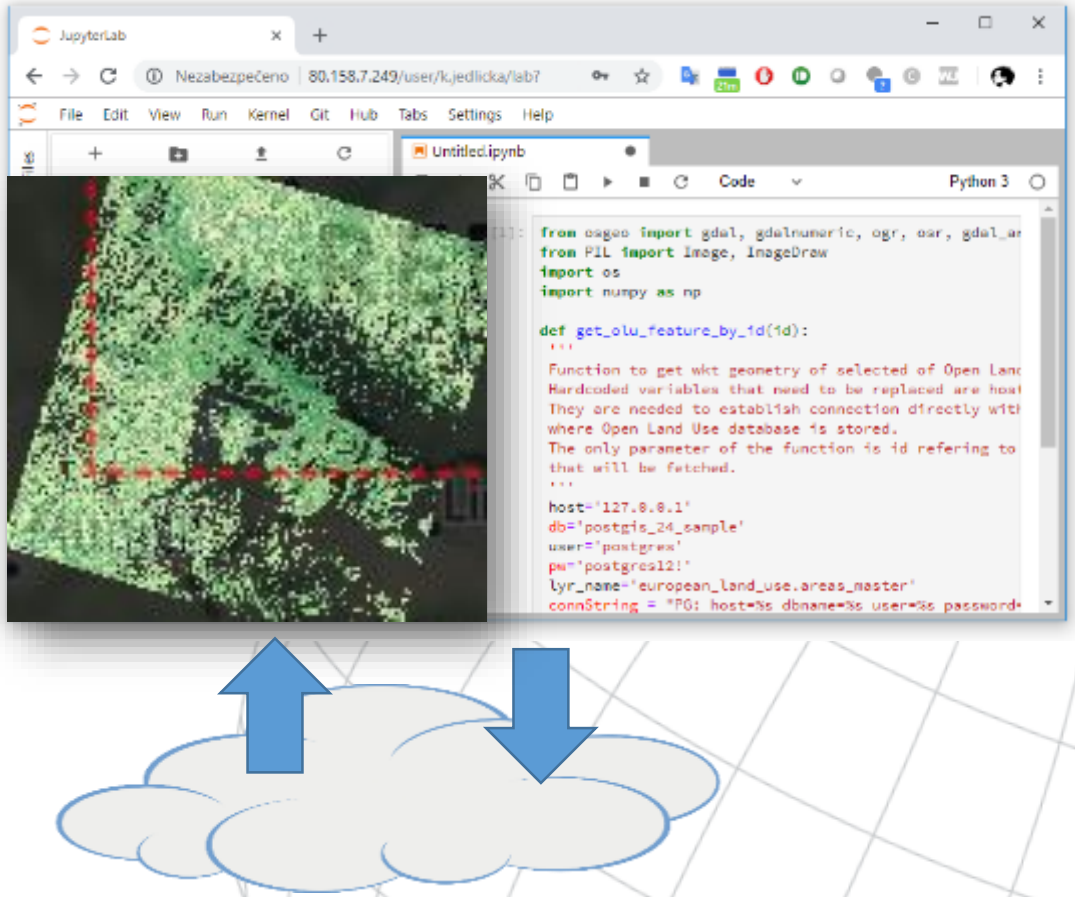
www.euxdat.eu

- EUXDAT proposes an **e-Infrastructure, which addresses agriculture**, land monitoring and energy efficiency for a sustainable development, as a way to support planning policies.

- Consortium: 9 partners from 7 countries
- Duration: 11/2017-10/2020
- H2020 topic: Platform-driven e-infrastructure innovation (EINFRA-21-2017)
- H2020 type of action: Research and Innovation Action
- H2020 pillar: Excellent Science

EUXDAT agriculture e-infrastructure

- Cloud platform
- Client side: web based coding environment
  - Jupyter Notebook & Python
- Server side (cloud/HPC):
  - GDAL/OGR
  - (GRASS)
  - Sen2Agri
  - …

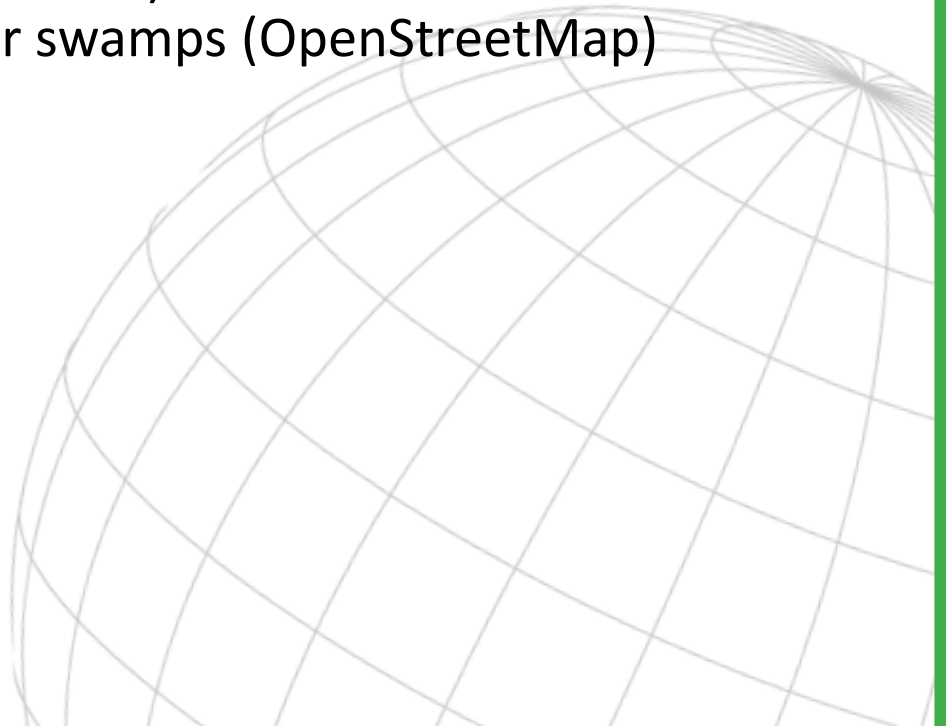


EUXDAT agriculture e-infrastructure

- Implementing defined scenarios
  - Open Land Use Map Improvement
  - Monitoring of crop status
  - Delimiting Agro-climatic zones
  - Looking for climatic patterns changes
  - Information support for field use recommendations
  - Effective utilization of natural resources

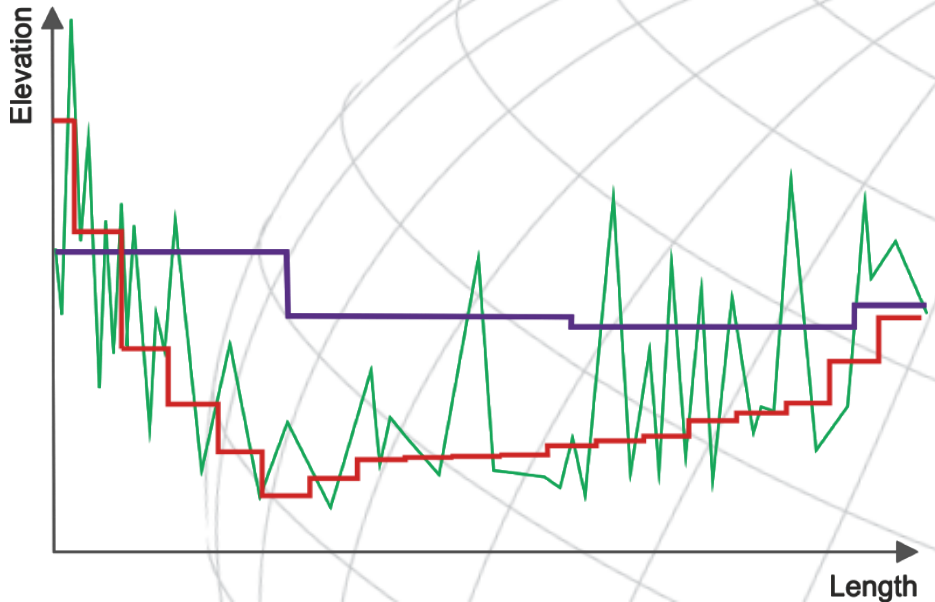
Delimiting of Agro-Climatic Zones

- **Goal:** to provide local agro-climatic maps by processing detailed EO data and climate model data.
- **Data:**
  - General **weather conditions** (large-scale weather models ~ Meteoblue API)
  - **Local topography** (elevation, North/South slopes ~ EU-DEM)
  - **Hydrology** ~ buffer effects, such as rivers, lakes, sea or swamps (OpenStreetMap)
  - Soil types (OLU).
- **Initial experiments:**
  - *Elevation* as a factor influencing temperature
  - *Slope orientation* as a factor influencing temperature
  - *Hydrology* as a factor influencing temperature
  - …
- **Verification:** meteorological expert needed



Delimiting of Agro-Climatic Zones

- *Elevation* as a factor influencing temperature
  - Temperature on Earth's surface decreases averagely by 0.65 °C for each 100 meters of elevation (under normal weather circumstances)
  - Temperatures provided by global meteorological models are related a lattice of particular geographic positions (with elevation defined as *an elevation 2 m above Earth's surface*)
  - DEMs used by global meteo models are sparse



Delimiting of Agro-Climatic Zones

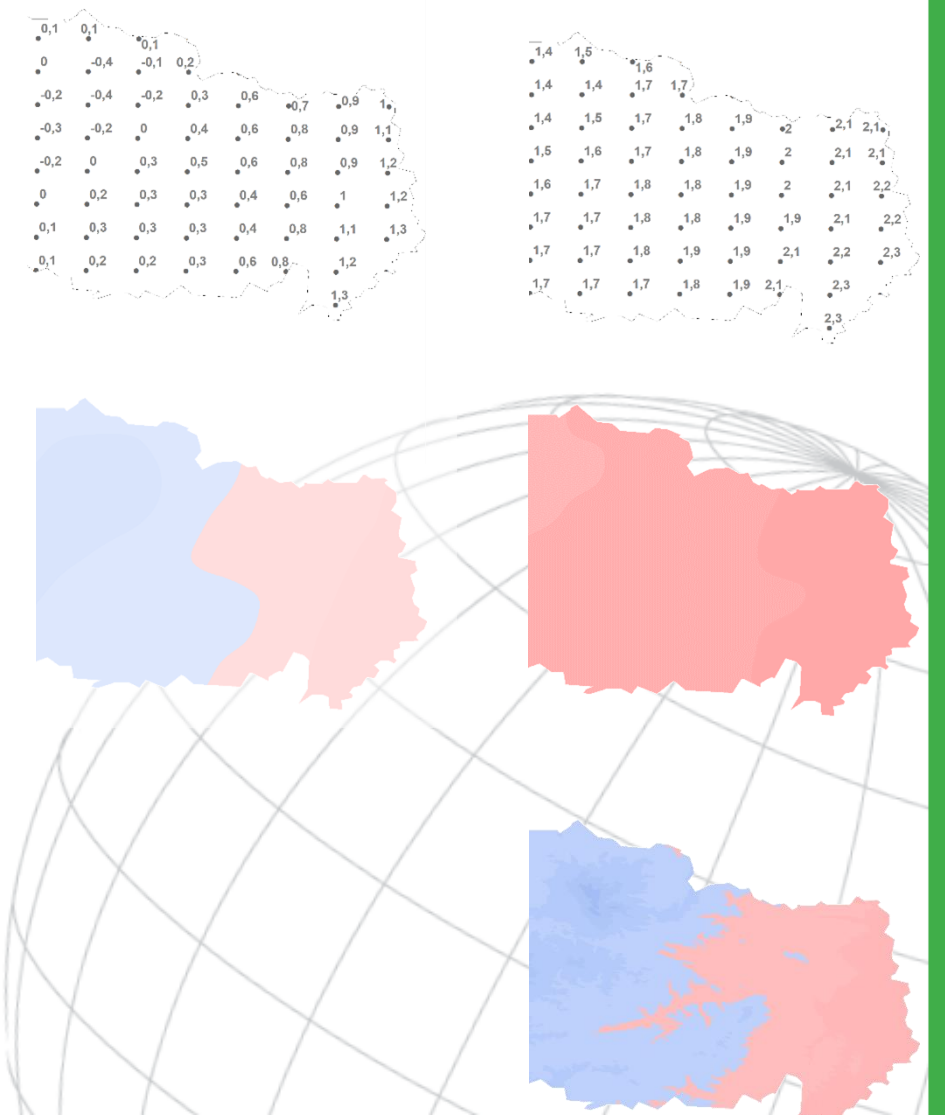
- *Elevation* as a factor influencing temperature
  - Input ~ sparse DEM (with approx. 4x4 km sampling) of temperatures estimated on earth‘s surface reduction to sea level:

    $T_0 = T_s + k * E_s/100$

  - Densification of the 4x4 km DEM T_0 temperature to 25 x 25 m spacing DEM using *spline interpolation*.

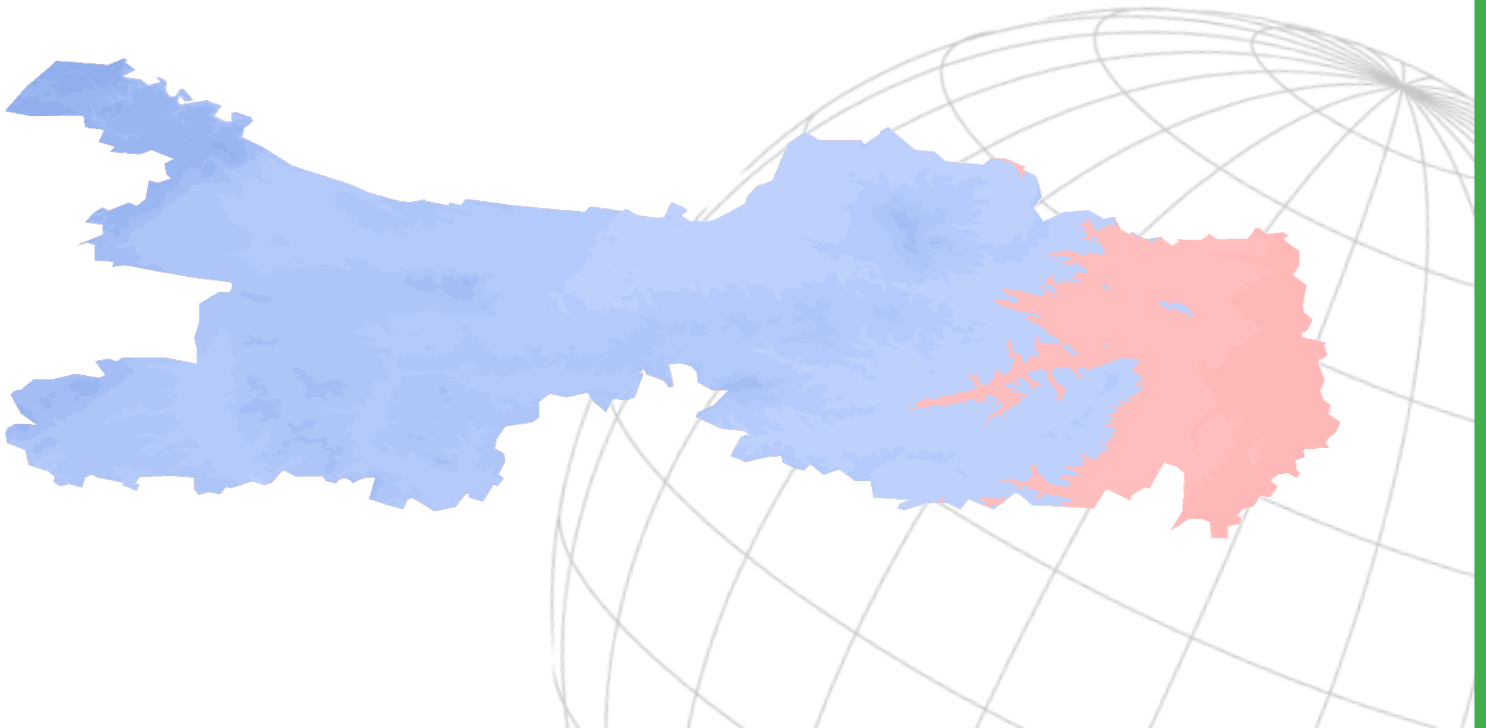
  - Applying the elevation factor to calculate temperatures back on surface, but on DEM with 25x25 m spacing.

    $T_s = T_0 - k * E_s/100$



Delimiting of Agro-Climatic Zones

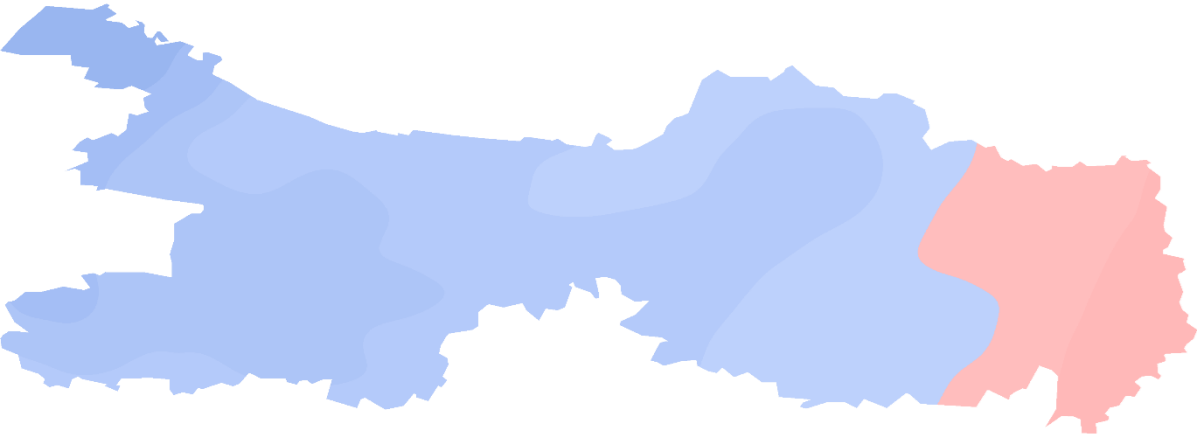
- *Elevation* as a factor influencing temperature
  - Temperatures on Surface (sparse)
  - Temperatures reduction to sea level
  - Applying the elevation factor back



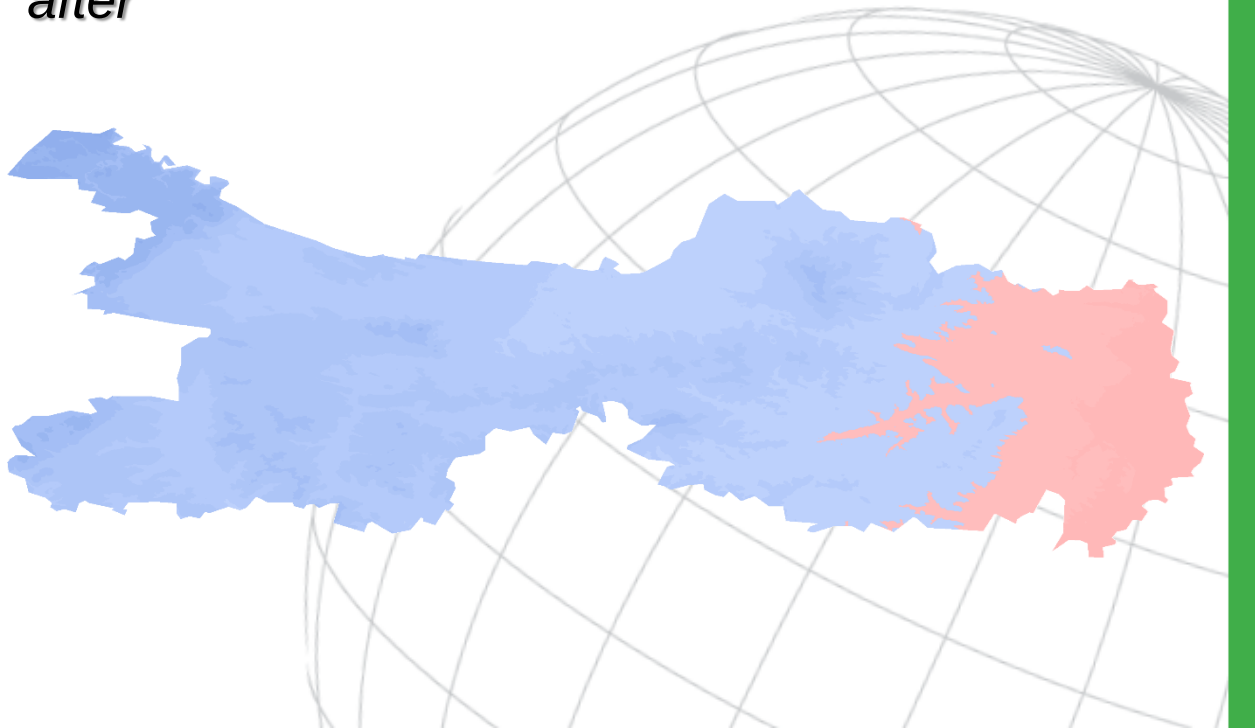
Delimiting of Agro-Climatic Zones

- *Elevation* as a factor influencing temperature

before



after



Delimiting of Agro-Climatic Zones

- *Hydrology* as a factor influencing temperature
  - Water accumulates thermal energy from sun and neighborhood.
  - Water has much longer thermal inertia than air.
  - Water smooths the daily temperature changes (lowering the temperature during the hot period of a day and increasing the temperature during night).
  - Such an influence subsides with a distance from the water reservoir.

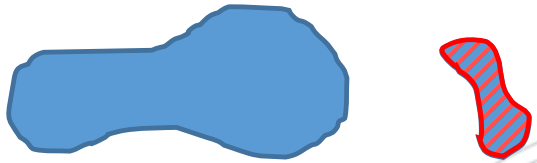
- Talking technically
  - Water reservoirs keep an average day temperature.
  - Water influence to temperature decreases inversely in proportion to distance (the closer a place is to the water, the more influence)
  - The influence ends in 1 km distance.

Delimiting of Agro-Climatic Zones

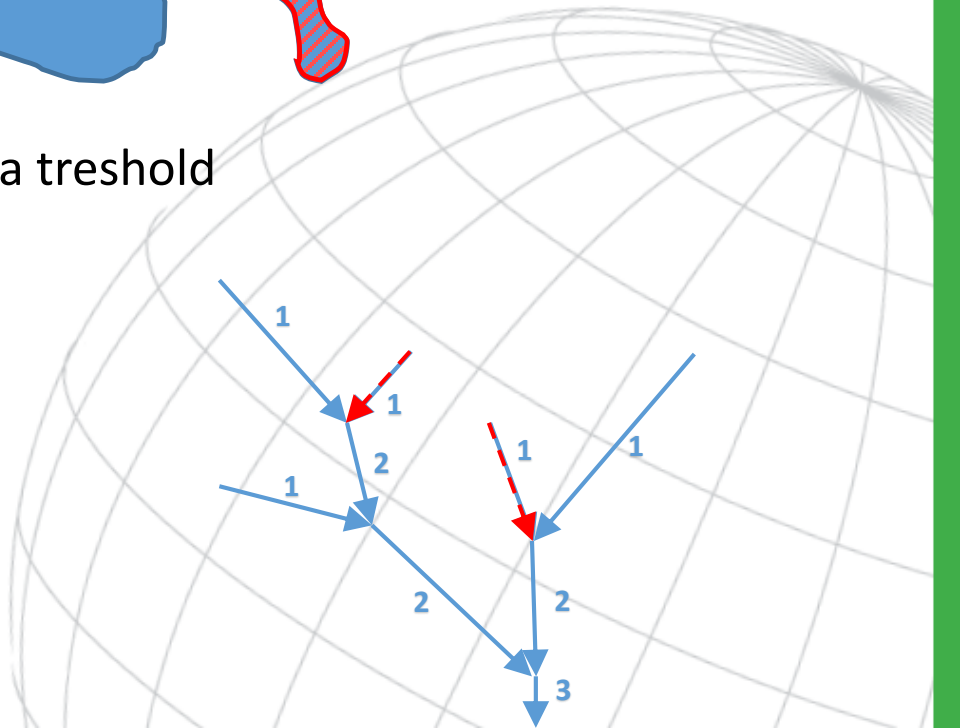
- *Hydrology* as a factor influencing temperature
  - Clean hydrologic data to exclude irrelevant water reservoirs
  - Calculation of the hydrologic effect to the temperature of a selected day hour

Delimiting of Agro-Climatic Zones

- *Hydrology* as a factor influencing temperature
  - Clean hydrologic data to exclude irrelevant water reservoirs
    - Water areas ~ exclude areas smaller than a treshold

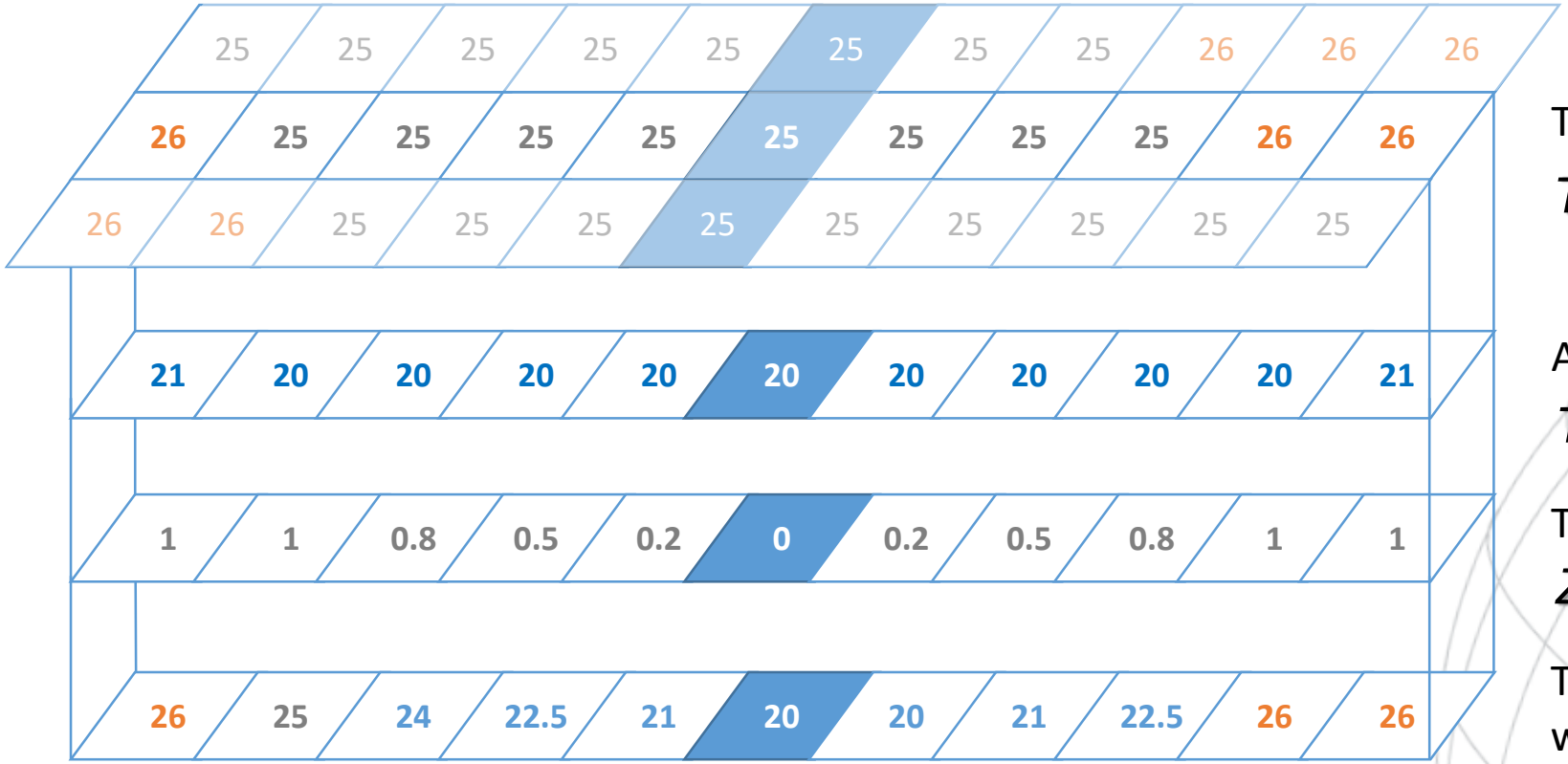


    - Water streams ~ exclude upper streams shorten than a treshold
      - Apply Strahler ordering
      - Exclude streams of 1st order shorter than a treshold



Delimiting of Agro-Climatic Zones

- *Hydrology* as a factor influencing temperature
  - Calculation of the hydrologic effect to temperature at **noon**



$$T_{s\text{-}hour\text{-}hydro} = T_{s\text{-}mean} + (T_{s\text{-}hour} - T_{s\text{-}mean}) * (Z_{influence})$$

Temperature on the surface at noon

$T_{s\text{-}hour}$

Average day temperature on the surface

$T_{s\text{-}mean}$

Transition zone effect

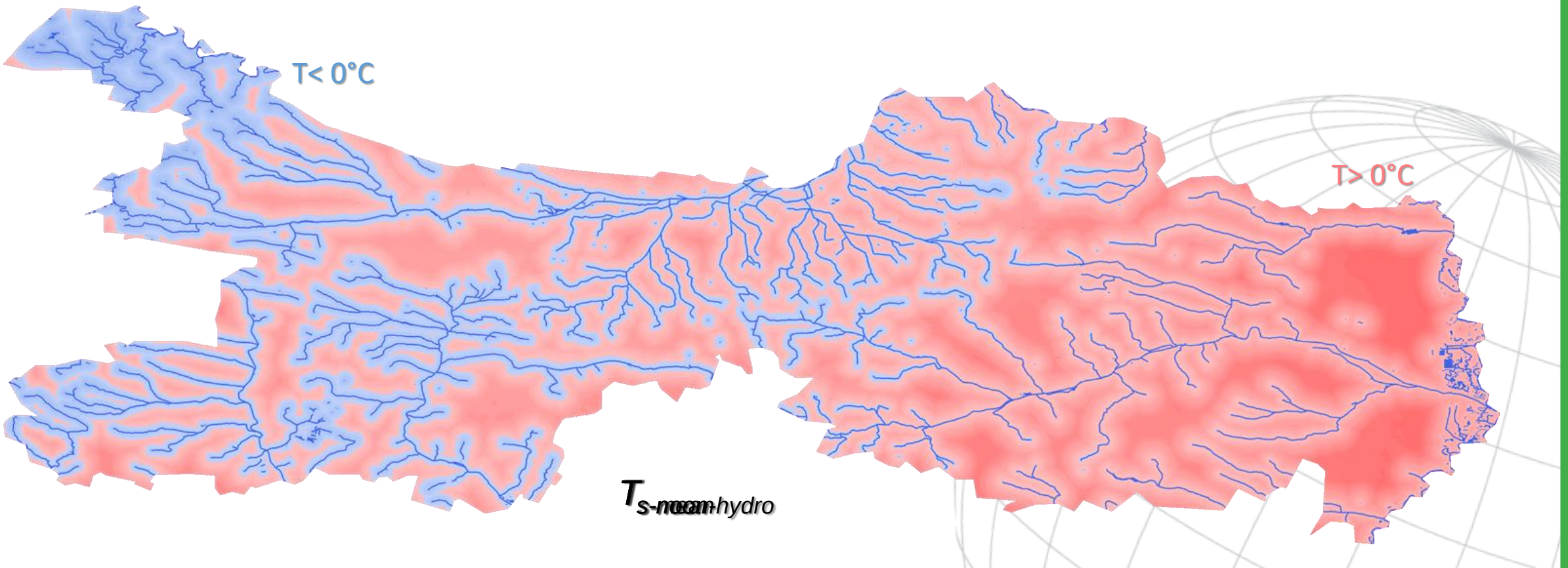
$Z_{influence}$

Temperature on the surface at noon with hydro effect

$T_{s\text{-}hour\text{-}hydro}$

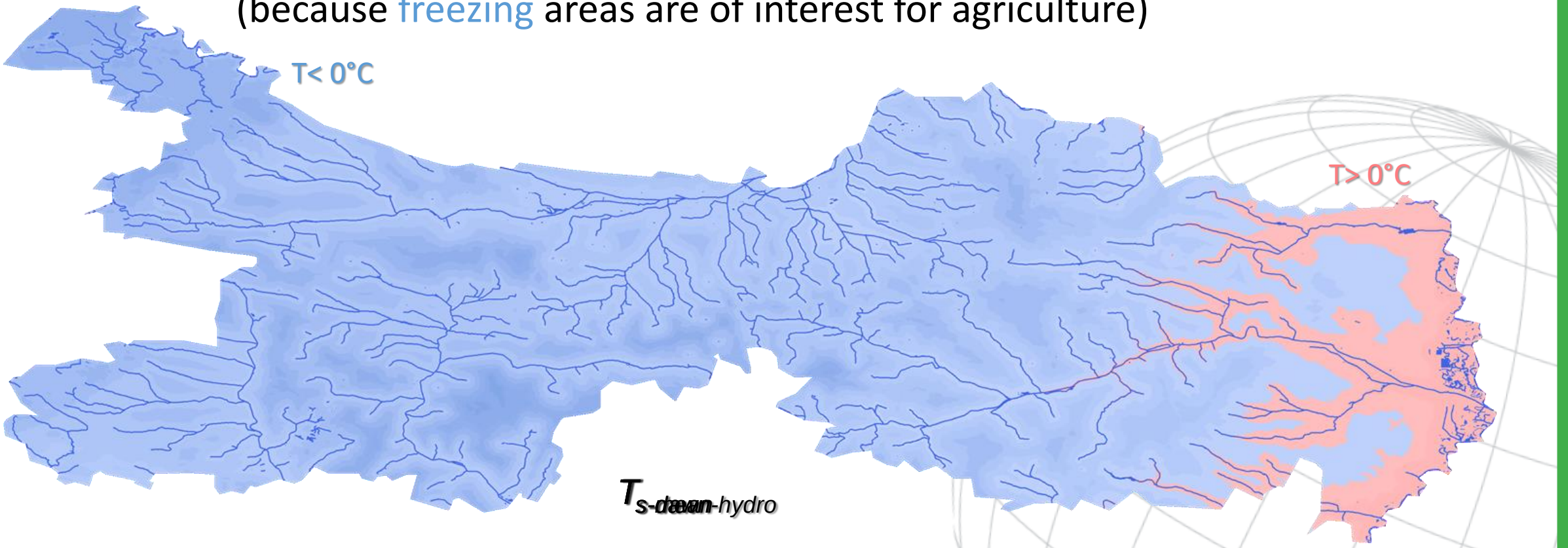
Delimiting of Agro-Climatic Zones

- *Hydrology* as a factor influencing temperature
  - Calculation of the hydrologic effect to 12 a.m. temperature



Delimiting of Agro-Climatic Zones

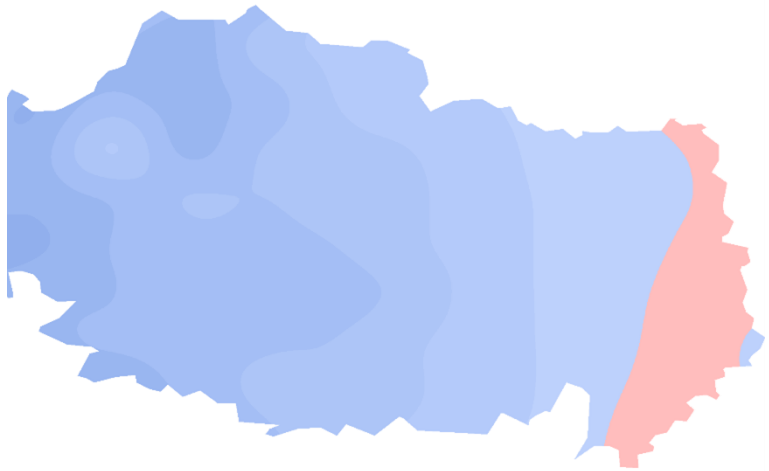
- *Hydrology* as a factor influencing temperature
  - Calculation of the hydrologic effect to 6 a.m. temperature (because freezing areas are of interest for agriculture)



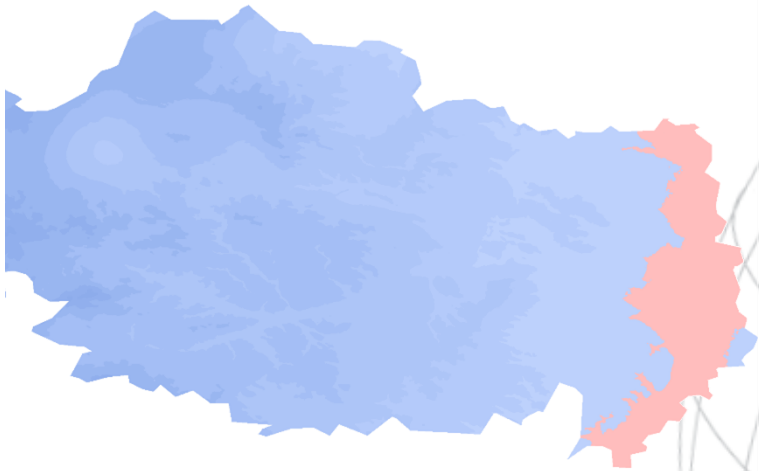
Delimiting of Agro-Climatic Zones

- Status of the art
  - Initial experiments performed
  - **Verification:** meteorological expert needed

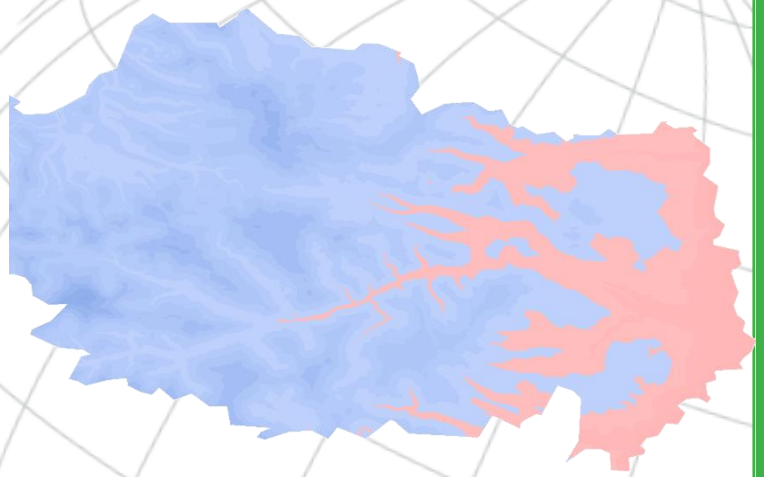
$T_{s\text{-}dawn\ (4x4\ km)}$



$T_{s\text{-}dawn\ (25x25m)}$



$T_{s\text{-}dawn(25x15m)\text{-}hydro}$



Zones for 1st of April 1998 – 2018