A first look at ERA5 for physically based water balance modelling of the Devoll Catchment, Albania

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https://en.wikipedia.org/wiki/Devoll_(river)#/media/File:Devoll_valley_in_Gramsh_district

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- ➤ Meteorological input data is not always readily available or with the required spatio-temporal resolution for modelling

- ➤ Viable alternative: **climate reanalysis datasets**

- ➤ Use of ERA5 reanalysis dataset for the **physically water balance** model in the Devoll catchment, Albania

Legend
- ☐ International borders   ▲ Cities
- ⊠ Devoll catchment   ■ Gauges

EPSG: 32634 WGS 84/UTM ZONE 34N
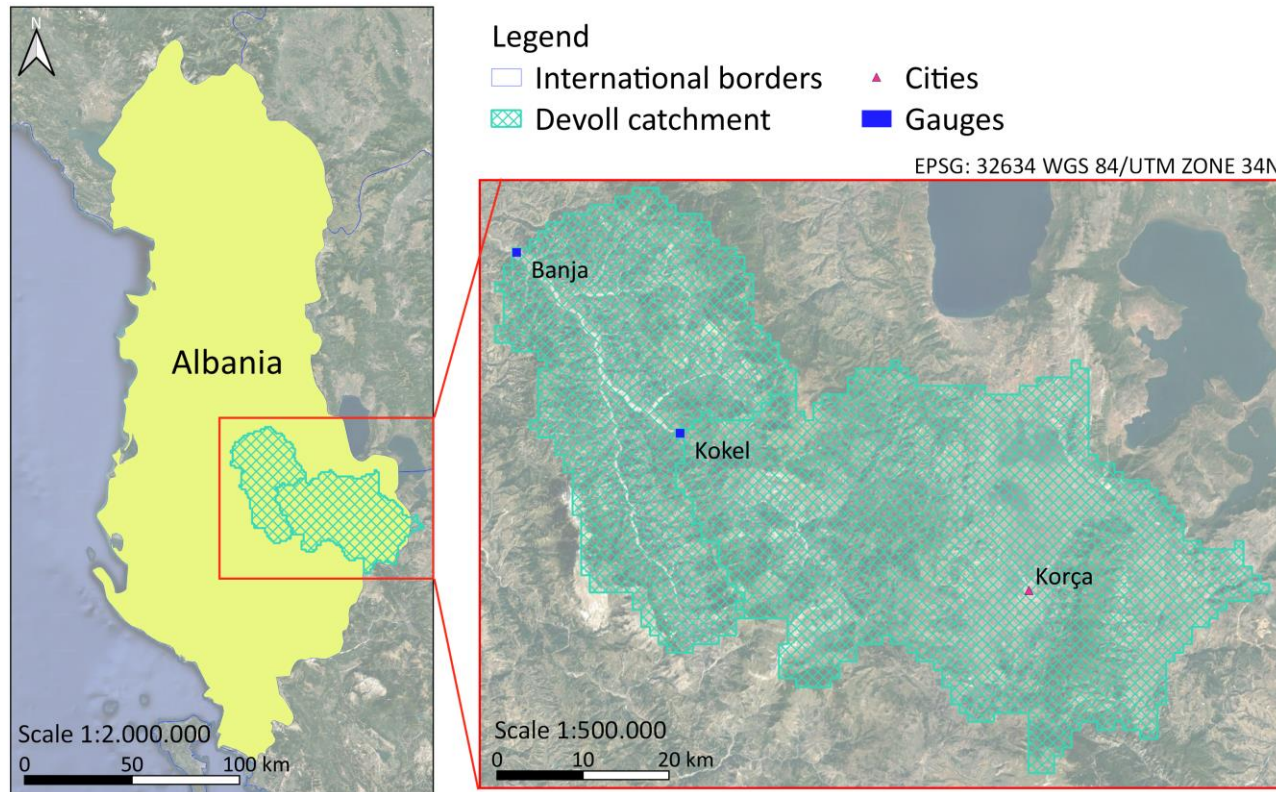
- *Mediterranean climatic region*: hot dry summers and mild rainy winters

- Area: approx. 3140 km^2

- *Flow regime*: snowmelt in upstream mountainous part, whereas precipitation dominates the lower regions
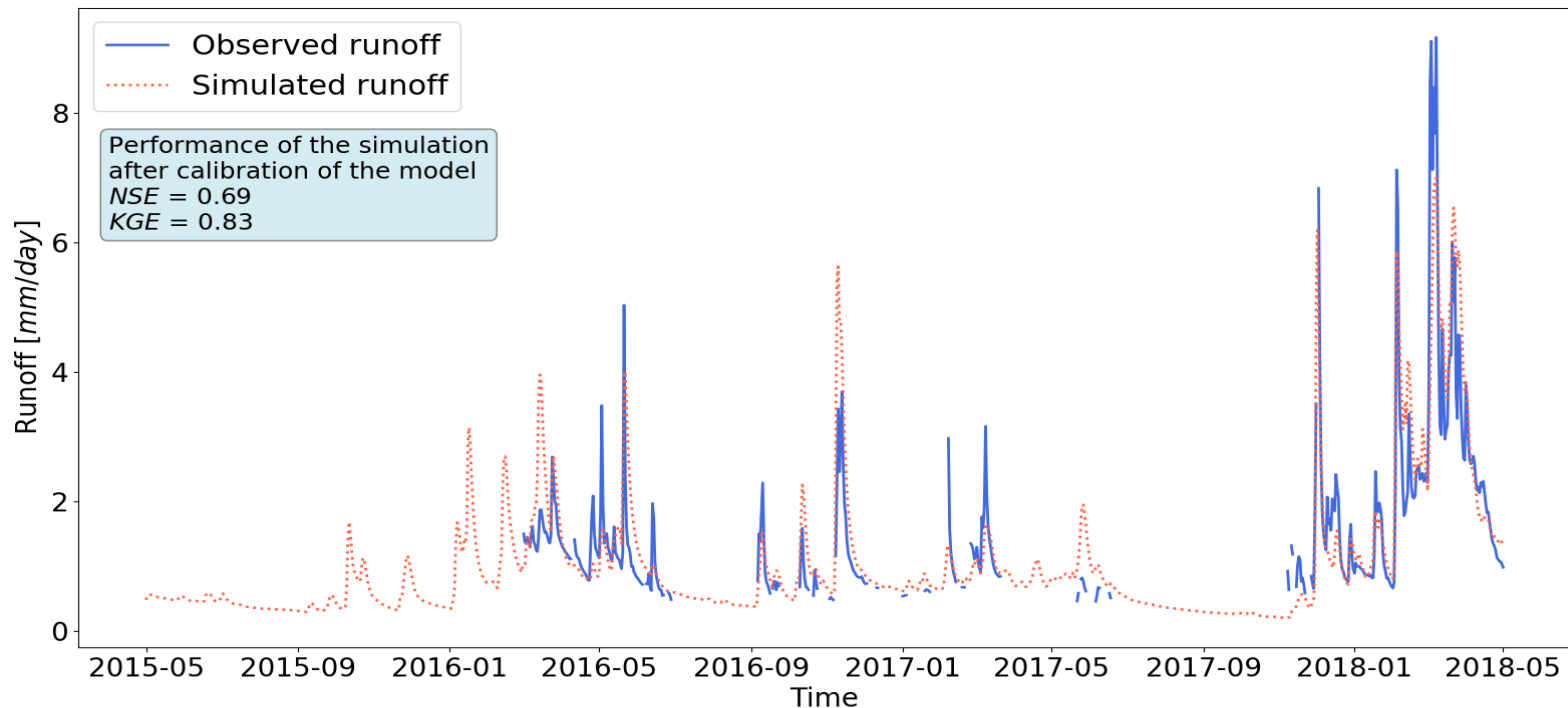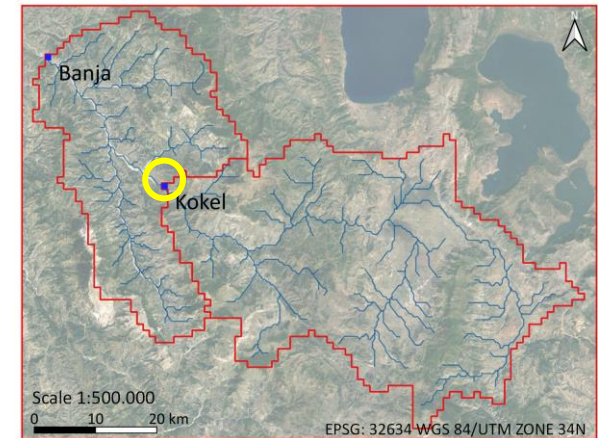
2. ERA5 reanalysis dataset

- ➢ Produced and continuously updated by the European Centre for Medium-Range Weather Forecasts (ECMWF)

- ➢ Combination of models with data from satellites and ground sensors

- ➢ Available from 1979 to almost present day in a 30 km grid with hourly resolution
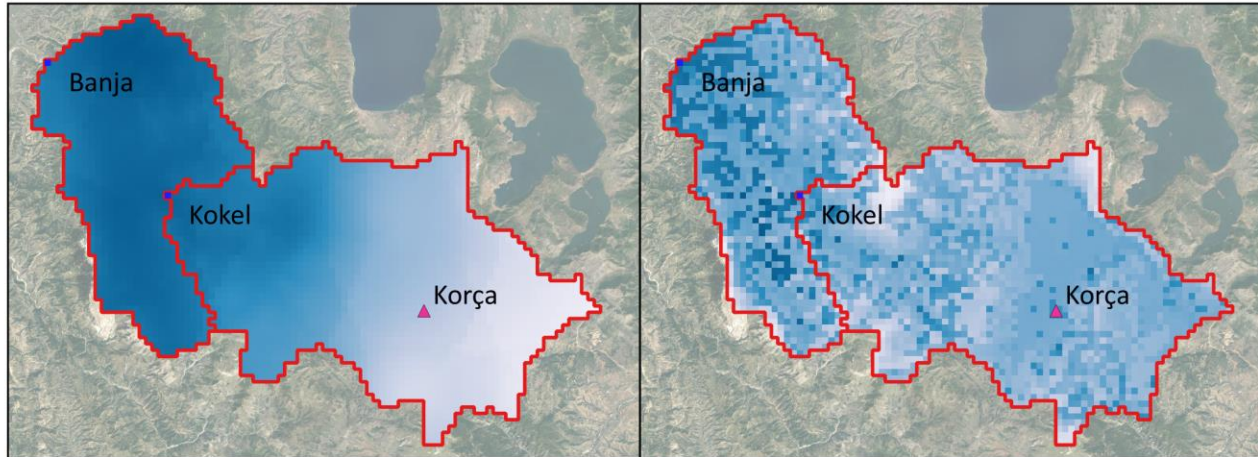
3. The model

- ➢ Grid-based **Wa**ter Flow and Balance **Si**mulation **M**odel **WaSiM-ETH** (Schulla 1996, 2019)

- ➢ Temporal and spatial resolution = daily, 1 x 1 km

- ➢ Soil model based on Richard's approach ➔ Water transport in the soil is based on hydraulic head gradients and soil physical properties

- ➢ **ERA5 input data**:

  - Precipitation
  - 2m and dew point temperatures
  - eastward and northward wind components
  - mean surface downward short-wave radiation flux

- ➢ Model calibration between observed and simulated runoff at "Kokel" station

- ➢ 11 parameters changed during calibration, including a precipitation factor ➔ 13% reduction of input precipitation

- ➢ **Good** performance of the simulation after calibration of the model

Scale 1:500.000
0   10   20 km
EPSG: 32634 WGS 84/UTM ZONE 34N

Performance of the simulation after calibration of the model
$NSE = 0.69$
$KGE = 0.83$

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Mean annual precipitation [mm]
Min = 870.5
Max = 1257.9

Mean annual Evapotranspiration [mm]
Min = 151.2
Max = 1074.9

Mean annual reference values in the Region of Korça (Eftimi 2010):

- Precipitation = 700 mm per year

- Evapotranspiration = 350 mm per year
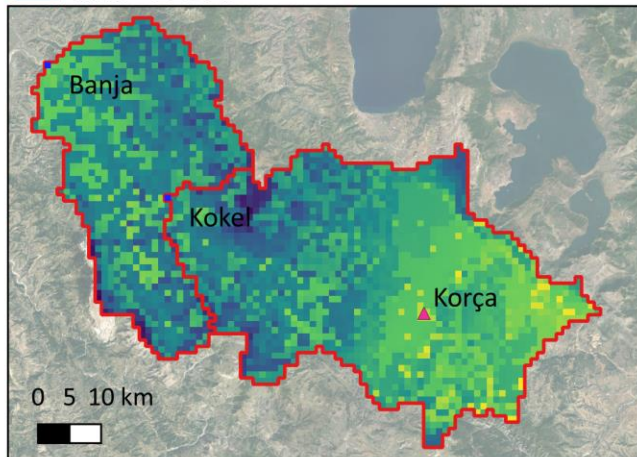
Mean annual runoff [mm]
Min = 35.0
Max = 1039.6

Scale 1:1000000
EPSG:32634 WGS 84/UTM ZONE 34N

5. Conclusions & Outlook

➤ Observed and simulated runoff follow the same dynamics: a close correspondence between flow peaks is achieved

➤ The **ERA5 reanalysis dataset** is a viable alternative for the **water balance modelling** in regions where meteorological input data availability is low or even absent

➤ However, a reduction of the input precipitation was required in the model

- A bias correction might be more suitable if precipitation from measuring stations were available

- A comparison with other regions were ERA5 was applied for the water balance modelling might be helpful to check the possible overestimation of the precipitation input

References:

Copernicus Climate Change Service 2017: ERA5: Fifth generation of ECMWF atmospheric reanalyses of the global climate. Copernicus Climate Change Service Climate Data Store (CDS). Available online at: https://cds.climate.copernicus.eu/cdsapp#!/search?type=dataset

Eftimi, R. 2010: Hydrogeological characteristics of Albania. Aqua Mundi, pp 79-92.

Google Satellite 2019: Google satellite for GIS.

Schulla, J. 2019: Model Description WaSiM. Available online at: http://www.wasim.ch/en/products/wasim_description.htm

Thank you!

Joint research project AXIS: "Evaluating Delivery Impacts on Reservoirs in changing climaTe and society across scales and sectors (DIRT-X)". Subproject 2: Hydrology and glaciology

Founded by:

Federal Ministry of Education and Research

Project number: 01LS1902B

Project Partners:

SMHI

universität innsbruck

NTNU

Universiteit Utrecht

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