THE GEOFRAME SYSTEM DEPLOYMENT IN THE ANALYSIS OF WATER AVAILABILITY AND SCARCITY IN THE PO RIVER BASIN DISTRICT AND MODEL CALIBRATION STRATEGIES

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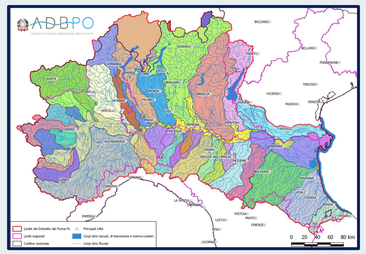
Introduction:



In 2021, the Po River Basin District Authority (ADBPO) undertook the implementation of the **GEOframe modelling system** on the whole territory of the district in accordance with the GCU-M (Gruppo di Coordinamento Unificato-Magre) to update the existing numerical modelling for water resource management, as part of the research project "**Data and models integrated system for the water resources management and the Po River basin district planning**".

- Better monitoring, estimation and simulation of the main hydrological variables characterizing the territory of the Po River district
- Water availability quantification across the entire Po River district and its tributaries
- Analysis of the water resources management impacts resulting from climate change or land use changes scenarios
- Identification of drought periods in real-time forecast and long-term prediction, including climate change impacts

The action plan of the Po River Basin District Authority aims to:

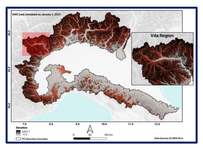
Deploy the **GEOframe** system over all the catchments in its territory

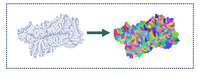
Calibrate and verify the results obtained by the hydrological and hydraulic models against measured discharges and water levels across the whole area

Analyze the water resources management impacts resulting from climate change or land-use changes scenarios

Where we started – the Valle d'Aosta pilot case:

- **Geomorphological analysis:**
  Spatial data: DEM + hydrological monitoring points --> GIS tools
  --> subdivision of the area of interest in the elementary units in which the hydrological cycle simulation takes place

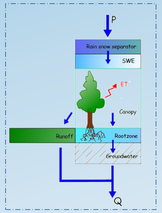




- **Calibration:**
  - "Zonal" calibration in correspondence of the hydrometers
  - 3 hydrological years period (generally 01/10/2015 – 30/09/2018)
  - KGE method

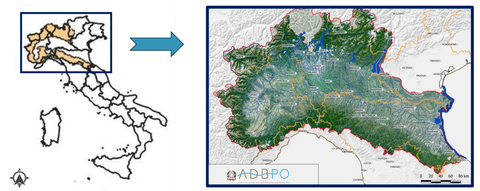
The GEOframe system:

- Conceptual semi-distributed hydrological model
- Developed by a scientific international community, leaded by the University of Trento
- Open source
- Flexible and modular
- Suited for operational applications



Scan me!

The Po River District at a glance

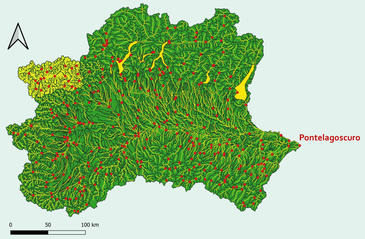


- longest Italian river
- 652 km length
- 38 main tributaries
- 3314 municipalities (2024)
- 8 regions and 1 autonomous province
- numerous environments and landscapes
- high biodiversity
- ~ 20 mln inhabitants
- > 32% agricultural national production
- > 37% national industries
- ~ 55% national hydroelectric production
- ~ 40% GDP

Methodology:

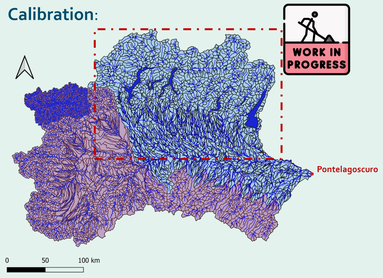
1. Data collection, validation, and preliminary elaboration
2. Geomorphological analysis
3. Spatial interpolation of the meteorological data (mainly temperature and precipitation) through the kriging components
4. Multi-site calibration of the snow melting and rainfall-runoff model parameters
5. Validation of the model results against measured data

The Po River Basin:



- 2879 subbasins
- 374 hydrometers

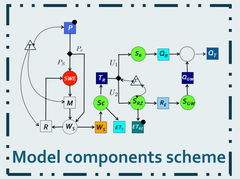
Calibration:

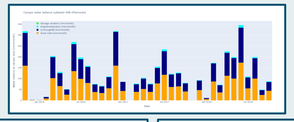


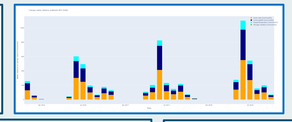
- 83 "calibrated hydrometers"
- LIFE CLIMAX PO

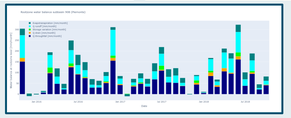
Calibration:

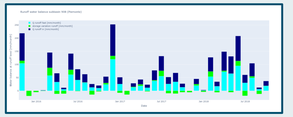
Water balance results:



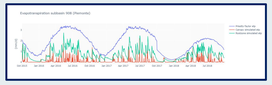


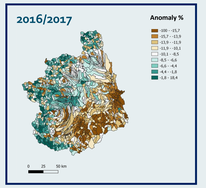






Outputs





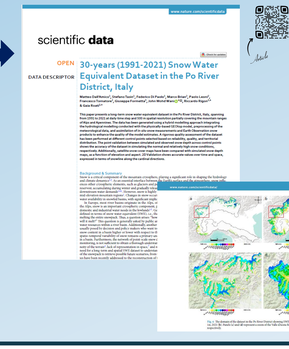
Soil moisture analysis at hydrologic year scale – anomaly with respect to the reference period 1991-2020

Correlated activities and next steps:

"CAMEL - Po" dataset where the geomorphology and the relative data of the Po River basin will be presented and distributed

Snow data cube that collects the SWE of the last 30 years as simulated with the model GEOtop for all the subbasins of the Po River

EGU Abstract



Hydrometeorological data cube where all the ground data collected since 1990 are interpolated according to the EEA 1kmx1km reference grid

EGU Abstract

Simulation and the discussion of daily hydrology as produced with GEOframe since 1990

EGU Abstract

Abstract

Sharing is encouraged