

An Open GIS based utility for the assessment of water resources availability and riverine hydropower capacity

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Introduction

The paper deals with some applied research activities carried out in the SMART Basilicata project that aims to select and develop innovative and technological solutions addressed to an efficient and sustainable management of environment, mobility and energy, to social participation and smart services use for both Public Administrations and citizens.

Aim

A Spatial Decision Support System (SDSS) achieved by an automatic procedure with a QGIS plugin has been implemented. This tool, named Hydro Smart Power, has a user-friendly interface in order to ensure a simple and effective use and is finalized to assist a human decision-maker in the water resources estimation, riverine hydropower evaluation and to the related ecological flow assessment at a particular site along the drainage network.

Method

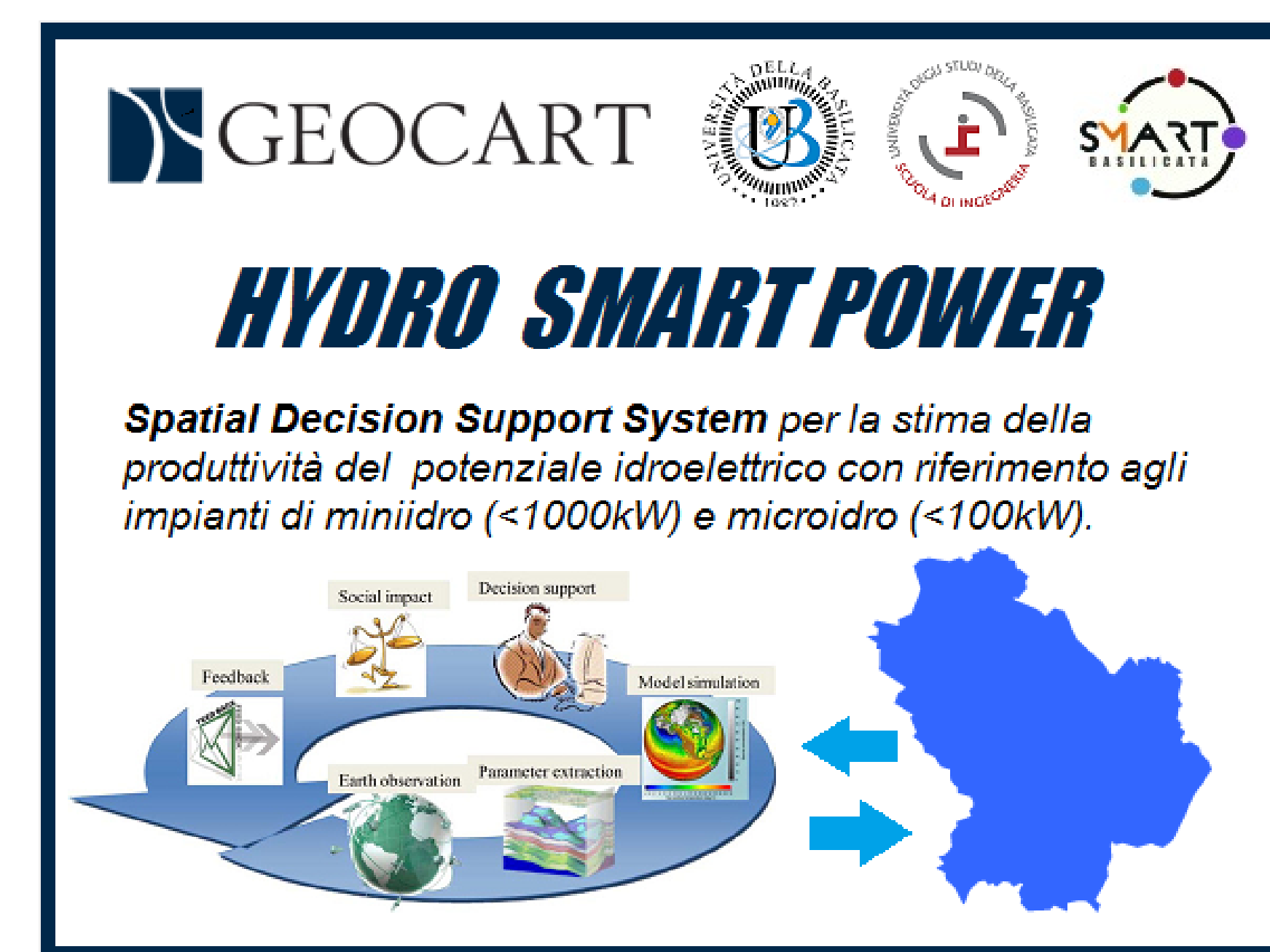
From an operative point of view, starting from basic information involving digital terrain model, hydrometeorological stations and daily-gauge rain data series, the implemented procedure allows automatic watershed delineation, spatially distributed average monthly rainfall assessment discretization and hydrological parameters estimation for the selected observation period.

The spatially distributed average monthly rainfall assessment has been carried out by the Thiessen polygons discretization based on the network of hydrometeorological stations.

Due to the presence of reservoirs, the hydrological parameters estimation refers to the application of re-calibrated hydrological regionalization formulae.

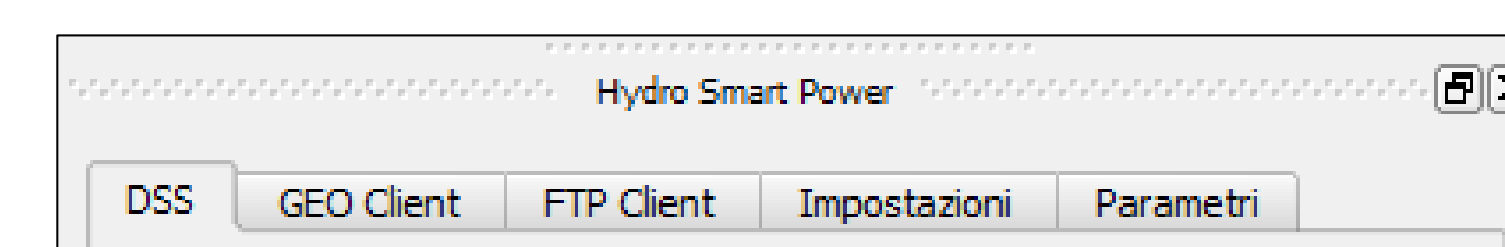
Furthermore, the tool estimates the ecological flow equal to the 20th percentile of the monthly average flow distribution, or with the application of the IHA code.

SDSS



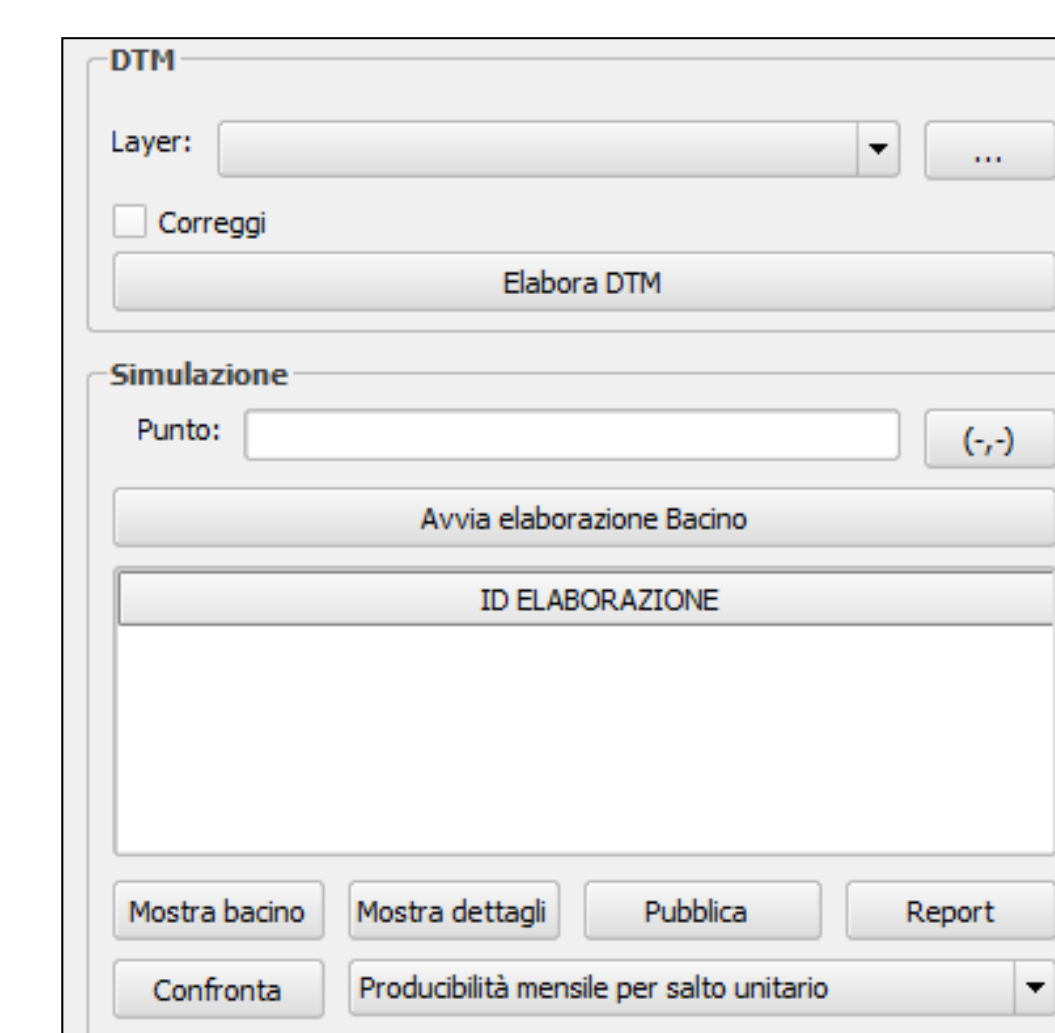
The tool consists of 5 main sections:

- DSS section
- GEO Client section
- FTP Client section
- Settings section
- Parameters section



Main sections of the application

In the DSS section are grouped the key functionalities of the Decision Support System that allow the estimation of the productivity of the hydropower potential.

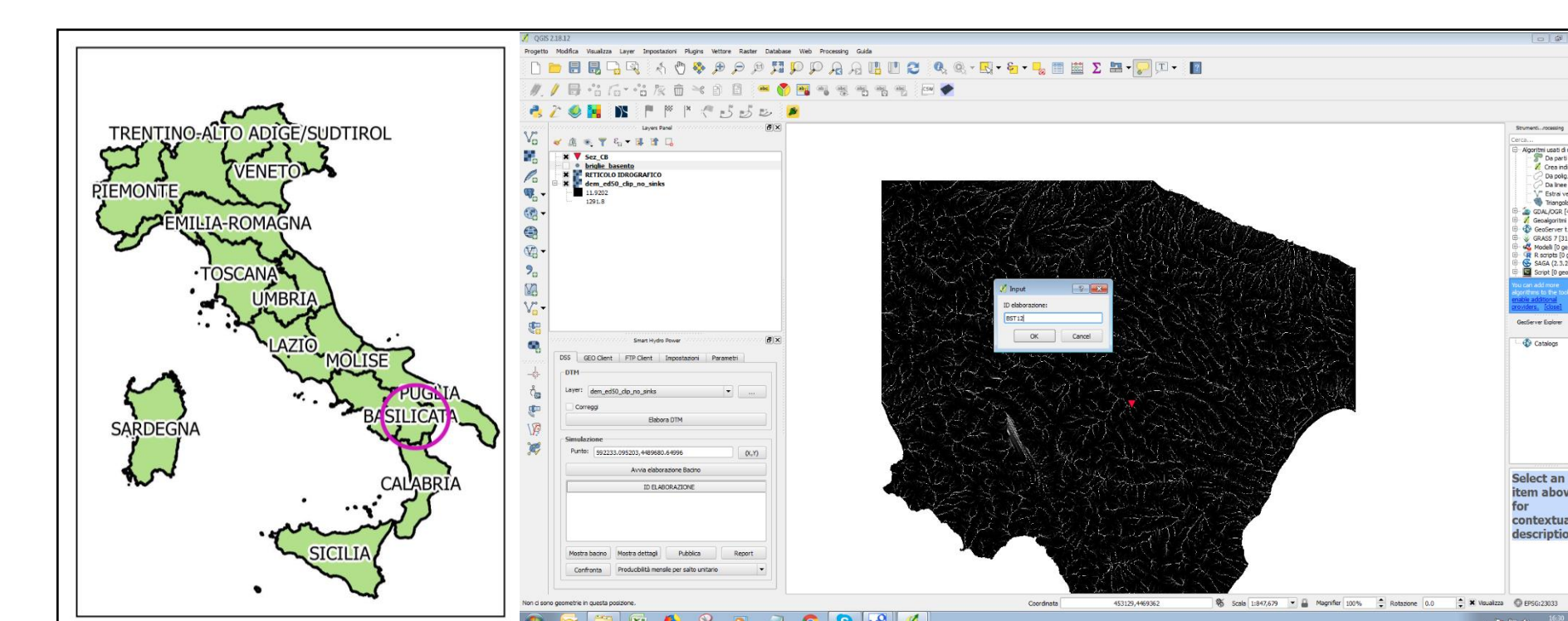


DSS Section

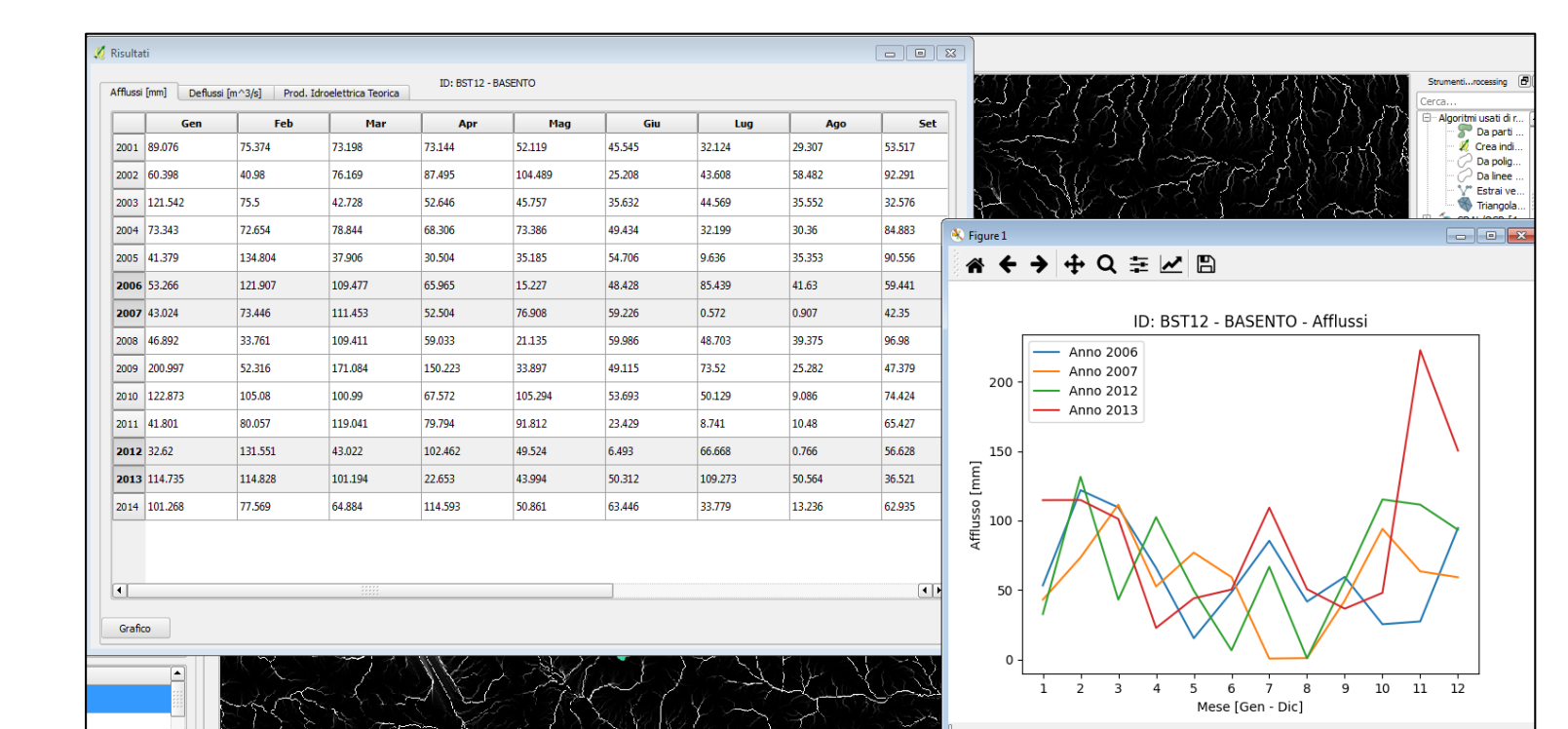
Application and results

The results of such assessment consist in monthly and annual volume amount of water, monthly and annual hydro renewable energy, theoretical hydropower plant capacity related to the head of 1 meter. Finally, all the results are reported and showed in both chart and table forms.

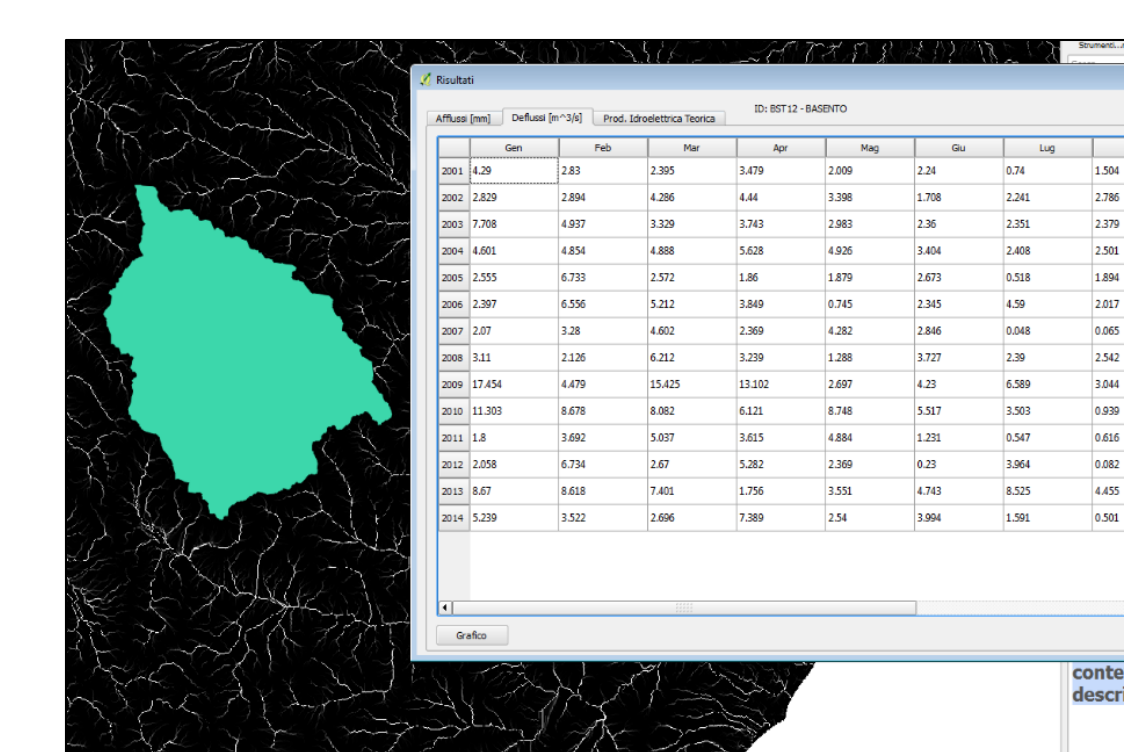
The first application of the tool has been carried out in the territory of the Basilicata Region, but its application can also be extended to other territories.



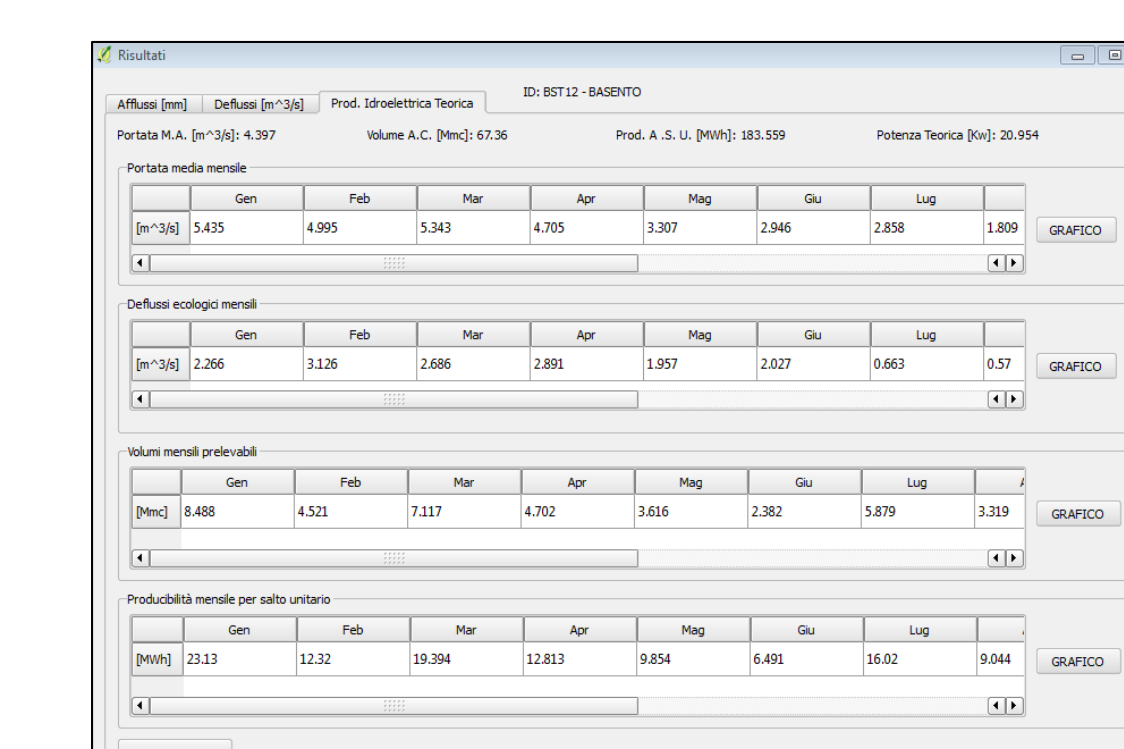
Analyzed site



Average monthly rainfalls

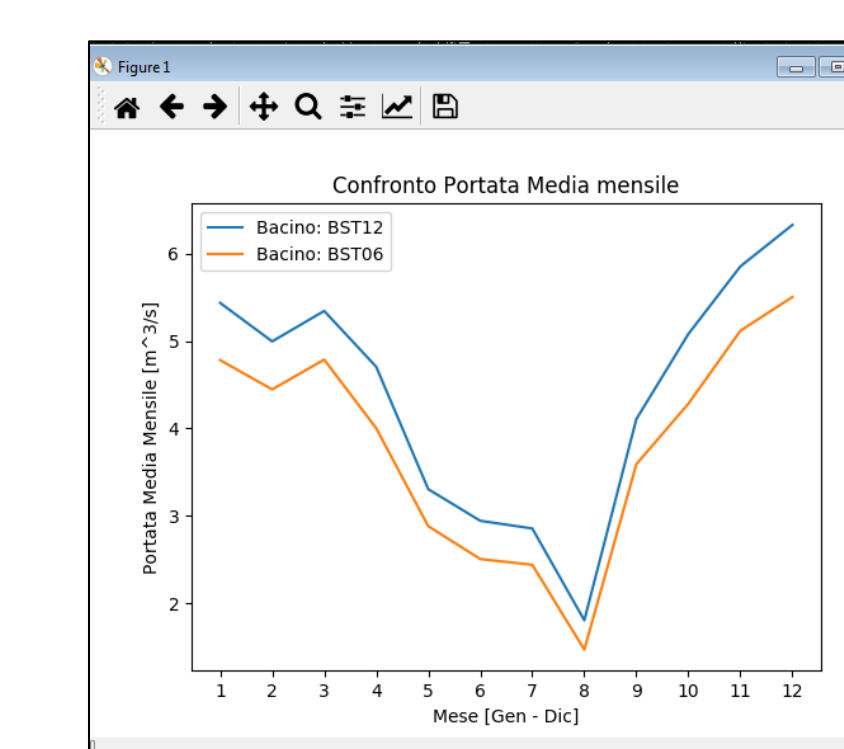


Average monthly flows

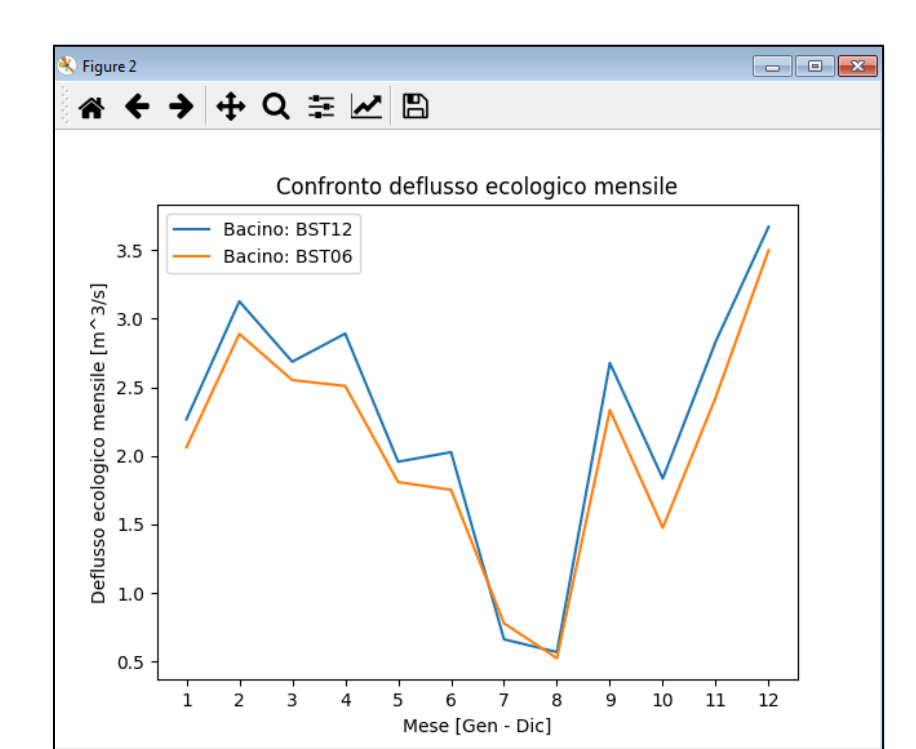


Hydroelectric productivity

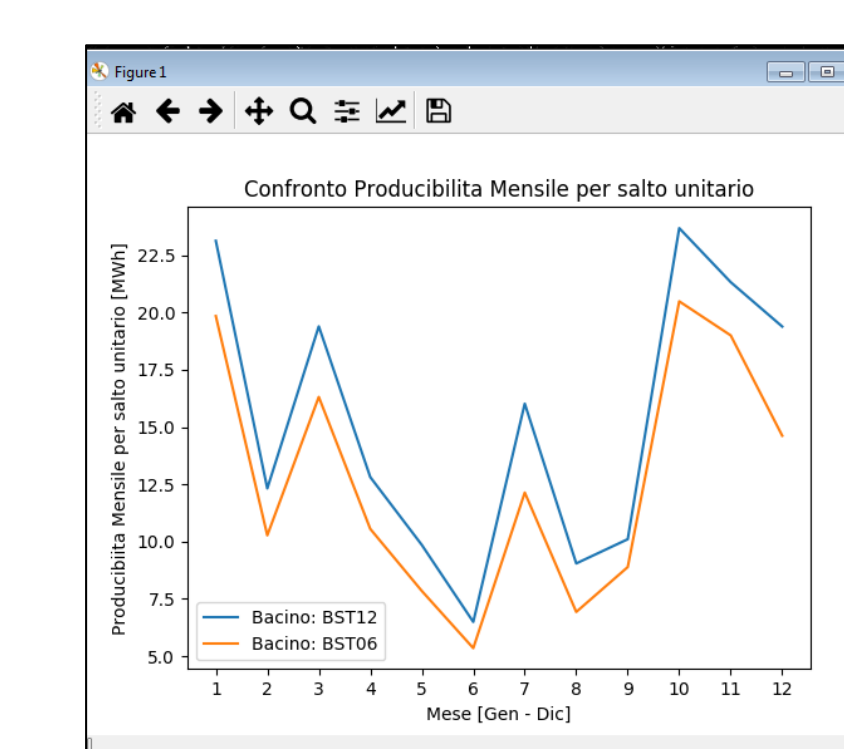
Comparisons



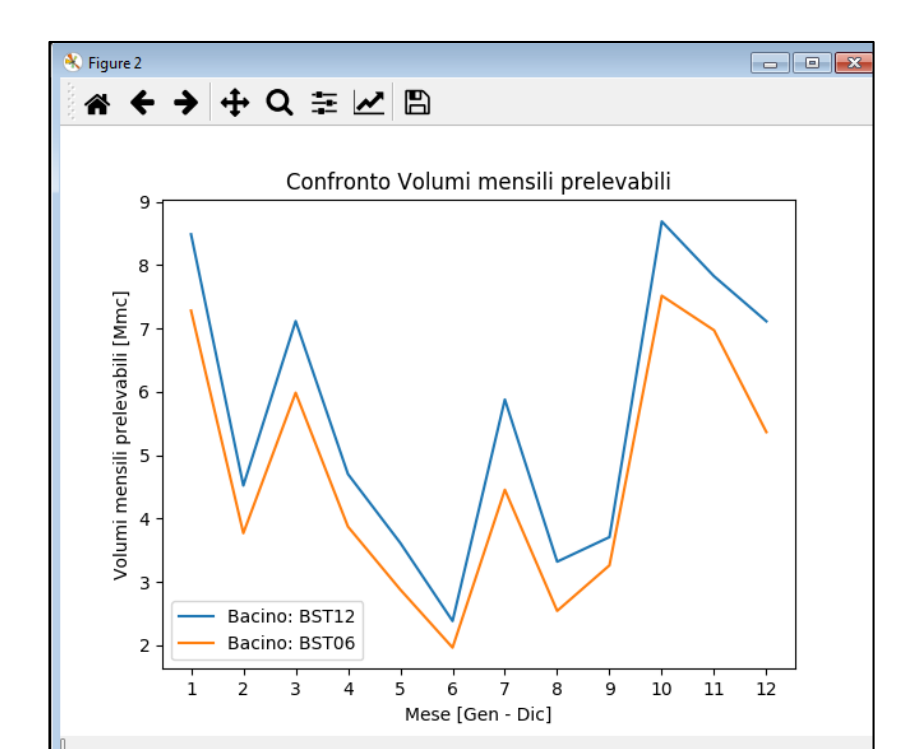
Average monthly flow



Monthly ecological flow



Hydroelectric production for a value unit of the head



Monthly volume of water potentially allowable

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