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Groundwater assessment for a proper management and sustainable use of the resources in the middle-high venetian plain

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This work describes a project that aims to assess and forecast the groundwater balance and the spatiotemporal behavior of fluxes in a regional aquifer located in the middle-high venetian plain between rivers Brenta and Piave (Italy) to analyze the impact of future irrigation policies and to define at regional scale the risk of contamination.

The area is widely exploited for agricultural purposes and over time many wells (owned by Water Service Companies and private bodies) have been drilled for the supply of drinking water. A dense network of ditches, that still guarantee most agricultural requirements by border irrigation, is replaced year by year with pressurized systems (sprinkler and drip). This change shows positive effects, reducing the amount of diverted water from rivers helping the Ecological Flows (Eflows) requirements (EU Guidance Document No. 31 2015). On the other hand, it actually reduces the infiltrated volumes (acting as artificial recharge) that sustain the groundwater reserve since centuries ago. Together with the growing number of active and potential sources of pollution, all this jeopardizes the water supply from wells intended for human consumption.

This situation requires proper knowledge and tools to anticipate consequences of a changing environment and to suggest policies for an appropriate management and sustainable use of groundwater.

The study area develops north to south from the Prealps to the middle of the plain, between Brenta River (west) and Piave River (east). Evidences from geological surveys show a sand and gravel aquifer extending from uplands in the north piedmont region to the southern one where a layered system of nine aquifers can be recognized. The hypothetical separation takes place along alluvial springs that origin the river Sile, that acts as a drain for the upper aquifer of the whole area.

A numerical model of the aquifer is under development using Feflow® by DHI, a finite element software able to reproduce the subsurface flow field and transport phenomena. Geological description and vertical stratigraphy of boreholes were used to build the geo-structural model, whose spatial extent was also chosen on the availability of data – water table, piezometric levels and/or fluxes – to be imposed on the boundaries. Rainfall, irrigation, evapotranspiration and water withdrawal artificially from wells or naturally from springs, as well as the flow interchange across the section of rivers, are the external forcing varying in time and controlling the water table and piezometric levels behaviors.

Water table and piezometric level information are fundamental in the calibration of the subsurface hydraulic parameters. The actual monitoring network, that considers sensors in wells property of Regional Environmental Agency and different Water Service Companies, has been improved to mitigate its non-uniform spatial distribution instrumenting 25 new positions to reach in the whole area (about 900 km^2) a total number of 84 monitored wells (density of about 1 sensor every 10 km^2).

Information about historical evolution of different irrigation techniques have been gathered from the three Land Reclamation Authorities managing the investigated area to reproduce the present situation and forecast future different scenarios.