

Proposers: Paolo Fabbri, Leonardo Piccinini

Titolo: *Impacts of urban sprawl on groundwater in Veneto Region*

Several areas of Italy are subject to the phenomenon of urban sprawl (US), causing an increase in "consumption" of the territory, very often not proportional to a rise in population. The Veneto region is affected by this phenomenon, which has been evolving over the past decade. The physical and chemical processes related to urban sprawl may have a negative impact on groundwater quality and/or quantity.

The main purpose of the project is to analyze the possible impacts of urban sprawl on shallow groundwater aquifers in Veneto region, through the hydrogeological characterization of three study sites. The first site is a large area, of about 400 km², located in the lower part of the alluvial Venetian plain, on the edge of the delicate Venetian lagoonal system, in the urban area of Mestre (VE). The second and third area are two experimental fields located in the upper and in the middle part of the same alluvial plain respectively at Villorba (TV) and Villaverla (VI).

The research program is articulated in 3 main work stages: (1) analysis of the urban sprawl affecting the studied areas, (2) data collection and field experimental activities, (3) modeling activity.

1) US evolution in the Veneto region on the last decade (2000 to 2010) will be reconstructed from acquisition and analysis of available remote sensing data (ASTER dataset and/or QuickSCAT/-DSM from NASA), available spatial data (CORINE Landcover) and available literature data (European Environment Agency, EEA). These analysis will be conducted in order to evaluate the dynamics of US with the specific focus on the increase in impervious areas.

2) Hydrogeological characterization will start by acquisition of potentiometric data on the study areas. For the first site potentiometric data both from the Venezia province database as well as collected from a monitoring network developed ad hoc, will be obtained and analyzed, while for the other study sites potentiometric data from Environmental Regional Protection Agency (ARPAV) database will be collected. Aquifer and slug tests will be carried out for some available wells in order to define the aquifer hydraulic conductivity. Moreover, dilution tests in wells and tracing multi-well tests, in particular in the experimental fields of Villorba and Villaverla, will be carried out in order to experimentally estimate groundwater flow velocities and hydrodispersive parameters. All this information will be spatialized by geostatistical methods and rendered in a GIS environment. Finally, precipitation data by ARPAV will be acquired and analyzed with a specific focus on the relationship to groundwater regimes. The recharge response times of these shallow groundwater systems will be analyzed studying the cross-correlation between groundwater levels and daily/hourly values of precipitation. This study is aimed at outlining quantitatively the main variations in these surface aquifers in the last 10 years.

3) The architecture of the reservoirs of aquifers will be reconstructed (within the first 20 meters) via geostatistical analysis. All the obtained hydrogeological parameters will be spatialized by geostatistical models and subsequently these results will be used to implement three hydrogeological numerical models, able to simulate equiprobable future scenarios even with different spatial distributions of lithologies and hydrodynamic/hydrodispersive properties. Moreover, future scenarios in terms of a recharge reduction of

the aquifer systems may be related both to urban sprawl (such as an increase in impervious areas) and to a modification of the rainfall regime due to climate change.

The modeling analysis results in different hydrogeological contexts will allow the identification of some synthetic indices able to quantify the effect of urban sprawl on shallow groundwater.