

Title: Analysis and modeling of natural and anthropogenic hydrogeological changes in the peri-Vesuvian area (southern Italy)

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Research program

The peri-Vesuvian area is a large coastal sector of Campania region (southern Italy), characterized by a complex hydrogeological and urban setting, due to the presence of different karst, volcanic, pyroclastic-alluvial aquifers underlying a highly urbanized and industrialized context.

Some of these aquifers (e.g. Avella Mts. karst aquifer) represent a strategic groundwater resource for GORI SpA, the private company that manages the integrated water service for ATO3 and for a population of about 1,500,000 inhabitants.

In the last century, the groundwater of this large and coastal peri-urban sector of Campania region has been extensively exploited for drinking, irrigation and industrial use. However, land use and groundwater use changes have caused hydrogeological changes (e.g. land subsidence, groundwater rebound, ground uplift) with consequent environmental problems (e.g. groundwater flooding, groundwater contamination). For this reason, the peri-Vesuvian area can be considered a case study of how different hydrogeological, natural and anthropogenic changes (urbanization, land use and groundwater use change), can affect the availability and quality of the groundwater resource and have negative effects on the hydrogeological environment.

Although the aquifers of the peri-Vesuvian area are an important groundwater resource for Campania region, an updated modeling of natural and anthropogenic hydrogeological changes of groundwater is still lacking. The objective of the research program is: (i) to develop a robust hydrogeological and hydro-stratigraphic model, based on a stratigraphic and hydraulic parameterization of the aquifers, (ii) to monitor the current groundwater levels in sample aquifers, to understand the causes and patterns of spatial and temporal variations in groundwater, and (iii) to develop groundwater flow models in sample areas, to simulate future scenarios, induced by abstraction and climate changes (i.e. recharge) on hydrogeological dynamics of aquifers.

Proposal for a PhD position

Starting from the aforementioned scientific background, a PhD position is proposed, by the development of collaborations with other national and international research centers, considering these collaborations as fundamental for the scientific growth of the PhD student, as well as for the achievement of scientific objectives.

During the three years, the research program will be organized as follows: *first year*) basic and specialist training for the PhD student, to address the research topic; data collection and literature review; implementation of a GIS platform, for cartographic development and hydrogeological modeling; *second year*) hydrogeological modeling of sample aquifers by use of advanced software (e.g. Rockworks, RockWare Inc.); development of multitemporal and multiscale hydrogeological models, by integrated approaches and use of terrestrial and satellite monitoring data; *third year*) hydrological analysis of the effects induced on groundwater by: a) climatic variations (e.g. rainfall decrease, increase of air temperature), b) land use change (urbanization) and groundwater use (variation in withdrawals) changes on hydrogeological variation (piezometric/hydrochemical variation), land subsidence, ground uplift and groundwater flooding phenomena.

Projects in progress

Research Agreement, signed between DiSTAR and GORI SpA (Optimal Water Resources Management), concerning scientific collaboration activities in the field of groundwater management in a climate change scenario. Total cost of the research agreement: € 170,000.00.