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Design of a 3D/4D hydrogeologic geo-database: an application in the so-called “Terra dei Fuochi” area (Campania, Italy)

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The monitoring data of spatial-temporal variation of groundwater properties (groundwater levels, hydrodynamic properties, chemical and isotopic characteristics, etc.), collected in different times and with different aims, are often scattered or missing. Moreover, a messy database generates huge amounts of data. Especially the handling of time as a fourth dimension usually requires terabytes of storage space. Therefore, an appropriate data collection, storage and management is required, that is a key concept for the 3D/4D GIS. The objective of this study is to produce a comprehensive data management model that optimizes the handling and storage of spatial-temporal data. The 3D / 4D hydrogeological geo-database with WebGIS implementation for the “Terra dei Fuochi” Campania (Italy), is capable of storing information relating to different parameters (groundwater levels, physical-chemical, isotopic characteristics, etc.) in the space and their variation over time.

Moreover, the model will be capable of handling various kinds of spatial-temporal applications. These include the proper handling of temporal variations (e.g. trends in nitrate pollution, decrease of groundwater levels, climate change effects, etc.) and spatial variation (delimitation of contaminated areas, areas with natural high levels of geogenic compounds, etc.) within a 4D model. The storage requirements will be reduced and spatial as well as spatial-temporal operations are accelerated significantly.

This model could also be used by land managers and restoration practitioners with little knowledge of groundwater, but still have an interest in the critical issues of groundwater, assisting the environmental managers in making decisions in environmental recovery projects.

A further development could be a mobile application providing the same results, enabling real time data in the field to be used in decision-making. That will provide a great opportunity for the knowledge advancement of the field of groundwater.