EGU23-8037, updated on 17 Jul 2023
https://doi.org/10.5194/egusphere-egu23-8037
EGU General Assembly 2023

Assessment of groundwater quality and piezometric levels using geostatistical methods in Grombalia aquifer, Tunisia.

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Groundwater sources in arid and semi-arid regions are expected to be gradually more stressed due to multiple causes, such as the depletion of surface water resources, water quality degradation, increasing demand of agriculture and economic and demographic growth. As a result, there is a need to secure the availability and quality of groundwater reserves in those areas.

Large and high-dimensional datasets are required to fully characterize the physico-chemical properties of the complex groundwater processes. Subsequently, statistical tools are used to provide estimations of these properties beyond the sampling locations, which are required in order to provide reliable assessments of the associated risks. Geostatistical tools are widely used in groundwater applications to estimate the spatial variability of quality parameters by combining different types of datasets to build local models of spatial uncertainty. Special attention is given to the kriging method, which provides an estimate of the unknown quality variable value along with a measure of uncertainty regarding that estimate.

In the current study, groundwater samples are collected from an unconfined aquifer, located at north-eastern Grombalia (Tunisia). Ordinary kriging is used to estimate the spatial variability of piezometric levels and quality parameters. Sampling data are subjected to suitable transformations prior geostatistical computations so that the Gaussian assumption is satisfied, whereas the results are back-transformed to the original space. Different numbers of neighboring data points are considered to decide the spatial extent of the search neighborhood by comparing cross-validation errors. In addition, indicator kriging is used to construct probability maps of the quality parameters, and identify regions that possess high probability to exceed irrigation water quality standards.

Acknowledgement

This work is conducted under ‘EXCELSIOR’ project (www.excelsior2020.eu), which has received funding from the European Union’s Horizon 2020 research and innovation programme under

Grant Agreement No 857510, from the Government of the Republic of Cyprus through the Directorate General for the European Programmes, Coordination and Development and the Cyprus University of Technology. This work is also supported by the PRIMA program under grant agreement No1923, project InTheMED. The PRIMA program is supported by the European Union.