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Understanding groundwater drivers in the Mediterranean region using a combination of modeling and in-situ data at a regional scale

Rafael Chavez Garcia Silva¹, Nahed Ben-Salem¹, Robert Reinecke², Michael Rode^{1,2}, and Seifeddine Jomaa¹

¹Department of Aquatic Ecosystem Analysis and Management, Helmholtz Centre for Environment Research - UFZ, Magdeburg, Germany

²Institute of Environmental Science and Geography, University Potsdam, Potsdam, Germany

The Mediterranean region is characterised by growing anthropogenic and climate pressures, resulting in increased water demand. Even though groundwater represents a strategic freshwater reserve in the Mediterranean, its status is becoming increasingly uncertain. The uneven distribution of data availability and scant data-sharing policies and systematic monitoring are significant constraints for management and vulnerability assessments. The objectives of this work are: i) characterization of significant changes in groundwater level time series in the region, ii) comparison of groundwater level models with in-situ data, iii) determine the influence of drivers in the temporal changes as well as the spatial distribution of groundwater levels.

A database has been developed with over 8,000 time series of groundwater levels collected from national monitoring systems of Spain, Portugal and France, concentrating most measurements after 1980. At first, a search for long term trends and temporal patterns is performed on the most complete time series in the 1985-2014 period. Correlations between significant trends and environmental and anthropogenic drivers are assessed. Furthermore, the outputs of three steady-state global groundwater models (Reinecke et al. (2019), de Graaf et al. (2015) and Fan et al. (2013)) are compared to both interpolated grid-based and piezometer observations. And the relationship between the spatial distribution of groundwater level with explanatory variables is characterized.

Significant groundwater level changes can be found in at least one third of the assessed piezometers. The simulated steady-state hydraulic head obtained from the three models showed a good agreement with the in-situ data in the Iberian Peninsula. A combined analysis of the temporal and spatial drivers for groundwater dynamics at a regional scale will ameliorate groundwater process understanding in the Mediterranean region. This study also makes a case about the importance of consistent and reliable monitoring as a necessary step for management of the resource.

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