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Combining a global groundwater model ensemble with in-situ data for groundwater assessment in the Mediterranean region

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Growing water demands in the Mediterranean region have increased groundwater exploitation, imposing urgent and efficient groundwater management. Sustainable management requires a proper understanding of groundwater status and accurate estimates of groundwater levels with less uncertainty. In this context, large-scale modelling has been shown to assess groundwater resources under changing conditions, especially in regions known for data scarcity. This study aims to quantify the steady-state groundwater levels at continental scales using a model ensemble and in-situ groundwater observations. To test the models' applicability and validity, we utilize one of the most monitored groundwater systems in the Mediterranean region, the Iberian Peninsula. Outputs of three global gradient-based groundwater models (Reinecke et al. (2019), de Graaf et al. (2017), and Fan et al. (2013)) were compared to observations from long-term groundwater monitoring network. The model ensemble showed reasonable performance in replicating the groundwater levels for shallow groundwater, but performance deteriorated with increased elevation.

In this study, we argue that we can develop continental scale groundwater maps for groundwater assessment by combining model results with in-situ data. Historical groundwater levels were used to test, train and validate the different combination methods. Here we present the outcomes and discuss the accuracy of the final product. We see this study as a benchmark approach of using multi-model ensemble and observations to deliver better groundwater steady-state conditions as a baseline for groundwater users and managers in the Mediterranean region.

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