

Using the turnover time index to identify potential strategic groundwater resources to manage droughts within continental Spain

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Abstract

The management of droughts is a challenging issue, especially in water scarcity areas, where this problem will be exacerbated in the future. The aim of this paper is to identify potential groundwater (GW) bodies with reduced vulnerability to pumping, which can be used as buffer values to define sustainable conjunctive use management during droughts. Assuming that the long term natural mean reserves are maintained, a preliminary assessment of GW vulnerability can be obtained by using the natural turnover time (T) index, defined in each GW body as the storage capacity (S) divided by the recharge (R). Aquifers where R is close to S are extremely vulnerable to exploitation. This approach will be applied in the 146 Spanish GW bodies at risk of not achieving the Water Framework Directive (WFD) objectives, to maintain a good quantitative status. The analyses will be focused on the impacts of the climate drivers on the mean T value for Historical and potential future scenarios, assuming that the Land Use and Land Cover (LULC) changes and the management strategies will allow maintenance of the long term mean natural GW body reserves. Around 26.9% of these GW bodies show low vulnerability to pumping, when viewing historical T values over 100 years, this percentage growing to 33.1% in near future horizon values (until 2045). The results show a significant heterogeneity. The range of variability for the historical T values is around 3700 years, which also increases in the near future to 4200 years. These T indices will change in future horizons, and, therefore, the potential of GW resources to undergo sustainable strategies to adapt to climate change will also change accordingly, making it necessary to apply adaptive management strategies.

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