

## **Groundwater influence on soil moisture memory and land-atmosphere interactions over the Iberian Peninsula**

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We investigate the memory introduced in soil moisture fields by groundwater long timescales of variation in the semi-arid regions of the Iberian Peninsula with the LEAFHYDRO soil-vegetation-hydrology model, which includes a dynamic water table fully coupled to soil moisture and river flow via 2-way fluxes.

We select a 10-year period (1989-1998) with transitions from wet to dry to again wet long lasting conditions and we carry out simulations at 2.5 km spatial resolution forced by ERA-Interim and a high-resolution precipitation analysis over Spain and Portugal. The model produces

a realistic water table that we validate with hundreds of water table depth observation time series (ranging from 4 to 10 years) over the Iberian Peninsula. Modeled river flow is also compared to observations. Over shallow water table regions, results highlight the groundwater buffering effect on soil moisture fields over dry spells and long-term droughts, as well as the slow recovery of pre-drought soil wetness once climatic conditions turn wetter. Groundwater sustains river flow during dry summer periods. The longer lasting wet conditions in the soil when groundwater is considered increase summer evapotranspiration, that is mostly water-limited. Our results suggest that groundwater interaction with soil moisture should be considered for climate seasonal forecasting and climate studies in general over water-limited regions where shallow water tables are significantly present and connected to land surface hydrology.