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# Integrated surface–subsurface hydrological modeling for the assessment of groundwater recharge in the Venetian high plain, Italy

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Groundwater accounts for almost 99% of the available liquid freshwater present on Earth and it is the main source of drinking water. It is recharged not only by rainwater (including losing streams) and snowmelt, but also by infiltration of water used for irrigation. In this study, CATHY (CATchment Hydrology), an integrated surface–subsurface hydrological model (ISSHM), is used to quantify current and future recharge fluxes in the Venetian high plain between the Brenta and Piave Rivers. This area, with a size of around 900 km$^2$, represents an important source of drinking water supply for the Veneto region, Northeast Italy. In compliance with European directive indications, to decrease water withdrawals from the Piave River and preserve its ecological flow, the irrigation management must be reviewed. First, we calibrated CATHY through a combination of FePEST and the Shuffled Complex Evolution algorithm, whereby both the bottom of the unconfined aquifer and the hydraulic conductivity field were estimated. After validation, the model was used to simulate a scenario in which the flood irrigation method, currently the most widespread in the study area, is fully replaced by sprinkler irrigation. The results show that in response to a 50% decrease in water abstraction from the Piave River, the total recharge decreases by about 10%, with a local decrease in the groundwater level, mainly limited to wells located in areas directly affected by the change in irrigation technique and where hydraulic conductivity is higher. Overall, this work demonstrates that ISSHMs are capable of reproducing groundwater dynamics and its drivers at high resolution and regional scales, representing useful tools to investigate possible responses of hydrosystems to future land use and climate change.