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# Irrigation in JULES Land-Only Simulations over South and East Asia

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Capturing soil moisture-atmosphere feedbacks in a weather or climate model requires realistic simulation of various land surface processes. However, irrigation and other water management methods are still missing in most global climate models today, despite irrigated agriculture being the dominant land use in parts of Asia. In this study, we test the irrigation scheme available in the land model JULES (Joint UK Land Environment Simulator) by running land-only simulations over South and East Asia driven by WFDEI (WATCH Forcing Data ERA-Interim) forcing data. Irrigation in JULES is applied on a daily basis by replenishing soil moisture in the upper soil layers to field capacity, and we use a version of the irrigation scheme that extracts water for irrigation from groundwater and rivers, which physically limits the amount of irrigation that can be applied. We prescribe irrigation for C3 grasses in order to simulate the effects of agriculture, albeit retaining the simpler, widely used 5-PFT (plant functional type) configuration in JULES. Irrigation generally increases soil moisture and evapotranspiration, which results in increasing latent heat fluxes and decreasing sensible heat fluxes. Comparison with combined observational/machine-learning products for turbulent fluxes shows that while irrigation can reduce biases, other biases in JULES, unrelated to irrigation, are larger than improvements due to the inclusion of irrigation. Irrigation also affects water fluxes within the soil, e.g. runoff and drainage into the groundwater level, as well as soil moisture outside of the irrigation season. We find that the irrigation scheme, at least in the uncoupled land-atmosphere setting, can rapidly deplete groundwater to the point that river flow becomes the main source of irrigation (over the North China Plain and the Indus region) and can have the counterintuitive effect of decreasing annual average soil moisture (over the Ganges plain). Subsequently, we will explore the impact of irrigation on regional climate by conducting coupled land-atmosphere simulations.