Local control on precipitation in a fully coupled climate-hydrology model

The ability to simulate regional precipitation realistically by climate models is essential to understand and adapt to climate change. Due to the complexity of associated processes, particularly at unresolved temporal and spatial scales this continues to be a major challenge. As a result, climate simulations of precipitation often exhibit substantial biases that affect the reliability of future projections. Here we demonstrate how a regional climate model (RCM) coupled to a distributed hydrological catchment model that fully integrates water and energy fluxes between the subsurface, land surface, plant cover and the atmosphere, enables a realistic representation of local precipitation. Substantial improvements in simulated precipitation dynamics on seasonal and longer time scales is seen for a simulation period of six years and can be attributed to a more complete treatment of hydrological sub-surface processes including groundwater and moisture feedback. A high degree of local influence on the atmosphere suggests that coupled climate-hydrology models have a potential for improving climate projections and the results further indicate a diminished need for bias correction in climate-hydrology impact studies.

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