High-resolution modeling of human and climate impacts on global water resources

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The number of global hydrological models (GHMs) have been developed in recent decades in order to understand the impacts of climate variability and human activities on water resources availability. The spatial resolution of GHMs is mostly constrained at a 0.5° by 0.5° grid (~50km by ~50km at the equator). However, for many of the water-related problems facing society, the current spatial scale of GHMs is insufficient to provide locally relevant information. Here, using the PCR-GLOBWB model we present for the first time the analysis of human and climate impacts on global water resources at a 0.1° by 0.1° grid (~10km by ~10km at the equator) in order to depict more precisely regional variability in water availability and use. Most model input data (topography, vegetation, soil properties, routing, human water use) have been parameterized at a 0.1° global grid and feature a distinctively higher resolution. Distinct from many other GHMs, PCR-GLOBWB includes groundwater representation and simulates groundwater heads and lateral groundwater flows based on MODFLOW with existing geohydrological information. This study shows that global hydrological simulations at higher spatial resolutions are feasible for multi-decadal to century periods.

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