The contrasting impacts of climate change on groundwater hydrology in the world’s major aquifers

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Groundwater is the source for approximately 40% of all global freshwater demand, and is thus critical for water supplies and associated food production in arid and semi-arid regions, especially during dry seasons. The increasing demand for water and food (due to population growth) and variability in water resources (due to climate change) have led to long-term groundwater depletion, compromising the sustainability of human water use in several regions of the world. Here, we utilized fully coupled climate model simulations from the Community Earth System Model Large Ensemble Project to investigate groundwater storage changes in the world’s major aquifers (Guarani, Southern Plains, Northwestern India, Middle East, Canning, North China Plain, and Central Valley) under future climate changes. The projections show that climate change contributes to changes in groundwater storage not only via changes in precipitation, but also through changes in plant transpiration under CO2 fertilization effects, reductions in snowmelt, and enhancement of surface evaporation, which collectively lead to contrasting effects between increased precipitation and increased evapotranspiration.

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