Modeling Study on the Impacts of Groundwater Pumping to Regional Hydroclimatology in 37 World Major Aquifers

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Groundwater pumping (GWP) introduces dormant fossil waters into the active hydrologic cycle and alters the mand and atmosphere water budgets, but its effects are poorly understood due to the lack of large-scale GWP information and hydrometeorological data to estimate these changes. In this study, two sets of global-scale model simulations by a fully-coupled climate-hydrologic model, one with GWP and the other one without, are conducted for the 1900-1999 period. The effects of GWP in affecting the land and atmospheric water budgets are investigated over the selected 37 major aquifers worldwide by analyzing the output data from both sets of simulations. The entire set of the internally-consistent water budget components, includ precipitation (P), evaporation (E), runoff (R), atmospheric vapor convergence (C), and changes in land, ocean and atmosphere water storages, are analyzed, and their differences between tow simulations are considered the effects due to GWP. The contribution of GWP to global sea level rise (GSLR) as a result of the changes in the land and atmospheric water budgets is also estimated via (1) the direct R contribution from land to ocean and (2) the indirect C contribution via atmospheric interactions.

Keywords: groundwater, water budget, sea level rise, model simulations

