Contribution of Groundwater Depletion to Global Sea Level Rise at Global, Continental and Aquifer Scales

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Rising sea level is projected to have detrimental effects on coastal population and environments. The IPCC Fifth Assessment Report (AR5) estimated that during the 1993–2010 period, in addition to the contributions from glaciers (0.76±0.37 mm/yr), ice sheets (0.60±0.19 mm/yr) and ocean thermal expansion (1.1±0.3 mm/yr), the change in terrestrial water storage (TWS), with the anthropogenic reservoir impoundment and groundwater depletion (GWD) being the identified key drivers, contribute to a +0.38 (±0.12) mm/yr of the total +3.2(±0.4) mm/yr observed global sea level rise (GSLR). In particular, of the changes in TWS to GSLR. This study investigates the impacts of groundwater pumping on the terrestrial, atmospheric and ocean water budgets, and quantify the contribution to global sea level rise (SLR) due to GWP, using a global climate modelling approach. The enhanced evapotranspiration due to irrigation from groundwater pumping perturbs the global water budget and results in a net transfer of water storage from land to ocean via two pathways: (1) the continental river discharge into the ocean which directly contributes to GSLR, and (2) the exchange of atmospheric water vapor between land and ocean which need to be balanced by ocean precipitation and evaporation, hence resulting an indirect impact on GSLR. This study analyses the 1900-99 mean and inter-annual contribution of GWD to GSLR at the global, continental (six main continents) and aquifer (37 global major aquifers) scales.

