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Projecting and attributing future changes of evaporative demand over China in CMIP5 climate models

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Atmospheric evaporative demand plays a pivotal role in global water and energy budgets and its change is very important for drought monitoring, irrigation scheduling and water resource management under a changing environment. Here, we first projected and attributed future changes of pan evaporation (E_pan), a measurable indictor for atmospheric evaporative demand, over China through a physical- based approach, namely PenPan model, forced with outputs form twelve state-of-the-art Coupled Model Intercomparison Project Phase 5 (CMIP5) climate models. An equidistant quantile mapping method was also used to correct the biases in GCMs outputs to reduce uncertainty in[U+3016] E[U+3017]_pan projection. The results indicated that the E_panwould increase during the periods 2021-2050 and 2071-2100 relative to the baseline period 1971-2000 under the Representative Concentration Pathway (RCP) 4.5 and 8.5 scenarios, which can mainly be attributed to the projected increase in air temperature and vapour pressure deficit over China. The percentage increase of E_pan is relatively larger in eastern China than that in western China, which is due to the spatially inconsistent increases in air temperature, net radiation, wind speed and vapour pressure deficit over China. The widely reported “pan evaporation paradox” was not well reproduced for the period 1961-2000 in the climate models, before or after bias correction, suggesting discrepancy between observed and modeled trends. With that caveat, we found that the pan evaporation has been projected to increase at a rate of 117∼167 mm/yr per K (72∼80 mm/yr per K) over China using the multiple GCMs under the RCP4.5 (RCP8.5) scenario with increased greenhouse gases and the associated warming of the climate system.

References:
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