Attribution of extreme precipitation changes during 1951–2015: An updated analysis using CMIP6 models

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Human-induced global warming is expected to accompany changes in hydrological cycle including stronger extreme precipitation through lower-tropospheric water vapor increases. Previous studies have detected anthropogenic influences on the observed intensification of extreme precipitation over the northern mid-latitude bands. However, smaller-scale detection studies for extreme precipitation have been limited, which is more important for assessing the flooding risk and preparing associated adaptation measures to the upcoming global warming. In this study, we conduct an updated detection and attribution analysis of the observed changes in extreme precipitation considering three continental-scale regions including North America (NA) and western and eastern Eurasia (EU and AS, respectively) as well as global dry and wet lands for an extended period of 1951-2015. The observed changes are compared with those from available CMIP6 multi-model simulations with different forcing factors using an optimal fingerprinting technique. Initial results indicate that anthropogenic signals are robustly detected in the observed increase in extreme precipitation over NA and EU, which are separable from natural forcing (solar and volcanic activities). Three-signal analysis further suggests that greenhouse gas influence is largely detectable in three continental regions in separation from natural and anthropogenic aerosol forcings. The counteracting drying influences of anthropogenic aerosols is also identified over AS although the signal is relatively weak to be detected. Anthropogenic influences are also detected over both dry and wet lands, but less robustly. Possible influence of model climate sensitivity will be further examined with comparison with CMIP5-based results.

Key words: extreme precipitation, detection and attribution, anthropogenic forcing, CMIP6