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Tendency towards more extreme precipitation climate in the CMIP5 models

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Both extreme downpour and extreme drought are manifestations of extreme precipitation. On the global scale, observational records have indicated increasing trends both in heavy precipitation and severe aridity during the recent decades. These trends are expected to continue in the future as global warming continues. Simultaneous increase both in wet and dry extremes, or if the increase in one extreme is larger than the decrease in another, can be regarded as an overall tendency towards more extreme precipitation climate. We studied this tendency based on a large ensemble of climate model simulations from the Coupled Model Intercomparison Project Phase 5 (CMIP5). We calculated the maximum 1-d precipitation (R1d) describing the wet and the maximum number of consecutive dry days (CDD) describing the dry extremes. Averaged over the globe, both indices indicated intensification of precipitation extremes, the percentage increase being approximately twice as large in R1d as in CDD. Moreover, in approximately 95% of global land areas precipitation climate was projected to become more extreme during the 21st century. In most areas, the projected intensification of wet extremes was the main contributor for the tendency towards more extreme precipitation climate but in many arid regions the intensification of dry extremes played a more important role.

As evaluated based on the projected changes in R1d and CDD, the tendency towards more extreme precipitation climate was a general feature among the CMIP5 simulations, regardless of the horizontal or vertical resolution of the models. We studied simulations under the Representative Concentration Pathway (RCP) scenarios 4.5 and 8.5 and the projected changes were more prominent under the high-emission RCP8.5 scenario, as expected.