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Impacts of half a degree additional warming on the Asian monsoon rainfall and extremes

Seung-Ki Min (1), Donghyun Lee (1), Erich Fischer (2), Hideo Shiogama (3), Ingo Bethke (4), Ludwig Lierhammer (5), and John Scinocca (6)

(1) Pohang University of Science and Technology, Pohang, Korea, Republic Of (skmin@postech.ac.kr), (2) ETH Zurich, Institute for Atmospheric and Climate Science, Zurich, Switzerland, (3) National Institute for Environmental Studies, Tsukuba, Ibaraki, Japan, (4) Uni Research Climate, Bjerknes Center for Climate Research, Bergen, Norway, (5) German Climate Computing Center (DKRZ), Hamburg, Germany, (6) Canadian Centre for Climate Modelling and Analysis, Environment and Climate Change Canada, Victoria, British Columbia, Canada

Despite the increased interest in the Paris Agreement and its 1.5 and 2.0 degree mitigation targets, associated assessments of regional-scale climate impacts have been very limited. Thus, scientific assessments of the associated risk and impact at regional scales are urgently required, and particularly the Asian monsoon region is one of the most vulnerable regions to global warming with frequent occurrences of weather and climate extreme events. This study presents an assessment of possible impacts of the Paris Agreement target temperatures (global warming of 1.5 and 2.0 degree above pre-industrial conditions) on the Asian monsoon rainfall and extremes, using newly available large-ensemble atmospheric global climate model datasets from the Half a degree Additional warming, Prognosis and Projected Impacts (HAPPI) project. By systematically comparing results between 1.5 and 2.0 warming simulations, we find that benefits of global warming mitigation by a half degree will be greater in more-extreme precipitation that usually bring larger impacts on the Asian monsoon region. Further, we explore physical mechanisms behind the more sensitive response in extreme precipitation to temperature increase and find an important role of thermodynamic contribution associated with changes in atmospheric moisture rather than dynamic contribution associated with changes in atmospheric circulation. Results from CMIP5 coupled global climate models under a transient warming scenario are also compared, which confirm that half a degree additional warming would bring more frequent and stronger heavy precipitation events, exerting devastating impacts on the human and natural system over the Asian monsoon region.