Effect of model biases on simulated changes of South Asian Summer Monsoon precipitation under the AR5 scenarios

Mujtaba Hassan[1], Pengfei Du[2]

[1] Department of Space Sciences, Institute of Space Technology, Islamabad Highway, Islamabad, 44000, Pakistan

[2] State Key Laboratory of Environmental Simulation and Pollution Control (SKLESPC) School of Environment, Tsinghua University, Beijing 100084, China

The presence of complex topographical features of Hindukush, Karakorum and Himalaya (HKH) mountain ranges has pose a great challenge to regional climate models (RCMs) in simulating the observed climatology. The South Asian summer monsoon (SASM) is one of the most energetic and prominent phenomenon on the Earth's climate system that presents high variability from June to September. In present research, we used regional climate model (RegCM4.3) to analyze the effect of biases on projected changes (2070-2099 minus 1976-2005) of SASM under the moderate and strongest representative concentration pathways (RCP4.5 &8.5).

The projected pattern as simulated by RegCM4.3 at the end of 21st century shows an increase in precipitation over the Indian Peninsula and the Western Ghats in contrast to weakened southwesterly seasonal monsoon flow (anomalous anti-cyclonic) at 850 hPa over the Arabian Sea and Peninsular India. We explored the dynamically inconsistency of increased rainfall by separating the whole study period into dry and wet years. Our results revealed that increased southwesterly flow in the wet period could be associated with excessive rainfall. Quantitative analyses of models' bias on the simulated change indicate that the biases have a significant effect on the projected patterns of summer monsoon rainfall. The dynamic of South Asia monsoon season is quite complex and there are several other factors that could affect future climate changes. Therefore, it is very difficult to specify a single reason that may strengthen the South Asia monsoon over the specific areas.

It is worth noting that the uncertainties related to internal dynamic of the models, regional forcing and observational-based climate dataset could undermine the confidence on the future projection. More sophisticated atmospheric physics and dynamics is required to better the model performances at regional scale.

Keywords: Model biases; South Asian summer monsoon precipitation; Climate change uncertainties