



Evaluation of CMIP5 Models for post-1950 Weakening of Indian Monsoon

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Indian summer monsoon rainfall (ISMR) impacts the life of more than one billion people; the mean seasonal (from June to September) rainfall contributes to 80% of total annual rainfall in India; and the intraseasonal to interannual variability controls the agricultural productivity and the gross domestic product (GDP) of the country. ISMR has been found to have a decreasing trend in the recent decades (post-1950), which poses a major threat to water and food security of India. In order to adapt to such changes, reliable projection of ISMR by General Circulation Models (GCM) is required. But majority of new generation climate models from Coupled Model Inter-comparison Project phase5 (CMIP5) fail to simulate the observed decreasing trend of ISMR; most of the models show either no trend or increasing trend. The reason behind such failure is investigated and it has been found that large scale geophysical processes, which are responsible for weakening of Indian monsoon, are not very well simulated by the climate models. The decreasing trend of ISMR is associated with the warming of Southern Indian Ocean (SIO) and anomalous cyclonic formation in the western tropical Pacific Ocean. Increase in sea surface temperature (SST) and expansion of warm pool in SIO in recent decades has decreased the meridional SST gradient and weakened the monsoon south-westerly winds. On the other hand, increasing SST and strengthening anomalous cyclonic formation in Pacific Ocean has set a favourable condition for increasing local precipitation, which brings cold and dry wind from continental subtropics to south Asian monsoon region by teleconnection. Both of these large scale changes are not properly captured by CMIP5 models, with few exceptions, which is responsible for their failure. Proper representation of these highlighted geophysical processes in next generation models, may improve the reliability of ISMR projections. Findings of this study alert the water resource planners to evaluate the CMIP5 models, before using them for adaptation strategies.