
How Extreme could trends in Indian Monsoon rainfall be?

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Abstract

We estimate possible extreme changes in the Indian summer monsoon rainfall for the coming decades. Using an ensemble of over 1600 initialized climate simulations from multiple seasonal predictions systems, we demonstrate how internal variability can exacerbate or alleviate the influence of forced climate change on Indian summer monsoon rainfall. Our estimates show that for the next decade there is a $\sim 60\%$ chance of wetting trends whereas the chance of drying is $\sim 40\%$. We find that wetting trends are systematically more favoured than drying with the increasing length of the period. We also quantify the likelihood of extreme trends and show that there is at least a 1% chance that monsoon rainfall could increase or decrease by one fifth over the coming decade. Monsoon rainfall trends are found to be strongly influenced by trends in sea-surface temperatures over the Nino3.4 region and tropical Indian Ocean, hence our estimates of rainfall change over the next decades are conditional on the timing of future El Niño Southern Oscillation phases and Indian Ocean warming under climate change. We also find that it is unlikely for the climate change signal for increased rainfall to emerge from internal variability by the year 2050 due to the large internal variability of monsoon rainfall. The estimates of extreme rainfall change provided here could be useful for disaster preparedness and aid the development of successful adaption policies on decadal to multidecadal time-scale.

Keywords: Rainfall Extreme, Indian Monsoon, Seasonal to Decadal Prediction, Internal Variability

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