

The Asian-Australian Monsoon: Dynamics of climate change over the Asian monsoon region

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The seasonal mean (June through September) rainfall associated with the Asian summer monsoon (ASM) dictates the socio-economic status of the densely populated regions of the World. Therefore, the monsoon performance in the future decides the very basic needs such as drinking water and rice production. On a positive note, compared to present-day levels, if the concentration of greenhouse gases is either doubled or quadrupled most climate models project an increase in time-mean monsoon rainfall while the associated circulation is weakened, known as precipitation-circulation paradox. Here, we present arguments based on both thermodynamic and dynamical feedbacks for this paradox. Then, the role of weakened monsoon circulation on the tropical Indian Ocean SST warming and its subsequent impact on the monsoon annual cycle is demonstrated through a series of sensitivity model experiments, and diagnosis of moist static energy budgets. Finally, based on all available observations and climate model integrations during 1951-2009, we investigate if the ASM has already responded to global warming. Here, we show an eastward shift in monsoon rainfall, i.e., an enhanced tropical western Pacific monsoon and weakened south Asian monsoon. From sensitivity experiments, we show that the rainfall increase over tropical west Pacific induces descent anomalies over India through westward propagation of Rossby waves.