

Skill of precipitation prediction with GCMs over north India during winter season

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Abstract

This study aims to analyse the skill of state-of-the-art of five general circulation models (GCMs) in predicting winter precipitation over northern India. The precipitation in winter season (December, January and February) is very important for Rabi crops in north India, particularly for wheat, as it supplements moisture and maintains low temperature for the development of the crops. The GCM outputs (seasonal mean forecasts issued in November) from various organizations are compared with the observed high-resolution gridded rainfall data obtained from India Meteorological Department (IMD). Prediction skill of such GCMs is examined for the period 1982–2009. The climatology, interannual standard deviation (ISD) and correlation coefficients have been computed for the five GCMs and compared with observation. It is found that the models are able to reproduce the climatology and ISD to varying degrees; however, skill of predictions is too low. Multi-model ensemble (MME) approaches have been employed. It is found that the weighted MME using multiple linear regression technique improves the prediction skill of winter precipitation over northern India. The teleconnection between the sea surface temperature (SST) and winter precipitation revealed that the SST over the Pacific Ocean affects the precipitation over north India in winter season. While this observed feature is represented well by some models with high fidelity, most models are unable to respond to SST variations in the Pacific Ocean in a realistic manner. Lagged correlations between the north India rainfall and SST over the Niño-3.4 region reveal that only two of the five GCMs get the observed simultaneous teleconnection correctly. Furthermore, only one of these two models has the observed phase lag with the strongest correlation as observed.

Keywords: north India; winter precipitation; predictability; general circulation models; MME