Comparison of statistical and dynamical downscaling methods for seasonal-scale winter precipitation predictions over north India

Climate Dynamics, (doi: 10.1007/s00382-018-4428-4)

Abstract: The main aim of the present study is to analyse the capabilities of two downscaling approaches (statistical and dynamical) in predicting wintertime seasonal precipitation over north India. For this purpose, a canonical correlation analysis (CCA) based statistical downscaling approach and dynamical downscaling approach (at 30 km) with an optimized configuration of the regional climate model (RegCM) nested in coarse resolution global spectral model have been used for a period of 28 years (1982–2009). For CCA, nine predictors (precipitation, zonal and meridional winds at 850 and 200 hPa, temperature at 200 hPa and sea surface temperatures) over three different domains were selected. The predictors were chosen based on the statistically significant teleconnection maps and physically based relationships between precipitation over the study region and meteorological variables. The validation revealed that both the downscaling approaches provided improved precipitation forecasts compared to the global model. Reasons for improved prediction by downscaling techniques have been examined. The improvement mainly comes due to better representation of orography, westerly moisture transport and vertical pressure velocity in the regional climate model. Furthermore, two bias correction methods namely quantile mapping (QM) and mean bias-remove (MBR) have been applied on downscaled RegCM, statistically downscaled CCA as well as the global model products. It was found that when the QM-based bias correction is applied on dynamically downscaled RegCM products, it has better skill in predicting wintertime precipitation over the study region compared to the CCA-based statistical downscaling. Overall, the results indicate that the QM-based bias-corrected downscaled RegCM model is a useful tool for wintertime seasonal-scale precipitation prediction over north India.