Assessment of CMIP5 models over north Pakistan for quantification of climate change impacts on future hydrology

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With the increase in the number of available global climate models (GCMs), it has become necessary to weight GCM outputs when using them to quantify the climate change impacts on hydrology. The accuracy assessment of GCMs give an idea whether the data projected by models is coinciding with the real time observed data so that they could be trusted for impact assessment studies. Data of 14 models, including interpolated and downscaled data, has been tested by comparison with observed daily data of 29 years (1976-2005) for 3 parameters (maximum temperature, minimum temperature and precipitation) over north region of Pakistan using statistical analysis including RMSE, SD and correlation coefficient along with some basis statistical tests. The results shows that models statistically downscaled by Spatial Disaggregating Quantile Delta Mapping (SDQDM) methods significantly comply with observed temperature and precipitation over the region. The statistical analysis of downscaled models show that maximum and minimum temperature shows stronger correlation and lower RMSE as compared to precipitation. Based on maximum temperature, NorESM1-M, inmcm4, CNRM-CM5 shows highest correlation and lowest RMSE while NorESM1-M, MPI-ESM-LR, EC-Earth shows better performance for minimum temperature among other models. In case of precipitation, all the models show weak correlation and high RMSE which depicts that CMIP5 models show passiveness in simulating precipitation over complex topography of north Pakistan. Hence, a single model could not be sorted out to be declared the best for this region due to the fact that model performance is place sensitive and highly dependent on latitudinal and topographical variation. The study provides important insight into performance of CMIP5 models over north Pakistan for their potential application in assessment of climate change impacts on downstream water quantity and its management.