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Bias correction and Downscaling of GCM for basin scale simulation

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Climate change impact studies are mainly based on the coarse scale resolution of the general circulation models (GCMs) under the different emission scenarios. The gap between the GCM resolution and basin scale resolution, downscaling is an essential tool to obtain relevant hydrologic simulation in basin scale. Climate change impact studies plays an important role to define suitable adaptation and mitigation strategies for resilient society and environment in basin scale. Local policy makers and communities also try to get information related with the impact of climate changes in their city or country. This paper emphasized on selection of appropriate GCMs from different GCMs by considering spatial correlation and seasonal evolution of each GCMs. After that, bias-correction of GCMs is carried out for extreme rainfall, normal rainfall and frequency of numbers of no rain day from area average of GCMs rainfall over the target basin. Bias-corrected scheme can removes the large bias of GCM precipitation although they fail to simulate the seasonal cycle before correction. Most of bias-corrected GCMs precipitation presented the increasing trend in both extreme event and annual precipitation in target basin. Moreover, downscaling is done by using the Global Satellite Mapping of Precipitation (GSMaP) products. This downscaling method shows the main advantages of satellite based rainfall products, which are available at global scale with high spatial (0.1 degree) resolution and high temporal resolution with daily or hourly scale. This method is neither computationally expensive nor difficult. In this downscaling method, GSMaP based areal average spatial weight over the target basin is defined and based on these weights ,bias-corrected areal average GCMs precipitation are downscaled. The resulted downscaled precipitation are evaluated against discharge flow at point scale and also basin scale, simulated by the Water and Energy Budget-based Distributed Hydrological Model (WEB-DHM) in both past (1981-2000) and near future (2046-2065). In this way, climate change impact assessment at basin scale for near future can be performed by using the low-resolution GCMs products versus high-resolution satellite products efficiently. This downscaling method fulfilled the gap between GCMs and local scale resolution differences without difficulty. Basin scale changes in stream flow and other characteristics in near future can be analyzed and adaptation and mitigation strategies can be prepared.