ASSESSMENT OF CLIMATE CHANGE IMPACT ON HYDROLOGY OF THE GANGES-BRAHMAPUTRA-MEGHNA BASIN AND IMPLICATIONS FOR FUTURE WATER RESOURCE MANAGEMENT

Summary

The intensity, duration, and geographic extent of floods in Bangladesh mostly depend on the combined influences of three river systems, the Ganges, Brahmaputra, and Meghna (GBM). In addition, climate change is likely to have significant effects on the hydrology and water resources of the GBM basins. However, detail hydro-meteorological analyses including climate change impact assessment with an advanced hydrological model aiming to acquire policy-relevant information necessary for climate change adaptation as well as for local water resources management in the GBM basins have rarely been conducted. To fill this gap, in this study, a macro-scale distributed hydrologic model, H08, was employed to assess impacts of climate change on basin-scale hydrology including runoff, evapotranspiration, net radiation, and soil moisture by using 5 CMIP5 GCMs through 3 time-slice experiments; the present-day (1979–2003), the near-future (2015-2039), and the far-future (2075–2099) periods. The model H08 was calibrated at a relatively fine grid resolution (10 km) via analyzing model parameter sensitivity and validated based on long-term (32 years) observed daily streamflow data. In addition, climate change impacts on manageability of hydrological extremes (both floods and droughts) in terms of necessary storage to smooth out hydrological variations were assessed by using Flood Duration Curves (FDCs) and Drought Duration Curves (DDCs). The results show that by the end of the 21st century, under the highest emission scenario, RCP8.5, (a) the entire GBM basin is projected to be warmed by ~4.3°C; (b) the changes of mean precipitation (runoff) are projected to be +16.3% (+16.2%), +19.8% (+33.1%), and +29.6% (+39.7%) in the

Brahmaputra, Ganges, and Meghna, respectively; and (c) evapotranspiration is projected to increase for the entire GBM (Brahmaputra: +16.4%, Ganges: +13.6%, Meghna: +12.9%) due to increased net radiation as well as warmer temperature. Over all, it is observed that the impact of climate change on the hydrological processes of the Meghna basin will be larger than those of the other two basins. From the duration curve analyses, it is also observed that, the manageability of the Meghna basin is expected to be more difficult due to increases of seasonal and annual variations of streamflow in the future. This information will contribute to direct water resource management in the basin and improve the design of adaptive measures. The findings can also be considered for risk management, planning for prevention, mitigation of disaster risk, and formulation of policies for water resources development.

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