Geophysical Research Abstracts
Vol. 17, EGU2015-9250, 2015
EGU General Assembly 2015

The impact of climate change on water resources: Assessment at the scale of the Indian subcontinent

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The large increase in the atmospheric concentrations of greenhouse gases has led to the global climate change phenomenon which is expected to have a strong impact on water resources on local, regional and global scales. The Indian subcontinent is vulnerable to climate change since the region is characterized by a strong hydro-climatic gradient due to monsoon and the geographic features, and hence poses extraordinary challenges to understand, quantify and predict future availability in water resources. In here, the impact of climate change on the hydro-climatology of the subcontinent is investigated by comparing statistics of current and projected future fluxes resulting from three emission scenarios (RCP2.6, RCP4.5, and RCP8.5). The use of different emission scenarios allows for the definition of uncertainty of future impacts. Climate projections from the CORDEX-South Asia framework have been bias-corrected using the DBS (Distribution Based Scaling) method and used to force the HYPE (HYdrological Predictions for the Environment) hydrological model to generate projections of evapotranspiration, runoff, soil moisture deficit, snow depth, and applied irrigation water to soil. In addition, we assess the changes on high and low flows from all river systems as well as the changes in the annual cycles. Overall, the high uncertainty in the climate projections is propagated in the hydrological impact model, and as a result the spatiotemporal distribution of change is subject to the climate projection. In general, results from all scenarios indicate a -20 to +50% change in long-term average precipitation and evapotranspiration, yet a higher change (-100 to +100%) in runoff. Analysis of annual cycles showed that climate change impacts vary between seasons whereas the effect is dependent on the region's hydro-climatic gradient. Future scenarios project a graduate increase in temperature from 1 up to 76○C on average, which further affects the need for irrigation and snow accumulation/melting processes in the Himalayas. Finally, climate change significantly impacts the hydrologic extremes, i.e. high and low discharge, for most regions, with the changes becoming more remarkable at the end of the century.

Keywords
Hydrological modelling, HYPE, climate change impacts, India, water resources, CORDEX, DBS