Geophysical Research Abstracts
Vol. 16, EGU2014-4536, 2014
EGU General Assembly 2014

Quantifying the climate change-induced variations in Saskatoon's Intensity-Duration-Frequency curves using stochastic rainfall generators and K-nearest neighbors

Md. Shahabul Alam (1), Alireza Nazemi (2), Amin Elshorbagy (1,2)

(1) Department of Civil & Geological Engineering, University of Saskatchewan, Saskatoon, SK, S7N 5A9, Canada, (2) Global Institute for Water Security, National Hydrology Research Centre, 11 Innovation Blvd., Saskatoon, SK, S7N 3H5, Canada

Intensity-Duration-Frequency (IDF) curves are among standard design criteria for various engineering applications, such as storm water management systems. Warming climate, however, changes the extreme rainfall quantiles represented by the IDF curves. This study attempts to construct the future IDF curves under possible climate change scenarios. For this purpose, a stochastic rainfall generator is used to spatially downscale the daily projections of Global Climate Models (GCMs) from coarse grid resolution to the point scale. The stochastically downscaled daily rainfall realizations can be further disaggregated to hourly and sub-hourly rainfall series using a deterministic disaggregation scheme developed based on the K-Nearest Neighbor (K-NN) method. We applied this framework for constructing the future IDF curves in the city of Saskatoon, Canada. As a model development step, the sensitivity of the K-NN disaggregation model to the number of nearest neighbors (i.e. window size) is evaluated during the baseline periods. The optimum window size is assigned based on the performance in reproducing the historical IDF curves. The optimum windows identified for 1-hour and 5-min temporal resolutions are then used to produce the future hourly and consequently, 5-min resolution rainfall based on the K-NN simulations. By using the simulated hourly and sub-hourly rainfall series and the Generalized Extreme Value (GEV) distribution future changes in IDF curves and associated uncertainties are quantified using a large ensemble of projections obtained for the CGCM3.1 and HadCM3 based on A1B, A2 and B1 emission scenarios in case of CMIP3 and RCP2.6, RCP4.5, and RCP8.5 in case of CMIP5 datasets. The constructed IDF curves for the city of Saskatoon are then compared with corresponding historical relationships at various durations and/or return periods and are discussed based on different models, emission scenarios and/or simulation release (i.e. CMIP3 vs. CMIP5).