Evaluating the impact of climate change on urban scale extreme rainfall events: Coupling of multiple global circulation models with a stochastic rainfall generator

Gonzalo Peña[1] , Assela Pathirana[2]

[1] MSc. Research Fellow - UNESCO-IHE, Westvest 7, Delft. The Netherlands
penac1@unesco-ihe.org
[2] Senior Lecturer in Urban Drainage and Sewerage - UNESCO-IHE, Westvest 7, Delft. The Netherlands
a.pathirana@unesco-ihe.org

ABSTRACT

Assessing the impact of climate change in an urban drainage context requires the use of tools and methodologies that work at the local scale and fine temporal resolution. This paper aims to provide a methodology for the downscaling of an ensemble of Global Circulation Models (GCMs) output in order to produce synthetic point urban scale rainfall series using an hourly stochastic rainfall generator. In order to combine the results of several GCMs, a previously developed methodology makes use of Bayesian approach to produce a probabilistic distribution of the factors of change for different statistical properties. These factors will be applied to the statistical properties of the observed data in order to re-evaluate the parameters of the rainfall generator.

Hourly rainfall data from the city of Kochi (Japan) for the period of 1976-2000 has been used to assess the proposed methodology. The stochastic downscaling process makes use of twelve GCMs as input for the periods of 2046-2065 and 2081-2100 and scenarios A1b, B1 and A2 as adopted by the intergovernmental panel on climate change (IPCC). Results are derived from multiple future realizations of climate for the different scenarios and periods.

The rainfall generator used is proficient in reproducing the extreme events for different rainfall durations but limited to return periods of ten years and smaller. The methodology produces results that are consistent with the different scenarios but by only taking the mean factor of change in the probability distribution, results presented are only indicative of a likely scenario. Further uncertainties present in the described methodology are discussed.

KEYWORDS

Climate change, extreme events, rainfall generator, stochastic downscaling