10th Alexander von Humboldt International Conference
Addis Ababa | Ethiopia | 18 – 20 November 2015
AvH10-71

Stationary vs non-stationary analysis of extreme rainfall in Addis Ababa

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Increasing flood risk is now recognized as the most important threat from climate change in most parts of the world, with recent repeated severe flooding in the world causing major loss of property and life.
This has prompted public debate on the apparent increased frequency of extremes and focused attention in particular on perceived increases in rainfall intensities. In the paper, a stationary Vs non-stationary analysis of annual extreme rainfall is performed using the case studies of the cities of Addis Ababa (Ethiopia) in Africa. For Addis Ababa the available dataset refers to a 47 years' time series (1964-2010).
Gauge station rainfall data are suitably fitted by Extreme Value Distribution (EVD) models. In particular, a comparison is made between inference models using the Maximum Likelihood Estimation (MLE) and the Bayesian one, highlighting differences and strengths. Furthermore, a comparison between a non-stationary regression and a stationary model is developed. In this case, the series doesn't highlight any non-stationary effect. Results achieved within the CLUVA (Climatic Change and Urban Vulnerability in Africa) EU project by the Euro-Mediterranean Center for Climate Change (CMCC) (with 1 km downscaling) for the IPCC RCP8.5 climatological scenario are also considered for extending the analysis until 2050 (86 years for Addis Ababa). At the long term the process seems to be non-stationary for the series. In addition, with reference to 100 years return period, the IDF (Intensity-duration-frequency) curves are also evaluated for the two cities using the Maximum Likelihood Estimation (MLE) approach and using as confidence intervals the 16 and 84 quantiles. The hydrologic impact of the different rainfall forcing scenarios is also evaluated by estimating the simulated hydrographs using a geomorphic approach.