Geophysical Research Abstracts
Vol. 12, EGU2010-9455, 2010
EGU General Assembly 2010

Statistical downscaling of rainfall and small-scale hydrological impact investigations of climate change

Patrick Willems (1) and Mathieu Vrac (2)

(1) Katholieke Universiteit Leuven, Hydraulics Laboratory, Leuven, Belgium (Patrick.Willems@bwk.kuleuven.be, +32 16 321989), (2) Laboratoire des Sciences du Climat et de l'Environnement, Gif-sur-Yvette, France (mathieu.vrac@lsce.ipsl.fr, +33 1 69087716)

Impact investigations of climate change on urban drainage require projections to be made on short-duration precipitation extremes. The relevant time scales can be as low as 10 minutes, which requires strong statistical downscaling of climate model simulation results. In this research, two sets of methods have been suggested and tested based on Belgian data. The first set makes direct use of the precipitation results of the climate models. They involve computation of quantile perturbations on extreme precipitation intensities, and the assumption that the same perturbations hold for daily and sub-daily time scales. The second set of methods is based on weather typing, and accounts for the low accuracy of daily precipitation results in current climate modelling. In these methods, climate model outputs on pressure (atmospheric circulation) are used to obtain precipitation estimates from analog days in the past. Different criteria for defining analog days have been tested. The weather typing methods have been further advanced accounting for the fact that precipitation change does not only depend on change in atmospheric circulation, but also on temperature rise. Results have been investigated as changes to precipitation intensity-duration-frequency (IDF) relationships. It is shown that both the quantile-perturbation and advanced weather typing based methods allow precipitation biases in climate model simulation results to be largely corrected. Both types of methods moreover produce similar short-duration changes in precipitation extremes, which gives some credibility to the downscaled impacts. The corresponding changes in IDF statistics show that the extreme precipitation quantiles typically used for design of urban drainage systems, can increase up to 30% by the end of this century. Those changes mean that sewer surcharge or flooding would occur about twice more frequently than in the present climate (if no other environmental or management changes are accounted for). This would have a significant impact on future urban water management and planning.