Geophysical Research Abstracts
Vol. 12, EGU2010-3319, 2010
EGU General Assembly 2010

Assessing the relative impact of urban expansion and climate change on high flows in a small catchment in Flanders (Belgium)

Lien Poelmans (1), Anton Van Rompaey (1), Victor Ntegeka (2), and Patrick Willems (2)

(1) Department of Earth and Environmental Sciences, Katholieke Universiteit Leuven, Celestijnenlaan 200E, 3001 Heverlee, Belgium (Lien.Poelmans@ees.kuleuven.be / Anton.VanRompaey@ees.kuleuven.be), (2) Hydraulics Division, Department of Civil Engineering, Katholieke Universiteit Leuven, Kasteelpark Arenberg 40, 3001 Heverlee, Belgium (Victor.Ntegeka@bwk.kuleuven.be / Patrick.Willems@bwk.kuleuven.be)

Flood risk is in Belgium, as well as in other European countries, of considerable importance because of the dense population and high industrialisation along the river banks. During the last decades it has become evident that global climate change has the potential to produce changes in the temporal and spatial distribution of precipitation and potential evapotranspiration and as a consequence will bring along changes in hydrological extremes (floods and low flows). In addition, land use change can significantly affect the catchment hydrology by altering several hydrological processes such as infiltration, evapotranspiration and surface runoff. Examining the sensitivity of hydrologic responses to these human-induced climate and land use changes is essential in order to formulate solid water management policies that effectively deal with the changing conditions. Hydrological models provide a framework for analysing the complex impacts on catchment hydrology. The overall objective of this study is to evaluate the relative impact of urban expansion and climate change on the catchment hydrology. The Molenbeek catchment (48 km^2) in central Belgium is taken as an example application. The streamflow in the selected catchment was simulated by coupling a simplified runoff model (SRM) to a complex hydrodynamic model, implemented in the InfoWorks RS modelling system. The model was calibrated and validated using observed land cover maps of 1988 and 2000 and a 15-min series of water depths, measured at the catchment outlet. Preliminary results show that the calibrated model is able to predict both the peak flows and the total flow volumes relatively well for a selection of summer and winter rainfall events. Finally, a sensitivity analysis was carried out to assess possible future high flows in the catchment under different scenarios of urban expansion and climate change. In a first step, the impacts of climate change and urban expansion were evaluated separately. Next, the combined impact and the relative importance of both were evaluated. Three different urban expansion scenarios (low – medium – high change) for 2050 that varied in terms of quantity of urban expansion were developed and were used as an input layer in the hydrological model. Furthermore, low, mean and high climate change scenarios, that were based on a combined dynamical-statistical downscaling method, were used to generate possible future rainfall and potential evapotranspiration series that could be used as input variables in the hydrological model. The model application shows that it is possible to estimate the combined and individual effects on high flows induced by both a changing climate and by a changing land cover.