Assessing the impact of climate change on catchment hydrology using the distributed models MIKE SHE and WetSpa

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Hydrological models are important to help us understanding processes, i.e. processes that are underlying the physical catchment structure and governing the water movement. Different types of hydrological models have been developed in the past. Catchments may be modelled by lumped rainfall-runoff models using basin average input data and producing total basin runoff. These models provide quick and reasonable results of the runoff behaviour. However, as these models are based on conceptual representations of the physical processes of the water flow lumped over the entire catchment area, they cannot be expected to accurately represent the catchment conditions. In this climate change impact study, in which the complete catchment hydrological system is important, more detailed physically based and spatially distributed models form an alternative to model the hydrological behaviour. These kinds of models maintain the physical details at a given grid size and consider the distributed nature of hydrological properties such as soil type, slope and land-use.

In this study two distributed models, MIKE SHE and WetSpa, were applied to the hydrologic system of the Grote Nete-Grote Laak in order to assess the impacts of climate change. The models have been developed based on a common dataset, and calibrated, with a focus on low flows. Special emphasis was put upon the low flow hydrology as the climate scenarios for Belgium point towards drier conditions during summertime. The objective of the study was twofold. A first objective is to evaluate the applicability of the MIKE SHE and WetSpa distributed models to a Belgian case study. How well do these models capture the hydrological behaviour of the system? Processes that are included in the models and that lead to the resulting output are analysed to disentangle their role in controlling high and low flows. Secondly, the models are used to assess the impact due to climate change. Changes in runoff totals, runoff regimes and extreme values - in particular low flows - are analysed.

This study is part of a larger research project about the impact of climate change on high and low flow extremes in Belgium. More information can be obtained at HIC@mow.vlaanderen.be.

Keywords: Climate change impact, Distributed modelling, MIKE SHE, WetSpa, Low flows, Model evaluation