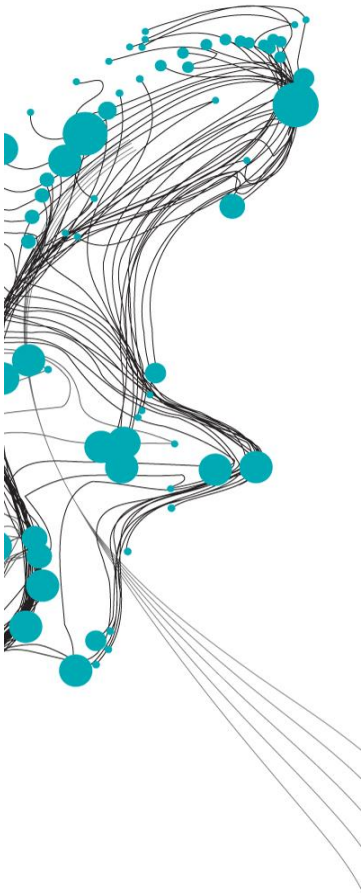
IMPACTS OF CLIMATE CHANGE ON FLOW COMPOSITION USING A MODEL TAILORED TO RUNOFF COMPONENTS



Generally, the impact of projected climate change on total river runoff is assessed. However, it is argued that the total runoff is not a sufficient indicator for climate change impacts on hydrology and additional insights in the composition of the runoff would be a step towards improvement of climate change impact assessments. The goal of this research is to gain more insight in the runoff components which together constitute the total runoff (*see Figure 1*) and how models can be tailored towards simulating runoff components during model calibration. These insights will then be applied to a test case by calibrating a hydrological model, tailoring it to simulate the runoff components and then using this model to assess the impact of climate change not only on the total runoff but also on the runoff components and the composition of the total runoff.

For the case study, the HBV hydrological model was used for rainfall-runoff modelling for three Polish catchments. The criteria that have been used in model calibration are the Nash-Sutcliffe (NS) efficiency criterion and the logarithmically transformed Nash-Sutcliffe (NSL) efficiency criterion. From the case study it is shown that there is a trade-off between using the different criteria in model calibration and the skill at which the hydrological model simulates the runoff components. This trade-off indicated that using the NSL in model calibration allows the HBV model to simulate the baseflow component at a higher skill than when the NS would be used in model calibration. No trade-off has been found between criteria used in model calibration and the skill at which the fast runoff component is simulated.

Assessing the impact of climate change was done using climate projection data obtained from the European branch of the World Climate Research Programme. Similar to findings from previous research, projected climate change results in an increase in annual runoff with the largest increases being observed in the winter and spring periods. The impact of projected climate change on the composition of the runoff has been tested on both annual and seasonal time scales. The results indicate that on both timescales none of the runoff components is projected to become more dominant and that the individual components increase proportionally to the total runoff increase. Lastly, changes in low flows have been assessed by looking at the 90th percentile (Q90) of the runoff. This indicated that the Q90 is projected to increase for each of the three Polish catchments between the 1976-2005 period and the 2021-2050 period, but then stabilizes and does not undergo any further changes in the second half of the 21st century.

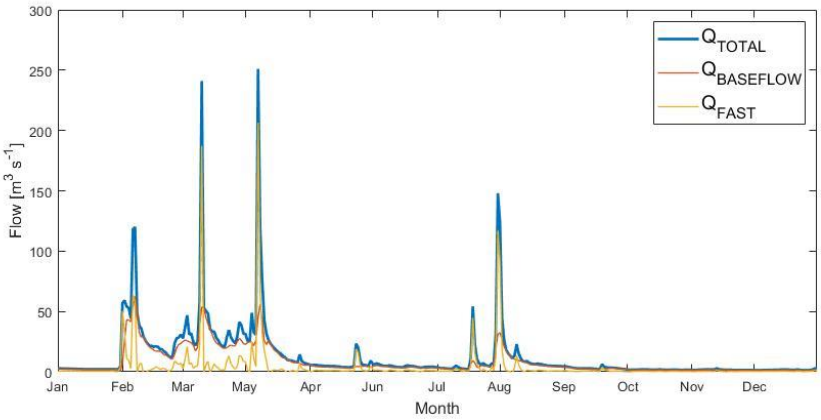


Figure 1: Example of runoff components, derived from the observed runoff in the Biala Tarnowska catchment for the year 2000.

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