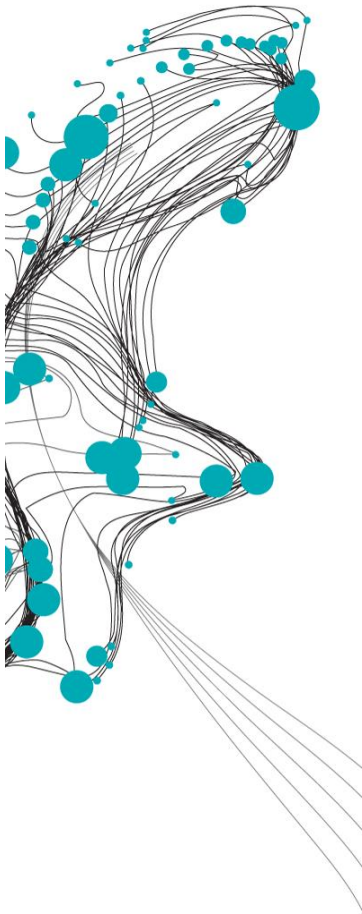# SKILL OF A DISCHARGE GENERATOR IN SIMULATING LOW FLOW CHARACTERISTICS IN THE RHINE BASIN

Low flows are important to consider in water management as they can have societal and economic impact: by e.g., navigation problems, lack of irrigation water for agriculture, salt intrusion, lack of cooling water and bloom of algae. Synthetic time series can be used for low flow frequency analysis and for gaining information about the development and characteristics of low flows beyond the observations. The discharge generator GRADE, consisting of a weather generator, a hydrological model and a hydraulic model, has given satisfactory results for simulating peak flows with large return periods in the Rhine basin. In this research the skill of the hydrological model, the skill of the weather generator and the skill of the combination of weather generator and hydrological model for simulating low flows in the Rhine basin are evaluated and a first start is made with the improvement of skill of the hydrological model.

Low flows are defined as discharges under the monthly thresholds used by the Dutch National Committee of Water allocation (LCW) and split into thresholds in the growing season and thresholds throughout the entire year. Analyses are conducted on the discharges, the low flow events (the duration and the cumulative discharge deficit below the threshold, Figure 1), lake levels, snow covers, groundwater levels and the meteorology. After the evaluation of the skill the hydrological model of part of the East Alpine sub-basin has been recalibrated.

The results from the evaluation of the skill show that discharges are mainly underestimated in the historical simulations. This causes more low flow events and more severe low flow events. In the Alps most underestimation takes place in the summer. In the synthetic series of the weather generator there are less dry periods (especially in summer), which makes that there are less low flows especially in the growing season. The skill of GRADE in simulating low flow characteristics is good at some points, but is based on the compensation of two errors as can be seen in Figure 2. The performance of the hydrological model for simulating low flow characteristics has been improved by the recalibration, which focused on low flow simulation and specifically on the simulation of snow.

Synthetic weather series are a useful tool in low flow risk assessment, when both the weather generator and the hydrological model give acceptable results. In this study is shown that models made for simulating peak flows are not necessarily acceptable for low flows. By tracing the important processes in the model (in this case snow) and with focus on low flow characteristics, improvements of the skill are possible.

A.M. Kersbergen

Graduation Date:
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Graduation committee:
University of Twente
Prof.dr. J.C.J. Kwadijk
Dr.ir. M.J. Booij

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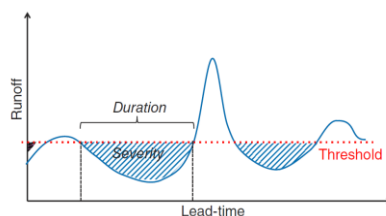Ir. M. Hegnauer
Dr. Ir. F. Sperna Weiland
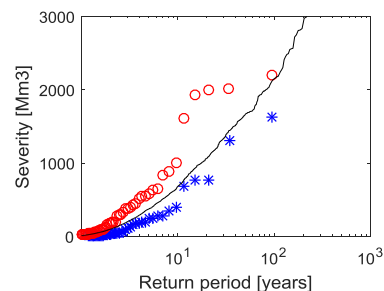
Figure 1: Definition of low flow events.

Figure 2: Return periods of severities of low flow events under the navigation threshold at Lobith. Blue = observation, red= historical simulation, black = synthetic simulation.

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