Title of the project:
Developing a new calibration method for 1D operational river models

Assignment no.: 15.24	**Internal/external:** External
Head graduation committee: tbd	**Daily advisor:** Raymond van Renswoude (RWS-ON) Anouk Bomers (UT)
Name(s) of participating companies or institutes: RWS-ON	**Start of the project:** asap

Required courses:
Hydraulic modelling
River Flow processes
Experience with Python

Short description of the project

1D river models (SOBEK), operationally used by Rijkswaterstaat, are fully based on detailed 2DH models (DFLOWFM). To do so, the 1D models are calibrated by minimizing the error in simulated water levels between the 1D and 2DH river models. This calibration procedure is executed by simulating one scenario, having a slowly increasing discharge as input for which the water levels and discharge distribution among the Dutch Rhine river branches are being controlled by altering the summer bed roughness. This procedure is executed for five predetermined discharge ranges. This method differs substantially from the classical calibration methods in which the summer bed roughness is altered to minimize solely the difference between simulated and observed water levels.

Even though the discharge distribution is included in the calibration procedure of 1D models, the currently used method does not allow for proper calibration of both this distribution and water levels. Therefore, this research focusses on improving the 1D calibration method such that the discharge distribution along the Dutch Rhine river branches can be accurately simulated, without compromising the accuracy in simulated water levels.

One potential solution is to reduce the maximum discharge considered in the calibrated discharge range scenarios. Currently, the 1D models are calibrated for a discharge up to 18.500 m^3/s. This is extremely high, while the river system cannot cope with such a high discharge (e.g. dikes start to overflow, while the hinterland that starts to inundate is not included in both the 1D and 2DH model domains). Therefore, the performance of the 1D model might be influenced by this unrealistic high discharge range in the calibration procedure.

This research will therefore analyse how the chosen maximum discharge range for calibration influences the model's accuracy, and eventually propose an optimal discharge range that corresponds better with the physical behaviour of the river system. Furthermore, correct prediction of the discharge distribution along the Dutch Rhine river branches will get a higher priority in the calibration procedure, as previous research has shown that including the discharge distribution in the

calibration results in more accurate predictions. However, it currently compromises the accuracy of water level predictions. Until now, it is unclear if an optimum can be found by both including the discharge distribution and water levels in the calibration procedure for 1D river models.

This project will mainly be executed at Rijkswaterstaat-Oost Nederland (Arnhem) and partially at Deltares (Delft) for the supervision of the 2D and 1D models, and the calibration procedure.