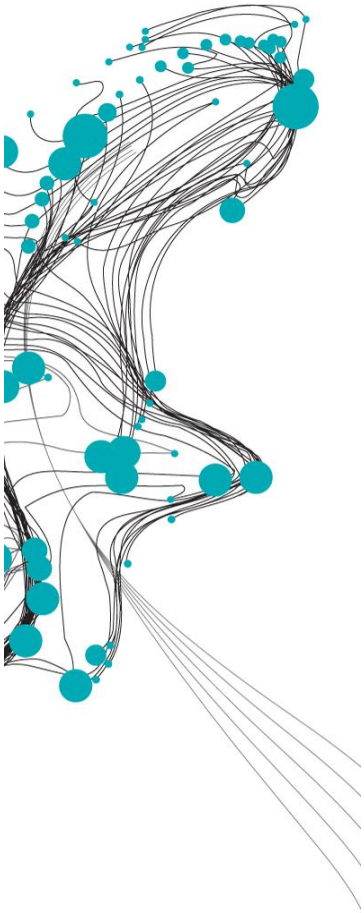
DISCHARGE AND LOCATION DEPENDENCY OF CALIBRATED MAIN CHANNEL ROUGHESS



Hydrodynamic river models are used to predict water levels along the river and support decision making in river management. Therefore, model predictions need to be sufficiently accurate. Hydrodynamic models are calibrated and validated to increase accuracy. Often the hydraulic roughness coefficient is calibrated because it is the most uncertain parameter in hydrodynamic river models. The physical bed roughness can vary along the longitudinal direction of the river due to differences in bed sediment. Moreover, as discharge increases, river dunes grow leading to an increasing bed roughness. Therefore, it is hypothesized that the calibrated main channel hydraulic roughness is mostly sensitive to the discharge and location in longitudinal direction of the river. The calibration study of Warmink et. al. (2007) confirms this hypothesis but does not explain why the calibrated roughness varies. The objective of the research is to provide explanations why these variations occur and whether location or discharge dependency is most sensitive.

In this study we calibrated the Manning coefficient of the main channel roughness of a 1D hydrodynamic model. The River Waal and IJssel in the Netherlands are used as case studies. The location dependency is investigated using a varying number of roughness trajectories. The discharge dependency is investigated using a varying number of discharge levels. Calibration is performed automatically using OpenDA. Validation is performed to check if the calibrated roughness values produces accurate water level predictions.

Results show that the transition from bankfull to flood stage (roughness decrease around 4000 m^3/s in Fig. 1), floodplain compartmentation (roughness peak around 6000 m^3/s in Fig. 1), 1D description in sharp river bends (only present in the IJssel) and the downstream boundary condition have a large effect on the calibrated main channel roughness. Furthermore, the calibrated roughness values and the validation (Fig. 2 and 3) show that calibrated main channel roughness is mostly sensitive to discharge. The overall increase of calibrated roughness with increasing discharge is consistent with increasing form drag from growth of river dunes.

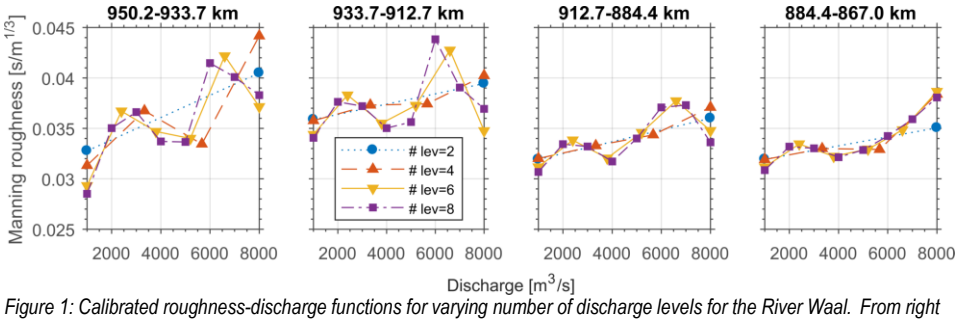


Figure 1: Calibrated roughness-discharge functions for varying number of discharge levels for the River Waal. From right to left plots show the functions from upstream to downstream sections between measurement stations. The most downstream section is not shown, because results are largely affected by the downstream boundary condition

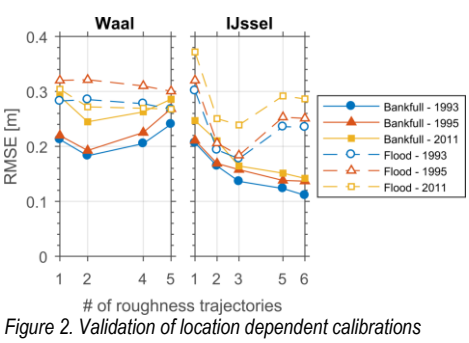


Figure 2. Validation of location dependent calibrations

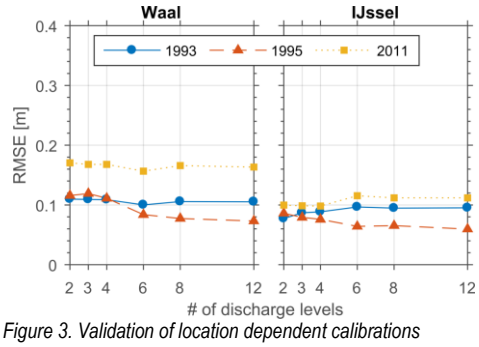


Figure 3. Validation of location dependent calibrations

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Warmink, J. J., Booij, M. J., van der Klis, H., & Hulscher, S. J. M. H. (2007). Uncertainty in water level predictions due to various calibrations. In CAIWA (pp. 1–18).

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