SENSITIVITY OF CHANNEL-SIZE ESTIMATIONS ON FLOOD INUNDATION MODELLING

Currently, the amount of people exposed to floods of 100 years return period reaches over 30% of world's population and is still rising. However, much of the damage caused by flooding could be alleviated using various safety measures which often include inundation modelling. Despite the development in measurement techniques for various hydrological values, channel dimensions remain quite difficult to account for remotely. Therefore, channel size approximations are widely used in hydraulic modelling in data-scarce regions.

It is a common assumption that the river channel size corresponds to the dominant discharge value. Most commonly, its value is adopted as an annual maximum flow of 1-in-2 years frequency. However, some rivers may flow out of bank seasonally (Niger River) or much more infrequently due to human modifications (Thames River in central London). Thus, the main research objective of this master thesis project was to determine how different channel size estimates influence the performance of flood inundation modelling.

LISFLOOD-FP model has been set up, calibrated and validated for December 1993 – January 1994 and January 1995 flood events on Rhine River. Then the commonly used 1-in-2 years annual peak flow channel size assumption was tested showing good alignment of the model outcome with the reference model run with known bathymetry (Figure 1). The maximum deviation in water depth prediction was limited to 5%, while also only 5% error was made in the simulated inundation area.

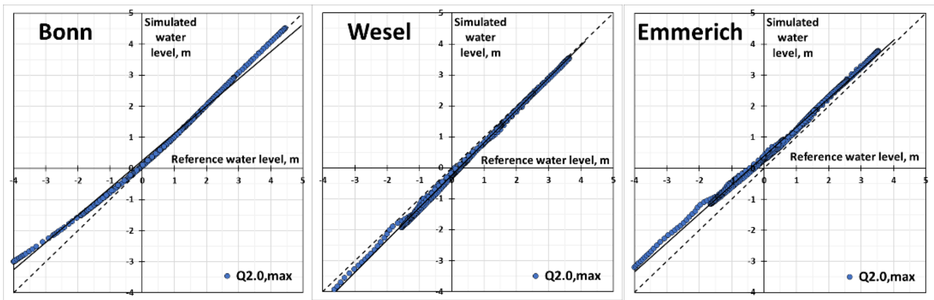

Figure 1: Correlation plot for predicted and reference water levels in Lower Rhine using annual maximum discharge with 2 years return period as bankfull flow approximation

Subsequently, the other channel size estimates were tested in a similar way to determine the best-fitted prediction for water level series over the Lower Rhine basin (Table 1). Those assumptions for bankfull discharge value considered annual maximum and mean discharges of various frequency, regionally defined value, effective and half-yield discharge estimates. It was found that the best-fitted simulation results were obtained for the initial guess of 1-in-2 years annual maximum discharge as well as for the regionally defined discharge value obtained from the hydraulic geometry relationships. Additionally, annual mean discharges of 10 and 50 years recurrence period estimates were found suitable for several river sections. Moreover, consequent use of those two assumptions could also be viewed as sufficiently good channel size estimate.

Table 1. Integrated goodness-of-fit metrics (average over the domain)

	Q1.5,max	**Q2.0,max**	Q5.0,max	Q2,mean	Q10,mean	Q50,mean	**Qhg**	Qeff	Qhy
RMSE	0.60	**0.19**	1.56	3.75	0.73	0.40	**0.23**	5.93	4.27
NSE	0.089	**0.97**	0.72	0.30	0.86	0.93	**0.96**	-0.09	0.22
U	0.033	**0.010**	0.051	0.041	0.017	0.014	**0.011**	0.052	0.04

The results of this study represent the means for channel approximation in rivers with relatively flat and densely populated large watershed areas and hydrometeorological conditions similar to those of Western and Central Europe. Therefore, the relevance of drawn conclusions should be studied separately for other conditions.

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