IDENTIFICATION OF ROUGHNESS FOR FLOOD ROUTING IN COMPOUND CHANNELS

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For flood routing problems, many rivers have compound sections and the roughness values in the main channel and floodplains are considerably different. However, studies on the identification of roughness coefficients have solved mainly in-bank flow problems. In this study, the inverse problem of estimating the roughness coefficient (Manning's n) has been extended to compound channels. The conveyance of compound sections is computed using the divided section method in which for any depth the conveyance is the sum of the main channel and floodplain conveyances. The values of roughness in the main channel and flood plains are identified as different parameters using an automatic optimization method. The writers adopt the well-known Preissmann's four-point different scheme to solve the Saint-Venant equations. The algebraic equation system is linearised and solved by using a double sweep algorithm (Liggett and Cunge 1975). The optimisation process involves minimising the square errors in observed values and simulated ones using Powell algorithm (Press *et al.* 1992).

The model is applied to Duong River in Vietnam where the roughness coefficient of main channel and floodplains are presented different constants values. The performance of the model is evaluated for different flood events in terms of sizes of peak discharges and flooding levels. The identified roughness values using different flood events are shown in Table 1 below. Figure 1 shows the stage hydrographs at Ben Ho as well as Thuong Cat where the water elevation data at this gauging station was not included in the objective function during optimisation. This can be used to verify the quality of identified parameters. The figure shows that the simulated stage hydrographs using identified roughness coefficients are matched quite well to the observed ones for all the flood events at this gauging station. From the table, it can be seen that the roughness values change with time not only from year to year and but also during each flood season. However, the identified roughness coefficients are rather consistent in a certain range.

The variation of roughness coefficients with water stage is also considered where the roughness coefficients are formulated as second order polynomial functions of water stage. The results indicate that for the case study the main channel roughness values are almost constant while the floodplain roughness values are changed rather more with stages. The performance of the model indicates the ability to apply the problem to natural channels.

Table 1. Identified roughness coefficients for Duong River from different flood events

Flood event	Observed peak discharge at Thuong Cat (m^3/s)	Observed peak stage at Ben Ho* (m)	Identified main channel roughness n_c	Identified floodplain roughness n_f
14/8-31/8/1995	5650	8.58	0.03322	0.06223
20/7-30/7/1996	5020	7.78	0.03019	0.05739
16/8-30/8/1996	6120	9.02	0.03149	0.06004
22/7-6/8/1997	4870	8.06	0.03399	0.06194
26/7-5/8/1998	4910	7.42	0.03365	0.05535

Note: * *the starting flood plain elevation at Ben Ho is 6.0 m*

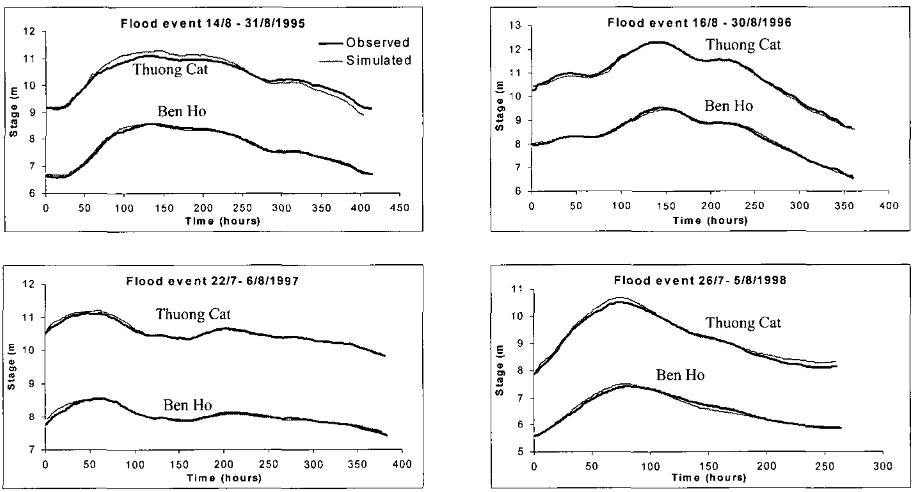

Fig. 1 Observed and simulated stage hydrographs (using identified roughness coefficients) at Ben Ho and Thuong Cat for different flood events.

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