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Hydrology and Earth System Sciences Discussions

Interactive comment on "The effectiveness of polder systems on peak discharge capping of floods along the middle reaches of the Elbe River in Germany" *by* S. Huang et al.

S. Huang et al.

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Replies to Förster (Replies are imbedded in the original text of the referee)

Investigating the effectiveness of the proposed polder system along the Elbe River is certainly an interesting application that may provide useful information for the actual flood risk management in the area. Huang et al. investigate this "effectiveness" for the case of one specific flood event. However, the effectiveness of the polder system is strongly affected by the flood wave characteristics. In our own study of the same polder system we found that the hydrograph shape is particularly important for the capping effect.

Authors' reply: This is the case for dyke breaches but not for controlled inflow to pold-

ers. We vary the duration and amount of flow into the polder to suit the flood wave characteristics, so that the most effective capping is attained. In essence, this is a general purpose of a modelling exercise of this type: to derive the best polder control scheme for the maximum possible peak discharge reduction.

In section 4.4 the authors state that the capping effect is not influenced by the upstream dike breach. This may be the case for the specific dike breach referred to in the paper, but cannot be generally concluded.

Authors' reply: This was and is not stated in the paper. We explicitly state that the capping is as much as 50 cm with dyke breaching.

Models of different complexity levels and hence computational effort may be used for investigating the polder system as described by the authors in section 1. They have chosen the quasi-2D model DYNHYD as it allows subsequent sediment transport simulations and secures short computational times as required for Monte Carlo simulation runs. However, if one is only interested in studying the effectiveness of the polder systems in capping the peak discharge in the Elbe River, a simple 1D model for the river coupled with a storage reservoir for the polder would suffice. This has been demonstrated in our own study to be published soon (by Chatterjee, Förster and Bronstert).

Authors' reply: But we are not only interested in studying the capping effect of the polder systems - we need the 2D representation for the sediment and pollutant transport simulations.

DYNYHD has problems in handling the flooding and drying process. In order to handle the flooding and drying, the authors have allowed a small amount of water to leak through the weir from the river into the polder. Though the authors state that this volume is very minute, considering the large areal extent of the polders, it would be helpful if the errors in the simulations were quantified. The problems will be further compounded when the emptying process of the polders is simulated.

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Authors' reply: We have added that the initial volume of water in the polder amounts to 1% of the filled polder.

In section 2.2 the authors state that the opening of the weir takes about 12 hours which is in fact not practically feasible. The practical opening time in general should not be more than 1 hour and this in turn has a considerable effect on the reduction in the peak discharge. Thus, an opening time of 12 hours would result in a significant difference in the results of peak discharge capping.

Authors' reply: Why is an opening time of 12 hours not practically feasible? We believe that it is very feasible and from a design-engineering perspective, it is also practical. The slower opening times throttle the flow into the polder to secure a more effective capping of the peak discharge. Otherwise, with opening times of less than 1 hour, a dyke breach would have been simulated, which is not the aim of this modelling exercise.

In the figures of section 4.1 and 4.2, the authors state that there is a good agreement between the observed water levels and those obtained from the model. However, this is only based on a visual inspection. It would be helpful to show the closeness of agreement between the two water levels by conducting statistical tests.

Authors' reply: Thank you, correlation coefficients have been included in the corresponding figures.

Interactive comment on Hydrol. Earth Syst. Sci. Discuss., 4, 211, 2007.