Hydrol. Earth Syst. Sci. Discuss., 4, S236–S241, 2007
www.hydrol-earth-syst-sci-discuss.net/4/S236/2007/

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.

Received and published: 4 May 2007

Replies to Anonymous Referee #1 (Replies are imbedded in the original text of the referee)

The paper presents an interesting engineering application that is clearly within the journal's scope of disciplinary fields. The issue of flood mitigation and disaster prevention is of high importance worldwide and has shifted even more into public awareness after the devastating flood events that struck large regions of Central and Eastern Europe in August 2002 - with the Elbe river basin among the most affected. It is particularly true that unsteady 2-D modelling of large floodplains, polders and inundation areas are computationally expensive, hence the 1-D channel-node system can provide an

efficient modelling alternative in these cases.

Authors' reply: Thank you.

The aim of the paper is clearly set forth within the introduction and coincides with the title. However, while the paper reaches a number of conclusions, some of them will actually require further discussion to substantiate the claims made. For instance, the control strategy of the weirs is always referred to as "optimal", but the paper does not state how precisely this control strategy was found.

Authors' reply: We have now discussed our optimisation strategy for polder filling to achieve maximum capping of the discharge peak in Section 3.2, which is complimented with an additional figure (now Figure 4).

Another example is the discussion of the sensitivity of the roughness coefficient in polders P4 vs. P1 which speculates rather than performing the actual work based on scientific methods needed to be conclusive about this issue. A number of other issues are discussed below.

Authors' reply: We have removed this sentence and reworded the text.

Regarding overall structure and language of the paper, it can be said that it is well structured and clear, even though some textual improvements may be required (see below). However, some figures will definitely need to be modified to become more easily understandable, and it also appears as if not enough care was taken in writing concise figure captions that actually correspond to the figure content.

Authors' reply: Many modifications have been done on the figures and the captions have been revamped to make them clearer in describing the figures.

Also, the authors are strongly advised to review the references cited in the text and listed at the end of the paper, as some cited literature is not referenced, and some listed references never appear in the paper's main text.

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Authors' reply: Extra care has been taken to insure accuracy in the references and citations.

Considering all of these issues, I recommend printing the paper once all open questions have been answered and the necessary corrections have been applied.

Authors' reply: Thank you very much.

The following individual issues will require further scientific discussion in the paper (page and line numbers refer to the print version): (a) At pg. 215, line 16, the authors state that backwater effects were also taken into consideration when calculating weir discharge in the hydrodynamic model DYNHYD. As the consideration of backwater effects is important particularly during large floods it should be worth more than a side note and discussed in more detail.

Authors' reply: The calculation for backwater effects has been described in more detail with a reference (Chow, 1973, "Open channel hydraulics", McGraw Hill, 680 pp.)

(b) At pg. 217, the polder control strategy is explained. Repeatedly the paper states that it resembles the "optimum" control strategy, even though the authors never explain how this strategy was found and how precisely the optimum was defined?

Authors' reply: We have now discussed our optimisation strategy for polder filling to achieve maximum capping of the discharge peak in Section 3.2, which is complimented with an additional figure (now Figure 4).

(c) At several locations within the paper, i.e. pp. 219, 220 and 224, the authors discuss their choices of bottom roughness coefficients and state that they have to be fine-tuned for each flood event. This issue is nothing new as it has always been a problem in using Strickler/Manning coefficients for roughness parameterization. However, using another sort of roughness parameter, i.e. absolute roughness as it is often used in 3-D models, or the use of lambda coefficients, can provide an effective remedy to this issue. The paper should address this matter more deeply to show that there are more solutions to

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the same problem than just fine-tuning the roughness parameter for every event.

Authors' reply: Thank you for this insight. Manning's roughness coefficient is a relative hydraulic roughness coefficient and factoring out, for example, the hydraulic radius to obtain an absolute hydraulic roughness coefficient or factoring in, for example, Reynolds number to obtain a lambda coefficient may be a solution that we have been looking for. This has been elaborated in the text and is a subject of future work.

(d) At pg. 223, the authors discuss their finding that the roughness coefficient is much more sensitive in P4 than in P1. I would feel more confident if this discussion would be based on facts rather than speculation as it is currently done in the paper. Furthermore, the discussion of the deviation in the boundary condition leading to higher capping of the discharge hydrograph is entirely confusing.

Authors' reply: We have investigated this more closely, and the effect is very small, hence, the sentence has been removed. The paragraph has been reworded to make the influence of boundary condition deviations on capping more clear.

(e) Figure 2 depicts the polders to be constructed and features a subdivision of polder P4 in P4a and P4b, and polder P1 in P1a through P1c. Either the text should elaborate on these subdivisions (preferred) or the figure should be changed.

Authors' reply: The figure has been changed so that only the notations P1, P3 and P4 are shown.

(f) It appears that the schematic drawing in Figure 3 does not contain the area constituted by polder P1c. Why?

Authors' reply: We did not find it necessary to include the additional polder area since the behaviour of the polder extremity would be captured by P1b.

(g) In several figures, particularly Fig. 6 and 8, a local peak in the simulated data during the first simulation day is clearly visible. This phenomenon may be either of numerical or physical nature, even though I suppose it is of numerical origin. This issue should

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be addressed and explained in the text.

Authors' reply: This peak is due to numerical origin. To avoid this confusion the x-axis on all the figures now begin at 0.5.

(h) The caption for figures 11 and 12 is almost certainly wrong. Please check.

Authors' reply: The captions have been corrected.

(i) In Figure 13, point (weir?) "j" is referenced. Where is it?

Authors' reply: "j" is actually shown in Figure 3 but it is very hard to see. We have fixed up the figure so that the letter is easier to distinguish.

There are also a number of technical corrections I propose: (1) Pg. 212, line 13: "sensitive analysis" should become "sensitivity analysis"

Authors' reply: This has been corrected.

(2) Pg. 212, line 23: "Petrow et al., 2006" is never referenced!

Authors' reply: The reference has now been included.

(3) Pg. 213, line 1: to my understanding, normally web links should be part of the references, not presented in the main text

Authors' reply: We are referring to projects, not specific documents, so this is ok.

(4) Pg. 213, line 3: see comment (3)

Authors' reply: We are referring to projects, not specific documents, so this is ok.

(5) Pg. 213, line 15: "which respect to" should be come "with respect to"

Authors' reply: This has been corrected.

(6) Pg. 213, line 24: "computationally extensive" should be changed into "computationally expensive"

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Authors' reply: This has been corrected.

(7) Pg. 214, line 1: "substance transport" is normally referred to as "solute transport"

Authors' reply: This has been corrected.

(8) Pg. 216, line 6: a better term for "depicting" would probably be "representing" in this context

Authors' reply: OK, the word has been exchanged.

(9) Pg. 218, line 1: the location referred here should be f2 rather than g

Authors' reply: This has been corrected.

(10) Pg. 218, line 11: please refrain from explaining the same issue a third time by paraphrasing what has already been said, and remove the sentence reading "In other words..."

Authors' reply: OK, the sentence has been removed.

(11) Pg. 221, line 8: "Förster et al., 2006" is never referenced!

Authors' reply: The reference is now included.

(12) References: Apel et al., 2004 and Saltelli et al., 2000 are not cited in the text

Authors' reply: The two references have been removed.

(13) Caption of Figure 2: the reference should read "IWK, 2004", not "IWA, 2004"

Authors' reply: This has been corrected.

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