

## ***Interactive comment on “Numerical simulation of levee breach by overtopping in a flume with 180 bend” by S.-T. Dou et al.***

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The authors would like to thank you for these valuable comments and suggestions, which will undoubtedly improve our submitted manuscript and the related figures. All the comments are considered seriously and corresponding modifications will be made in the new version of the manuscript. In the following parts you can find our reply to your comments: 1- The author uses the words break and breach. I would recommend the word breach for progressive failures of levees and breaks for instantaneous failures. Please update this in the entire paper. f.e. Breach flow, breach width. Re: Thank you very much for your advice; we use “break” or “breach” according to the exact meaning of the words in the new version of manuscript.

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2- The author uses the SWEs to model the breach growth. However for normal full scale breach formations the flow accelerates rapidly down the downstream face of the embankment. These rapid vertical accelerations are in conflict with the assumption of a hydrostatic pressure distribution which underlies the SWEs. Re: As you mentioned that in the SWEs it is assumed the pressure distribution is hydrostatic while the rapid vertical accelerations occurs in levee breach flow and this may bring out false result. But we can also find that SWEs is widely used in modeling shock waves, like dam break and levee break flow in some typical case studies, and it is demonstrated that the result can represent the reality well(ZHOU J. D, 2001; WANG X., 2009; LIANG Q., 2009; WANG D. W., 2012; Wu W. M, 2012, etc). So we think SWEs can be used here.

3- Figure 10: gives the cross sectional failure of the breach. I believe that the change in cross sectional shape is governed by a geotechnical failure caused by a seepage flow and do not represent the reality correctly. Mentioning of the processes at hand in change in cross sectional breach shape would be beneficial. Re: Fig. 10 shows the cross section of the breach along the flow. Expansion of the incipient incision on the top of the levee was indeed governed by a geotechnical failure as the slope was great, after that the sand was carried by flow. The breach crest level getting lower as shown in fig. 10, when t=250s the breach has expanded a lot and the crest level has become almost steady. This result is in accordance with the phenomenon in the experiment mentioned in this paper.

4-Section 3.2. This part is quite unclear due to references to the right side of the break of the outer river. Maybe a picture with numbered locations would give a more clear description. Re: thanks a lot for your advice, we will check this section carefully and make it clearer for readers.

- Rate of flow of the breach = breach flow rate. Re: Thank you very much for your advice, we have checked and revised it.

6- Section 3.3. Please use the words: Breach invert level, or breach crest level to

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refer to the change in level of the cross sectional breach. The elevation in levee top is unclear. Re: Thank you very much for your advice, we have checked and revised it.

- The paper could do with a general update of the professional terms. Re: Yes, we have checked all the professional terms and try to express our idea more clearly.

7- Page 3950 line 25: "The proposed calculation mode of break scour depth and lateral widening can effectively simulate the levee breach of sandy soil levee ". I disagree with this conclusion since the test setup and results solely allow for the conclusion that the code is able to model the lateral erosion rates with accuracy. The use of SWEs, the sudden reduction in test levee height during the start of the test are not representative for a full scale levee breach process. Hence I would recommend that the author limits his paper and conclusions to the lateral widening of the breach. Re: We simulated the lateral widening combining with scour of the breach crest. Indeed this study emphasizes the modeling of lateral widening and it is also the most difficult parts in modeling levee breach. We checked this conclusion and made the emphasis clearer.

8- Since the paper already focuses mostly on the lateral widening, and considering the outcome of the experiments, and the fact that the change in the cross sectional breach shape is barely mentioned, I would recommend to rename the paper: Numerical modelling of the lateral widening of a levee breach.....etc Re: As we mentioned above, lateral widening is the emphasis of this study and we will consider your advice seriously.

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