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Hydrology and Earth System Sciences
Discussions

Interactive comment on "Assessing the impact of hydrodynamics on large-scale flood wave propagation – a case study for the Amazon Basin" *by* Jannis M. Hoch et al.

Jannis M. Hoch et al.

j.m.hoch@uu.nl

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We thank the anonymous reviewer for his/her evaluation of our manuscript and helpful comments.

With regard to comment #1, we fully agree with the reviewer that it is necessary to evaluate the sensitivity to model parameters and to calibrate and validate them whenever possible. In this case, however, we investigate the improvements that can be obtained by using different hydrodynamic model set-ups when forced with simulated hydrology, in this case from the large-scale hydrological model PCR-GLOBWB. Thus, we opt to tune the hydrological output in terms of volume by optimizing at the basin scale a selection of five parameters in PCR-GLOBWB as outlined in the manuscript, resulting in

a 38% lower RMSE and a KGE improved by 68%. We do acknowledge that this procedure may not become perfectly clear in the manuscript, and will improve this in the revised manuscript. A further reason why we are reluctant to calibrate the model is that eventually we wish to apply our approach on the global scale. Local, expressly basin-scale- calibration would be desirable with the objective to improve forecast skills but it will introduce inconsistencies among the global datasets used and jeopardize their validity for ungauged basins. Bearing in mind the above, we fully subscribe to comment #2 and recognize that validating the modeled flood extent is of major importance; it adds an additional check on the validity of the different hydrodynamic models and tests the effects of wetted perimeter and resistance more directly than by validating against the observed discharge hydrograph only; also, observations of flood extent, e.g., by remote sensing, provide a denser global coverage than discharge observations. Thus, it offers a way to check the validity of the hydrodynamic models over larger areas, also in data scarce regions. At the time of writing, though, we chose not to validate against flood extent for two reasons. First, the spatial resolution of the hydrodynamic model is around 2.5km for the finest cells which introduces a mismatch when validated against finer-resolution satellite imagery that is directly due to resolution. This obscures the actual error that should be attributed to model structure and parameterization. Second, the temporal coverage of remotely sensed flooding may have gaps that further complicate a comparison with the continuously simulated flood extent. This issue can partly be addressed by matching the maximum flood extent over chosen periods (e.g., weeks, months . . .) but this will emphasize the effect of the local topography and dilute the ability to assess the skill of the different hydrodynamic models. Therefore we decided initially to concentrate on validating the simulated discharge at Óbidos. In light of the reviewer's comment we will try and accommodate a validation against the flood extent from remotely sensed data bearing in mind the limitations that we list here directly above. Depending on the quality and meaningfulness of the outcome, we will add this to the revised manuscript. In case quality and meaningfulness are considered to be insufficient, we will add this relevant validation step in an already started follow-up case

study that employs the coupling procedure at a much finer spatial resolution (< 1km). In any case, we expect the validation against flood extent to provide relevant information on the skill of the hydrodynamic models to simulate flood extent over space and time which cannot be gathered from a validation against discharge alone.

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