Hydrol. Earth Syst. Sci. Discuss.,
doi:10.5194/hess-2016-442-RC2, 2016

Hydrology and Earth System Sciences
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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.

D. Yamazaki (Referee)

bigasmountain1022@gmail.com

Received and published: 25 October 2016

This manuscript describes the differences of simulated river hydrodynamics among hydrology model, hydrodynamic model, and coupled model. The work is interesting because comparison of river routine framework has not been widely studied yet. Though some modifications are needed, I think this manuscript has a potential to be published on HESS after minor revision.

<Specific Comments>

P3.L32: 2D models experience problems in case the actual river width is smaller than the grid size and also in case there are multiple rivers within one cell, although it is

possible to partly overcome that by applying sub-gridding routines (Neal et al., 2012; Yamazaki et al., 2011).

> CaMa-Flood (Yamazaki et al., 2011) is a 1D global river model, so this description is not accurate.

> Please also note that MGB-IPH (Paiva et al., 2011) and CaMa-Flood (Yamazaki et al. 2011; 2013) are different from other 1D-hydrology and 2D-hydrodynamic models. They are 1D continental- or global-scale river models, but they utilize a shallow water equation as the governing flow equation. Other hydrology-type river models use kinematic-wave equations, and other 2D hydrodynamic models cannot easily be applied to continental scales. It is better to provide a careful review on these models.

P7.L6: River depth d [m] was subsequently estimated from river width w [m] by means of the following equations from Paiva et al.

> Is the river width calculated from drainage area? Or is it given by GWD-LR?

> The hydro-geometry equations (eq.1 and 2) are suitable for describing the general increase of the channel depth and width from upstream to downstream. However, if the width is given from observation (i.e. from GWD-LR), the equation (3) cannot be used to account the local variation of channel depth. In general, given that the discharge is same, channel is deeper when the width is smaller (and vice versa).

P8.L22: the finest spatial resolution (2.5 km $\times$ 2.5 km) for areas with lowest HAND values

> How the elevation of each 2D mesh is defined? Is it given as the average of 3sec pixels within the mesh? Or minimum elevation within the mesh? Please describe the detail because this could largely change the hydrodynamic simulations.

P8.L8: For the present study, river depth d was computed as a function of upstream area Ad

> Is this assumption consistent to the 1D/2D model? Given that the hydrodynamic simulation is very sensitive to channel bathymetry, we cannot rigorously compare the difference between the 2D and 1D/2D models if bathymetry is not consistent.

P9.L13: a delta volume was computed based on daily river discharge, surface runoff, and water layer volumes

> Please provide more detailed information on how to couple the hydrology and hydrodynamic models. I guess, river discharge is used at the 2D-model's upstream boundaries, while surface runoff is used within the 2D-model's domain. But I'm not sure how the water layer volume is used.

P10.L3: Forcing the model with discharge observed at GRDC-stations, we found that the aggregated input discharge as obtained from upstream GRDC-station observations accounted for only 59% of the discharge generated in the basin as observed at Óbidos (Figure 5).

> Please describe the locations of GRDC stations used as upstream boundary input. Please also calculate how much percentage of the basin area is covered by the GRDC gauges. Without the above information, readers cannot understand the $\sim$30% underestimation is reasonable or not.

P10.L13: the simulated discharge is consistently higher than of both the purely hydrology- and purely hydrodynamic-based models

> This is quite unusual, and I guess there is a possibility of a bug in the codes. The river routing scheme can alter the timing of hydrodynamics, but it does not change the total amount of flowing water (i.e. water mass is conserved).

> Therefore, one potential source is a loss of surface water (evaporation or infiltration). Please calculate the amount of surface water loss in PCR-GLOBWB, and confirm that the loss can explain the difference between the Hydro-only simulation and the coupled simulation.

> If the loss cannot explain the discrepancy, then please check the river network structure of each modelling framework. Especially in a coarse-resolution river network such as at 0.5 degree, the merging location of the mainstem and branches could be unrealistic.

> The error in mass balance calculation is critical, so that the cause of discrepancy should be examined more carefully.

P10.L34: A closer inspection of model results, nonetheless, reveals that the rate of increase as well as decrease of the rising and falling limb, respectively, is higher compared to the purely hydrology-based run.

> The rate of increase/decrease strongly depends on channel bathymetry. If the channel is deeper, the discharge increase faster, and vice versa. Therefore, the noted difference cannot be simply related to the way of coupling models.

P12.L18: We also found that GRDC-forced runs show stronger attenuation and lagged peak discharge due to the longer average travel time required to propagate from the boundaries through the model domain.

> Whether travel time becomes longer or shorter depends on the location of the input GRDC gauges. If the travel time could be longer if the missing input from neglected branches are located in downstream, but the travel time could be longer if neglected branches are in upstream.

Figure 7:

> Water depth is highly affected by local channel bathymetry. I think it is also better to compare the water surface elevation (above sea level), because water surface elevation is determined by larger-scale hydrodynamics.

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