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Geoscientific Model Development Discussions

Interactive comment on "Modeling surface water dynamics in the Amazon Basin using MOSART-Inundation-v1.0: Impacts of geomorphological parameters and river flow representation" *by* Xiangyu Luo et al.

Anonymous Referee #2

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The paper presents improvements on the parametrization of the MOSART surface water model. State of art methods are used to update river model and inundation parametrization. The model is evaluated in the Amazon basin and several simulations were performed to evaluate the role of the DEM, river geometry parameters, and backwater effects. The subject addressed by the paper is important. With new data available for regional/global hydrologic simulations, there are several new efforts to improve hydrological models. And the documentation of new improvements/updates of models, as the MOSART, fits the goal of GMD journal. Also, the study of impact of model errors and different parametrizations are important guide future model develop-

ments. The paper is generally clear. However, it seems that most of the conclusions from paper analyses were already provided by the past modelling studies in the Amazon (e.g. Paiva et al., 2013, Getirana et al. 2012, Yamazaki et al., 2011, Beighley et al., 2009; Baugh et al., 2013). For example, the past studies already pointed for the importance backwater effects and flooding, performed sensitivity studies on the role of river geometry errors and DEM errors on amazon simulations. So I guess that it would be better to present the paper as a documentation of the improvements of a specific model (MOSART) to move toward state of art methods. And to clarify that the analyses could reproduce similar conclusions from the past studies. So, as the documentation of model parametrizations fits the GMD journal scope, I think that the paper could be published. But it needs to be reviewed clarify the actual contributions, by addressing the comments above and below.

Introduction: I feel that the main goal of this paper should be to document improvements on the MOSART model. So it is important to provide more details in the intro section.

Page 2. Line 25. Which of these challenges were addressed by this paper in a novel way that was not done by the past efforts?

Page 3. Line 9. Vegetation errors from SRTM DEM were removed globally by F.E. O'Loughlin et al. 2016 RSE. Please review and discuss it in the paper.

Page 3. Line 22. See also analyses from Paiva et al., 2013 WRR.

Objectives. What is the new proposed contribution? If the contributions are limited to updating MOSART model with state of art methods, then I think that you should specify it in the objectives and introduce MOSART in the intro section.

2.1. How the model defines what is main river network and tributary subnetwork?

Eq.1. It seems g can be removed from equation... Continuity equation is not shown.. Please show it.

How these equations (kinematic and diffusive) are solved? Please provide details on the numerical methods. finite difference, finite volumes, implicit, explicit? Criteria for time step, spatial discretization? What is done to avoid mass errors. . ..

2.2. It is not clear how you compute river bed elevation? Is it simply the lowest DEM pixel of the catchment? How the model accounts for the fact that SRTM DEM does not see the river bed? And the fact that the river profile is not flat?

2.3. How the basins are defined? What is the input data? Hydrosheds? Please make it clear.

Pag. 6 Line 30. What is the criteria to define river length? How time step is defined? How these choices affect model errors (model numerical stability, mass errors, numerical dispersion,. . .) ? Please clarify and discuss it.

2.4. Vegetation Errors. Was the corrected DEM validated ? Please justify and compare these methods to the global SRTM DEM product free of veg errors recently developed by F.E. O'Loughlin et al. 2016 RSE.

2.6. Line 16. What literature was used to define Manning at 0.03 and 0.05?

I feel that the parametrization of Manning needs more justification (past studies or calibration). How these choices will impact model results?

2.7. Line 6. Why average manning of 0.03 ? You should use the average Manning from the reference simulation or use other approach to isolate the effect of variable vs constant manning.

2.7. What is optimal combination? Was any calibration performed?

3.1. How the model performance compare to past modelling studies in the Amazon? Please discuss it in the manuscript.

3.2. Equation 7. Do you use this equation to estimate a parameter for simulation? If yes, this explanation should appear o section 2. Why this approach were selected?

How it compares to previous studies? How this choice impact model results? See Paiva et al., 2013 for an analyses of impact of bed elevation errors on simulations.

3.2. How model performance for river elevation compares to previous modelling studies in the amazon? Please discuss it in the manuscript.

3.3. How model performance for flood extent compares to previous modelling studies in the amazon? Please discuss it in the manuscript.

4.1. How these analyses compare to previous analyses of impact of DEM and floodplains on Amazon simulations from previous modelling studies?

4.2. It is not change in channel storage capacity that changes simulation. It is changes in channel conductance capacity.

4.3. How these analyses compare to previous analyses of channel geometry from previous modelling studies?

4.3. I'm not sure if this analysis is conclusive. It is not possible to be sure that the differences in results are related to variable Manning or if it is because a specific value of 0.03 was chosen. This value may be different from the average value of the control simulation. I suggest the computation of the average Manning from control simulation and using this value for the new simulation.

4.3. How these analyses compare to previous analyses of Manning role from previous modelling studies?

Figure 10. This figure is confusing. It's hard to understand the break in the profile. Please review it.

4.4. Line 20. See also analyses on the importance of backwater effects for amazon simulations from Paiva et al., 2013 WRR and Paiva et al., 2013 Hyd.Process. Please compare and discuss in the manuscript.

Conclusions. Line 20. Review Yamazaki et al., 2013. WRR for discussion in Catchment

vs grid based simulations.

Conclusions: I'm not sure if there are new conclusions /findings that were not addressed by the past modelling studies in the Amazon (e.g. Paiva et al., 2013, Getirana et al. 2012, Yamazaki et al., 2011, Beighley et al., 2009; Baugh et al., 2013). The past studies already pointed for the importance backwater effects and flooding, performed Sensitivity studies on the role of river geometry errors and DEM errors on amazon simulations. It is important to recognize that the analyses from this paper only reproduced similar conclusions from the past studies. And also clarify that the new contribution from this paper is mostly on updating/improving the parametrization of an specific model, i.e. MOSART model by including improvements tested or suggested by the previous studies.

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