

Interactive comment on “Model cascade from meteorological drivers to river flood hazard: flood-cascade v1.0” by Peter Uhe et al.

Anonymous Referee #1

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General Comments

Firstly I would like to congratulate the authors on producing such a well written manuscript. As someone who knows something about all the components in the model cascade but wouldn't call myself an expert in any of them, I was able to follow the methodology easily. There is a logical progression through each step and the links between models (data transfer, domain/resolution changes, required assumptions etc.) are explicitly explained. I didn't even spot a typo until line 545!

As the authors mention, there are a growing number of attempts in the literature to create model cascades from meteorology to flood inundation. Many of these attempts have remained largely conceptual due to the challenges of identifying consistent data to run each component in the model cascade for global applications. The authors

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should therefore be commended for their thoughtful application of the model cascade to the Brahmaputra river and helpful commentary on how they have addressed these issues of data scarcity using available global data sets. The complete case study adds significant value to this manuscript.

Excepting a few minor edits, I would recommend this manuscript for publication.

Specific comments

The justification of this approach is to improve on climate change assessments that use precipitation or river flow as a proxy to flood hazard. The authors should make it clear throughout the abstract and introduction that the model cascade they have designed could be used for this application (or indeed has been designed for this application) but this step isn't included in the current manuscript.

Line 19 I would argue the impact of floods is largely driven by the vulnerability of the population and infrastructure in the locations that they hit rather than the catchment characteristics (see the literature on “no natural disasters”). Climate change assessments (sometimes) take this into account by including projections of increased population etc. This model cascade does not go as far as to model impacts in this sense (ending at flood inundation/hazard) and I think this should be explicitly acknowledged in the text which does stray into discussing impacts in several places. You should check your terminology throughout the manuscript. Also can you justify in the text why you haven't included impact modelling into the cascade?

Whilst I think the following suggestion would increase the impact of the manuscript, I do not consider it an essential pre-requisite to publication as the model cascade is already well described and documented. As a model description paper to enable others to set up a similar approach (and for general appreciation of the significant undertaking this type of model cascade is to set up) I would like to see as assessment/table (which could be descriptive) of how important each step is in the model chain; how much time does it take, is the required data easily available, what assumptions have been made

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to make the step possible, and does including it as an explicit modelled step in the cascade notably improve the end result/reduce uncertainty. Although I note a future paper using climate projections is planned, perhaps you could consider a comparison of your results against just using the precipitation or river flow as a proxy within this future work to demonstrate the benefit of using a full model cascade.

Technical corrections

Figure 1 schematic. The last impacts picture isn't very clear, I think it's a collapsed bridge, but better images are probably available. However this manuscript only takes the model cascade as far as inundation modelling, there is no attempt to model vulnerability / impact beyond water depth so I would question if the impact images are misleading here.

~Line 55 I would move the statement from the bottom of page 5 "to investigate changes in future flood risk. . ." to page 2. The introduction could lead the reader to think you are going to present a climate change simulation, I would be explicit early on that you are presenting a model cascade that could support this type of assessment in the future. Similarly I think you could add a line to the end of the abstract along the lines of "this approach could be used to assess the impacts of climate change by. . . . [changing the meteorological drivers]"

Line 145. Could you include evidence of this in the appendix?

Line 199 I suggest "we did not have ACCESS TO the. . ."

Figure 5 and 6 I suggest adding the lines you already have in the text "a value of 0 indicates. . ." to the figure caption so figures can be interpreted easily.

Line 415 channellings of modelling wetlands / very flat floodplains is a general issue for hydrological models and not unique to this application. Could you cite some other examples to demonstrate the challenge.

Line 465 please specify why this area of the catchment was selected to demonstrate

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the inundation modelling

Line 509 what would these limitations mean if this model cascade was being used to assess climate change impacts?

Line 547. The terminology used in the conclusion is slightly confusing / inconsistent i.e. "high resolution flood inundation", "fine scale flood risk information". These terms are relative, what is presented in this manuscript could be described as high resolution compared to what is currently available for flood modelling globally at these type of scales, but it is not high resolution in the more general context. The discussion within the manuscript has previously focussed on the challenges of adequately describing the topography, river network etc in the absence of high resolution data.

Line 545 missing or incorrect word (the = this?)?

Line ~550 would this model cascade be of potential use for flood forecasting in data/resource poor regions of the world or are the run times prohibitive?

Table 4 The definition of pluvial flooding refers to "flash flooding caused by short, very intense precipitation events". Could you clarify if you consider this to be before water enters a watercourse or if you would also include flooding from small watercourses. I think there is potential for confusion in the definition here as the methodology only includes watercourses with catchments >250m². Including pluvial flooding would require a continuum of approaches to go from catchments of 250m² to pluvial flooding which many not be as simple as implied in line 545.

Interactive comment on Geosci. Model Dev. Discuss., <https://doi.org/10.5194/gmd-2020-280>, 2020.

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