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Interactive comment on "Application of CryoSat-2 altimetry data for river analysis and modelling" *by* R. Schneider et al.

Anonymous Referee #2

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This paper describes the application of remotely sensed altimetry data from the CryoSat-2 satellite to large scale hydraulic modelling, using the Brahmaputra Basin as an example. While the paper is generally well written and clear, there are a few issues related to the focus and balance of the paper that will need addressing.

The remote sensing aspects of the study seem very well described, but the description of the hydraulic modelling is relatively weak. In this respect, the novelty of the work lies in the use of the Cryosat-2 data rather than the hydraulic modelling. In fact given the current research in large scale hydraulic modelling the approach used in the paper is overly simple. Moving beyond the "virtual gauge" is of great research interest and I think this study has real value here, particularly with the fusion of drifting orbit and Envisat virtual stations. The filtering using a dynamic Landsat water mask is also of value and overall I think there is sufficient novelty in the work for publication.

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While there are some issues to address, I do not think further modelling is required. I think most of the issues can be addressed with changes to the core text. There should be better reference to existing large scale hydraulic river modelling and more discussion/openness about the modelling limitations.

Some more specific points that should be addressed:

(1) The work seems to miss some aspects of recent research that I would assume would be relevant to the work. For example no mention is made of studies that use ICESAT – another dataset that has been used for similar hydraulic model calibration. There is also no reference to the relevant work on channel representation in large scale 1d-2d modelling such as that of Neal et al (2015) (and previous studies).

(2) Why only use a 1d model when there are plenty examples of this scale of hydraulic model using 1d&2d? Essentially all the floodplain and braided river section details are being lumped into the single triangular cross-section, so I am not sure how valid the representation of the river/floodplain is in the end. It might work as a simple water level response function that can be calibrated (as demonstrated in the paper), but it losses any physically based reality in representing the river and its floodplain, thereby limiting the value to the model for basin/river/floodplain studies. It is possible of course that the hydraulic conditions are such that the detailed representation of the channel is less important, such as found by Trigg et al 2009 on the Amazon. However there is no detail provided to show this is the case, for example what are the Froude numbers for the flow? It has not been demonstrated that the resulting model has value outside of the modelled scenario. I don't think that the model necessarily has to be redone, but I do think its limitations need more discussion.

(3) More discussion is required on the uncertainty in flow produced by the rainfall runoff modelling and how it affects the hydraulic modelling.

(4) There is reference to the dynamic nature of river channel with regards to the water mask, but no discussion of the how important this geomorphology might be to the

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simple triangle river channel model used.

(5) I am not clear on how the SRTM is actually translated into the triangle river channel. Has the raw SRTM data been processed to remove the vegetation bias? What is actually used for the 1d triangle, the width and depth of the river extracted from the SRTM? If so maybe river width from landsat would be better for the width and estimate of depth from geomorphological relationships (Leopold, and Maddock, 1953) would be better? What size are these calibrated triangles. Do they bear any resemblance to the real river sections?

(6) Manning's is mentioned but no values given. Given its direct control on water levels and it should have some link to expected values it should not be omitted. Given the crude nature of the cross-sections and the fact that Manning's will compensate for lots of missing processes in this regard, I am not sure the calibrated Manning's values will bear resemblance to what might be expected for such a river.

Refs: Neal et al, 2015. Efficient incorporation of channel cross-section geometry uncertainty into regional and global scale flood inundation models, Journal of Hydrology. Trigg et al 2009. Amazon flood wave hydraulics. Journal of Hydrology. Leopold, and Maddock, 1953, The hydraulic geometry of stream channels and some physiographic implications, U.S. Geol. Surv. Prof. Pap.

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