

Hydrol. Earth Syst. Sci. Discuss., referee comment RC1  
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## **Comment on hess-2021-97: Hydrometeorological drivers of flood characteristics in the Brahmaputra river basin in Bangladesh by Hossain et al.**

Anonymous Referee #1

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Referee comment on "Hydrometeorological drivers of flood characteristics in the Brahmaputra river basin in Bangladesh" by Sazzad Hossain et al., Hydrol. Earth Syst. Sci. Discuss., <https://doi.org/10.5194/hess-2021-97-RC1>, 2021

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The manuscript analyses the hydrometeorological factors that contribute to the occurrence of devastating floods in the Brahmaputra river (Bangladesh). The authors focus on three exceptional events characterised by either long duration, rapid rise or high water level. They use observational and reanalysis data, together with climate indices to determine the most relevant hydrometeorological drivers leading to each flood type. The authors find that strong La Niña favours long duration floods, whereas localised precipitation supports rapid rise floods. Conversely, other drivers are identified as more influential for high water level cases.

The authors tackle a relevant topic which fits within the scope of the journal and may be of great interest for readers. However, the structure of some parts of the manuscript needs to be revised in order to provide an enhanced description of the objectives of this study, its background and its conclusions. Therefore, I recommend a major revision to improve the quality of the manuscript before its publication.

### **General comments**

Some parts of the manuscript require a revision to avoid repetitive ideas and improve discourse flow, as some parts of the text are rather disconnected. In addition, the authors should explain better the rationale behind each of the analysis described in the manuscript.

Besides the structure of the manuscript, I missed a more detailed analysis of the meteorological situation leading to localised short-duration rainfall events, which are key for rapid rise floods according to the manuscript's conclusions. Have the authors considered which mesoscale or local-scale atmospheric factors contribute to these intense rainfall events? If not, are they aware of any study that analyses this aspect for the events considered here (or others of similar nature)?

Moreover, it gives the impression that the 33-year data is not fully exploited. Some of the analyses shown in the manuscript could be extended to other years to better highlight the

differences between the selected years, when exceptional floods occurred, and the rest. This is only done for some drivers, but not for all, which can be confusing for readers.

### **Specific comments**

**Abstract (L26-27):** Does the last sentence refer to the drivers analysed in this study or to sedimentation and morphological changes? If it is the latter, I suggest removing this sentence, as this aspect is not investigated in this study nor anything related to climate change. In this case, I would replace this sentence by a new one that summarises the main conclusions of the manuscript.

**Introduction:** I recommend modifying its structure. I think it would be more appropriate to start with more general aspects of flooding in the area before introducing the details regarding the most devastating cases. In addition, the whole section should be carefully revised to avoid repetitive ideas (e.g., L37-38 and L46-47) and provide a coherent text that focuses on the most relevant aspects that will be discussed in the following sections.

**L36:** I suggest moving Fig. S1 to the main manuscript.

**L59-61:** Why are these factors chosen?

**L62:** Why are these cases analysed in more detail?

**Section 3:** The beginning of this section is too abrupt. I suggest adding an introductory sentence indicating the value of each data source for this study.

**L212:** Please, add a map illustrating the Niño 3.4 region or provide some geographical references or the area.

**L236-243:** The current wording of this part of the manuscript is confusing. Please, clarify what is intended to be said.

**L250:** I propose including other years in the supplement.

**Section 5.1:** Can mesoscale or local-scale mechanisms be analysed? (see general comments)

**Fig. 4b:** I suggest including mean JJAS rainfall for each year in this panel.

**L356:** Please, define "sweet spot".

**Section 5.1.3:** Please, add a brief introductory sentence.

**L451:** The authors should mention some of these "other drivers".

**L483:** The relevance of these "short-duration rainfall events" motivates an analysis of them (see general comments).

**Section 5.2.3:** Please, add an introductory sentence indicating why is soil moisture relevant.

**L488:** Can the data confirm that "basin-wide and frequent rainfall events maintained soil moisture" and thus, avoid saying "it is likely"?

**Section 5.2.4:** Again, add some introduction to this section.

**L529:** I suggest including these values in a table.

**L534:** I recommend adding Fig. S6 to Fig. 10.

**L537-538:** The authors should give some recommendations to perform this task.

**L563-565:** I suggest moving this sentence to the beginning of the subsection. This kind of sentences can be used as introduction for other subsections (see previous comments).

**L586-588:** Please, move this sentence to the beginning of the subsection.

**Section 6:** As it is currently written this section is more like a summary than a discussion. In addition, the two subsections include various repetitive ideas. I suggest summarising the whole section in order to succinctly provide the most important take-home messages for readers.

**L671-672:** The selected cases fall in different categories. This classification should be better explained to avoid confusion.

**L674 onwards:** Strong La Niña seems to be a necessary but not sufficient condition for long duration floods. This idea should be emphasised.

**L686-688:** Accurate forecast of heavy rainfall is extremely challenging for small scales and long lead times. The authors should clarify the spatial and temporal scales of interest and include some references indicating the feasibility of this proposal and/or its associated challenges.

**Table 2:** I recommend moving this table to the supplement.

**Section 6.2:** Climate change and disaster management perspectives: Since climate change is not considered in this study, I suggest moving this part to the conclusions as a subject to be considered for future work.

**L737-738:** The simultaneity of the two factors seems crucial for the development of long duration floods. This idea should be highlighted in the discussion, rather than focusing only on strong La Niña.

**L746-747:** All climate change discussions should be moved here (see previous comment).

### **Technical corrections**

**L45:** Fig. 3 is cited before Fig. 2 (L115).

**L56:** I suggest "(e.g. 2017 floods). Indeed, the Bangladesh Flood Forecasting and warning Centre (FFWC) is keen to improve early warnings for these events".

**Caption Fig. 3:** Consider a slight modification of the caption, for instance: "Dates on which water level (WL) exceeded the danger level at the Bahadurabad station on the Brahmaputra river (see Fig. 1b for location of the gauge) indicated by a coloured dot. The colour represents WL value as indicated in the legend". Please, also indicate the threshold for severe flooding.

**L210:** El Niño (La Niña) -> El Niño (La Niña).

**L215:** Please, define IPRC/SOEST.

**L238:** MJO -> (MJO).

**L246:** Remove the parenthesis from the reference to Wheeler and Hendon.

**L298:** Please, define ECMWF.

**L328:** "floods in August 2017 was" -> flood...was or floods...were.

**Caption Fig. 4:** Is 2010 missing in the caption?

**L487:** Please, add a coma between monsoon and soil.

**Caption Fig. 12:** Please, mention the different vertical scales for each panel.