

Anonymous Referee #1, 04 May 2023

This study presents an important national-scale assessment of flood risk in India. The methodology is adequate and the manuscript is well written. I thus recommend its acceptance in HESS after minor review.

My only concern is that it is not clear throughout the text how reservoirs were considered in the study. In some parts of the methodology it is argued that the model is calibrated with dam storage data, and that the model considers the role of dams. Yet later it becomes more clear that actually the C-ratio was used, which is a proxy of storage effects; i.e. dams were actually not simulated by the model. Please clarify it across the text. Also, C-ratio is a proxy of storage effects and has some limitations. RoR dams can sometimes have high C-ratio but low impacts on downstream hydrology. Please add something about it to the discussion.

Thanks. We appreciate the constructive comments and feedback and agree that it is important to provide a clear and consistent explanation throughout the text. We have revised the manuscript to ensure a more coherent presentation on the methods to include reservoirs in our study.

We have revised the text related to C-ratio. We would like to highlight that the model considers the role of dams and C-ratio is not a proxy of storage effects, rather it is an indicator which is estimated to quantify the influence of dams on streamflow. However, we acknowledge that the C-ratio has its limitations and may not fully capture the complexities and variations in the impacts of reservoir operations. Specifically, we recognize that in the case of run-of-the-river (RoR) dams, despite having a high C-ratio, may have limited downstream hydrological impacts due to their operational characteristics. In the revised manuscript, we have added clarifications and included a discussion that highlights this point, emphasizing that the C-ratio alone may not provide a comprehensive assessment of the effects of dams on downstream hydrology. Therefore, we have revised the manuscript to provide a more accurate and thorough understanding of how reservoirs, including RoR dams, were considered in our study.

Minor comments:

Line 15-16 This sentence is too vague, please rephrase it: 'Sub-basins in the Ganga and Brahmaputra River basins witnessed the greatest flood extent during the worst flood in the observational record.'

Thanks. We have addressed the comment in the revised manuscript.

L. 66 This reference on the number of dams is from 2000. Is this number updated?

Thanks. We have addressed the comment in the revised manuscript.

L. 100 GSW cannot estimate flooded vegetation and is usually limited for flood events because of cloud influence. Furthermore, your analysis is for 1901-2020, yet GSW covers only 1985-present. Please clarify the use of GSW in the text.

Thanks. We have addressed the comment in the revised manuscript.

L. 121 At this stage, it seems that you've simulated the dam impact on downstream hydrology, but later in paragraph 138-148 you mention that the dam potential impact on hydrology was calculated with the C-ratio. Please clarify it throughout the text.

Thanks. The comment has been addressed in the revised manuscript.

L. 212-213 To illustrate the fact that 'the worst flood in the same year did not affect all the sub-basins within a river basin', it would be very interesting to see a heat map of the drainage network colored according to the year of the worst flood in the century. It would be easy to make it based on the model outputs.

Thanks. We have addressed the comment in the revised manuscript.

L. 221 It would be important to present in the larger map the locations of the sub-basins (a to j)

Thanks. Done.

L. 234-234 Are there any references (especially in grey literature) that could be used to support your findings of when the worst flood occurred in the different sub-basins?

Thanks. We have addressed the comment in the revised manuscript.

L. 279 Change to uppercase: 'C-ratio'

Thanks. Done.

L. 338 Typo: 'Hirabayashi et al. (2013)'

Thanks. Done.

L. 336 I missed in the discussion some comments about which mitigation measures are being undertaken by India at multiple government levels.

Thanks. We have revised the discussion.