REFEREE-1 COMMENTS

Dear Authors, thank you so much for replying to previous comments and uploading the revised version of the manuscript. I am grateful for your hard work and dedication in responding to all the comments raised. However, there are still some major issues that need to be critically addressed. Please find the following major and minor comments that should be taken into account with detailed explanations.

Thank you for your valuable feedback and for taking the time to review our revised manuscript. We sincerely appreciate your constructive comments and detailed explanations, which have helped us further improve the quality of our work. We have carefully addressed the major and minor issues raised and have submitted a revised version of the manuscript accordingly.

Major Comments:

i. Thank you for explaining the limitations of this method raised in comments #2 and #3. Please indicate where you modified your manuscript (indicate line numbers).

We have incorporated the necessary modifications in the revised manuscript. Regarding the comment on Line 117 earlier, we have included the clarification in the revised manuscript at Line 417: "Also, the TSA technique used in this study is not dependent on the watershed but rather on the slope and height of the terrain. The method relies on how water interacts with the landscape based on the terrain's incline, which directly influences the accuracy of flood depth estimation." Please let us know if any further revisions are needed.

ii. I am still not convinced about the discussion part of this manuscript. I expect more consultation on the previous research findings here. See the presentation quality of similar studies, e.g., https://doi.org/10.1029/2022WR032031.

Thank you for your feedback on the discussion section. We have carefully revised the discussion and updated in manuscript

iii. I couldn't find any suggestions for future research in the manuscript

Thank you for your feedback. We have now included suggestions for future research in the revised manuscript (Lines 461–466), as follows:

"Future research will aim to test this methodology across diverse regions of the country to evaluate its broader applicability. Additionally, efforts will focus on refining the approach to better accommodate varying terrain conditions, particularly steep slopes, and improving the alignment and sensitivity of DEM-based flood depth estimations. Further advancements will involve enhancing TSA for improved flood depth estimation in complex terrains, extending validation efforts using remote sensing data such as UAV-based LiDAR and Sentinel-3 altimetry, and integrating the proposed methodology into real-time flood monitoring systems to support disaster response and large-scale flood assessment."

iv. Please explain the scale of applicability of your methodology with a detailed explanation of why it is limited to that specified scale (if limited to some small or large scale).

Thank you for your feedback. We have clarified the scale of applicability in the revised manuscript. Our methodology is not restricted to a specific study area but is more suited for large-scale flood assessments due to the availability of field measurements for validation. Since we compare our results with real-world field measurements from CWC gauge stations, which are typically distributed over large river basins, applying this method to smaller areas is challenging due to the lack of such validation data. However, the approach itself remains scalable and adaptable to different regions, provided that appropriate validation datasets (e.g., UAV-based LiDAR, additional hydrological data) are available. Please let us know if further clarification is needed.

v. Please explain how you deal with backwater effects in the complex floodplain. Both HAND and TSA can't consider the effect of backwaters due to artificial structures like canals, bridges, road embankments, levees, etc. Because your DEM never accounts for such infrastructures. Using recently developed high-resolution DEM can help to resolve these problems. However, it might be computationally expensive if you have a large study area. One useful suggestion for this is to manually superimpose these artificial structures on your existing DEM and continue the analysis.

Thank you for your valuable suggestion. We acknowledge this limitation and have included a discussion in the revised manuscript at Line 436:

"The TSA method fails to accurately represent flood depth in permanent water bodies and reservoir backwaters due to the lack of bathymetric data in DEMs, which only capture surface elevations. This can lead to underestimation or misinterpretation of flood depths, particularly in regions affected by backwater effects. Integrating bathymetric data or hydrodynamic models could significantly improve the accuracy of these estimations. Similarly, using hydrologically conditioned DEMs that account for artificial structures like bridges could also enhance accuracy."

vi. Most of the measurements are only taken from/near the main rivers, which are not representative of the complex floodplains. The main rivers are less dynamic than the floodplain in terms of water depth. Probably, you may not have measurements other than these locations, however, you can use indirect methods like interviewing the local community about the water levels of those flood events with reference to flood marks on known fixed objects/locations like permanent trees, buildings, etc. Please provide limitations if you cannot do this due to specific reasons.

Thank you for your insightful comment. We acknowledge this limitation and have addressed it in the revised manuscript at Line 442

"A further challenge in validating flood depth estimates lies in the limited availability of field measurements, which are primarily taken near river gauge stations. This restricts validation to areas near main rivers, making it difficult to assess flood depths farther from these regions. Field measurements are also constrained by accessibility issues, limiting the ability to validate the model across the entire floodplain."

vii. On line 235, you mentioned as you implemented a first-degree polynomial TSA. In my view, the first-degree polynomial is a big simplification for a natural flood plain with diverse

topography. The first-degree polynomial assumes a smoothly sloped topography which is way far from your case. Please justify why you chose a first-degree polynomial for TSA. For example, why not a higher-degree polynomial which is more representative?

Thank you for your insightful comment. We acknowledge the concern regarding the selection of a first-degree polynomial for TSA. In the revised manuscript (Line 235), we have clarified our justification: "With a gentle slope or remaining nearly flat across large areas, floodwater follows the path of least resistance, gradually filling depressions and expanding outward rather than forming sharp elevation differences. Given this characteristic, using a first-degree polynomial equation in Trend Surface Analysis (TSA) is a rational approach for modelling the floodwater surface. A first-degree polynomial represents a linear trend, which effectively captures the gradual variation in water surface elevation across the flooded area. This ensures that the estimated water surface reflects the actual spread of floodwater rather than introducing artificial discontinuities that would arise if higher-degree polynomials or abrupt elevation changes were assumed."

Minor comments

i. Check subtitle 3.1 on line 140, I believe either you forgot the conjunction word 'and' or have a typo.

Thank you for pointing that out. We have corrected the typo and included the conjunction word 'and' in subtitle 3.1 in the revised manuscript.

ii. Please check editorials like missing spaces (lines 46, 114, 252, 264, 265, 270, 283, 286, 346)

Thank you. Updated in revised manuscript.

iii. Check for grammatical sentence restructuring (line 275)

Thank you. Updated in revised manuscript.

iv. Some readers might not be familiar with ERDAS Imagine software (line 288), better to cite a reference for this.

Thank you. Updated in revised manuscript.

v. Figure 8(e) and its description from lines (346 – 347) is not needed.

Figure 8(e) is necessary as it serves as the legend for Figures 8(a) to 8(d). Since the legend remains the same for all subfigures, we have retained it for clarity.

vi. Please be consistent with cross-referencing figures e.g., line 289 (Fig 6), line 344 (fig 8), line 375 (fig 10)

Thank you and updated in revised manuscript.

vii. The visual quality of Figure 10 is still blurred

Thank you and updated in revised manuscript.

REFEREE-2 COMMENTS

It is recommended to review punctuation and spaces in several places in the document. It is recommended to replace the title of the section ‘Results and Discussion’ with the term ‘Results’.

Thank you and updated in revised manuscript.