Gridded Flood Depth Estimates from Satellite Derived Inundations

Author's Reply v2

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We thank the editor and the reviewer for their insights, comments, and time. The manuscript has been revised following the comments received. A detailed point-by-point response to each comment and corresponding action are provided in the following sections. Where necessary for context, previous comments and responses have been included in grey.

All changes to the text are marked in red on the provided 'track changes' version of the manuscript.

Editor's Comments

> *In your response to R1 you state that "As for pursuing a sensitivity analysis, we agree this would provide valuable information, especially for potential users desiring to extract depths from satellite derived inundations." I would suggest to add something about the value of this to the discussion..*

The following sentence has been added to the Conclusions: "Additionally, a sensitivity analysis of the key parameters and input data characteristics (e.g., resolution) would provide useful information for those planning to use tools like RICorDE."

RC2 Comments

> *The presented floodwater depth calculation methodology, RICorDE, is innovative in its coupling of HAND and "raw" elevation data to produce more hydraulically robust results. The manuscript is well written and the authors did an overall good job at explaining the new elements in the workflow. This paper can be of great interest to the community. I have a few concerns:*
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> *1. The authors opted not to share their code and tool in an open repository - this is their right but disappointing, especially considering that they developed this tool based on open-source resources (primarily FwDET). The tool also seems to be specific to Canadian data sources, maybe a more generic version can be shared. This is not critical for the paper's publication but will considerably increase its impact in my opinion.*

Thank you for your review and comments.

The intention is to have the tool be open source once we can resolve some contractual issues.

The tool is inspired by FwDET but does not rely on any source code from FwDET. However, many other opensource libraries are used (GRASS, QGIS, WBT, etc.). As mentioned on line 114, the tool does include scripts to pre-process from Canadian data sources, but alternate data sources could easily be provided by users.

RC2 Comment #1 - consider informing the readers about that

The 'Code Availability' section has been revised as follows: "Please contact the authors or visit the project page (https://github.com/cefect/RICorDE_pub) to obtain a copy of RICorDE. Future releases of RICorDE are planned to be open source."

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2. The evaluation of the tool is based solely on remote sensing-derived flood maps. This choice is understandable but as the paper shows it is hard to isolate the source of the error in the model prediction. The evaluation presented is of great value but the authors can quite easily use the hydraulic-model inundation extent as input, similar to what others have done. The authors justify their choice but it, nonetheless, leads to uncertainty of how much the new methodology is an improvement over FwDET or a result of "improving" the remote sensing errors by shrinking the flooding domain. The reader will benefit from knowing the answer.

The motivation for our tool is to develop depths from remote sensing data, therefore we used these as inputs to the tool. Others have used inundation from hydraulic model outputs – presumably as an intermediate step towards eventually working with remote sensing data. We provided the same satellite derived inputs to both RICorDE and FwDET and compared the results. The first phase of RICorDE develops a hydraulically derived inundation, removing egregious errors from the flooded domain. This algorithm is a part of RICorDE, and we therefore do not separate it for a comparison against FwDET.

RC2 Comment #2 - at least shortly discuss this issue

Line 99 states "[…] no study with a fully automated method reported accuracy against satellite derived inundations." The additional sentences have been added to the "Tool Inputs" section: "This differs from many previous studies (Raney and Cohen, 2019; Cohen et al., 2018; Scorzini et al., 2018) that employ inundations from hydrodynamic models in their performance evaluations. For this study, satellite derived inundations of real floods are used in the evaluation to better reflect the intended application of RICorDE and the stated objectives of the tool. However, this makes it difficult to directly compare the results of our evaluation with the evaluations of others."

3. The authors all but ignored the issue of runtime. They mention "longer runtime" in line 336 but offer no further details. This is quite an important aspect for depth calculation from remote sensing as these are often used for flood response and large-scale applications. The authors should report their model and FwDET runtime for their case studies. This can be most useful for future users and developments.

Our tool is optimized for accuracy – not runtime. This may make it more useful for flood vulnerability research than for disaster response; however, it could still be used in some contexts for disaster response. Run times for the four case-tool combinations have been added to Table 1. For the next version of RICorDE, we will focus on improving these run times (e.g., parallelizing), as mentioned on line 362.

[Referee 2]: RC2 Comment #3 - add a short discussion of the new runtime results.

[EDITOR]: Note that with regards to the question of run-time, my understanding is that this is now included in Table 1 already.

Run time values were previously added to Table 1. In addition, the following sentence has now been added to the "Results and Discussion" section: "These runtimes show that RICorDE, which was designed for accuracy not speed, is substantially slower than FwDET-QGIS."

4. There are no floodwater depth maps presented with the exception of a very small insert and the "trusted" data. This is a major emission. As the authors discuss, floodwater depth estimations often include sharp transitions (strips) in the map. RICorDE primary premise is in its innovative treatment with boundary cells which has the potential of alleviating this problem. Yet, this is neither presented nor discussed in the manuscript. Reducing unrealistic artifacts in the depth map is important for improving its accuracy and since practitioners are much less likely to trust products that include clear errors.

Fig. S3 and Fig. S4 have been added to show the resulting depth raster outputs of both tools for both study areas.

RC2 Comment #4 - the new figures are a very powerful demonstration of the new tool's advantage. Strongly consider adding at least one of them to the manuscript.

A detail map comparing the three gridded depth results has been added as the new Figure 3.