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Natural Hazards and Earth System Sciences
Discussions

Interactive comment on "The Floodwater Depth Estimation Tool (FwDET v2.0) for Improved Remote Sensing Analysis of Coastal Flooding" *by* Sagy Cohen et al.

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This paper documents an incremental improvement to the FwDET tool making it more suitable for flood depth estimation along coastal or permanent water body locations. Additionally, the paper documents substantial improvement in the technical aspects of the tool by converting it to Python and making it more open for community use. While the tool is good the presentation of it in the paper could use some improvement to show the true value of the 2.0 version of FwDET. – We thank the referee for the time and effort in reviewing the manuscript. The comments are useful and constructive. See our response to each point below.

Specific comments: Pg 2, line 13: This sentence is unsupported here and hard to believe given the uncertainty present in the depth estimates. Is a depth estimate with uncertainty +/- 0.33 m more useful to rescue and relief efforts than a map of low water crossings? How will this information be used by decision makers in real time? – This work was actually motivated by end-user requests from the Dartmouth Flood observatory and personal discussion with first responders (particularly the former chief of staff of the Austin Fire Department). For first responders, water depth information is valuable for assessing road accessibility and getting a sense of danger to people and vehicles. The sentence is generic and does not refer to a specific tool or methodology; it is meant to describe the key motivation for this study by emphasizing the importance of water depth information. There is also no claim that water depth estimation is necessarily more important than other information.

Pg. 4 line 2: It may be helpful to talk about how much work is necessary to prepare the cost raster from the land-cover map. Is this a quick process, or will these need to be precomputed for real use? – This was added to the sentence: "... (through e.g. identification of permanent water bodies) ..."

Pg. 5 [4] line 8: Is the QGIS version of the script really FwDET 2.0 or is it FwDET 1.0? Either way this is an excellent improvement, but clarification on the version may be useful to the readers. – Good point. We added this sentence: "It is therefore not a full solution of FwDET v2.0 but it does include the coastline boundary cell identification procedure."

Pg. 6 line 2: It would be helpful to express the error as a percentage of the overall depth. A error of 0.18m sounds small, but it is an error of about 50% of the observed heights. –These values were added to both case studies (24% and 14% of the model mean average depth)

For the Brazos River, the depths quadruple to about 2 m, but the error stays constant at around 0.16 m. So this method performs much better for deeper water situations,

or there is an inherit limitation to the method that results in a lower bound on the error of around 0.15 m? – No, the error goes up to 0.31m but it is true that the relative error is reduced from 24% to 14%. This is likely because the river itself is included in the statistics which is deep and 'easy' for the tool to calculate. This point was added in the text (section 3.1): "The lower relative bias in the Brazos case study compared to the Norfolk-Portsmouth case study is likely due to the inclusion of the river itself in the statistical calculations. The river segment is relatively deep, and its water depth is relatively easy to estimate (not considering its true bathymetry)."

Pg. 7 line 5: Very impressive performance speed up! –Thank you!

Pg. 8 line 5: Is the fragmentation due to cloud cover? If so should future work proposed be how to extrapolate with FwDET to regions between fragments? – No, this seems to be a more or less accurate classification given the sensor resolution. We added this sentence: "The remote sensing classification used appears to be accurate representation of ground conditions given the sensor resolution."

Overall: While the Brazos River example is compared for both FwDET 1.0 and FwDET 2.0, there is no example illustrating the problem at coast lines for FwDET 1.0 and how FwDET 2.0 solved the problem. The description of the improvements to the method could also benefit from better clarity on how locations are being chosen. For example, the line artifacts are attributed to this too so it may be useful to have a map showing just the locations used for the depth estimation with the FwDET 1.0 vs 2.0. – FwDET 1.0 does not work at coastal regions as the boundary elevation at the coastline is lower than the flooded domain. As a result, all the cells closest to the coastline (relative to the inland boundary) receive a no-data value. There is therefore no point in comparing the two versions in these locations. This was now clarified in the text: "A Comparison to FwDET 1.0 is not valuable for this (or any coastal) case study. This is because FwDET 1.0 does not work at coastal regions as the boundary elevation at the coastline is lower than the flooded domain. As a result, all the cells closest to the coastline (relative to the inland boundary) receive a no-data value."

Another example is a float-integer-float trick is mentioned, but not described what it is or how it is used. – We added this to the relevant sentence: ". . . (multiplication of the DEM by 106 and then dividing it by the same factor after the tool run) . . ."

The methodology is also missing a description of how the modeled inundation rasters were converted to polygons for FwDET? Simply water depth > 0.0, or is there smoothing applied or another threshold chosen? – We added this sentence in section 2.2: "The rasters are converted to FwDET inundation extent input polygons by re-classifying all non-zero water depth cells as 1 and using the ArcGIS (or equivalent QGIS) 'Raster to Polygon' tool to generate a feature layer."

Please also note the supplement to this comment:
https://www.nat-hazards-earth-syst-sci-discuss.net/nhess-2019-78/nhess-2019-78-AC2-supplement.pdf

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