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Hydrology and Earth System Sciences
Discussions

Interactive comment on "A Multi-sensor Data-driven methodology for all-sky Passive Microwave Inundation Retrieval" *by* Zeinab Takbiri et al.

Anonymous Referee #2

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The manuscript has successfully demonstrated a new algorithm for estimating sub-pixel inundated fractions under all weather conditions. By pairing SSMIS multi-frequency observations with MODIS based flood area values during the training period, a weight matrix is identified such that the inundated fraction of a given pixel can be estimated solely from the multi-frequency SSMIS observations over the K-nearest neighbors. This research is built upon traditional wetland/flood mapping approaches that use either passive microwave or VIS/IR alone. The improved spatial and temporal resolutions will contribute to flood monitoring skills during monsoonal seasons. The manuscript is overall well written, but a few areas need further clarification and/or improvement.

Detailed comments:

1) I strongly recommend improving the description of the retrieval algorithm (Section 3).

a) The most important component missing in this section is information about estimating inundated fraction solely from passive microwave observations (e.g., for the year 2015, or during the monsoon season). As shown in the flowchart (Figure 3), the last step is to calculate the inundated fraction using Eq (2), where the coefficient matrix c is optimized from microwave observations (Eq. (4)) and the corresponding inundation fraction (in Fs) is from MODIS (i.e., MWP). How does this work in cases where the Fs value from MODIS is unavailable? I assume the 'dictionaries' (from 2010-2014) are used, but I couldn't find the relevant text?

b) The number of vectors in matrix B needs to be consistent throughout the manuscript. The dimension is n-by-M according to Line 12 on Page 6, where n is the number of frequency channels (i.e. 7) and M is the number of vectors. However, according to Figure 2 N is the number of vectors (and N=n$\times$m), which is confusing. Similarly, it is unclear if the M vectors (Page 6, Line 11) refer to microwave observations in both time and spaceâĂŤor just in space? Assume the domain contains 10 rows and 20 columns, and there are microwave observations for over 300 hundred time steps. Does this mean that M=10$\times$20 (as indicated in Figure 2), or that M=10$\times$20$\times$300 (which is more likely)?

c) Because the K-nearest neighbor search is essential for this study, a bit more information on this process will be helpful. This also relates to the above comment (1b)âĂŤwill the K- neighbors be selected from one time step, or from multiple observations that occur during different time steps? Since the K- neighbors have a better chance of being geographically close to the pixel of interest (and are from the same time step), will the random selection of 2$\times$106 pairs of brightness temperature and inundation fraction make the Knn less representative?

d) Parameters $\lambda 1$ and $\lambda 2$ in Eq. (4) are not defined until at the end of Section 3. The selection of λ and α are made through “cross validation studies”, which are not explained.

e) In Figure 3, there are a few constants that are never explained and never provided with values in the manuscripts (such as K, kP, and p).

2) In Section 4, the validation conducted using the probability of “hit” and “false alarm” should be compared between the dry season and wet season. This will help to better understand the results. For instance, there are much fewer missing data points from the MWP during the dry season than during the wet season. Does this mean that there will be a smaller probability of false alarms accordinglyâĂŤor can the cloud cover/flag from the MODIS product be used to compare results over the 12.5 km pixels with and without cloud contamination?

3) Figures 7a and 7c indicate an overestimation (as compared to 7b and 7d) in regions close to the rivers, and an underestimation in regions not connected to major rivers. Please consider adding some discussion on this.

4) The highlight of this algorithm is the capability to produce inundated sub-pixel fraction results under all-weather at a daily temporal resolution. Therefore, results and validations which contribute to evaluating these skills are preferred. Specifically, it would be interesting to see 1-2 examples showing the daily results (similar to Fig. 7), and comparisons of the sub-pixel fraction values (e.g. using scatter plots) between the MWP and microwave based estimations.

5) There are a number of reasons contributing to the mismatch between the MWP and microwave based estimations. Something important missed in the discussion is the error associated with the MWP. Some discussion about the uncertainties associated with the results is recommended.

6) Although I agree that the water level and the inundated area are correlated, I don’t

think it is the best practice to simply average the water levels from 11 gauges to represent the basin. During a flood event, the water level at an upstream gauge located in a steep valley may increase a lot more (and/or faster) than a downstream gauge. However, the downstream gauge is more representative of the basin’s condition.

7) A few minor issues:

a) Page 9, line 1: Change “problem” to “equation”.

b) Page 9, line 7: It should be Fig. 6, not Fig. 7.

c) Fig. 3: If the Tb images are intended for all years (see comment 1c), please revise the figure accordingly.

d) Fig. 4b: This figure needs units.

e) Fig. 5: Should the word “weights” be removed from the top of the right panel?

f) In some of the figures, the panels are denoted by a, b, c, etc.âĂŤbut not in all cases. Please be consistent.

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