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Interactive comment on “Evaluating flood potential with GRACE in the United States” by T. Molodtsova et al.

Anonymous Referee #1

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General comments

This is a short and interesting paper, which reads well. It presents a quantitative validation of Reager’s Flood Potential Index (RFPI), first introduced by Reager and Famiglietti (2009), based on the GRACE Terrestrial Water Storage Anomaly (TWSA) product. The quantitative validation for the continental US is presented as the main objective and novelty aspect of the paper, for which a statistical framework (i.e. Receiver Operating Analyses (ROC)) is detailed utilizing two observational flood datasets, i.e. spatial (GIS) and meta-data from the Dartmouth Flood Observatory (DFO) and a US Geological Service (USGS) gauge data base. Additionally, a flood event in Eastern Africa is presented in the Results section to demonstrate the usefulness of RFPI in developing countries. The latter case-study has no prior introduction and comes somewhat as a

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surprise, also considering the paper's title. It further lacks the analytical rigor of the US analysis. On the other hand, the East African case-study mentions a forecast lead time (i.e. the month preceding the flood), which I failed to discover in the US analysis. According to Reager and Famiglietti (2009), RFPI takes into account the storage amount of the previous month, so one may implicitly assume a lead time of up to one month, but this should be stated explicitly. I suppose it would also help to include the RFPI equation in the Data and methodology section, which would save a reference check. Further, in the Discussion section, the authors state they expect the RFPI to be especially useful in developing countries with less dense hydrological monitoring networks. While perhaps a valid observation in itself, based on the US analysis or the one example of a flood event in East Africa, it seems unfounded. In all, the paper appears to lack cohesion. The case-study of flood risk detection in developing countries, now presented as an add-on to the US analysis, should either be omitted or expanded with other examples or additional (ROC) analysis, using the (global) DFO data base. If included in the Results section, it should at least be referred to in the paper title and also be introduced in the Data and methodology section.

Specific comments

Paper title, page 6977:

As mentioned above, the title "Evaluating Flood Potential with GRACE in the United States" does not cover (all of) the paper's content, i.e. the case-study in Eastern Africa. I suggest to either change the title or omit the case-study from the paper.

Page 6979, line 5:

Please check reference: Wang, Q., Watanabe, M., Hayashi, S., and Murakami, S.: Using NOAA AVHRR data to assess flood damage in China, *Environ. Monit. Assess.*, 82, 119–148, 2003. The abstract of this paper does not mention AMSR-E or passive microwave data.

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Section 2 Data and methodology, page 6981-6982:

As mentioned in the General comments, I suggest to include the RFPI equation, as these values are later used as threshold values in the ROC analysis. The use of RFPI values as thresholds should also be stated (more) explicitly in Section 2.3 Forecasting Skill assessment. In the text, I suggest to refer to “RFPI threshold value”, as opposed to just “threshold value”.

Section 3 Results, page 6983:

In Figure 7c, the water storage deficit is presented as a confirmation of RFPI predictive skill. This is somewhat confusing, as it is part of the RPFPI equation and basically shows RPFPI without the monthly rain total. Having said that, an inclusion of a rainfall time series would benefit the graph.

Section 4 Discussion, page 6984-6985:

Line 2: “We found that the RFPI has (a) good predictive skill for flood monitoring”. As mentioned earlier, it is not stated explicitly for which lead time RFPI has predictive skill. Line 27 says “..it has a unique ability to (. . .) increase warning time by a few weeks. This seems to hint at a forecast lead time of up to one month, but this should be stated explicitly in the Forecasting skill assessment section.

Line 13-23: The authors speculate an update of the TWSA data may have influenced the research results, although tests provided similar results. This is another surprise, which if investigated rigorously, should be should introduced in the Data and methodology Section. At this point, the information is of no use. Suggest to delete.

Most of the graphs need some more attention, as legend entries, captions, symbols and text don’t match. See technical corrections below.

Technical corrections

Overall, English is functional, although arguably not consistently concise. Some

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changes are suggested below:

Page 6979, line 24-25: “An estimated range of the amount of water a region can hold”

Page 6979, line 26: “RFPI ranges from $-\infty$ to 1”

Page 6980, line 4: replace “spanning” with “ranging” or “and extend”

Page 6980, line 7: “Two observational flood datasets”

Page 6980, line 14-15: Replace “if a” with “in case of”, replace “flood event of long duration” with “a flood event of long duration”

Page 6980, line 16: Replace “damage to infrastructure and loss of life as reported by media” with “media reports”

Page 6980, line 16: Replace “its coverage is” with “it is”

Page 6980, line 18: Delete “for particular organizations”

Page 6980, line 26: Rephrase: “Each gage reports a flood as a flow overtopping the natural or artificial banks on a daily basis.”

Page 6982, line 5: See also General comments. Replace “a range of possible threshold values” with “a range of possible RFPI threshold values”

Page 6982, line 7: Replace “An” with “A”.

Page 6982, line 8: Replace “(0; 1)” with “(0; 0)”?

Page 6982, line 21: Replace “Values” with “value”.

Page 6982, line 27: Replace “with” with “to”.

Page 6983, line 1: See also General comments. Replace “The optimal threshold values” with “The optimal RFPI threshold values”.

Page 6983, line 5: Replace “strong predictive skill level” with “satisfactory predictive

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skill level”. The interpretation by Morrison (2005) should not be confused with the AUC threshold values defined in the Forecasting skill assessment section.

Page 6983, line 8: See also General comments. Replace “the optimal threshold values” with “the optimal RFPI threshold values”.

Page 6983, line 16: Replace “becoming” with “and ranks as”.

Page 6983, line 17 and line 18: Delete “have”.

Page 6983, line 19: Replace “months” with “month”.

Page 6983, line 22: Replace “Figure 7c confirms this by demonstrating” with “Figure 7c further illustrates this showing”. The water storage deficit is part of the RFPI equation, so it should not be presented as a confirmation. As mentioned above, the inclusion of the RFPI equation in the Data and methodology section would benefit the paper.

Page 6983, line 23: Replace “the significant drop” with “a significant drop”.

Page 6983, line 25: Replace “disaster” with “flood”.

Page 6984, line 4: Replace “Method’s skill” with “RFPI skill”.

Page 6984, line 6: Replace “over-sensitive to recent precipitation” with “sensitive to precipitation”

Page 6984, line 7: Delete “the”.

Page 6984, line 8: Delete “accumulated from the previous months”.

Page 6984, line 8: Rephrase “This also affects RPFPI in spring”.

Page 6984, line 9-12: Rephrase “RFPI sensitivity to precipitation is less of a limitation in warmer climates and/or data sparse regions, e.g. developing countries, as evidenced by the DFO database. In all, inclusion of snowmelt is expected to improve RFPI skill.”

Page 6985, line 1: Delete “only”.

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Page 6985, line 6: Spell out CRED acronym.

Page 6985, line 8-9: Delete last sentence, as it re-iterates line 3-4.

Table & Figures

Page 6989, Table 1: Replace “TRP” with “TPR”.

Page 6990, Figure 1, Caption, Replace “(green dotes)” with “(green dots)”

Page 6992. Figure 3, Legend entry for “Random guess” does not match dashed line in graph. Make legend symbols of Figures 3, 4 and 6 consistent. Replace “FPI” in legend with “RFPI” for consistency. Caption, Replace “(purple)” with “(blue)”.

Page 6993, Figure 4, Replace “FPI” in legend with “RFPI” for consistency.

Page 6995, Figure 6, Legend does not match the graph, as “Winter” seems to have the highest AUC in the graph and the lowest AUC in the legend and vice versa for “Summer”. “Random guess” legend entry should be dashed, as in Figure 4.

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