

***Interactive comment on* “Technical note: Analysis of observation uncertainty for flood assimilation and forecasting” by Joanne A. Waller et al.**

Anonymous Referee #1

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The manuscript presents an analysis of the uncertainty of remote sensing-derived water level observations used for the real time constraint of flood forecast models. Specifically, the diagnostic approach presented by Desroziers et al. (2005) is applied to assess the uncertainty of spatially distributed water level observations derived from a sequence of seven high resolution SAR images acquired during the November 2012 flood event in the lower Severn and Avon rivers (UK). The hydraulic model is Lisflood-FP and the data assimilation scheme is the Local Ensemble Transform Kalman Filter. Extraction of remote sensing-derived water level values, model set-up and data assimilation scheme were presented in previous publications (respectively, Mason et al. 2012 and Garcia-Pintado et al., 2015). This manuscript firstly provides a summary of the diagnostic approach presented by Desroziers et al. (2005) and then the description of

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the experimental design. In the results section, the authors provide an extensive analysis of the error statistics and quantify the spatial and temporal correlation of errors.

In my opinion this study provides an interesting contribution to the literature and it has potential application for the assimilation of remote sensing derived observations in flood forecast models. I would like to recommend the publication of this manuscript after minor revisions. Specifically, I think that the novelty of the study should be explicitly stated (the additional contribution of this study should be highlighted and explicitly compared to the previous applications of the diagnostic approach of Desroziers et al. (2005)). Moreover, I think that the overall presentation should be improved (the language is sometimes too informal), especially in the results section.

Please find my detailed comments below.

Title: I wonder whether “flood assimilation” is the most appropriate wording. The authors might consider a slight change in the title (“assimilation in flood forecast models”).

Page 1, Lines 7-8 “The estimated correlations do not behave as expected”: could you please be more explicit? I suggest briefly stating what the expectation was and how the results are different from the expectation. This is explained later in the manuscript (page 6), however, the abstract should provide a comprehensive (and independent) description of the topic discussed in the manuscript.

Page 2, line 13 “unbiased”: is bias the only error type in Remote Sensing-derived observations of floods?

Page 2, line 18 “as is standard in other assimilation applications”: I suggest rephrasing this sentence. Could you please provide examples of the “other assimilation applications”? Could you please improve the fluency of the sentence?

Page 2, line 19 “typically retaining approximately 1% of the pre-thinned observations”: I suggest adding at least a reference.

Page 2, line 20 “clustered observations”: the authors might consider commenting

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on the algorithm presented in D.C. Mason, G.J.-P. Schumann, J.C. Neal, J. Garcia-Pintado, P.D. Bates, Automatic near real-time selection of flood water levels from high resolution Synthetic Aperture Radar images for assimilation into hydraulic models: A case study, Remote Sensing of Environment, Volume 124, 2012, Pages 705-716, ISSN 0034-4257, <https://doi.org/10.1016/j.rse.2012.06.017>. This algorithm was used to derive the WLOs used for the study presented in the manuscript (as stated in page 4, line 26). I think that a brief discussion on the approach and results of the algorithm (for instance, the algorithm includes the estimation of the spatial autocorrelation of the set of candidate water levels) will provide a more comprehensive analysis of the topic and enhance the impact of the study presented in this manuscript. The authors might consider adding this discussion somewhere in the manuscript (not necessarily in the introduction).

Page 2, lines 21-24: is the discussion on DA of satellite-derived soil moisture strictly relevant here?

Page 2, lines 24-30: this paragraph underlines the potential benefit of DA of RS-derived WLOs for flood forecast and the importance of a detailed understanding of observations uncertainty. I believe that moving this paragraph after line 11 could improve the readability of the manuscript. This paragraph contributes to a more general introduction on the relevance of the topic. I suggest discussing error types, data thinning, and uncertainty estimation after this general introduction.

Page 2, line 31 “directly”: is this the most appropriate word? Do the authors mean “computed in a systematic way”?

Page 2, line 34 “with good results”: would it be possible to clarify this statement?

Page 3, line 4: is a new paragraph required?

Page 3, line 5-6 “Thus, we then consider”: could you please rephrase this sentence? (e.g. Consequently, . . .).

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Page 3, line 7 “is related not related”: please correct this.

Page 3, lines 8-9 “we show that . . .”: how is this result related to the papers cited in page 2 line 34? I would like to recommend adding a sentence to clarify the novelty of the study presented in the manuscript.

Page 3, lines 11-12: could you please improve the fluency of this sentence?

Page 3, line 15: are the superscripts correct?

Page 3, line 21: could you please rephrase the last part of the sentence?

Page 4, line 30 “error” is repeated.

Page 4, line 30 “gross error measurement”: could please the authors clarify this statement?

Page 5 line 2 “typically”: what do the authors mean here? “Typically” in this dataset or “typically” in the literature?

Page 5, figure 1: the authors might consider adding the underlying map (or at least the river network).

Page 6, lines 9-10: could the authors please clarify this statement?

Page 6, lines 17-18: please correct capital letters, full stop.

Page 6, line 20 “than those we estimate”: I suggest rephrasing this sentence.

Page 6, line 31: the authors might consider replacing “shoulder” with something more formal (here and in the next paragraphs, e.g. page 7, line 6).

Page 7, line 6: is “are resulting in the increase. . .” correct? I wonder whether the authors mean that observations in different areas lead to “the increase of . . .”

Page 7, line 10 “and therefore the results are subject to greater sampling error”: could the authors please clarify this statement?

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Page 8, line 6 “we see”: I suggest replacing this with something more formal.

Page 8, line 12: please rephrase this sentence.

Page 8, line 16 “to keep the forecast on track”: could the authors please clarify this statement?

Page 9, line 6: the authors might consider replacing “end of the flood” with “receding limb” or something more formal than “end”.

Page 9, line 9 “More study is needed in this context”: the authors might want to add details on future work/research needs.

Interactive comment on Hydrol. Earth Syst. Sci. Discuss., <https://doi.org/10.5194/hess-2018-43>, 2018.

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