

Hydrol. Earth Syst. Sci. Discuss., referee comment RC3
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Comment on hess-2021-330

Anonymous Referee #3

Referee comment on "Monitoring surface water dynamics in the Prairie Pothole Region of North Dakota using dual-polarised Sentinel-1 synthetic aperture radar (SAR) time series" by Stefan Schlaffer et al., Hydrol. Earth Syst. Sci. Discuss., <https://doi.org/10.5194/hess-2021-330-RC3>, 2021

The paper describes an experiment to monitor numerous small lakes in the PPR region in USA, which expand/shrink and increase/decrease in number according to precipitations.

The authors used time series of the Copernicus Sentinel-1 SAR mission, together with a high-resolution DTM, to detect the extension of water on each of the time series images, which in this area reach a temporal sampling rate of 12 days.

The paper appears well written and describes a great deal of work. The choice of data and processing is effective, and the conclusions appear convincing and interesting. I particularly appreciate the use of the VH polarization channel as an additional information source, as it appears somewhat underrated in the current literature.

The processing algorithm is based on a Bayesian framework to derive maps of posterior probabilities that each pixel is inundated in each time slice, relying on priors and, in this case, external ancillary data (the DTM) for the a priori water and non-water distributions. The Bayesian framework allows to derive such maps as real numbers (the actual probability value), while the authors in the end perform some thresholding to arrive at binary water/non water maps. Although clearly this representation is more straightforward to interpret by a wider audience, I find that a good deal of information is actually lost with the thresholding. Dealing with a continuous indicator such as the final water probability allows to retain some form of confidence measure about the presence of water given the other sources of information, which is somewhat more complete than a binary map. Moreover, it allows using a different set of evaluation tools. For instance, ROC analysis allows to derive detection efficiencies (e.g. the AUC), as well as threshold values to binarize the maps, optimized with respect to the different pixel populations. I would like to know the authors' opinion on this issue, and at least see some comments in the manuscript justifying their choices.

Apart from this "methodological" point, I have only some minor comments as follows.

Line 226: it would be useful to clarify what are these two "histogram portions"... maybe add an equation (as for eqs. 5 and 6)...?

Line 236: "where... respectively". This sentence is not very clear to me.

Line 246: this mention of Bayes' theorem could be moved somewhere before eq. (4) for clarity.

More generally, the procedure described in sect. 2.3 is a little bit involved, so it would be beneficial to add a flow-chart or a pseudo-code algorithm description to better clarify how it works.

Figure 6: labels c) and d) are not visible (black background). More generally, labels should be probably enlarged a little for visibility. How are the false color composites in panels e) and f) obtained exactly?

Line 394: "adverse" -> "opposite"?

Figure 8: please add some explanation and possibly a reference for the LOESS acronym and meaning.

Line 409: correct citation.

Lines 407-416: I believe this period contains points which are partially repeated later in the following paragraph. You may want to consider merging this with the subsequent text.