We wish to thank the reviewer for the helpful comments. You can find our replies below in red.

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.

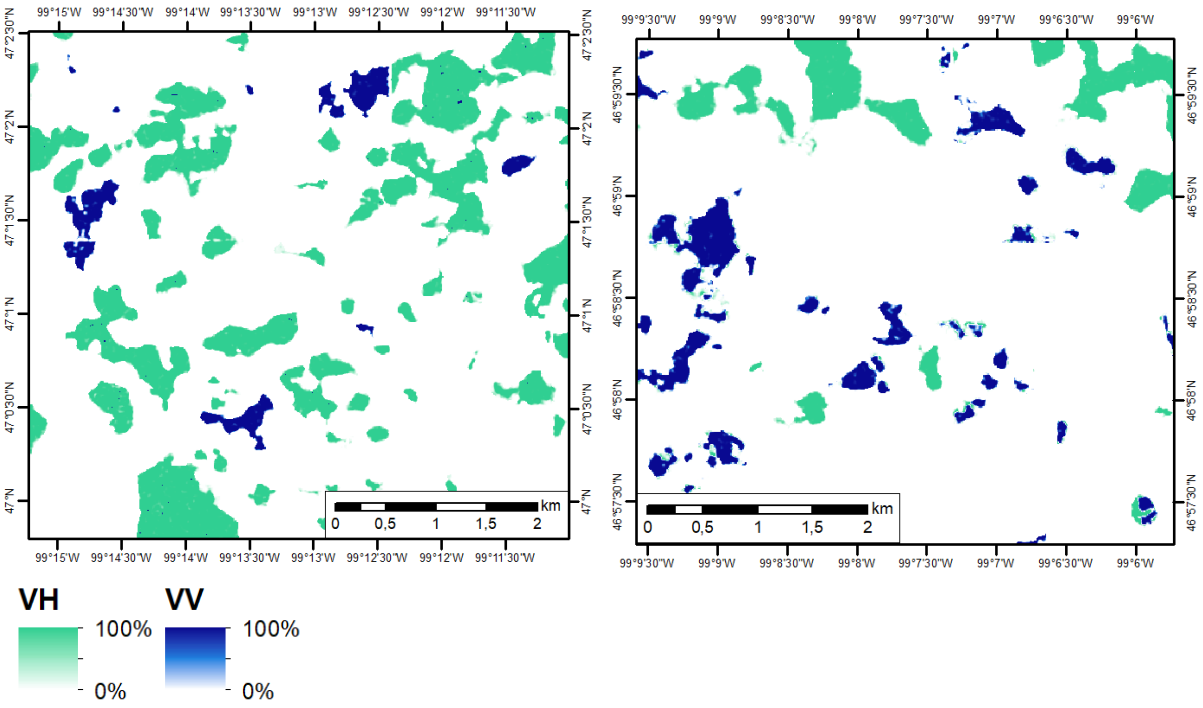
The paper appears well written and describes a great deal of work. The choice of data and processing is effective, and the conclusions appear convincing and interesting. I particularly appreciate the use of the VH polarization channel as an additional information source, as it appears somewhat underrated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

This is a very helpful comment. It is true that information is lost when binarizing the probability maps. In the end we chose to binarize them in order to make it easier to compute the water areas reported in section 3.2 as this was our main interest in this paper. The information on water probability is however useful.

The two maps below show the posterior probabilities, $p(w|\sigma^0_{VH})$ and $p(w|\sigma^0_{VV})$, for VH (in green) and VV (in blue) polarisation, respectively, for the binary maps shown in Figure 6c,d of the manuscript. As it can be seen, the borders between high and low water probability are quite crisp in most of the cases. This is due to the inclusion of the HAND-derived p(W) prior probability. There are some areas with intermediate p values, mainly between high-probability wetlands.

This is obviously important for illustrating our conclusion that the integration of HAND helps with the avoidance of false positives. We can add these maps to either Fig. 6 or to the Appendix. In the text, we will add the aforementioned considerations in the paragraph in lines 297-310. In the discussion around lines 346-352 we can also add that, in this case, we chose fixed thresholds for binarising the probabilistic maps to simplify the process and mention the advantages of ROC analysis to derive thresholds.



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)...?
The term “histogram portions” is not well chosen. We propose to change this sentence to “where μ_1 is the mean of all $\sigma^0_p \leq \tau_i$ and μ_2 the mean of all $\sigma^0_p > \tau_i$. σ_1^2, σ_2^2 are their variances.” τ_i is the initial Otsu threshold and will be defined in line 223.

Line 236: "where... respectively". This sentence is not very clear to me.
The word “respectively” is used erroneously here, we will remove it. In addition, we will change line 231 to “The parameters of the backscatter distributions for water, w, and land, l, for each pothole were estimated as …”

Line 246: this mention of Bayes' theorem could be moved somewhere before eq. (4) for clarity.
We propose to mention it in line 114 to have it in the introduction so that the reader knows what to expect: “We use a probabilistic approach based on Bayes’ theorem combining SAR backscatter…”

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 3 shows a flowchart of the overall procedure but it is not well bound into the text. We propose to add some details on the “pothole specific threshold retrieval” and to number the key elements of the flowchart. Like this the different elements can be easily referred to in the text and it will be clearer for the reader which part of the overall processing is being described.

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?
Thank you for pointing this out. We will make the labels white and enlarge labels in general. We will modify the caption: “false-colour composites (red – near infrared, green – red, blue – green) of NAIP imagery acquired 4 July 2016.“

Line 394: "adverse" -> "opposite"?
We will change it.

Figure 8: please add some explanation and possibly a reference for the LOESS acronym and meaning.
LOESS stands for “locally estimated scatterplot smoothing” and is described in Cleveland et al. (1992). It is also often referred to as the Savitzky-Golay filter. We will add some explanation in the text (section 2.4).

Line 409: correct citation.
We will correct it.

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.
In response to the comments of another reviewer we propose to reorganise section 3.2. By having a clearer structure it will become easier to avoid repetitions such as these.

We propose to split the section into two subsections: in 3.2.1, we will describe the results by explaining the temporal dynamics of number of water bodies, total water area and median water extent as observed using Sentinel-1 data (Figures 8-9). In 3.2.2, we will discuss our observations in the context of hydrometeorological conditions (i.e. discharge, precipitation) and discuss their impacts on the observed intra-annual surface water extent dynamics. After this, we discuss the observed inter-annual dynamics in the light of dry and wet periods as indicated by PDSI. This structure should be much clearer.

References:

W. S. Cleveland, E. Grosse and W. M. Shyu (1992) Local regression models. Chapter 8 of Statistical Models in S eds J.M. Chambers and T.J. Hastie, Wadsworth & Brooks/Cole.