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Interactive comment on "InSAR time series analysis of seasonal surface displacement dynamics on the Tibetan Plateau" *by* Eike Reinosch et al.

Anonymous Referee #1

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An InSAR time series analysis considering a temporal interpolation of the displacement signals following various velocity models for areas where coherence is not maintained over a given threshold for all interferograms was applied to Sentinel-1 images over two locations around Nam Co Lake on the Tibetan Plateau. Results are used to study freeze-thaw processes, seasonal sliding and linear creep and are discussed with regard to the local geological knowledge and put in the context of the few other studies performed over the Tibetan Plateau.

The manuscript is well written and concise. The style chosen by the authors includes many statements with condensed information and very few general background infor-

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mation. Much is written with the necessary approximation, but the statements are essentially correct in their formulation and content. I appreciate very much this style of presenting the work, even if one has to take into consideration the fact that a reader without a deep knowledge on many different aspects (InSAR, periglacial phenomena, etc.) might find it difficult at some points to follow the discussion.

The InSAR analysis includes many assumptions (e.g. regarding the interpolation when coherence is lost or the interpretation of the observations in the satellite line of sight direction), but this is well communicated. The images are prepared with great care and include a lot information, that the authors decided not to comment in every detail but rather to summarize for what they considered the most relevant aspects (which again I very much appreciate).

The paper is pertinent to The Cryosphere and I recommend minor revision with consideration of the following points.

l. 153. Remove exclusively.

l. 164. Please be more precise regarding the selection of the temporal and geometrical baselines. Which are minimum and maximum time intervals included in the analysis? As far as I know the Sentinel-1 baseline tube is consistently kept very small so that spatial decorrelation should not be an issue. Did you really exclude interferograms based on the spatial baseline?

l. 205. What exactly do you mean by "the orbital phase was corrected via a polynomial function"? Which function did you used? How did you determined the coefficients?

l. 214. The paper by Dong et al. (RSE, 2018, https://www.sciencedirect.com/science/article/abs/pii/S003442571930389X) might be of interest in this case and should be possibly included in the reference list.

l. 199. A coherence value of 0.1 is very low, really close to the pure noise level. If most of the interferegrams have in any case a much larger coherence value and the

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0.1 threshold was considered to be able to have a spatially consistent solution, then I can understand this choice. But if most of the interferograms have such a low level of coherence, then the results would not be reliable. Please comment.

l. 310. Change the order of the columns of Table 2 to reflect the order of the discussion of Sections 4.3 to 4.5.

ll. 382-384. This is in my opinion too speculative and should be removed. As stated at lines 362 and 396 to 398, vegetation, streams and other water bodies are common phenomena which reduced the coherence without being to be considered “unstable”.

Figure 3. Harmonize the order of the legends with panels A and B. Acknowledgements to Copernicus and DLR are not required here.

l. 259, ll. 531-532 and l. 571-572. A drawback of all InSAR time series techniques is the maximum detectable rate of motion, which is related to the possibility to correctly unwrap the phase. A phase cycle at C-band corresponds to 2.8 cm and aliasing are well possible already for half of that value. As mentioned before, the maximum time interval considered in your analyses is missing, but if interferograms spanning several months are considered, than I would expect problems in correctly computing the rate of motion already for few tens of cm/yr (e.g. for three months 2.8Ãů90×365 = 11.35 cm/yr). If small coherence values are retained, than the most obvious consequence of such an analysis is an underestimation of the rate of motion, in particular for small objects. Please consider if underestimation of the rate of motion for the most rapidly moving detected landforms cannot be the reason of not seeing a change of motion during the year. In addition, include a statement about what you estimate to be the maximum detectable rate of motion of your analyses.

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