

This paper presents a new inventory of 255 active rock glaciers in the Uinta Mountains, Utah, from velocity maps of InSAR. The authors compared their inventory to the previous studies and discussed several aspects of the datasets, including the geomorphic and dynamic patterns, temporal displacements on the selected three rock glaciers, possible responses to climate changes, and the hydrological implications. This study shows the strength of InSAR for mapping and investigating active rock glaciers, although it is not the first one. The study also gives insights into how the unique climate change pattern in Uinta Mountains, which is different from the other places like European Alps and Asian Himalaya, would influence the dynamics of the rock glaciers there. The paper is overall well written and structured and can be accepted after minor revisions. My concerns mainly lay in the methodology part. Some details of the data processing need to be clarified or explained.

(1) The uncertainties of the surface velocities from InSAR should be evaluated. Significantly, the centimeter-level magnitude of velocities of rock glaciers presented here should be carefully interpreted because the atmospheric errors always reach such magnitude. The author asserted that they use the ERA-I global weather model to mitigate tropospheric delay in Sentinel-1 interferograms. However, the correction performance of the low-resolution ERA-I data may degrade at the small-scale targets like rock glaciers.

(2) The author compared their InSAR-based inventory to the inventory of Munroe et al. (2018), whose inventory method should be also summarized in the paper. Munroe et al. (2018) may compile both the active and inactive rock glaciers, while this study only compiles the active ones.

(3) The sensitivity of InSAR LOS measurements vary with respect to the aspects of rock glaciers. This may explain why little correlations were found between the InSAR LOS measurements and the topoclimate factors. The authors may calculate surface velocities along the downslope directions of rock glaciers and then probe the correlations.

### **Specific comments**

Line 81 Add sub-title for section 2, e.g., '2 Study area and InSAR analysis.'

Line 91 Does 'Average precipitation' refer to the mean annual precipitation?

Line 125 The author stated that "To improve spatial resolution, selected one-year interferogram pairs were reprocessed with a USGS 3DEP DEM with 10 m pixel spacing". Which year of the image pairs were selected? Also, if the high-resolution DEM with 10 m spacing is available, why did the author remove the topographic phase using the SRTM data that has a coarser resolution (~ 30 m).

Line 146 Please elaborate on how did you address the average annual velocities from the ascending and descending stacks of 1-year interferograms since the observations from ascending and descending

SAR data have different looking directions. Furthermore, from my understanding, should average annual velocities be improved by averaging three-year InSAR observations, rather than only using the 1-year data.

Line 160 Please indicate the local reference points for phase unwrapping in Fig. 3 for the three selected rock glaciers.

Line 100 Please give a short summary of the inventory method used by Munroe et al., (2018), and the method for estimating the storage water of the rock glaciers.

Line 217 Rock glacier velocities cannot be correlated with 'morphology.'

Line 282 LOS velocity is a projection of real ground 3D velocity along the Satellite side-looking direction. It seems arbitrary by simply saying 'LOS measurements underestimate the true 3D velocity'.

Line 300. Please note that the correlation analysis between surface velocities and topo-climate factors requires that the surface velocities are in the same direction. The non-correlation pattern may also arise due to the diverse aspects of the rock glaciers.

Line 315 The statistical differences between this study and Munroe et al. (2018) may also be a result of the two studies' different inventorying methods. Munroe's (2018) inventory consists of both active and inactive rock glaciers, while this study only includes the active ones.

Line 374 The presence of 155 inactive rock glaciers supports this claim.

### **Comments on Figures**

Figure 5. Add captions for Fig. 5c.

Figure 8. More displacement time series points are expected to be shown as 26 ascending, and 32 descending SAR scenes have been used to perform the SAR time series analysis. In comparison, it seems that no more than 20 displacement points are shown in (a-c).