Reviewer #3

RC: *The authors present the TerraTrack tool, an open-source workflow based on a cloud processing chain that analyses Sentinel-2 images to identify and monitor the displacements of slow-moving landslides. The tool uses different methods for optical image analysis, and its outputs (velocity maps and displacement time series) are compatible with GIS software for further interpretation. Overall, this tool represents a valuable advancement, providing enhanced support for landslide detection and monitoring efforts.*

The paper is well-structured and well-written; however, some aspects should also be considered.

Please review the attached document for detailed general and specific comments.

AR: We thank you for your very helpful comment. Please find addressed each point below.

RC: *Lines 211-212 – You mention that the output time series is compatible with the 'InSAR Explorer' plugin. However, this is not the case. The files need conversion for this. Please clarify this.*

AR: Thank you but it doesn't need conversion. The csvs can be directly uploaded in QGIS and then opened with InSAR explorer. Is there any specific problem you encountered here?

RC: *The figures are not mentioned in the text at all, except Figure 4. Also, in section 4.1, which is about the Slumgullion case, you refer to a figure about the Chaos Canyon landslide (lines 246-248). This is a bit confusing. Can you fix this or switch the sections if it is more appropriate?*

AR: Thank you for catching this. Now we mention all the figures in the text and we replaced the chaos canyon mention with the slumgullion one.

RC: *It would be better to use the Copernicus DEM rather than the SRTM. COPDEM has a more recent version of Earth's surface, and although it is a DSM that includes buildings, infrastructure, and vegetation, it is often better for calculating morphometric variables, especially if the tool performs poorly in forested areas.*

AR: Thank you for this comment. We considered using the Copernicus GLO-30 DEM, because it offers improved high-latitude availability. However, TerraTrack uses the DEM only for deriving morphometric variables (slope and aspect) for post-processing filters, not for the displacement estimation itself. Because Copernicus GLO-30 is a DSM that includes vegetation and built structures, it can introduce small-scale surface irregularities that affect slope and aspect calculations, particularly in forested areas. For our application, we prefer SRTM because it provides a more terrain-oriented representation and more stable morphometric filtering.

RC: *Did you try comparing the displacement results with the in-situ instruments' recordings? I understand that this approach complements InSAR measurements, but it would be nice to know how much the calculated displacements differ from ground truth. For example, Slumgullion has been very well investigated with in-situ instruments, and such a comparison could be conducted.*

AR: Thank you for this comment. A direct quantitative comparison with in-situ instruments is not straightforward, as TerraTrack provides 10 m pixel-averaged surface displacements over multi-month to multi-year image pairs, whereas ground instruments measure point-scale motion with different temporal sampling and reference frames. In this study, we therefore focus on consistency in spatial patterns and displacement magnitudes using independent remote-sensing products. At Slumgullion, TerraTrack reproduces the characteristic faster central track and peak velocities of ~4 m yr^{-1}, consistent with published remote-sensing estimates (e.g., Hu et al., 2020, Van Wyk de Vries et al., 2024).

RC: *What is the performance of the tool in areas covered by snow for large periods of the year (higher than 4-6 months)? Can you show such an example?*

AR: Thank you for this comment. Chaos Canyon provides an example of an area with seasonal snow cover lasting several months per year. In general, the performance of TerraTrack in snow-covered areas depends on the persistence of trackable surface features. If snow cover remains spatially coherent and retains stable surface texture between image

acquisitions, feature tracking can still produce reliable displacement estimates. However, when snow accumulation, melting, or redistribution significantly alters surface patterns between acquisitions, correlation quality decreases. In such cases, low-quality matches are filtered out through SNR and PKR thresholds, reducing the number of valid observations contributing to the final stack. This can increase uncertainty in the median displacement map due to fewer valid pairs.

RC: *Are forests or highly vegetated areas limiting the use of Terratrack? Probably should be mentioned in the discussions section.*

AR: Thank you for this comment. Vegetation can influence the performance of optical feature tracking, particularly in areas with seasonally variable canopy cover. In such environments, changes in vegetation structure between image acquisitions may reduce correlation quality and increase decorrelation noise. However, TerraTrack operates on Sentinel-2 NIR imagery and uses quality filtering (SNR/PKR thresholds) and multi-pair stacking, which help mitigate these effects when surface patterns remain sufficiently stable. Performance therefore depends on vegetation type, seasonal variability, and temporal baseline. We have added a clarification in the Discussion section to explicitly acknowledge this limitation.

RC: *Google Colab limits the analysis of large areas, depending on the plan. I think this point should also be addressed in the discussion section.*

AR: Thank you for this comment. We agree that Google Colab may impose practical limitations for very large areas due to runtime and memory constraints. However, TerraTrack is not restricted to Colab and can also be executed locally on a user's own machine or in alternative cloud environments with greater computational resources. We have clarified this point in the Discussion.

REFERENCES

Hu, X., Bürgmann, R., Schulz, W. H., & Fielding, E. J. (2020). Four-dimensional surface motions of the Slumgullion landslide and quantification of hydrometeorological forcing. Nature Communications, 11(1), 2792.

Van Wyk de Vries, M., Arrell, K., Basyal, G. K., Densmore, A. L., Dunant, A., Harvey, E. L., ... & Dadson, S. J. (2024). Detection of slow-moving landslides through automated monitoring of surface deformation using Sentinel-2 satellite imagery. Earth Surface Processes and Landforms, 49(4), 1397-1410.