

We sincerely thank the anonymous Referee 1 for the constructive comments on the manuscript. We greatly appreciate the time and effort invested in the review process, as well as the helpful suggestions provided. We agree that the suggested revisions will improve the quality and clarity of our work. We believe that a revised version of the manuscript will adequately address the points raised.

In the following, all reviewer comments are reproduced and addressed. Our responses are provided in blue for clarity.

RC1: '[Comment on egusphere-2025-6432](#)', Anonymous Referee #1, 06 Jan 2026

Feedback Ref. 1

Summary and overall assessment

The paper presents the first systematic field evaluation of dock-based UAV systems for geohazard monitoring across three alpine environments and introduces an automated end-to-end workflow for displacement and change detection. The topic is timely and important; however, several sections remain too general, and the case-study specific results and methodological details need expansion to demonstrate what was concretely achieved and learned at each site. Here are the major comments. Further comments are in the pdf.

Clarify what dock-based UAVs enabled beyond multitemporal UAV campaigns. The Paper should explicitly state how **the dock-based approach changed feasibility, frequency, reliability, and safety compared** to conventional campaign-based UAV surveys, and tie this to site-specific outcomes. Add for each site, a brief paragraph that contrasts “what would have been possible with manual UAV campaigns” vs. “what the dock enabled”. The advantages and limitations of the method should be discussed.

Thank you for the suggestion. We will explain in more detail how dock-based approaches improve feasibility, frequency, reliability, and safety compared to conventional campaign-based UAV surveys and will link it to each study site. We will address the advantages and limitations more thoroughly in the discussion section. We further emphasise the specific situations in which dock-based UAV systems provide clear advantages, such as in hazardous or inaccessible terrain, under the need for high temporal resolution. At the same time, we will acknowledge scenarios where conventional multi-temporal UAV surveys may be sufficient, such for example for sites that only require monthly flight intervals and that are easily accessible. We will highlight more clearly in the manuscript that dock-based UAV systems require stable power supply and high band with internet connectivity to operate reliably. Satellite derived internet access and solar powered setup can facilitate a usage in some off-the-grid locations, but deployment can be difficult in high-latitudes or regions where the necessary infrastructure is missing.

Define a **clear research question per case** study with geohazard focus

We agree with this valuable suggestion and will revise the manuscript to include clearly defined, research questions for each case study. These questions are designed to better link the

methodological approach to the specific hazard processes and monitoring objectives at each site. The overall research question is to evaluate to what extent automated UAV monitoring can improve monitoring of geohazards. The three case study sites show very different settings, process characteristics and spatial extents, expected surface changes and deformation rates: 1) For the study site Supphellebreen: How can high-frequency, automated UAV monitoring capture short-term glacier dynamics in a steep and inaccessible icefall and what temporal and spatial resolution is required to capture these dynamics? 2) For the study site Skjoldal: How can automated UAV systems be used for analysing complex slope instabilities with low displacement rates and what are the implications for long term deployment? 3) For Blatten: What are the possibilities and limitations of the dock-based UAV system to monitor the temporal evolution of secondary hazards in restricted post-disaster zones, and what lessons can we learn from the deployment in Blatten?

Expand the Methods section that the reader can follow the result chapter. Describe the workflow steps in more detail and explain the differences between multi-temporal UAVs. Specify **which datasets/timings** were compared. E.g. whether successive pairs (A–B, B–C, C–D) are processed, or whether all time points are referenced to a baseline (e.g., A–B, A–C, A–D), and why (e.g., to maximize sensitivity to acceleration vs. minimize decorrelation). This is important to understand the results.

Thank you for this comment. We will expand the method section and describe the workflow in more detail. Also, we will make clear that the results are processed as successive pairs.

Accuracy assessment: Whether a detailed accuracy assessment is necessary depends on the research question. When analysing small deformations close to the detection threshold, such as those at the Skjoldal rock slope, it is crucial to understand the limitations of dock-based UAVs. A level of detection is necessary for all study sites (even for every data pair) when analysing displacements. Consideration of accuracy is important for the applicability of dock-based UAVs for continuous deformation monitoring.

We thank the referee for this helpful comment. We agree that the extent of the accuracy assessment depends on the specific research question. The primary aim of this study is to demonstrate the overall applicability of dock-based UAV monitoring systems and to present a transferable workflow for assessing displacement rates in challenging and inaccessible terrain. Within this scope, the accuracy assessment is intended as a representative example of how a level of detection (LoD) can be quantified in inaccessible terrain following established practices in UAV-based monitoring studies (e.g., Chudley et al., 2019). In the revised manuscript, we will make the following changes: 1) Site-Specific LoD: We will provide individual LoD values for every study site to improve result interpretability. 2) In table 3, we will also summarize the mean, minimum, and maximum LoD values across the datasets. This highlights the system's capability to detect centimetre-level displacements. 3) Expanded discussion: We will include a more robust discussion regarding the limitations of this approach when monitoring slow-moving mass movements. A more detailed investigation into the underlying processes at Skjoldal and Supphellebreen is planned for a follow-up study. We will also add that refining positioning and further lowering LoD thresholds remains a key direction for future research.

The **result section should focus on the differences between multi-temporal UAV and dock-based UAV and** its significance to geo-hazard monitoring.

We will address the differences between multitemporal UAV surveys and dock-based UAV in the discussion section. We agree that this is an important aspect to include.

Add a subsection with **advantages and limitations**.

We agree with referee 1 and 2 and we will add such a subsection to the discussion.