Review of egusphere-2025- 5011: Glacier surge activity over Svalbard from 1992 to 2025 interpreted using heritage satellite radar missions and Sentinel-1

Summary

This manuscript presents a comprehensive compilation of glacier surge events in Svalbard spanning more than 30 years, using data from five heritage satellite SAR missions (ERS-1/2, JERS-1, ENVISAT ASAR, ALOS PALSAR and Radarsat-2) and current satellite SAR missions (Sentinel-1 and ALOS-2 PALSAR-2). Building on the work of Kääb et al. (2023), the authors extend the observation period to 2015-2025 and reprocess the dataset following the methodology of Leclercq et al. (2021). The updated analysis largely confirms previous findings while identifying several additional surge events. The authors report a notably higher number of surges during the most recent decade compared to earlier periods since 1992. Through simulations, they argue that neither random phase interference nor purely external forcing can fully explain the observed variability in surge frequency. They suggest that periods of positive climatic mass balance in the mid-2000s, potentially combined with enhanced meltwater production in 2013, may have contributed to increased surge activity. However, given the incomplete understanding of surge initiation mechanisms, these links remain tentative. While the number of surges observed between 2015 and 2025 is remarkable, it does not appear unprecedented when accounting for potential observational biases in earlier periods, such as around the 1940s.

This is a well-written manuscript that aligns closely with the scope of The Cryosphere and provides valuable insights into glacier surge activity in Svalbard. The long-term perspective and consistent reprocessing of multi-mission SAR data are particularly strong aspects of the study. I have only minor comments and suggestions that may help further improve the clarity and consistency of the manuscript.

Specific comments

- L430: The phrase should read "between 1995 and 2004". Referring to the period between 1995 and 2005 would imply an 11-year interval.
- Figure 13
  The vertical line between 2024 and 2025 appears to indicate a decadal boundary. If so, this should be clarified. Otherwise, it seems inconsistent with the periodization already shown (-1994, 1995-2004, 2005-2014, 2015-2025). While not a major issue, it would improve clarity to adopt a fully consistent scheme in both manuscript and figures (e.g., -1995 / 1995-2005 / 2005-2015 / 2015-2025, or -1994 / 1995-2004 / 2005-2014 / 2015-2024 / 2025-present).

- Table 2 and 3
  - The ordering of rows is unclear. Table 2 appears to be sorted by ascending surge start date, whereas Table 3 seems to be ordered by longitude. For consistency, I suggest sorting both tables by surge start date.
  - Additionally, Tables 2 and 3 use different coordinate precisions for latitude and longitude. Is this due to the use of different DEMs? If so, this should be clarified in the table caption.
  - For table 3, it would also be helpful to indicate, for the italicized cases, which additional sensors observed the same surge events.
- Use of X-band SAR data

  Do the authors plan to include X-band SAR missions (e.g., TSX/TDX/PAZ, COSMO-SkyMed, or commercial missions such as ICEYE and Capella) in future analyses? While the manuscript notes that L-band does not provide a measurable improvement under the observed conditions, it would be interesting to briefly discuss whether X-band observations could offer a useful compromise. Collaboration with commercial providers may also increase temporal sampling of surge evolution, which could be valuable for future studies.