

Dear Copernicus Publications editorial support team,

We have revised our manuscript in strict accordance with the responses we provided based on the two reviews we have received, see itemized responses below where the reviewers' comments are in black and our responses are in red. A clean version of the revised manuscript and a marked-up version showing the changes made have been uploaded to the system.

Best regards,
Tazio Strozzi

RC1

- What is the availability of the data generated by this work, especially the mosaicked annual radar maps and the maps of NDI for each glacier? It would be good to guide the readers with a data availability section.

A section on Data availability was added. In addition, as indicated by the Copernicus Publications editorial support team, a section on Declaration of Competing Interest was added.

- L302-304: The ENVISAT—RADARSAT-2 and ERS-2—RADARSAT-2 analyses seem to be the only cross-platform comparisons throughout the study, but I can't find any results or discussion later in the manuscript. What is their performance in terms of surge detection?

In the revision of the supplement we have included as Figure S13 images of the differences in the backscatter intensity between ENVISAT in 2010 and RADARSAT-2 in 2012 for Blomstrandbreen and the Nathorstbreen glacier system (also including Zawadzki breen and Polakkbreen) and an image of the differences in the backscatter intensity between ERS-2 in 2011 and RADARSAT-2 in 2012 for Blomstrandbreen. In addition, we update the Sensor column in Table 2 by including RADARSAT-2 for Nathorstbreen, Zawadzki breen, Polakkbreen and Blomstrandbreen and ENVISAT for Blomstrandbreen and we included a short text describing these analyses in the manuscript.

- L469: For one simulation, are all surges drawn from the same normal distribution? Or is each surge drawn from a different normal distribution with the mean and standard deviation randomly assigned? How many surge events are drawn?

We updated in the revised version of the manuscript as follow: "We modeled surges as cyclic events with 50-1000 active members and return times drawn from the same normal distribution depending on the mean and standard deviation (mean 50–300 years, standard deviation 10–200 years) [...]."

- L491-498: It would be helpful to provide more details for readers to understand the simulation. According to Figure 16, this analysis is only performed for the case with $F = 15/\text{decade}$, correct? How many surging glaciers are there in one run? Are there also a few million simulations aggregated into these results?

We updated the revised version of the manuscript as follow: "Partial or full phase-synchronization (surges set to start at the same time) given the historical baseline can lead to periods of 3 surges per year or more (Figure 16), but [...]"

- Copyediting suggestions:
 - L244: ... detection over Svalbard “using” the ENVISAT...?
The sentence “We considered for historical surge detection over Svalbard the ENVISAT ASAR images acquired between winter 2003 and winter 2010.” was changed to “We considered the ENVISAT ASAR images acquired between winter 2003 and winter 2010 for historical surge detection over Svalbard.”
 - Figure 11: Since the glaciers are not aligned along the southwest to northeast direction, it would be good to add labels of glacier names to each surging glacier for better identification with the caption.
Agreed, labels of glacier names were added to Figure 11.

RC2

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.

This sentence was changed to “10 surge-type events initiated in the 10 years between 1995 and 2004”.

- 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).

We clarified in the caption to Figure 13 that the vertical lines indicate a ten-year boundary.

- 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.

Table 3 is now sorted 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.

We now consistently use RGI v7.0 for both Table 2 and Table 3 and applied the same precision for latitudes and longitudes.

- For table 3, it would also be helpful to indicate, for the italicized cases, which additional sensors observed the same surge events.

Agreed, in Table 3 we included for the cases printed in italics 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.

We expand the final paragraph of the conclusions by explicitly mentioning X-band data: “In this regard, X-band SAR missions such as TerraSAR-X, COSMO-SkyMed, ICEYE or Capella offer a good opportunity to detect local surges.”