We are grateful to the reviewers who suggested many helpful changes. They also made us aware of the parts that needed adaptation to ensure our concept was understandable to the reader. We considered all comments and our answers can be found in the following. The review comments are marked in bold and our answers in italic and blue colored font.

<u>Response to General comments (Review 2):</u>

Although technical details of the crow-sourced mapping application are available in Appendix A, however, if some details and potential issues could be mentioned or discussed in the manuscript, it would benefit other crow-sourced applications. A fundamental assumption of using a crow-sourced system is that it allows many people to contribute to a task that cannot be completed by a few experts. If the task does attract many people, how many concurrent users are allowed in the system? How to synchronize data? In fact, it's not easy to recruit volunteers for mapping specific features (e.g., permafrost-thaw features) that most people are not familiar with, as demonstrated by Huang et al. 2023 (Huang, L., et al. Identifying active retrogressive thaw slumps from ArcticDEM. ISPRS Journal of Photogrammetry and Remote Sensing, 205, 301–316), how are you going to recruit contributors for a continuous monitoring task besides mapping events? How to manage large datasets if you use the crow-sourced system for much larger areas?

Thanks for the suggestion, we will gladly provide more detail on the mapping application, such as its task assignment strategies and data management, in the appendix. With regard to the issue of recruiting contributors, we will add some ideas to the discussion section, e.g. the integration with popular crowd-sourced mapping apps, and the continuous collaboration with educational institutions.

<u>Response to Specific comments (Review 2):</u>

L6: "positional accuracies", validated against what data?

This was validated against polygon center points mapped by experts. We will state this more explicitly in the revised manuscript.

L13: "the largest non-seasonal component of the cryosphere"? largest in area?

It is the largest in area indeed. We will state this more explicitly.

A screenshot of the web-based crow-sourced mapping application would be helpful for readers to understand its functions and capabilities.

Thanks for the suggestion, we will add a screenshot of the application to the respective section of the annex.

L146: "crowd-validated"? I am a little confused, as these results will still need to be validated by the experts?

We consider the centers of the clustered volunteer-contributed ice-wedge polygon centroids as "crowd-validated", but we agree to remove this term and replace it with "volunteer-contributed" as it might be ambiguous.

Figure 3 would be good to show a zoom-in region, like Figure 4.

We add the zoom-in region to the figure.

Figure 7, please show a zoom-in Figure, like Figure 8.

We add the zoom-in region to the figure.

L239: Where is the difference between "manually digitized reference polygons" and "expert-derived polygons"?

Expert-derived polygons are generated via the network reconstruction method described in the manuscript from approximate polygon **center points** digitized by experts. Reference polygons are manually digitized **as polygons** by experts without the need to fall back on the network reconstruction method. Comparing expert-derived polygons with reference polygons manually digitized by experts allows for assessing the quality of the output of the network reconstruction method.

L286: "betweenness" a sentence to explain betweenness and its importance would be helpful for readers without a hydrological background.

Betweenness centrality provides a measure of the importance of individual channels for water drainage within hydrological networks (Marra et al., 2021). Channels with high centrality act as critical connectors, linking otherwise isolated parts of the network and thereby playing a key role in maintaining or enabling overall drainage. In the context of the hydrological function of ice-wedge polygon networks, through segments with high centrality are likely to carry disproportionately large water fluxes, as they concentrate flow. Consequently, they play an important role in the transport of dissolved nutrients and other substances, while also being more susceptible to enhanced erosion and thermokarst development (Rettelbach et al., 2021).

L324: "the overall time available for the crowd-sourced mapping process", What's the time referring to? The event duration?

This does not necessarily refer to a single event, but to the overall person-hours of volunteer contributions that can be mobilised for a specific crowd-sourced mapping process, i.e. the mapping of a given area of interest. We will reformulate in the manuscript to clarify.

L369: "especially when high-resolution elevation data is unavailable"? This is confusing. This manuscript still requires high-resolution imagery. From my understanding, the need for spatial resolution is determined by the observing objects, that is, smaller features require higher spatial resolution.

"High-resolution" here refers to horizontal resolution and vertical accuracy of elevation data. Automated processes often depend on high resolution elevation data, e.g. to detect subtle elevation differences in narrow ice-wedge polygon rims/troughs. Elevation data of the necessary resolution is not globally available. Our approach does not depend on elevation data at all, but it does require high-resolution imagery.

Response to Technical suggestions (Review 2):

L169: "()rettel-bach2021quantitative"?

This is a formatting error of the citation to be corrected.

L309: change "inSAR" to "InSAR".

This is to be corrected.

References:

Marra, W.A.; Kleinhans, M.G.; Addink, E.A. Network concepts to describe channel importance and change in multichannel systems: Test results for the Jamuna River, Bangladesh. Earth Surf. Process. Landforms 2014, 39, 766–778.

Rettelbach, T.; Langer, M.; Nitze, I.; Jones, B.; Helm, V.; Freytag, J.-C.; Grosse, G. A Quantitative Graph-Based Approach to Monitoring Ice-Wedge Trough Dynamics in Polygonal Permafrost Landscapes. Remote Sens. 2021, 13, 3098. https://doi.org/10.3390/rs13163098