Dear Editor,

We have carefully revised our manuscript taking into account all of the comments and suggestions by you. See Responses to the Comments as follows, the black words are the comments, while the blue words are our responses. Thanks so much for the help and guidance.

Best regards,

Yours sincerely, Jun Xie, Xiangfang Zeng, Chao Liang, Sidao Ni, Risheng Chu, Feng Bao, Rongbing Lin, Benxin Chi, Hao Lv

The current version has scope improvement, including my general and minor comments. At this stage I invite the authors to revisit their revised manuscript once more to ensure the presentation is really clear and concise, especially for the conclusions section, which may be strengthened.
In summary, I encourage you to pay attention to:
* presenting your findings in a well written format;
* in the Conclusion, to emphasize the key novel outcomes of this study; and
* provide an outlook how these may translate into further development of their method.

Re: Thank you for your suggestion. We modified the Conclusion as,
"In this study, we analyzed data of a dense DAS array deployed on a frozen lake, which enables the observation of a substantial amount of seismicities associated with ice dynamics. Utilizing a machine learning method, we identified two types of seismic events, namely, icequakes and LFEs. Icequakes exhibited good correlations with ice fractures and local air temperature. The precise location of icequake provided a depiction of ice fracture map. The icequake frequency showed a positive correlation with air temperature, that is, higher temperature results in more icequakes. The LFEs were identified as dynamic flexure of the ice plate. The dispersion curve of LFE signal was used to investigate the Young's modulus of ice, which is close to 9 GPa in this study. The methods used in this study can be applied to glaciers and ice shelves for monitoring microseismicity and icebody itself. Especially, deploying DAS array with a larger aperture on ice shelf is possible to capture longer-period LFE signal, providing constraints on physical properties such as thickness and Young's modulus of ice shelf. Moreover, DAS based seismic activity observations combined with remote sensing techniques can provide us with more in-depth monitoring and research on dynamic changes and disintegration processes."

General comments:
l30: Suggest to add DAS data's role as effective information into (early) warning systems. Add after "Walter et al., 2023)".

Re: Thank you for your suggestion, however, we believe the potential of DAS as effective

information into (early) warning systems is not suitable here. Because in this part we focus on the seismicities on the glacial environment rather than the applications of seismic tools. Therefore, we added it in line 36, as “”

In recent years, Distributed Acoustic Sensing (DAS) has shown its potential in many applications (Zhan, 2019) such as, microseismic monitoring, seismic imaging, earthquake early warning (e.g., Farghal et al., 2022).”

References:

Farghal, N. S., Saunders, J. K., and Parker, G. A.: The Potential of Using Fiber Optic Distributed Acoustic Sensing (DAS) in Earthquake Early Warning Applications, Bulletin of the Seismological Society of America, 112, 1416–1435, https://doi.org/10.1785/0120210214, 2022.

Zhan, Z.: Distributed Acoustic Sensing Turns Fiber-Optic Cables into Sensitive Seismic Antennas, Seismological Research Letters, 91, 1–15, https://doi.org/10.1785/0220190112, 2019.

l40: Add missing "by" to read "outperformed by the geophone array".

Re: added.

l61: Split into two sentences to read "The water depth of the Xiliushui Reservoir ranges from 45 to 65 meters. The ice thickness in the reservoir reaches around 0.5 meters during boreal winter."

Re: split.

l135ff: I encourage you to explore the location bias further and to include a note on your findings here.

Re: We conducted a synthetic test using the theoretical travel times. To calculate the theoretical traveltimes, we assumed the DAS cable was shifted southward by 10 meters and added a random error of 0.01 s to each traveltime. The location results deviated northward from the true location (Fig. R1). This illustrated the systematic bias caused by the misalignment of the fiber-optic cable.

In line 140 of the revision, we added,

“We conducted a synthetic test using the theoretical travel times. To calculate the theoretical traveltimes, we assumed the DAS cable was shifted southward by 10 meters and added a random error of 0.01 s to each traveltime. The location results deviated northward from the true location (Fig. S7). This illustrated the systematic bias caused by the misalignment of the fiber-optic cable.”

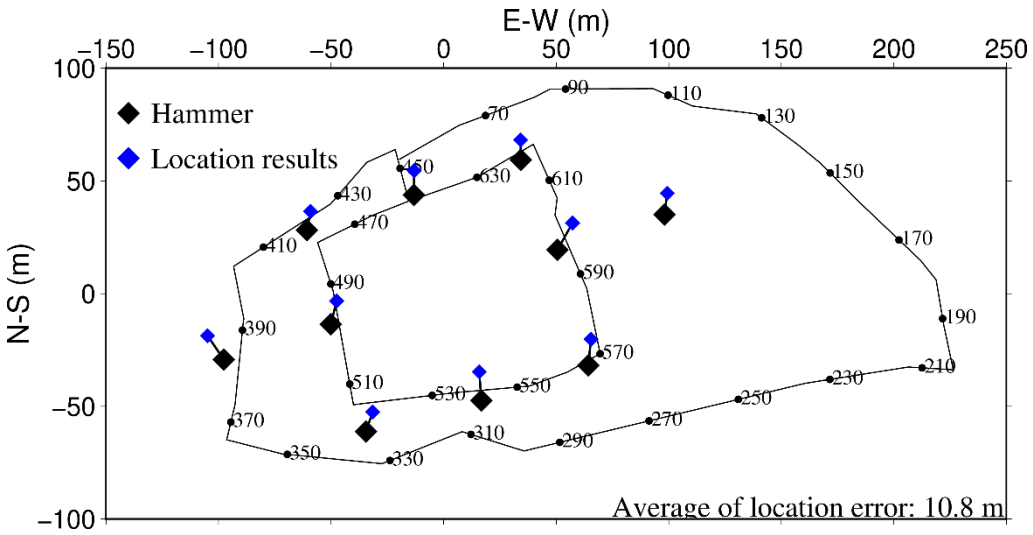

Figure R1 Synthetic hammering locations. Black diamonds are the ground truth and located hammering points.

Minor comments:

* "in situ" is spelled without hyphen (i.e., NOT "in-situ") but in italic font.

Re: changed.

* "data" are plural: I.e., correct "data is" to "data are". I.e., l114.

Re: modified.

* I assume this will be fixed in typesetting, but indentation at the beginning of each reference will increase readability.

Re: added.

l203: Check format of the following unit "Hz*m" with regard to the "*" symbol. I suggest to remove it.

Re: we changed it to Hz·m.

l204: Add space before "Mindlin" to read "(e.g., Mindlin, 1951)".

Re: added.

l207: Remove "etc.".

Re: removed.

l121: Remove "layer" from "snow layer".

Re: removed.

l223: Remove double space from "In cracked".

Re: removed.

l297: "professional" in "for their professional suggestions" is not quite the correct term, pls replace.
Re: we replaced “professional” as “insightful”.

l298: Correct "editors" to "editor".
Re: corrected.