Xiaoguang Pang and colleagues develop an ice thickness inversion model based on laminar-flow theory that explicitly incorporates a sliding law, whereas basal sliding parametrization is often neglected or oversimplified in comparable approaches. They apply their model (ITMSL) to 16 glaciers across High Mountain Asia (HMA). First, they compare ITMSL with two other laminar-flow-based inversion methods (Gantayat adn Millan). Second, they compare ITMSL with four additional ice thickness inversion models that are well established in the literature.

I received now a new version of the manuscript after a first tour of review. I thank the authors for their work to account for my comments on their first manuscript. However, after reading the new version of the study, I think some of my initial comments were not well addressed and the manuscript still requires improvement.

I want also to inform the authors that the document provided to track changes between versions of the manuscript is not usable in its current form. New text is highlighted in red with a line to the margin of the pages where the previous sentence should be written. Most of the time the previous content is not written and only "Times New Roman" is displayed.

The line numbers refer to the newest version of the manuscript.

Major Comment

While reading the paper, it is difficult to be convinced of the added values of ITMSL.

First, it slightly outperforms Millan and Gantayat over these 16 glaciers. However ITMSL was calibrated with ice thickness measurements glacier by glacier while Millan calibrated his model at regional scale. This difference in calibration (and thus in application at large scale or not) could also explain the better performance of ITMSL versus Millan.

Second, I still see no explanation in the manuscript to motivate the use of ITMSL instead of any other inversion methods. Some of these approaches do not require more data that what is needed for ITMSL and seems to better performs as you show in section 5.3. Maybe the reduced complexity reduces strongly the computational time and this is clearly an advantage but this should be referenced in the manuscript. You indeed mention : "*Although complex ice thickness inversion models offer advantages in physical realism and inversion accuracy, their high computational cost, large number of parameters limit their application in regional and global scale glacier volume studies*" while we see several of these methods applied at large scale (Farinotti et al.,2019, Cook et al. 2023, Frank et al., 2026). Or maybe the simplicity of SIA allows for physical understanding of glaciological phenomena. Again the added value of ITMSL should be more emphasized.

Thanks you for introducing ITMIX in the introduction. However I'm not convinced by the analysis performed around fig.11. I do not see the point of this analysis in term of benchmarking the performance of ITMSL with respect to other models. Analysis of the performance of ITMSL without (or with a reduced set of) ice thickness measurements compared to other models should be a way to answer this issue. This will also enhance the added value of ITMSL if working without ice thickness measurement.

Minor Comments

0) Abstract

1. L.18-20 : "*Currently, ice thickness inversion models based on ice velocity have*

achieved significant progress in regional and global studies of glacier thickness and volume. However these methods simplify the parameterization of basal sliding […]".
I would prefer to limit this statement to SIA based inversion model not on all inversion model using ice velocity.

2. L.21-22: this sentence is doubled.

1) Introduction

1. L.59 : You must introduce and expand the acronym ITMIX.
2. L.64 : "typically requiring two or more types of data from digital elevation models (DEMs)". Only 1 DEM is provided in ITMIX where most of the state of the art inversion models participated. Where does this statement come from ?
3. L.73-74 :"*with uncertainties reaching tens to even hundreds of meter*" should be express in % of mean ice thickness to generalize across various glacier size.
4. L.76 : simulations → inversions
5. L.78-80 : I'm wondering if this conclusion from ITMIX II is useful for the purpose of your study.
6. L. 199 : When introducing the model of Millan and Gantayat you will use as benchmark, you should give the references.

2) Methods

1. L.150 : SIA acronym was already introduced before.
2. Table 1 : what are the values of u_s displayed in the table ? Mean, Median, max ? From which observations ?
3. L.189-201 : This paragraph reads strange. You introduce Weertman and Budd's sliding law but you did not introduce the Coulomb's sliding law. Then you say you use the law of Coulomb.

3)Model instructions

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4) Model experiments

1. L.298-300 : " *This indicates that the B value range is not universally suitable for all glaciers, [...]*". I'm wondering if you could not argue the opposite. For most of the 16 glaciers, the RMSE difference between ice thickness inverted with different values of B and measured ice thickness is smaller than 2%. It never exceeds 4%. This small sensitivity to the parameter B makes the model relatively easy to extent to other glaciers without ice thickness measurements. This is encouraging even if it needs to be further investigated.
2. Table 2 : It is a very personal choice. I would like to see visual separation between the 2 first columns and the 2 last columns since they content the same variables.
3. L.315-316 : mean ice thickness of a glacier from GPR measurement is the mean of the measurements ?
4. L.321 : lowest → thinnest ?
5. L.321-322 : « *ITMSL exhibited closest agreement with GPR data, indicating superior accuracy relative to the comparison models.* ». Are they other models calibrated against individual ice thickness measurements ?
6. Fig.6 : I'm not sure the colormap of panel d correspond to its associated colorbar. I'm not able to localize this green in this colorbar.
7. L.349 : "*Gantayat's assumed 0.25, which induces substantial thickness overestimation*." is not in contradiction with this previous sentence : "*In terms of mean ice thickness, ITMSL (114.63 m), Millan (104.90 m), and Gantayat (98.39 m) differ from one another, with Gantayat being the lowest*"

8. Table 3 : the caption should be reformulated. I do not understand it. Mean ice thickness and motion characteristics extracted at GPR point locations estimated from GPR, Gantayat, ... for the 16 glaciers.
9. Table 3 : what are the values of u_s displayed in the table ? Mean, Median, max ? From ITMSL ?
10. L.356 : What are the GPR-validated thickness data ? measurement non used to calibrate ITMSL ?
11. L 362-363 : "*exhibit higher deviation in ice thickness inversion using ITMSL compared to Millan et al., 2022, and the changes in mean and relative errors are limited, the improvement in accuracy still confirms the […]*". I do not understand "*and the changes... limited*". I would cut the sentence before it and add between parenthesis "*see RMSE, ME and RE in fig7*". Improvement with respect to what ?
12. L.370 : Both ME and RE → Positive values of ME and RE ?

5) Discussion

1. L421-427 : I would reformulate here since you binned the ratio distribution in 10 bins of 0.1. From this bin analysis, 2 regimes can be defined. The bias is reduced with Millan in the 0.1-0.4 regime (median closer to 0) but even in this regime, the interquartile range and the outliers of ITMSL are better than those of other models.
2. Fig.10 : colorbar does not use the correct colormap. ylabel miss a "space" between ice and thickness.
3. L.445 : We compared → We compare now ?
4. L463-464 : What is the value of ice thickness displayed in fig 12 ? why only one value per glacier. I'm not sur comparing only the mean ice thickness is a good indicator. Again you should refer to what ITMIX has done so far.
5. Fig.12 : Caption : mean, median, max ice thickness per glacier ?
6. L.484 : All ME but one are negatives in fig.12. How can you say that :" *The ME quantification confirms a systematic positive bias*" ?
7. Fig.13 : Space between Ice and thickness in xlabel.
8. What is the difference between the GPR ice thickness measurement subtracted to the DEM and the GPR derived bed measurement ? This should be explained tounderstand the difference between fig 12 and 13. I repeat this question from my previous review since I'm still not able to understand why fig.12 and fig.13 are different. Inverted bed = DEM – inverted thickness. GPR bed = DEM – GPR thickness. In that case the scatter plot between inverted and GPR quantity should be the same for bed and for thickness.
9.

6) Conclusion

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Reference :

Cook, S. J., Jouvet, G., Millan, R.,Rabatel, A., Zekollari, H., & Dussaillant, I. (2023). Committed ice loss in the European Alps until 2050 using a deep-learning-aided 3D ice-flow model with data assimilation. Geophysical Research Letters, 50, https://doi.org/10.1029/2023GL105029

Farinotti, D., Huss, M., Fürst, J.J. *et al.* A consensus estimate for the ice thickness distribution of all glaciers on Earth. *Nat. Geosci.* **12**, 168–173 (2019). https://doi.org/10.1038/s41561-019-0300-3

Frank, T., van Pelt, W.J.J., Rounce, D.R. *et al.* Global glacier-free topography reveals a large potential for future lakes in presently ice-covered terrain. *Nat Commun* **17**, 3985 (2026). https://doi.org/10.1038/s41467-026-72548-9