Kang et al. evaluated the basal thermal conditions of the Lamber-Amery system by using a combined model of a forward model and an inverse model. Results from six experiments based on different geothermal heat flux (GHF) products indicated different distributions of basal temperature and modelled basal melting. By comparing the modelled warm-based region and basal melting rates with locations of subglacial lakes, this study found that two most-recent GHF products based on aerial geomagnetic observations provided best constrain as the basal thermal conditions. Overall the manuscript is generally clearly written. However, the structure needs further modification and some of the description and figures need more improvements.

Here are some general comments:

The finding about consistency between the high basal friction heating and the fast-flowing regions can be easily seen from the way how you calculate the friction heating (Q=tao*velocity), which is less innovative as one of findings in a high-quality peer-reviewed paper.

The section of 3.1.1, 3.1.2, 3.1.3 is nearly same with Wolovick et al. (2021). The authors could just cite this paper rather than copy all these sections. Just make it clear about the different setup you used from Wolovick et al. (2021).

The structure of the paper is a little bit confusing. I suggest moving Sec. 4.2 to Sec. 3.2. Sec. 4.1 Experiment design could fit into end of Sec. 3. Leave Sec. 4.3 as a separate section Sec. 4.

About the improvement of basal friction coefficient, is it original from this study? If yes, I suggest you to mention it in your conclusion section. Besides, I did not see any evaluation about this improvement. Comparison of the difference of simulated and observed surface velocity before and after this improvement is necessary here.

When you talk about the effects of different GHFs on the modelled basal melting, you ignored that fact that different GHFs only affect the modelled basal melting in low-flowing regions even if those six GHFs show different distribution in the fast-flowing region. It further confirmed that friction heating dominated the basal melting for fast-flowing region while the GHF dominated the basal melting in slow-flowing region.

I don't think the Abstract and Conclusions highlight all of the valuable findings in this study. I suggest a serious revision on it.

Several places across the text are lack of citations or need more relevant literature. Some of the figures are not cited accordingly in the text. See the details below.

Specific Comments:

L37: "evidence of extensive subglacial rifts and lakes" citation please.

L77: "for ice temperature" → "ice temperature simulation".

L83-85: Unfinished sentence I guess. "inferred ice and basal temperature"? Or I misunderstood your meaning here.

L101: "in" → "part of"

L104: How did you choose the central streamline here? Where are those datasets (basin boundary, ice front) from? Please add citations.

L115-117: citation of the grounding line dataset and the subglacial lakes.

L123-124: It's not clear tome how and where these two datasets are combined. You should make it clear in Fig. 1.

L156: This is your first time to mention inverse method and Elmer/Ice. Please add citations.

L319: In the boundary condition section (Sec. 3.2.2), you did not mention the constrain for the surface mass balance and basal mass balance for the floating part. Please make it clear here.

L362: This equation is not clearly explained. What is each component in the numerator? Please also add citations for this equation.

L368: The experiment design is quite similar to the multi-cycle spin-up used in Zhao et al. (2018). If yes, please cite the paper here.

L395: citation for the statement "Basal friction in reality depends on basal temperature"

L415: delate "the" after "the modelled".

L416: Do you mean test with different GHFs gave you similar modelled surface velocity? If yes, the statement you made here is not accurate. The only thing you can say is that the inverse method is not sensitive to the choice of GHF product as the boundary condition, which could be one of your findings here.

L427: 500 m/yr. Do you mean the velocity near the GL? If yes, make it clear.

L432: The cyan color is not clear to me. Suggest to change a different color.

L433-434: Why do you chose the contour of 0.5 and -0.5 here? What's the meaning behind those two contours. Please explain.

L339-440: But for the fast-flowing region, we did not see any significant differences. You should make it clear when you talk about the different distribution of warm base.

L441: "In the Li experiment", please cite the figure here. "high" → "highest"

L442: "the basal temperature over most of the domain reaches the melting point", you should add "except for the southern part of domain"

L447: citation for "subglacial mountains"

L455: "heat conduction" → "basal heat conduction". Please add the velocity contour in Fig. 6. About the "fast-flowing tributaries", you didn't define it in Fig. 4a. Do you mean region with velocity higher than 50 m/yr?

L456: "0-30" → "30"

L457-459: Why do you think Purucker shows lower values here? Please explain.

L460: From Fig.7 ,we can tell no significant difference across these 6 experiments. It's better to make a statement here.

L463: when you say reach 2000 mW m-2 at the GL, do you mean all these three glaciers? Or just Lambert?

L478: there are two Fig. 8 here.

L505: I think GHF distribution largely govern basal thermal conditions for the slow-flowing region.

Add citations for "Many previous studies"

L511-L515: Too long sentence. Please split it.

L513: Don't understand what you mean here by "puts warm-based conditions outside of the locations of the observed lakes"

L514: delete "if"

L517: I don't think you use the same inversion method by Wolovick. Do I misunderstand anything here?

L520: What is "ice bed"?

L525: So what? What is the advantage behind it? This could be a highlight of your study.

L542: what do you mean by "ice sheet connected to the ice shelf"? "frictional heating means"? This sentence is not clear to me.

L555: delete ","

L573: "in area" → "in slow flowing area"