Parrenin et al. report a 2.5D "flowtube" model that utilizes a coordinate transformation that greatly improves the numerical efficiency. This coordinate transformation was developed in previous publications roughly a decade ago, so the primary new aspect of this work is providing the model code so that others can more easily use the model. This paper is well suited for Geophysical Model Development.

The manuscript is clearly written and the primary equations and assumptions are well described and justified. The figures are informative, and are mostly auto-generated from the code. There is no particular scientific conclusion to the paper, which is ok since that is not the primary purpose. The application to EDC-BELDC is appropriate and demonstrates the model capabilities.

I have used this model before and found it useful, functional, and well documented.

Thank you very much for your careful and constructive reviewing work on our manuscript.

I have only a few suggestions given below:

- The conclusion is missing text and should be expanded upon.

We have expanded the conclusion:

5 Conclusions

For the interpretation of radar-observed isochrones or ice core chronologies, it is sometimes necessary to simulate the age of the ice in an ice sheet. We have developed a numerical model to calculate the age of the ice along a pseudo-steady flow tube of an ice sheet. Our Eulerian-Lagrangian scheme combines advantages of Eulerian and Lagragian schemes. There is a regular

grid where the age is calculated, as in Eulerian schemes, which is significantly more convenient than having to define initial particle positions and tracking these positions during the time evolution. But at the same time, ~~and~~ there is no numerical diffusion, as in Lagrangian schemes, and our model is numerically very accurate. Our model is computationally ~~With our assumption that 1/a and that z_Ω and linear piecewsie functions~~ effective, ~~which opens~~opening up new prospects for optimizing its parameters according to observations, which requires many forward simulations runs. We have applied our model to the DC-BELDC flow line and we have shown that horizontal flow is non negligible there, with ice particles sometimes travelling >15 km which has implications for the age scale of the ~~Beyond EPICA~~BELDC ice core. The next step is to optimize the parameters of the model according to age observations such as radar-observed isochrones and ice core dated horizons, which is done in the companion manuscript, Chung et al. (2024).

- In the abstract, intro, and conclusion, the coordinate transformation should be described with an additional sentence. What is the gist of the coordinate transformation?

We now refer to this coordinate system as "logarithmic flux" coordinate system and specify that it tracks ice trajectories.

- L21 - change "most important" to "largest" since "most important" is an opinion

Done.

- L22-25 - give references for each of these points and separate with semicolons rather than commas

Done.

- L26 - make "type" plural

We think you referred to L36 and we corrected to "types".

- L50 - make "scheme" plural

Corrected.

- L234 - change "in front of" to "compared to"

Corrected.

- L256 - change ">15km" to ">20km" to be consistent with other locations in the paper

Changed every occurrence to ">15 km" since it is the most correct estimate.

- Figure 1. I don't understand the labeling of "Q(x)" beneath the ice sheet, should it be m(x)? The caption could also use more description of what the symbols represent.

This originally was "Q_m(x)", the melting flux, but a bug in our software skipped the subscript during pdf export. This is now corrected.

- Figure 5. Can you describe why the red dashed lines in the top panel for the core sites don't reach the bottom of the graph? I think this is because the model domain gets to older ages than is actually found at the ice core sites, but it isn't clear.

We added this sentence to the caption:

Figure 5: Mesh of the age_flow_line-1.0 model experiment in the (π,θ) (**top**) and (x,z) (**bottom**) coordinate system. The positions of the EDC and BELDC deep drill sites are plotted in dashed red. The observed bedrock is in thick black and the mechanical bedrock in violet. For better readability, the resolution of the grids has been decreased by a factor of 5. Note that in the top panel, the EDC and BELDC ice cores do not extend down to the bottom of the mesh, since this mesh converges asymptotically towards the mechanical bedrock but never reaches it. These figures were automatically generated by the age_flow_line-1.0 software.

- Figure 6 - I think added subpanels with the horizontal flux shape function plotted for each core site would make the figure more interpretable

We added the Ω flux shape function for the two ice cores in Figure 10.

- Figure 9 - mention in Figure 9 caption that the vertical thinning functions at EDC and BELDC are shown in Figure 10

Done.