The Cryosphere Discussions

The Cryosphere Discuss., referee comment RC2
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Comment on tc-2022-23

Anonymous Referee #2

Referee comment on "Predicting the steady-state isochronal stratigraphy of ice shelves using observations and modeling" by Vjeran Višnjević et al., The Cryosphere Discuss., https://doi.org/10.5194/tc-2022-23-RC2, 2022

Review of Višnjevi Ì□c et al

Summary: This work uses a simple, observationally driven ice flow model to forward model ice shelf stratigraphy with a given atmospheric and ocean scenario. The method is validated with Elmer/Ice model. The model predictions are then compared with radar observations over Roi Baudouin ice shelf. The internal layers in the LMI region resolved by the radar are compared with the model-derived internal layers. As the ice shelf model uses a steady state assumption, this is a way to predict if an ice shelf is in steady state if the mode predictions agree with observations of internal stratigraphy.

Major comments:

This is an important concept. The transition of LMI and CMI and the percentage of the ice shelves that comprise of LMI/CMI component can have important consequences for ice shelf stability. However, the paper is not very clearly written, in my opinion. The authors need to take another look at the sections to improve readability.

The white LMI/CMI boundary in Figure 7- I assume it is modeled. Is there a possibility to provide an uncertainty in the depth of the LMI/CMI layer?

Why only Roi-Baudouin was chosen for validation? Was any other ice shelf considered for the validation with airborne radar? Is Ross Ice Shelf not a good candidate for comparison?

The presence of marine ice may be sporadic on some ice shelves, but extensive on others (example the Ronne-Filchner ice shelf). The limitation of this method needs to be acknowledged, particularly along lines 234-240.

Figure 10 needs a panel of basal melt rates from Adusumilli et al. The comparison of LMI/CMI composition with basal melt rates will be interesting and important. For example, does the basal melting pattern differ considerably on either side of the ice shelf?

Minor comments:

How do the upstream grounded ice surface look like in Figure 7? Are there crevasses, blue ice etc. that would prevent the identification of layers below the LMI/CMI interface? A figure delineating the possible surface conditions would be helpful.