

Interactive comment on “Glaciological characteristics in the Dome Fuji region and new assessment for 1.5 Ma old ice” by Nanna B. Karlsson et al.

Anonymous Referee #1

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This paper presents a new map of the bedrock topography in the Dome Fuji region, East Antarctica, using recent airborne radar surveys. The new map is used (i) to update the study of Van Liefferinge and Pattyn (2013) and infer areas that are probably not currently at the pressure melting points; i.e. potential areas to find ice million year old ice; and (ii) estimate the potential drainage routes of identified wet areas. A continuity index of the internal layers seen in the latest radar data is shown to estimate the potential of tracing layers from the Dome Fuji ice core location to identified Oldest Ice location; However this part is not very conclusive.

This new data set will be useful to drive further geophysical investigations in the area

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to refine potential locations for Oldest Ice.

However, I think few points require more consideration from the authors:

- The title and conclusion claim that this study is a new assessment for 1.5 Ma old ice. The 1.5 Ma is a target of the Oldest-Ice project, but the study does not demonstrate that ice as old as 1.5 Ma could be retrieved in the area. The fact that the basal ice may not be at the pressure melting point for the present day conditions is not a sufficient condition to retrieve ice older than 1.5 Ma; this could be affected by basal disturbances, past melting conditions etc... Van Liefferinge and Pattyn (2013) speak of “suitable sites for the preservation of million year old ice”. At this stage it is too early to say that it could be up to 1.5 Ma. This will have to be refined by further studies aiming at providing potential ages for the basal ice. In this prospect it would be useful here to recall the age of the ice at the bottom of the Dome Fuji ice core.
- The new thickness map: Kriging naturally comes with an estimate of the uncertainty. This estimate is lost when merging the new map with bedmap2. It seems that this merge is needed because they exclude the Soviet data and thus have no data outside of the new thickness data area. It seems that there is a high spatial resolution of the new thickness data, so that providing the grid with the new data and the uncertainty estimate (eventually masked to give data only at grid points where the closest distance is less than 20 km) might be more useful for further investigation than this merged map where the uncertainty information has been lost. It is not clear if the gridded data really include the old German and Japanese data, as the raw individual points are compared to the gridded product (page 4, lines 9-12)?
- New Prediction of Oldest Ice Locations: because they use a 1D thermokinematic model, all other parameters being identical to Van Liefferinge and Pattyn (2013), the solution depends only on the local ice thickness and not on the topography,

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i.e. the thickness gradient. So for oldest ice locations, we should have differences between the old and the new studies only if areas are significantly thicker or shallower; which seems not to be the case here; there is only a better description of the topography and there is no large areas with significant differences with bedmap2. So it seems not surprising that there is a good agreement between the old and new map. Moreover, I am a bit concerned by the validity of the 1D assumption when the model is run with a horizontal spatial resolution (here 500m) much lower than the ice thickness. A more in-depth discussion on the limits of this approximation to study potential local variations is required and avoid the risk of over-interpreting the results.

Minor points:

In all Figures in stereo-polar projection have the longitude the labelled "W". It should be "E"? In Fig. 1: make the symbols bigger for Dome Fuji station and OIR camp. Fig.2 : It could be interesting to show some surface elevation contours. Fig.3 : The color scale shows the full range from 0; but in the figure, a threshold has been applied to show only values > 5 mW/m²? Page 9, line 9; "(white arrow, Fig. 5)". There is no white arrow in Fig. 5.

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