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The Cryosphere Discussions

Interactive comment on "Brief Communication: New radar constraints support presence of ice older than 1.5 Ma at Little Dome C" *by* David A. Lilien et al.

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The authors report a new ground based ice penetrating radar study of a potential ice core site. The new observations resolve internal reflecting horizons at a greater depth than previously observed. Tracing these horizons from the dated EDC core extends dated horizons as old as ∼600 ka into the study region. These observations give important new constraints on depth age modeling for ice older than the dated horizons. The authors use a modified Dansgaard-Johnson model to determine that stratigraphically intact ice dated to older than 1.5 Ma may exist at this site.

This is a fine contribution and is timely given the ongoing efforts to recover a mid-

Pleistocene transition spanning ice core. I have one point of concern and some additional small comments.

On line 100 and 101 the authors state 'In addition to the continuous horizons, there were some that could be identified near both ends of the radargram, where horizon slopes are relatively flat, but not in the middle. We also traced these partial horizons where possible.' How is it known that the same horizon is traced on both sides of a visibility gap? Under what conditions is it 'possible'? Figure 2 appears to show some examples of tracing over a visibility gap. These gaps included significant variation in horizon slope, is this what is meant by 'relatively flat'? This methodology should be described in more detail as well as its impact on horizon age uncertainty. Perhaps the horizons which were traced over gaps in visibility, which I presume tend to be the deepest horizons, are not suitable for tracing. I cannot evaluate this potential as I do not understand what is done. Which horizons are not completely continuous from EDC to BELDC? The reader should be given more information about the practice used and its impact on analysis/conclusions. For instance, what happens if, say, the 6 deepest horizons are excluded from the analysis or all horizons that have gaps.

Model uncertainty seems to be understated. Line 156 appears to be the only location where specific model age error is stated (+/- 76 ka), which is about 5% of the magnitude. This seems to be significantly less than what is depicted in Figure 3b. If I trace a horizontal line at depth 2500 (the approximate depth in which the authors state 1.5 Ma is reached) the gray shaded region extends from ∼1 Ma to some value greater than 1.5 Ma. Seems to me that the model results suggest that at a depth of 2500m the age would be some value greater than 1 Ma, with a range that extends to beyond 1.5 Ma. Its full range is not depicted. The figure seems inconsistent with a stated deviation of +/- 76 ka.

Because 1.5 Ma is an age discussed in the manuscript, perhaps figure 3b x-axis should extend beyond this magnitude.

How the specific BELDC location was identified as the most suitable for the location of a bore hole (as opposed to others within the new survey) could be described in more detail, or a citation added. The reader would like to know it is relevant to apply the model in this location.

L33: Shallowest lake? I don't believe lake depths are known. Perhaps the authors mean beneath the least amount of ice?

L78: report the value from Winter et al. and where those depths located (at the core, at the end of the new line, both?, elsewhere?)

L105: Referring to lakes as shallow when depth of ice overburden is being discussed unnecessarily confuses terms.

L126: extra 'of'. Despite of the lack

L128: 'e.g.,)' in citation

L129: section 4.2, Is this section mostly methods?

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