The Cryosphere Discuss.,
https://doi.org/10.5194/tc-2017-69-RC1, 2017

The Cryosphere Discussions

Interactive comment on "Is there 1.5 million-year old ice near Dome C, Antarctica?" *by* Frédéric Parrenin et al.

H. Conway (Referee)

conway@ess.washington.edu

Received and published: 6 June 2017

The authors make a compelling case for the existence of >1.5myr-old ice near Dome C; nice work!

They leverage existing ice-core data from nearby EPICA Dome C, airborne radar data, and an established 1-D ice-flow model, [Concerning the radar, you might also cite the recent manuscript: Winter et al. 2017. Comparison of RES measurements and synchronization with the EPICA Dome C ice core. The Cryosphere, 11, 653–668, www.the-cryosphere.net/11/653/2017/, doi:10.5194/tc-11-653-2017].

I have a few questions/comments: 1. Eqn. 2, suggests that R(t) is spatially invariant and that temporal variations in accumulation rate and melt rate are covariant. Is that

the assumption? If so, how does this fit with statements on lines 75-80 that melt rate varies with ice thickness, geothermal flux and accumulation rate? I would have thought that R for melt would vary both spatially and temporally. Perhaps this is related to your model result of high spatial variations of geothermal flux in the region (eg. line 185).

2. Lines 199-201: It is not clear that there are sufficient data constraints (especially histories of accumulation rate and thickness) to construct a realistic 3-D model. However I agree that using new rapid access technologies are the next step.

3. Figures are my main concern: (i) Fig. 1. Text refers to directions south-west of EDC (line 164) and north-east of EDC (line 164). Fig. 1 labels longitudes but not latitudes; at a minimum a north arrow would help orient the reader.

(ii) Fig. 2 shows UTIG profile and gives locations of NP and LDC along this line, and yet Fig 1. shows them offset from the profile by ∼10km and 15km respectively. Please clarify. It would also be useful to show start and end locations of the radar profile in both Figs so the reader does not have to figure it out.

(iii). I struggle with color scales in Figs. 3&4. It is hard t discern gradients in inferred properties that are discussed in the text. Perhaps either changing the range of the color scale, or constructing line plots of a and m would help illustrate the spatial patterns discussed in the text.

(iv) Fig. 3. Line 155 you state why you use 60m above the bed as the transition between disturbed and undisturbed stratigraphy. Hence why do you show results for 150m above the bed (Fig 3, Bottom left)?

(v) Fig. 4: are the accumulation and melt plots the temporally mean values at each point? It would be good to discuss the relevance of the spatial pattern of the p' plot, and I think a plot and discussion of R(t) would also be most informative.

Other editorial comments: Lines 21, 156, 170, 242, 243, and perhaps other places. One of my mentors has pointed out many times that "inverting" or "inverted" means

“to turn upside down”; “to reverse in position, order, direction, or relationship”. That is, although you use inverse problem methods, you are not inverting solutions. Rather you are inferring, or deducing solutions.

Line 89: “poorly known” is used twice in the same sentence.

Eqn:13, perhaps better written as m= (Go-G)/(piLf); [when Go>G; 0 when Go<G]

Line 156: “stratigraphically” rather than “stratigraphycally”.

Interactive comment on The Cryosphere Discuss., https://doi.org/10.5194/tc-2017-69, 2017.