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The Cryosphere Discussions
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Interactive comment on "Brief communication: "Oldest Ice" patches diagnosed 37 km southwest of Dome C, East Antarctica" *by* Olivier Passalacqua et al.

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This manuscript uses a three dimensional ice sheet modelling approach to explore the basal age and resolution of the ice sheet at Dome C, in a region where bedrock relief is likely to be conducive to preservation of very old ice: up to 1.5 Ma or more. The study appears well-posed and the work is a nice summation of what this approach can tell us regarding basal age and resolution. It is an important advance that is required for targeting future drilling locations and should be valuable in guiding additional exploratory studies. I have only minor comment concerning the modelling itself. The paper does suffer in places from somewhat non-standard English usage, some of which intrudes a

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little on readability. While fully appreciative of the authors' first language I respectfully suggest these items be edited for clarity – noting a native English speaking author is on the list. I see the other referee has commented in similar vein – I will not generally specify the linguistic items for correction below. Detailed comments: Title: In general I disfavour the usage of Dome C as a "point location" synonymous with Concordia Station, as the entire region is really Dome C. Suggested use would be to have the title read "Oldest Ice" patches diagnosed at Dome C, 37 km southwest of Concordia Station. I however leave it to the authors to consider, as it is not a substantive concern.

Line 25: Define IGE on first use Line 37: " and [provide] sufficient resolution" Line 48: Fischer et al. actually stipulate no more than 20 ka m-1 although this may now be thought too coarse. I have heard targets of 14 ka m-1 used. In any case, the 10 ka m-1 is not consistent with the reference. Figure 1 caption: "show the hold [sic] of the domain" Line 74: relaxed for 50 years .... How is the reader assured that this is adequate? Naively it seems very short. Maybe just reword to say that this period proves sufficient to propagate away initial discontinuities or similar. Line 77: "focus on a region where basal melting is probably null" - this may be true for the high points, but the domain most certainly includes areas of basal melt, so how is it that a no sliding condition is OK? Line 95-100: It is not clear from the description why the use of stress exponent n=3 is valid. Indeed there is some varied opinion in the literature over the best value to use in various situations particularly ice divides (see e.g. Martin et al., JGR, 2009; Martin and Gudmundsson,TC, 2012; Petit et al., JGlac, 2007). While not wishing to create imbalance in the treatment in this paper by opening an extensive discussion, some context to the literature would be useful. More importantly for understanding the results of this modelling, could the authors arrive at a statement as to whether an exponent n=3 is likely to under- or over-estimate age and resolution? That is, is it conservative to the aim of finding old ice? Lines 128-130: Maybe an example of the language clarity issue, but it is hard to see what is meant by "the outputs still keep their relevance when analysed relatively to themselves" Line 138: the "water limit" at 480m needs a little explanation, where does it come from and what is the reference height (I

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assume it means 480 m.a.s.l.). Line 171: An example where the “Dome C” not equal to “Concordia” nomenclature issue comes up. I’d favour “Concordia”. Figures 2 and 3: Axis labels in particular are too small. Figure 3 would benefit from all text being larger. Line 216: “our biggest central patch” isn’t so easy to follow as using the labels provided: I assume it is “Patch A”.

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