

## ***Interactive comment on “Promising Oldest Ice sites in East Antarctica based on thermodynamical modelling” by Brice Van Liefferinge et al.***

### **Anonymous Referee #2**

Received and published: 2 July 2018

The study by Van Liefferinge et al titled “Promising Oldest Ice sites in East Antarctica based on thermodynamical modelling” deals with an important topic in this field. It is timely and worthwhile publishing after revising several points that need clarification as following.

Comments and questions

(1) The surface temperature, accumulation, ice thickness and GHF are important boundary conditions, but the surface temperature data used in this present study for both Dome F and Dome C are not clear. Please clarify them (in a table, for example), and discuss the uncertainty and its influence upon the results in the discussion section.

C1

(2) The vertical flow that is used in the advection term is based on the equation (2), which is based on Pattyn, 2010 and Van Liefferinge and Pattyn, 2013, but this is certainly an approximation. Please discuss the effect of the assumption that is made on the result in the discussion section. For example, Parrenin et al, 2017 use different assumption but how does the difference affect the present work?

(3) Neglecting the rock temperature calculation would overestimate the amplitude between the glacial-interglacial condition and then can underestimate the GHF limit for the oldest ice. Please discuss this problem in the discussion section.

(4) Why is the threshold of ice thickness to find the oldest ice for Dome F and Dome C different, 2000m and 2500m, respectively?

(5) How was the lower limit of ice thickness to find the oldest ice determined?

(6) For Dome C, Parrenin et al, 2017 show the location of melt and estimate the possible GHF from modeling and radar data analysis. Discuss what we learn from the present study after knowing the publication of Parrenin et al 2017.

(7) Plot the “Little Dome” and Dome C in the map (or show both locations) and discuss the result related to this area.

Some minor comments:

P.3 L10-12: refer to the data of GHF known at those sites.

P.3 L17-18, I cannot understand what you mean by this sentence, “Furthermore, the mechanisms that control the geometry. . . . .”.

P.4 Figure 1: please show the temperature change of Dome F, too.

P.6 Please show the map of  $T_s$  obs (the observed surface temperature) including Dome C and Dome F. It is not clear which dataset is used.

P.6 Ice thickness history taken from Pollard and Deconte, 2009 should be shown (per-

C2

haps in Figure 1) for the aid of understanding the results.

P.8 L12, “adding . . .basal roughness threshold value of 20m. . .”. The meaning is not clear.

P.9 Figure3. Is this for Dome C? Please show both Dome C and Dome F and explain the difference.

P.9 L8, “mainly due to shallower ice”: how much caused by the ice thickness and surface temperature?

P. 10 Figure 4. Show in the caption that the area with ice flow within 2 m/yr is displayed.

P. 11 L2-3, very good that the higher spatial resolution is shown and discussed in the following section, but the Figure 7 and Figure 8 should be displayed in the same resolution.

P.11, L7, show the latitude and longitude of “Little Dome C”.

P. 12 Why is the red area around the triangle larger in Fig.7 (b) than Fig. 8 (b)? I cannot understand how this was determined.

P.12 Figure 7. (d) displays the ice thickness but the Figure 8. (d) displays the Basal topography. For the readers’ understanding, it is better to use the common variable (either ice thickness or basal topography)

P.12 L7 “lower bed roughness at Dome Fuji than Dome C” is not easy to understand.

P.13 Figure8 (a) and (b): Why are the number of triangles and their location different in the two figures?

P. 16 Figure 9 (d) Why does Snyder (2016) show the “map” of surface temperature change? Snyder 2016 is only providing a time series.

P. 16 Figure 9 (d): Surface temperature changes between 1.5Ma and 0 Ma? This is not possible. Please check and rewrite what you mean.

C3

P.17 Figure 10: Clarify which difference (and the sign) is meant.

P.17 L6, explain more why “ less promising due to thinner ice cover”. Thinner ice could be promising in freezing condition. Discuss the advantage and disadvantage.

P.17 L11: Where are the “two areas”?

P.17 L13: “evocative of a horst” is not understandable.

P.18 L4: “a number of candidate locations” are not clear in the figures. Please make a summary figure to enlarge and focus the locations.

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Interactive comment on The Cryosphere Discuss., <https://doi.org/10.5194/tc-2017-276>, 2018.

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