Anonymous Referee #2 (response)
Received and published: 10 July 2013

This paper from van Liefferinge and Pattyn discusses the use of two ice-flow models to evaluate potential sites for obtaining the oldest ice in Antarctica. The motivation for the study is well made and clearly links into wider discussions the ice-coring community is having at the moment with regard to why it would be optimal to find ice across the Mid-Pleistocene Transition (MPT). The paper is well structured, guiding the reader through the main issues. A model that neglects horizontal advection is used as a starting point to explore potential sites using three "best estimates" of geothermal heat flux as one of the key inputs. Later (Section 4), thermomechanical modelling is introduced, using an updated form of Pattyn's (2010) model, and in Section 5 the inputs are tuned using known distributions of subglacial lakes to calibrate basal conditions. The two approaches produce consistent results, namely that apparently the best sites for targeting the oldest ice appear to be close to existing ice cores. Perhaps the best promise lies around Dome A/Ridge B, but there remains uncertainty from this whether one can reach the MPT even there.

I find the paper well conceived, a useful exercise, and excellently written. As a result my comments are minor. I would like to see some discussion of the few points I raise below, but otherwise my comments are largely restricted to minor grammatical corrections, appended in the attached supplement.
We would like to thank the referee for the amendments; they were very useful for improving the manuscript.

Fig. 2, 4, 5, 6, 7: I think these would all benefit from an annotation of where the key sites actually are, e.g. Dome Fuji, Argus, Ridge B etc. Okay, many readers will probably be familiar, but nevertheless some readers are probably not.
We made a new figure of the Antarctic ice sheet with the main features on it. The map also displays geographical coordinates so that a comparison with the general polar-stereographic coordinates can easily be made.

Fig. 3 and text on p.2866: Can we have just a little more clarity on what exactly it is that defines where the black rectangle has been drawn? From this I think the limits are, essentially, arbitrary, in that deltaG (x axis) needs to be positive and s.d.G (yaxis) needs to be "smaller rather than bigger". If they are arbitrary, make this explicit; otherwise define.
The rectangle is more or less arbitrary chosen to make sure that the selected sites have a high probability to be cold-based. In fact, the error is in the Figure caption of Fig. 4, where the limits were wrongly expressed, which may lead to confusion, but this error has been corrected for (see Referee 1). We now wrote in the text that this is arbitrarily chosen and why we take these values. We wrote: ". Although the limits of the rectangle are arbitrarily chosen, they assure that the probability of reaching cold ice at the bed is sufficiently high."

p.2865 Mostly in the paper all symbols in the equations are well elucidated in the text, but I don't find here an explanation for vH nor z'. One can of course source these from Pattyn (2010) but still, in an otherwise standalone work, for completeness these would best be written out here too.
V_H is defined in the text as being (v_x, v_y). z' has been changed in zeta now (see referee 1), but the accent is added as part of the integration.

Throughout the manuscript including in the reference list, Purucker (2013) should be spelt with 'ck' and Fox Maule should not be hyphenated, i.e. Fox Maule NOT Fox-Maule.
This has been corrected

p.2870 We are promised a discussion on the choice of sigma values but I didn't actually then come across this. Can this be more explicitly included? Do these choices affect the similarities in results between the two different models?
We removed the remark between brackets and immediately discussed the choice of these values: "A σ-value of 0 means that no correction is carried out. Larger spans describe potential influence areas, and give a wider range than those explored in \citet{pattyyn10}." The choice only adds more uncertainty to the GHF database. In any case, this does not lead to any similarity between both model approaches. It is a way to include additional uncertainty.

p.2875, lines 12-16. The presentation of these data as a supplement or in an appropriate repository will certainly be a major addition to the paper as well as a very useful resource for the community. As a statement to appear in the CP paper on its publication, however, this sentence needs to be revisited in the light of what the authors can make available at the time of publication, i.e. don't publish the final manuscript saying these "will be" available – publish saying what is available already.
The data will be put online. The 'will be' has been removed and changed into 'has been'.

Overall I congratulate the authors for a clearly written and useful paper.
Please also note the supplement to this comment:
http://www.clim-past-discuss.net/9/C1421/2013/cpd-9-C1421-2013-supplement.pdf

We take into account all comments of the supplement:

pg. 2860
- **ln, 2 done**
- **ln, 7 done**
- **ln, 11 done**
- **ln, 22 done**
- **ln, 25 done**
- **ln, 26 done**

pg. 2861
- **ln, 1 done**
- **ln, 5 done**
- **ln, 9 done**
- **ln, 12 we add a hyphen for all "ice-core" words when are used together so often they are thought of a single word**
- **ln, 16 done**
- **ln, 18 we rewrote "ice sheet" with capital letters where Ice Sheet is used as a proper noun i.e. Greenland Ice Sheet, Antarctic Ice Sheet**
- **ln, 19 done**
- **ln, 21 see previous (ln, 18)**
- **ln, 23 done**

pg. 2862
- **ln, 1 done**

ln, 10 ok removed

pg. 2863

ln, 2 we add units of Gmin

pg. 2864

ln, 3 done, done

ln, 6 we rewrote the sentence : "where horizontal advection is absent or negligible", and removed brackets

ln, 12 we changed "hence" by "i.e.,"

ln, 16 done

ln, 17 done

ln, 24 added

pg. 2865

ln, 3 done

ln, 10 done

ln, 20-24 We rewrote the paragraph from ln, 17 to ln, 24 by : "Their values of GHF are in the same range as Shapiro (2004), but the spatial patterns are markedly different, and the G2 values are considerably higher in many regions. The third dataset G3 represents a recent update of G2 derived by Purucker (2013). This uses low-resolution magnetic observations acquired by the CHAMP satellite between 2000 and 2010, and produced from the MF-6 model following the same technique as described in Fox Maule et al. (2005)."

pg. 2866

ln, 10 done

ln, 12 done

ln, 20 done

ln, 24 rewrote: "The thickest ice, as expected, corresponds"

ln, 26-27 change in: " These restrictions (combined with the ice-flow speed limit and minimum ice thickness) mean that only a very few areas in the central part of the Antarctic Ice Sheet can be considered likely to host cold-bed conditions."

pg. 2867

ln, 1 see previous comment

ln, 2 done

ln, 8 done and we added the sentence: "This is corroborated, in reality, by the abundance of subglacial lakes around Dome Concordia." as suggested

pg. 2868

ln, 10 done

ln, 13 done

ln, 14 done

pg. 2870

ln, 2 done

ln, 6 see comment pg. 2861 ln, 12

ln, 20 changed

ln, 24 done

pg. 2871

ln, 8 changed in "**An initial inventory contained 145"**

ln, 10 rewrote as suggested

ln, 12 done

ln, 14 changed

ln, 15 rewrote

ln, 21 done

pg. 2872

ln, 23 we added the hyphen and also in the whole text when are used together so often they are thought of a single word

pg. 2873

ln, 12 done

ln, 14 ok

ln, 15 ok

ln, 22 coma removed

pg. 2874

ln, 9 done

ln, 27 done

pg. 2875

ln, 2 done

ln, 7 done

ln, 9 done

ln, 12-16

pg. 2879

ln, 17 we changed "Puruker" in "Purucker" and also in the whole text

pg. 2882

the caption is now: "of the GHF datasets. The magenta triangles are the major drill sites"

pg. 2883

caption: done (3)

pg. 2885

caption: rewrote as : "Top: Mean basal temperature according to the ensemble of 15 experiments (see text for more details), corrected for the dependence on pressure. The color scale is truncated at -10°C. Bottom: Root Mean Square Error (RMSE, °C) according to the same ensemble."

pg. 2886

caption: done (2)

pg. 2887

caption: done (2)