

## ***Interactive comment on “Interhemispheric coupling and warm Antarctic interglacials” by P. B. Holden et al.***

**Anonymous Referee #1**

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This paper by Holden and co-authors is presenting new and very interesting modelling results using an intermediate complexity model GENIE-1. Through three types of model simulations (two transient 800 kyr simulations, three ensemble of GENIE-1 transient simulations over TII and three equilibrium simulations with a GCM, HadCM3, at 130 kyr) the authors try to reconcile the lacking of evidence of warmer than present Antarctic temperatures in GCM simulations during the last interglacial. Temperature reconstructions from Antarctic ice core records (Dome C as well as Dome F) are indeed showing short intervals of warmer than present temperatures at the beginning of the present and past three interglacial periods. However, the slowdown of the Atlantic Meridional Overturning Circulation in response to a meltwater forcing during terminations is not able to explain all the range of Antarctic warming without an additional albedo feedback resulting from a retreat of the West Antarctic Ice Sheet (WAIS). The

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article is well written, accurate and understandable also from researchers not specialized in the field of modelling. The subject is appropriate for publication in *Climate of the Past*. I recommend that the article be published with only some minor revisions, listed below.

I have one concern regarding the implication of a removal of WAIS: in fact this would allow a freshwater release in the high latitude southern ocean expected to shut down convection, reduce southward heat transport, increase sea ice cover and associated albedo feedbacks and therefore cause high latitude southern ocean cooling (Weaver et al., 2003 *Science*; Swingedouw et al., 2009). How these ocean circulation changes, possibly associated to an Antarctic freshwater release, would be reconciled with the modelling results reported in this paper? There is something about this at page 2560 (from line 16 to 18) but . . . .

Moreover, something should be added about other type of evidence about early interglacial optima, like in the Southern Ocean records or at low latitudes. . . .

In the following there are some minor science and technical comments:

Page 2557, line 26: the reference Masson- Delmotte et al., 2009 is now 2010. Please, change here, at page 2558 (line 8) and in the Reference list.

Page 2558 (line 12): what do you mean that global radiative forcing is similar to modern? There are differences between the Holocene and MIS5.5 orbital configurations: eccentricity is much stronger during last interglacial (enhancing the impact of precession) and the phase between precession and obliquity is different.

Page 2560, line 20: FFX . . . . please, specify what it is . . . . freshwater flux?

Page 2561, line 14: LPC . . . . please, specify what it is.

Page 2563, line 4: modelled SST, specify in which grid cell.

Page 2563, line 18: are the Dome F temperature reported here (from Kawamura et al.,

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2007) corrected for moisture source temperatures (through deuterium excess) or not?

Page 2563, 22-23: the temperature reconstructions, at least, at 317 ky BP are quite similar at Dome F and Dome C.

Page 2564, line 4: .... Spikes in Dome F temperatures ..... yes but also at Dome C.

Page 2564, line 25: EMBM .... please, specify what it is.

Page 2565, line 19-21: "These simulations. .... peaking in the vicinity of Dome F....". This sentence is not clear in my opinion and looking at the figure does not help. Please, explain better.

Page 2565, line 22-23: "... during the three...." I would say "the two".... see comment above.

Page 2566, sentence from line 7 to 13: I have some problems with this sentence. ... Is the word "earlier" here meaning older in time?

Page 2574, Figure 2 caption: specify better that the pink, blue and brown lines in fig e) are Antarctic SAT.

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Interactive comment on Clim. Past Discuss., 5, 2555, 2009.