

## ***Interactive comment on “A comparison of the present and last interglacial periods in six Antarctic ice cores” by V. Masson-Delmotte et al.***

**B. Vinther (Referee)**

bo@gfy.ku.dk

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Review of A comparison of the present and last interglacial periods in six Antarctic ice cores

Summary: This paper presents a thorough review and analysis of the present and the last interglacial as seen in the water stable isotope records of 6 Antarctic deep ice cores. For 5 of the ice core records it is even possible to place the records on the same time scale and make a comparison of the water stable isotope evolution through the two interglacials. Common signals are extracted from the 5 records using principal component analysis and deviations from these common signals are calculated for the records. It is intriguing news that these deviations tend to show similar evolutions for the two interglacials. An exhaustive discussion of the different possible causes for the

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inter-core differences is given, covering the most likely scenarios that could yield the observed signals (i.e. changes in precipitation source area, transport and seasonality – and glaciological effects such as upstream conditions in areas of ice flow and past changes of ice sheet elevation).

This paper is in my opinion an excellent and essential review of the East Antarctic water stable isotope records from the present and last interglacial advancing the interpretation of these records significantly. My only major point of criticism is that the glaciological effects – while discussed in the main body of the paper – are completely left out of the conclusion. I think that the fact that glaciological effects could explain most of the inter-core differences for the two interglacials deserves to be mentioned; especially in the light of recent high-profile studies (e.g. Sime et al. 2009a,b) trying to interpret such differences in terms of changes in the relationship between local temperature and water stables isotopes.

Corrections, suggestions and questions:

Page 2269, line 16: “during glacial” should be “during the glacial”

Page 2270, line 6: “at high” should be “in high”

Page 2270, lines 7-8: “Change in ice core isotopic composition are affected by changes in climate and water cycle” does not read well. I think “Ice core isotopic composition is affected by climatic change and changes in the water cycle” is better.

Page 2270, line 29: Some times “Vostok” is shortened to “VK”, but this is not mentioned here?

Page 2271, line 18: “from ice core” should be “from the ice core”

Page 2271, line 19: “between ice core” should be “between the ice core”

Page 2272, line 9: “in precession” should be “in the precession”

Page 2272: lines 25-26: Later the short “GICC05” is used (i.e. on page 2290, line 7)

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for the Greenland time scale, so introduce this name here and include a reference to Rasmussen et al. 2006 where GICC05 was formally introduced.

Page 2273, line 2: "In EPICA" should be "In the EPICA"

Page 2273, line 9: "about 600 years" should be "500-600 years"

Page 2276, lines 12-13: "However, not in all cases the humidity" should be "However, it was not in all cases that the humidity"

Page 2277, line 3: I'm unsure of what is meant here with respect to DF and VK temperatures. Are all years less than 2 deg C different, such that temperatures are highly correlated?

Page 2277, line 23: "discussed in Sect. 2.1" should be "discussed in their Sect. 2.1"

Page 2277, line 28: Which "drilling site" are we now talking about?

Page 2278, line 16: "due the" should be "due to the"

Page 2280, line 6: "on the period" should be "for the period".

Page 2280, lines 9-11: As stated later, the sea ice cover can influence the location of the moisture source. Have you tried to do the calculations for the months of minimum (JFM) and maximum (ASO) sea ice cover instead of JJA and DJF?

Page 2280, line 20: Would be good if the statement on the expectations for VK excess could be elaborated – i.e. aren't there other important factors for excess than source locations?

Page 2281, line 22: "Antarctic Isotope" should be "the Antarctic Isotope"

Page 2282, line 26: "They allow to" should be "They allow us to"

Page 2284, line 21: "near Dome F area" should be "near the Dome F area"

Page 2284, line 28: "they do not" should be "they did not"

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Page 2285, lines 9-10: This sentence does not read well – please reword this.

Page 2285, lines 14-15 "thining. These assumptions only hold true if the" should simply be "thinning, if the"

Page 2285, line 19: "downward the" should be "downward towards the"

Page 2285, line 20: "upstream effects" should be expanded to "upstream effects to be applied to these ice core records"

Page 2285, line 23: "lies" should be "relies"

Page 2286, line 1: "twice higher than the" should be "twice as high as the"

Page 2286, line 4: "of" should be "and"

Page 2286, line 5: "(Fig. 6b)" should be "(their Fig. 6b)"

Page 2286, line 6: "accumulation changes" should be "accumulation rates"

Page 2286, line 18: "difficult to be realistically simulated by" should be "difficult to simulate with"

Page 2287, line 24: "reach" should be "resolve"

Page 2288-2290: General comment: Instead of writing that "data are available on a ~0.15m step" then write "data are available in ~0.15m resolution". This term "step" is used many times on these 3 pages where "resolution" would be better.

Page 2288, lines 3-4 and line 9: This walk-through of the Vostok cores is confusing – is BH8 both a shallow core and a deep core? And what does 3G refer to? Please clarify.

Page 2289, line 8: The B32 core span the period from A.D. 167 to A.D. 1997, i.e. it does not contain any B.C. ice.

Page 2290, line 2-4: This is not clear; please clarify what is the problem with the TD age scale?

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Page 2290, line 4: “to Vostok” should be “to the Vostok”

Page 2290, lines 18-19: “Here, we use for the last interglacial a” should be “For the last interglacial we use a”

Page 2290, line 26: “now” should be “therefore”.

Page 2291, lines 8-9: “the Holocene records lies on” should be “the Antarctic Holocene records relies on”

Page 2291, line 11: What are these “cosmogenic isotope variations” used for? Please elaborate.

Page 2291, line 20: “on EDC3” should be “on the EDC3”

Page 2291, line 21 and line 22 “lies”, should be “relies”

Page 2292, line 22: “near” should be “from”

Page 2293, lines 5-6: Move “however” in front of the sentence, i.e. “However, glaciological”

Page 2293, line 8: “on stable” should be “on the stable”

Page 2293, line 9: “a” should be “an”

Page 2293, line 13: “simulated EDML” should be “simulated the EDML”

Page 2293, lines 14-15: “of surface” should be “of the surface”

Page 2294, line 2: “A sub product of . . . glaciological model” should be reduced to “A sub product of the 1-D glaciological modeling”

Page 2296, line 1: “in local” should be “in the local”

Page 2298, lines 22-24: This sentence does not read well, please reword.

Page 2299, line 15: “an” should be “a”

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Page 2301, lines 3-4: “in modern should be “in the modern”

Page 2301, line 4: “source” should be “sources”

Page 2303, line 27: “EOF” should be “EOFs”

Page 2304, line 25-28: Is the uncertainty on the EDC3 age scale sufficiently small to rule this possibility out? Please elaborate on how big the EDC3 age scale uncertainty is during the last interglacial.

Page 2305, line 14: “and progressively reduced” should be “which progressively declined”

Page 2306, line 20: Add a reference to Vinther et al. 2009 after the word “changes”

Page 2306, line 21: “on past temperature changes” should be expanded to “on past temperature and elevation change”

Page 2306-2309: General comment on the conclusion: As I stated in the summary, I’m puzzled that the conclusion does not mention glaciological effects at all. Given the  $\delta^{18}\text{O}$  to elevation slope of 1‰/100m stated in section 5.4 and the residuals shown in figure 7, it is clear that most of the residuals can be explained by 100-150m of elevation change at the various East Antarctic drill sites. While it is not possible to prove that such elevation change did happen, I think that this possibility should be stated clearly in the conclusion.

Page 2306, line 23: “these” should be “six”

Page 2307, line 13: The EDML record is quite similar to the PC1 during the two interglacials, so is it really correct to define EDML as a “coastal” site? TALDICE and PC1 are much more dissimilar. . .

Page 2308, line 24: “constraint” should be “constrain”

Table 1: What is the unit for Acc.? Please add this info to the table.

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Table 2: Here the present interglacial is defined as 0-12.1 kyr, but on page 2273, line 8 it is defined as 0-12.2 kyr!

Figure 2c: Is there any explanation, that the scatter in values is so big between neighboring grid-points?

Figure 5: The legend does not explain the meaning of the dashed curves.

Figure 7: The reference to figure 5 should in fact be to figure 6.

Reference: Rasmussen, S. O., et al. (2006), A new Greenland ice core chronology for the last glacial termination, *J. Geophys. Res.*, 111, D06102, doi:10.1029/2005JD006079.

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