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Climate of the Past Discussions



# *Interactive comment on* "Using beryllium-10 to test the validity of past accumulation rate reconstruction from water isotope records in East Antarctic ice cores" *by* A. Cauquoin et al.

**Anonymous Referee #3**

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Cauquoin et al. compare different reconstructions of past accumulation rates for the EDC ice core site for the period from 260 to 355 yr BP (one glacial-interglacial cycle). The new aspect is the assessment of 10Be concentrations measured in the EDC ice core for this purpose.

As already commented by F. Parrenin the whole 10Be discussion relies on the assumption of dry deposition being the determining (and only) process for 10Be deposition. This can be questioned considering that the reconstructed accumulation rate changes by a factor of 3 over a glacial-interglacial cycle i.e. making it likely that the deposition processes could also change. I think this possible problem needs to be discussed in much more detail. This uncertainty also implies that the 10Be approach is not a strict

"test" for the validity of other reconstructions (as implied by the title). It is rather very useful additional information that can support or question other approaches. I think this has to be reflected in the title.

A remark that should also be included: There is a similar 10Be concentration – accumulation rate relationship observed in the Central Greenland ice cores even thought the accumulation rates are much higher (e.g. Wagner et al., 2001). It is unlikely that Central Greenland is dominated by dry deposition leading to this relationship. It can also be explained with an atmospheric "wash out" process that leads to a 10Be depletion with higher accumulation rates (rather strengthening the argumentation by Cauquoin et al.).

I think it is necessary to explain the details of the underlying assumptions for the geomagnetic field correction. Is it assumed that the 10Be record reflects the globally averaged 10Be production rates? Is a "polar bias" assumed? Are the records normalised before the geomagnetic field correction (i.e. only relative changes considered).

In spite of these uncertainties, I think the approach by Cauquoin et al. is interesting. Varying the dD-accumulation rate relationship according to formula 5 to minimise the residual 10Be flux variance is an interesting approach and could indeed provide useful information on the dD/accumulation rate relationship (again assuming that dry deposition is the only process for 10Be deposition). However, this approach needs to be explained (how has it been done).

The constant flux approach is more simplistic but still interesting. However, I was wondering if this approach does include a geomagnetic field intensity correction (which it probably does as it seems). Nevertheless, this needs to be more clear since "strictly constant 10Be flux" could easily be misunderstood.

I was also wondering if LGM/Holocene climate can be compared to MIS-10/MIS-9 climate. This is implied in the model-data comparison. A key sentence in this context is: "Still the accumulation rate vs. temperature slope reconstructed from water iso-



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topes in ice core is the same for the transition between MIS 10 and MIS 9 and the last deglaciation". This sentence needs more explanation or at least a reference.

I am not an expert in the field but I was wondering why NGRIP is at all relevant in this discussion ("The other background scenarios for the 4 other ice cores (NorthGRIP, EDML, Taldice, Vostok) are kept identical as those of AICC2012 (Bazin et al., 2013; Veres et al., 2013)"). NGRIP does not go back to MIS9/10.

Figure 3: Since ice cores do not directly provide past temperatures it would be helpful to repeat where the temperature estimates for EDC come from (reference to formula 3 I guess). I think linking back to the formulas (1-5) in the text (where appropriate) would be very helpful (e.g. instead of only describing in words).

References:

Wagner, G., Laj, C., Beer, J., Kissel, C., Muscheler, R., Masarik, J., and Synal, H.-A., 2001, Reconstruction of the paleoaccumulation rate of central Greenland during the last 75 kyr using the cosmogenic radionuclides 36Cl and 10Be and geomagnetic field intensity data: Earth Planet. Sc. Lett., v. 193, p. 515-521.

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Interactive comment on Clim. Past Discuss., 10, 3421, 2014.