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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Modeling cosmogenic radionuclides ^{10}Be and ^{7}Be during the Maunder Minimum using the ECHAM5-HAM General Circulation Model" *by* U. Heikkilä et al.

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Anonymous Referee 2

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In this paper, the authors investigated the major factors influencing the concentrations of cosmogenic radionuclides (10Be and 7Be) measured in ice cores, by comparing 10Be and 7Be concentrations and deposition fluxes during Maunder Minimum (MM) and Present Day (PD) modeled with the ECHAM5-HAM GCM.

The authors showed that the 32increase in the mean global production rate of 10Be during MM leads to about 32and the zonally averaged 10Be deposition change deviates locally (due to changes in precipitation rate and transport) only by around 8authors conclude that the climate changes do influence the 10Be deposition fluxes but not enough to disturb the production signal significantly, and thus the common method to reconstruct the solar activity from the 10Be measured in ice core is reasonable. This paper is well written and the scientific questions addressed are within the scope of ACP. I recommend the publication of the paper in ACP after the following comments are addressed.

1. Table 1 gives 10Be and 7Be global averages in MM and PD and change. Fig. 7 shows the 10Be deposition fluxes and change at different latitude. I would suggest that authors present a figure showing the zonally averaged vertical distribution of mean 10Be production change (in percentage) between MM and PD. The latitude and altitude distributions of mean 10Be production change will provide useful information about the maximum and minimum regions of the change that will help the readers to better understand the deposition flux change at different latitude and also the discussion with regard to stratosphere-troposphere exchange.

We included the suggested figure in the manuscript.

2. Field et al. (J. Geophys. Res., 111, D15107, 2006) studied production and climaterelated impacts on 10Be concentration in ice cores using the Goddard Institute for Space Studies ModelE GCM. Field et al. found significant latitudinal differences in the response of 10Be fluxes to 10Be production changes. They also showed significant climate-related 10Be concentration variation in both Greenland and Antarctica, which appears to be different from one conclusion of this paper (i.e., small climate-induced changes especially in polar regions). The author briefly mentioned the work of Field et al. in the Introduction. I think that the results of Field et al. should be discussed in more detail. Specifically, the

ACPD

7, S9405–S9407, 2008

Interactive Comment

authors should discuss both the consistency and difference between Field et al.8217;results and their own findings.

Unfortunately it is not possible to compare our results in detail with previous results by Field et al. [2006] because their experiments were different in character from our Maunder Minimum experiment. They separated the different factors which affect the polar Be-10 fluxes (modulation of the production of Be-10 and different climatic effects) to assess their relative contributions to the deposition changes. Our goal was to change both the Be-10 production and the climate to identify the dominant component. Unfortunately these results do not allow a direct comparison in magnitude with experiments where only the Be-10 production or climate is changed.

Nevertheless, we now included a more detailed comparison in the manuscript. Field et al, [2006] conclude that "Be-10 response to climate should not be neglected when inferring production changes" and "Interpreting the Be-10 record without accounting for possible climate-related changes carries the risk of inferring the existence of solar changes that are larger than those which actually occurred". We would like to stress that they do not state that the climatic effects would distort the production signal. Unfortunately this misinterpretation has been used as an argument against the use of Be-10 for solar activity reconstructions [i.e. Foukal et al, Nature 443, 2006]. The conclusion of Field et al. [2006] that climatic effects do have an influence on the Be-10 fluxes is in good agreement with our results. Our intent was to go a step further and and to quantify these climatic effects.

Interactive comment on Atmos. Chem. Phys. Discuss., 7, 15341, 2007.

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7, S9405–S9407, 2008