

## ***Interactive comment on “ $^{10}\text{Be}$ in late deglacial climate simulated by ECHAM5-HAM – Part 2: Isolating the solar signal from $^{10}\text{Be}$ deposition” by U. Heikkilä et al.***

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Received and published: 4 December 2013

The manuscript presents a study of the climatic variability on deposition of  $^{10}\text{Be}$  in polar ice. The authors compare the results for runs corresponding to a deglaciation period with those for a control pre-industrial run. In particular the authors are interested in the level of 11-yr production signal potentially observable in the  $^{10}\text{Be}$  data. This is interesting enough to warrant publication in CP. However, the approach suffers from an important issue – lack of comparison with real data (see below). Accordingly, both reliability and the level of realism of the model need to be demonstrated before the paper can be recommended for publication.

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### General comments:

1. The authors analyze data simulated by their model. However, the issue of how well the simulated data represents real measurements is not addressed. In fact, what studied is propagation of the 11-yr signal throughout the authors' climate model. First, the authors need to show (or at least briefly discuss with references to more detailed papers) that the model is able to reproduce the observed variability of real beryllium data at this timescale, as made e.g. by Usoskin et al. (JGR, 2009). I do know that the authors have something to show here and that their model is quite reliable in this sense, but this should be done explicitly, for the benefit of a reader. Without showing that the model does reproduce  $^{10}\text{Be}$  variability at inter-annual time scale, the study does not make sense.
2. Even though this is a Part 2 paper, the authors need to describe (at least briefly) the details of the model and  $^{10}\text{Be}$  production.
3. The authors focus on the 11-yr solar cycle for the period of 12 kyr ago. Sufficient time resolution of  $^{10}\text{Be}$  data is not yet available for that period. Typically, only 10-yr, 22-yr or 50-yr averaged solar activity is reconstructed from cosmogenic isotopes, without pretending for resolving individual cycles (see works by Steinhilber, Beer, McCracken, Usoskin, Solanki, Muscheler, etc.).
4. How is natural quasi-decadal variability of the climate accounted for? How much it is known for the deglaciation?

### Specific comments:

1. Page 5629, line 5. A reference to a broad review is recommended here, e.g., a book by Beer et al. (2012) or a review by Usoskin (LRSP, 2013) rather than specific papers.

C2795

2. Page 5630, line 15. An idea that cosmogenic nuclide variability can be separated in the frequency domain into high-frequency solar and low-frequency geomagnetic components was proven invalid (see., e.g., Snowball Muscheler, 2007; Usoskin, 2013). There are low-f variations of solar activity and high-f of the geomagnetic field.
3. Page 5630, line 18. reference to Hathaway (LRSP, 2010) would be more appropriate here than Richardson et al. The cycle length varies not as  $11 \pm 1$  yr but between 8-9 and 13-14 years (or even up to 16 yrs during Grand minima if we trust the results of Miyahara et al.).
4. The model used for  $^{10}\text{Be}$  production is unclear. The production curve must be shown and fully explained. I was unable to find details of the production neither here nor in Paper 1, nor even in a paper referred to in Paper 1. The authors refer to  $^{14}\text{C}$  reconstruction (page 5631, line 26) concerning the production during the last deglaciation, but  $^{14}\text{C}$ -based reconstructions are not available outside the Holocene. In the next line it is said that the modern 11-yr cycle is added ON TOP of that. This sounds inconsistent. The 11-yr cycle should be added not on top of the mean production but around the mean. Is it what is meant? Moreover, it is unclear why modern cycles are added to some reconstructed level. Why cannot the authors use just the modern production?
5. In Figures 2 through 10, visual gaps are needed between the runs to guide the eye that the sub-panels represent different periods of time. Presently it looks like a continuous curve. The time scale should be shown in the X-axis. Presently it's totally unclear for a reader what is the time span of the panels.

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Interactive comment on Clim. Past Discuss., 9, 5627, 2013.