Interactive comment on "Synchronization of ice core records via atmospheric gases" by T. Blunier et al.

T. Blunier et al.

Specific comments:
1) In assigning ages to GRIP from NGRIP the GRIP delta age is preserved. GRIP delta age must depend on a model or calculation of GRIP accumulation rate. Does the new NGRIP time scale for GRIP change GRIP accumulation rate enough to also change GRIP delta age?

To calculate original GRIP Δage the same densification model was used that we use now. At most times before 20 kyr BP the accumulation rate for GRIP has to be changed within 10% to obtain the NGRIP age. This would lead to about 100yr shift in Δage. However, rapid changes of CH4 and Greenland temperature are in phase applying the original Δage (Schwander et al., 1997). Without new data on either accumulation rate or timing of CH4 versus Greenland temperature there is no need to recalculate Δage.

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2) The method of putting GRIP methane on the NGRIP time scale makes sense for the most part. It is not clear, however, if it is any different than using the Rasmussen match points to re-date the GRIP core ice age scale on the NGRIP time scale, then applying the original GRIP delta age to get an "NGRIP-based" time scale for the GRIP methane data. If not, this would seem a clearer way to explain what is done.

The explanation in the manuscript was probably a little technical. What it comes down to is applying the Rasmussen match to the GRIP gas age. We reformulated this section for clarity.

3) The other reviewer brought up good points about the potential limitations of the densification modeling and I think that these should be addressed.

See response to reviewer 2

4) Although it is good to see the uncertainty in delta age dealt with quantitatively, propagated through the synchronization, I suggest that the authors spend more time discussing the values they choose for the uncertainties in temperature and accumulation that go in to their estimate of delta age uncertainty.

Estimating uncertainties of temperature and accumulation rate is difficult. On long time scales ice flow and moisture transport models are in agreement with the ice core time scale. How big the uncertainty on a shorter time scale, important for the close off, is difficult to say. We give the uncertainty at 25% so that if such an estimate becomes available one can scale the uncertainty.

5) Three different ways of comparing NGRIP and DML are discussed and the authors maintain that all three approaches give the same result. I suggest that this statement be supported with some quantitative evaluation of the differences between the approaches.

The solutions are within the uncertainties of the synchronizations. The important thing here is that there is no indication of a systematic bias. A further statistical evaluation of

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the different methods seems not appropriate to us.

Technical corrections 1) The paper is fairly clearly written, though English usage is a bit awkward in places. Some additional editing with that in mind would be useful.

We did our best to improve our use of the English language.

2) The reference to Shackleton et al on page 366 seems out of place since that paper was trying to absolutely date an ice core record via correlation and the next sentence says that this can not be done.

We deleted the introductory paragraph on efforts to absolute dating of ice cores.

3) How big are the uncertainties in the synchronization? I did not see that reported.

The numbers at the rapid temperature increases are given in Figure 3. We added a reference in the text.

4) It is stated that the impact of a 25% accumulation rate on delta age is the same as a 2% temperature change, but this statement does not have a context. Why is this particular statement important?

Δage depends equally on accumulation rate and temperature. The statement simply illustrates what effect those uncertainties have.

5) On page 369, "fitting" the model time scale ss09sea to the counted time scale is mentioned. What does the "fitting" refer to? Is the counted scale GICC05? Is it counted below 41 kyr? I believe this information is in other papers, but should be repeated here for the reader.

We clarified

6) On page 373, the statement that methane and Greenland temperature variations are similar is true for timing, but note necessarily for amplitude.

On that same page we state that "Although the two signals are very similar there are

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differences in the structure of the temperature and the CH4 records."

7) Is it possible to plot the 10Be records to show how well they match for NGRIP vs. EDML?

To our knowledge 10Be has not been measured in EDML yet. The location of the peak is given by it's location in the EDC core transferred to the EDML core via the volcanic match.

Interactive comment on Clim. Past Discuss., 3, 365, 2007.

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