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Climate of the Past Discussions

Interactive comment on "The EDC3 chronology for the EPICA Dome C ice core" *by* F. Parrenin et al.

Anonymous Referee #2

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This is an important, well-thought-out and well-written paper that provides a comprehensive analysis of time-scale constraints at EDC3 in Antarctica. It relies on a sensible stepwise approach: initially modeling ice accumulation and flow, and then pattern-matching comparisons against independently dated levels, and finally revisions by a form of tuning. The authors admit to possible imperfections in this time scale based on uncertainties in several factor, including: the use of air content as a tuning parameter, changing differences in gas/solid ages within and between ice cores, and the assumption that 18Oatm has had a fixed phase versus insolation forcing.

A major contribution of this paper is clear evidence of the much greater role of anomalous ice flow during some intervals than the larger science community has previously realized. Major problems are obvious below 400K in EDC3, especially the exaggerated thickness of marine isotope stage 13, while more subtle problems are now evident in isotopic substages 5.4, 5.5, and late in stage 6. For continuity with the past, the au-

thors should comment on whether or not the new ages for this interval help to resolve part of the age-old debate (Lorius and colleagues versus SPECMAP) about dating this interval. The marine-based estimates have been revised because of improved dating of coral-reef high stands. These changes have reduced but not eliminated the marine/ice-core differences, but have they been eliminated?

The only confusing part of the paper is the comparison with the Lisiecki-Raymo marine O18 time scale in figure 3. The authors compare the estimated ages of the EDC3 deuterium record (an 'early-responding' parameter) against the marine O18 record in the Lisiecke-Raymo stack (O18 is a late responder because it is dominated by ice volume). In an apparent (?) attempt to adjust for this difference, the authors shift the marine O18 time scale 2500 years back in time, yet the adjusted O18 time scale in figure 3 remains younger by $\sim$4000 years. The likely reason for this persistent offset is that the actual lag of northern ice volume relative to June 21 insolation at the tilt and precession periods is more like 6000 years. The average offset of $\sim$4000 years shown in Figure 3 probably reflects the fact that the authors of this paper have fully removed the ice-volume lag. [Also, in this regard, the text on p. 590 says the age difference between the two signals is -2.5K to +1.5K, but Figure 3 shows a range of -6K to 0K].

Lesser matters:

Abstract and intro: I would avoid calling this time scale the 'offical' EDC chronology. This is the newest chronology arrived at by the EDC group, but the term 'official' seems to foreclose future efforts, either by EDC or others.

p. 583: The 4200 year age for the middle of the two 10Be peaks near the Laschamp event is not correct.

p. 590, line 2: the word should be 'shortened'.

Finally, I cannot help noting that this new time scale shows that the warm part of stage 11 (as defined by the deuterium signal) had come to an end by $\sim$398K, the time of

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the insolation minimum that provides the closest stage 11 analog to the present-day insolation minimum. This new EDC3 time scale supports my hypothesis that a major cooling would have been underway for the last several thousand years, had it not been for early greenhouse gas emissions by farmers.

Interactive comment on Clim. Past Discuss., 3, 575, 2007.