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Climate of the Past Discussions

Interactive comment on "Differences between the glacial cycles of Antarctic temperature and greenhouse gases" *by* A. W. Omta

Anonymous Referee #1

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The paper presents a number of thoughts regarding a few characteristics of Antarctic temperature and greenhouse gas concentrations from the EPICA Dome C record which are available from public data centers. An argument is made that the temperature is a linear combination of the CO2 record and obliquity, and some preliminary and only qualitative conclusions are drawn.

Major comments:

1) It is not clear what the purpose of this paper is. The analysis that is presented in this paper on this single paleoclimate archive are preliminary at best. All conclusions base on spectral analyses from one core location, some correlation calculations and many qualitative statements throughout the paper. There is very little scientific content, and it seems that the author has invested a minimum amount of time into the statistical

analysis or the corroboration of findings using different methods.

2) After reading the paper several times, I am left with the impression that this would rather qualify for an average term paper written after an introductory course on ice age cycles. Unfortunately, I do not see any new or original insight that would deserve publication in Climate of the Past. The "decomposition" of the temperature signal into various components (obliquity, CO2, residual) is not done in any quantitative way as far as I can tell from the description.

3) The author presents a number of thoughts which seem to me rather obvious and would not lead to a new way to consider glacial-interglacial cycles. This would be rather surprising given that only one location is analysed, and given the rather little effort spent in this analysis. Incidentally, I should stress that the "100,000-year problem" does belong to one of the grand challenges in paleoclimate dynamics. But I am convinced that in order to advance knowledge regarding the mechanisms involved in glacial-interglacial cycles one needs to take a global view and hence include information from marine sediment cores covering the same time window.

More specific comments:

4) p 989, line 8-10: this has been long known and is an obvious statement.

5) p 990, line 10: "structural differences" sounds good but is not defined what this means here. Does the author mean more than just spectral analyses and correlations?

6) p 991, para starting line 12: "pattern similarity" suggests a deeper analysis than just calculating correlations of time series.

7) p. 992, lines 3-8: this seems a poor man's analysis and does not yield an estimate of uncertainty or a quantification of the variance explained by the different contributions.

8) p. 992, line 18: it has been shown by many studies that the deuterium record of inland Antarctic ice cores registers more than just local temperature and is often representative of an over-regional signal. In particular, the combination of dD and

d18O in the form of d-excess provides information about the climatic conditions in the source areas of Antarctic precipitation.

9) p 992, lines 21 ff: the discussion here shows gaps in the knowledge of the methane cycle. In particular, many studies on the interpolar difference of CH4 concentrations, and hence different source locations, are not even mentioned.

10) p 993, line 1-14: These are entirely qualitative considerations with no quantitative basis.

11) p 993, line 15-22: this is a dead alley that does not even have to be mentioned.

12) p 994, line 1-2: this is not the only possibility. It is much more likely that one quantity may react to the 100 kyr cycle and the other simply responds to the changes in the first but not directly to the 100 kyr cycle. Obviously there is the alternative view that there is no 100 kyr cycle at all.

13) p 994, line 23: what does "autonomous" mean here? If this not elaborated, e.g. mentioning a specific feedback cycle leading to self-sustained oscillations, this statement seems of little use.

14) p 995, line 11-12: there is a confusion here. 7000 years is the maximum absolute ice age-gas age difference. The *uncertainty* in this estimate is relevant here, not the absolute value.

15) p 995, line 15 ff: it seems that the understanding of the isotope thermometer is limited. It registers only rapid temperature changes and hence is a powerful method in Greenland ice cores when abrupt climate changes are being quantified. However, the use of d15N and d40Ar is limited in Antarctic ice cores where (i), the temperature variations are generally slower and, (ii), the firn column, due the low accumulation, contains gas covering a longer period.

16) p 995, lines 20ff: this discussion is rather superficial and in my view not correct. Many studies have demonstrated that without the changes in GHG radiative forcing,

glacial cycles would not have the amplitude they exhibit.

Recommendation:

Due to the serious lack of scientific content and the absence of quantitative analysis, I recommend that this paper be rejected. Unfortunately, I do not see a straightforward way for the salvation of this material, and therefore I do not suggest "major revisions". The material could be the starting point of either a series of model simulations (which would provide some quantitative underpinning of the claims made), or a much more extended analysis of a variety of high-quality paleoclimate records going far beyond the three records from one location.

Interactive comment on Clim. Past Discuss., 8, 987, 2012.