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Climate of the Past Discussions

Interactive comment on "The calcium-dust relationship in high-resolution data from Dome C, Antarctica" *by* F. Lambert et al.

Anonymous Referee #2

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The authors compare three species used as dust proxies (insoluble dust particles, Ca2+ and nssCa2+), measured in high resolution along the EPICA Dome C ice core, and evaluate their level of correlation over the past 800 kyr. The ms is in need of improvement - the data have been previously published (Lambert et al, Nature v.452, 2008) so the ms relies on its interpretation for novelty, and the interpretation is far from exhaustive. The ms is reasonably well written but there are some areas where the argumentation can be made clearer, more appropriate reference can be made to previous studies, and the author can attempt to provide a more far-reaching interpretation of the data, appropriate to a "discussion" forum.

Specific comments:

Affiliation 4: British not Britisch.

p.1117, line 20 - This paragraph describes the possible influence of sample acidity on Ca concentrations, but the argument seems to be confused between the acidity in the melted sample and the effect of the analytical method. The authors are correct in noting that the influence of acidification after melting could lead to a systematic variation between IC and CFA measurements of Ca+, but this should be clearly distinguished from the effect of varying acidity within the ice matrix - a topic discussed by Ruth et al (Ann. Glac, v35, 2002). The publications of Ruth and coworkers should be treated in much greater detail in the literature review as this manuscript makes only a marginal advance beyond the findings that they have already demonstrated.

p.1120, lines 15-19, The writing here is very unclear, as the authors seem to be comparing previous interglacials with the LGM and Ca and nssCa with Ca and insoluble dust...If a comparison is being made it should be done more clearly.

p.1121, line 16, assess not asses.

p.1123, lines 1-9. I think that the observation of a distinct change in dust-calcium correlation since 600 ky BP is perhaps the most novel finding of this ms. It should be discussed in much more detail and treated with reference to other species which have been determined in the ice. More work should be done to identify whether this is an artefact of the crystal structure and deformation effects or whether this is an actual climatic signal. I find that this ms, which is struggling for novelty, would do well to embrace such an interesting facet of the dataset.

pp1124/5. The discussion of the strange behavior during MIS16 may possibly be related to the changed Ca behavior in the oldest 200 kyr of the record. I think that the discussion of MIS 16 behavior needs to also be treated with regard to the crystal structure and other proxies in this well-measured ice core, in order to more appropriately distinguish matrix effects from climatic effects.

The presentation and discussion of Figure 6 leaves much to be desired. To begin with, the authors might consider using the blue end of the scale for colder climate regimes

and the red end for warmer climate regimes. It seems strange that only one glacial termination is discussed. Obviously the most recent termination would be the best resolved but cannot be used due to the large gap in the data, so perhaps MIS 13-11 could be used for comparison to see if the trends in Fig 6 are repeatable? Further, it seems strange to describe dust as "interglacial" based on its nssCa/dust ratio and infer that this dust originates from South America. A growing body of evidence indicates that South America is not a unique source of dust to Antarctica, especially during interglacials, so it seems to be a quite tenuous link that is drawn from behavior observed in MIS 7-5 to South American glacial dynamics. The authors could spend much more time here developing a stronger appreciation for what such an enormous dataset has to offer.

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