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Climate of the Past Discussions

Interactive comment on "Interpreting last glacial to Holocene dust changes at Talos Dome (East Antarctica): implications for atmospheric variations from regional to hemispheric scales" *by* S. Albani et al.

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Dear Aloys,

we have appreciated your constructive comments on our manuscript. We reply here within the open discussion to some of the main points that you have raised, while a full point-to-point response will come with the edited version of the manuscript.

Best regards, Samuel Albani and co-authors

Comment: P 151, line 10: could Sr and Nd isotopic end-members help in quantifying

remote and local contributions?

Response: Unfortunately it is not possible from the Sr and Nd isotopic composition of the samples to assess the local vs remote contribution from a quantitative point of view. While the presence of local dust is confirmed by various indicators (see Delmonte et al., 2010b for example) some recent analyses (still unpublished) by SEM-EDS on TALDICE Holocene dust samples show ubiquitous presence of volcanic material mixed with dust, even in the very low-concentrated background samples. While in terms of the insoluble particles flux this is a minor contribution that does not alter significantly the absolute values and the interpretations of our records, this obviously limits the possibility to use the Sr and Nd isotopic fingerprint of "bulk" dust extracted from the samples. In the case of TALDICE therefore, the end-members are at least three: local dust from Antarctic sources, volcanic material (probably reworked) and remote dust potentially originating from Australia or Patagonia.

Comment: P 151, first paragraph: I wonder how relevant this discussion on possible Australian dust reaching Talos Dome (according to models) is? Especially as the main findings of this study derive from the coarse ("local") signal, not on the fine (remote) one. I would therefore suggest to remove it (preferred), or to move it some place else (in this case maybe P 153 in the second paragraph when EDC and Taldice LGM fluxes are compared). In any case, the connection between the first sentence ("The starting point. . .") and the paragraph is awkward and so I would drop this sentence (which is clearly not essential).

Response: The reviewer is right in identifying the coarse fraction of dust as one of the main aspects supporting our discussion. Nonetheless, the fine fraction – that is the parameter directly comparable to EDC – is composed by both local and remote dust. Since we discuss trends in the fine fraction by comparing TALDICE and EDC, it is important that we state among our assumptions that we are not able to distinguish any contributions to those trends (and absolute values) during the Holocene by an additional source which may be present, despite our present inability to depict its amount

and origin.

Comment: Section 4.1, second paragraph: since the significant dust flux-δ18O correlation during the Holocene is an important outcome of the paper, I was surprised not to find any dust flux vs δ18O plot, where the better correlation at Taldice (especially for the coarse fraction) may be apparent when plotted together with EDC data. Similarly, I would have expected to find on figure 3 or 4 the comparison between the correlation of Taldice dust (coarse mode in particular) and temperature with time and similar correlation at EDC (as in Figure 2 of Lambert et al., [2008] for instance). I am sure there must be a good reason why such plots were not shown, but I think it would be of interest for the reader if the authors provided a few words on this.

Response: The reason why we did not include such kind of plots is because we think that they would not be notably more informative than the plots already shown, and because their construction implies a series of steps involving transformation of the original data. We show one of the possible examples (see figure). We took the smoothed profiles from Figure 4 as a basis, and because the data points are not paired for any of the 4 time series to be considered we have re-interpolated the curves with a common 200 years' time step. Then we calculated the correlation between dust flux and δ18O (inverse) for both EDC and TALDICE, using 2000 years moving windows, and plotted the resulting curves. Correlation of 1 represents the strong link between low temperatures and high dust flux, in the chosen configuration. For TALDICE we can see imprinted in this graph the main features of the dust- δ18O relationship as depicted in the text, with e.g. high correlation during the Holocene between 8 and 3 kyrs BP, whereas the dust-temperature correlation at EDC is extremely unstable during the Holocene. While the suggestion made by the reviewer is pertinent and sounds good in principle, we would say that while this kind of plot carries the information, the result is not particularly effective and as such not worth to be included in the text. By the way, the differences in resolution among the records and the relatively low resolution of our TALDICE dust data for finer scale interpretations, require too much "transformation" of the original

data than we think is . Thus we think it is better just to show the raw data and a very smooth filtered curve which still allows to highlight the main trends discussed in the text.

Comment: P 157, lines 2-5: although this hypothesis may hold true when comparing the ACR and the early Holocene periods (as dust flux increases throughout the transition), it is not applicable to the LGM-Holocene changes; indeed, as acknowledged P 156 lines 22-24, there is little change in the 5-10μm dust flux across the transition; there is even a reduction in the 5-10μm flux between the LGM and the early Holocene. So, is there really a need for additional sources to explain the data? And if, as discussed in the text, more sources are indeed becoming available during the deglaciation (in addition to the one existing during the LGM), it should then be mentioned that this implies a weakening of dust transport from these local sources during the Holocene compared to the LGM.

Response: The reviewer is right in stating that we have not explicitly linked in the text the decrease in local dust flux on the glacial-interglacial time scale (even if not nearly comparable to the 20-fold decrease of remote dust at EDC) to a weakening of dust transport from local sources, which we could deduce as the possible explanation. We will try to explicit this aspect in the text. Concerning the additional dust sources, we do have evidence that they became available (see Delmonte et al. 2010b and references therein), and so it is reasonable to relate this piece of information to the dust profile.

Comment: Figure 4: this plot shows that there are remarkable similarities in the variability of the dust flux at EDC and Taldos during the late Holocene (similar ups and downs between 6 and 2 kyr BP); this seems to support the evidences pointing to possible changes in atmospheric pathways during the late Holocene (P 157, lines 21-23), but this may also suggest that the changes that affected transport from local sources may have been connected to larger scale atmospheric features (as evidenced by the variability observed at EDC). I didn't see any mention of it in the text (maybe I just missed it), but I think this an important point that should clearly be discussed. Similarly, a con-

nected point that should also be examined is the fact that most of the decrease in dust flux during the late Holocene is due to the decrease in the 1-5 μm fraction (Figure 3). Two possibilities: much of it is locally derived (which would imply the connection mentioned above between large scale atmospheric features and regional ones in Northern Victoria Land) or most of it is from remote sources as in EDC and then the decrease must tell something about reduced transport efficiency during the Late Holocene with respect to EDC where there was only little changes throughout the Holocene.

Response: One thing to point out is that the strong similarity between EDC and TALDICE in the late Holocene gets less evident if one looks carefully at the raw data. While a general decreasing trend is clear, whether the oscillations are in phase is too difficult to argue given the resolution of our data. That said, we welcome the solicitation to add a bit more to the discussion of the relative importance that trends in local vs remote dust (also compared to EDC) show in this particular period.

Interactive comment on Clim. Past Discuss., 8, 145, 2012.

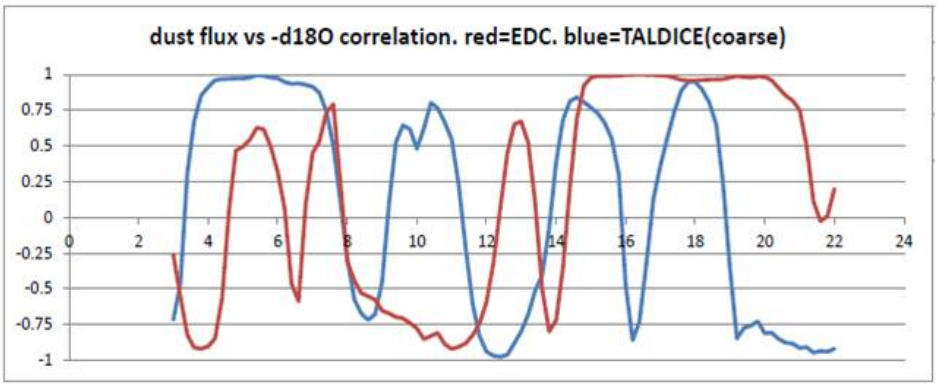

Fig. 1.