

## ***Interactive comment on “Dust and associated trace element fluxes in a firn core from the coastal East Antarctica and its linkages with the Southern Hemisphere climate variability over the last ~ 50 yr” by C. M. Laluraj et al.***

**Anonymous Referee #2**

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General remarks:

The authors present dust and trace element data from a shallow firn core in coastal Dronning Maud Land, Antarctica. They mostly relate changes in the records mentioned above to changes in the Southern Annular Mode. It is an interesting study and the results the authors show lead to the assumption that there is an interesting message in the dust record of this core. However, the methods are partly questionable and the paper generally suffers from the lack of a sound meteorological background, which becomes evident in many formulations/quotations in the text and in the simply wrong

C949

Figure 5.

Specific comments:

I do not address the points reviewer #1 already discussed unless I disagree.

I do not point out single language mistakes either, the text needs language editing.

1842

11-13: here is some confusion of easterlies, westerlies etc. (see below)

23: delete “the”

1843

4: what is an atmospheric “event”?

5ff: rewrite: the origin is not related to accumulation rate or atmospheric cleansing  
What do you mean by “weak hydrological cycle”?

1844

27: it would be interesting to see the data from the whole core and it would strengthen the statistics, however, I agree that during the past 3-4 decades distinct changes have been observed and it does make sense to look at the most recent period only. Also, the reanalysis data are more reliable during this time than before 1979.

1846

16: there are more recent mass balance studies of DML that could be quoted here 25:  
Marshall (2003) found substantial differences in SAM index derived from Reanalysis data and for observational data

1848 6: I assume it is meant in this ice core?

7: air temperature where?

C950

This is not supported by other studies in coastal DML (Ekströmisen, Fimbulisen, Neumayer, SANAE)

10ff: this is pretty unclear: what do you mean by atmospheric turbulence, why should dry air lead to violent storms? Australia is most likely no dust source for DML

1850

13: it is not clear what is meant by “stronger transport”

Trajectories:

Calculation of trajectories for only one month of a restricted time period to investigate the transport in the time period that is covered by the ice core data seems to be quite arbitrary. The choice of 10 days is not explained either. It should make a difference if dry or wet deposition is considered. I am not a dust expert, but I would assume that, in the coastal areas, wet deposition is not negligible. At least this should be discussed. Trajectories also can never be discussed without cross-checking the results with the general synoptic situation(s) during the transport. Trajectories with kinks, as shown in Fig. 4, are very unlikely to represent the real path of the air/dust particle. The colours in Fig. 4 are not explained either and generally Fig. 4 is too small (especially the labels) to really recognize more than the coarse features. The choice of 1985 as threshold year for observed changes of various parameters is quite arbitrary, too.

1851

2nd paragraph. The whole paragraph should be rewritten. “Positive shift” sounds more like a sudden jump rather than a gradual increase/tendency to positive values in the SAM index.

20: It does not make sense to distinguish between the circumpolar vortex and the “southern westerlies” .

21: shifts in the wind don't “alter” the circulation pattern, the winds are the circulation.

C951

The relationship between SAM and dust is described only qualitatively, a figure and a quantitative correlation would be helpful and more convincing.

1852/1853

These paragraphs are hard to read and contain several contradictory and incorrect statements.

2: Australia as a modern dust source is unlikely.

4: first it is stated that there was a “positive shift” in SAM in the 1960s, now it is after 1985. These formulations are all pretty vague, and there is not much happening in 1985. Which SAM index and what kind of filter/smoothing is used in Fig. 2? The authors use the terms circumpolar vortex and westerlies in a quite confusing (confused?) way. What is meant by “gradient of zonal wind strength? Here periods of different length are compared. Fig. 2f is contradictory to Fig.1 in fig1a the zonal wind speed at the core site is way higher than in the the later period in Fig. 1b. the “strength” of the westerlies is hard to assess since it depends on latitude and longitude. Thus the general statements of the authors concerning these winds are not clear. Page 1853/54 are not understandable, and Fig. 5 is incorrect. On average, the coastal areas of Antarctica are under the influence of cyclonic activity in the circumpolar trough, whereas a large-scale subsidence of air masses is observed under anticyclonic influence above central Antarctica. The “enhanced polar easterlies” are due to stronger cyclones and not related to surface anticyclones (l 14.). Enhanced westerlies would lead to stronger zonal transport of dust, but also to reduced meridional (southward) transport. Here again the question of wet deposition comes up.

1854

20ff: This does not make sense. I find it hard to comment on any single sentence here. The whole section 3.2 has to be rewritten. There is an obvious lack of understanding of the dynamic processes involved, which results in wrong statements, strange formu-

C952

lations and mixing up of cause and effect.

Since the structure of the paper makes it difficult to write a well-structured review, I would like to answer to the questions to the reviewers now:

Does the paper address relevant scientific questions within the scope of CP?

Yes. SH climate of the past 50 years is discussed in relation to ice core data.

Does the paper present novel concepts, ideas, tools, or data?

Yes. New data from a firn core are presented. New ideas, too, though some wrong ideas amongst them.

Are substantial conclusions reached?

Yes. Not necessarily sufficiently supported by the data and used methods.

Are the scientific methods and assumptions valid and clearly outlined?

No. Especially the choice of the 1985 threshold is arbitrary and no reason is given for it.

Is the description of experiments and calculations sufficiently complete and precise to allow their reproduction by fellow scientists?

Principally yes. The authors do not hide anything, only the description of what they did and why is not always easy to understand.

Do the authors give proper credit to related work and clearly indicate their own contribution?

Yes. However, the text often sounds like just a row of citations, which does not make it easier to read/understand what the authors mean.

Does the title clearly reflect the contents of the paper?

Yes.

C953

Does the abstract provide a concise and complete summary?

Yes.

Is the overall presentation well structured and clear?

No

Is the language fluent and precise?

No

Are mathematical formula, symbols, abbreviations, and units correctly defined and used?

There are no formulas in the paper, the use of the term wind strength rather than wind speed is not correct.

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Interactive comment on Clim. Past Discuss., 9, 1841, 2013.

C954