

Response to Anonymous Referee #2

Schüpbach et al present an interesting paper based on new nssCa and ssNa records from the coastal Talos Dome East Antarctic ice core. Results are discussed in a good amount of depth. The authors suggest that source strength changes are the main drivers of changes over the last 150 ky.

The paper would benefit from some restructuring and rewriting. In particular, readers would benefit from better subtitling, and a clearer division between Methods, Results, and Discussion.

I do not attempt to note all changes which should be made in the detailed comments below, a variety of minor grammar and writing problems are left to the authors to identify and fix.

Detailed comments:

Should Dome F results be included within the study?

It was our intention to include also Dome F as well. We have contacted the Aerosol Consortium of the Dome F ice core early this year, however, the data was not yet available. And also in August, after another request for the data, they were still not available. Therefore, we have not the possibility to include the Dome F data into our multi-site comparison. However, this would be a task to do as soon as the data are available in the future.

Presentation of the model of aerosol transport (p3337 onward) should be within the Methods section.

The corresponding model description section has been moved to the methods section, where it fits in much better, thanks for this suggestion.

The manuscript would benefit from an explicit Discussion section, separate from the Results section. This would let the authors shorten their Results section and should also help with organising/sub-titling material. Subtitling is very poor, and provides the reader with little useful guidance in the organisation of the material/manuscript. Trying to provide mechanistically slanted subtitles, or perhaps if this proves extremely difficult, time-periods would be much more helpful.

We thank the reviewer for his comment on the insufficient structuring of the manuscript. We have improved the structure of the manuscript. We tried to implement separate Results section and Discussion section. However, this made the manuscript structure even more confuse, jumping from one proxy to another proxy forth and back, the same with the different ice cores. Therefore, we kept the original Results and Discussion section, but made some substantial restructuring therein. In particular we divided the Results and Discussion section into an ssNa and an nssCa subsection in order to improve the readability. Like this the guidance within the manuscript is much improved compared to the original manuscript.

In addition, subtitling has been improved to give better guidance to the reader. Additionally, we added some text where we describe the structure of the paper at the beginning of the Results and Discussion section.

The writing is quite poor in several places. The manuscript should be read closely and sentences fixed as necessary.

The entire text has been revised with focus on language and structuring and fixed where necessary.

Don't use unnecessary abbreviations e.g. if ADV and SSA are only used a couple of times, easier for the reader if written out in full.

The mentioned abbreviations are substituted by the full text and not used any more in the revised manuscript.

Numbers less than ten are usually written out in full i.e. one rather than 1, 'factor two' rather than 'factor 2'. And better to write 'one to one relationship' rather than 'slope 1'.

The text has been changed accordingly.

Numbered comments:

P3323,L16 rewrite

Rewritten:

"Our transport model applied on ice core data is further validated by climate model data."

P3324, L11 12 What about marine cores?

The marine cores in the SO regions usually have specific stratigraphic limitations due to the lack of biogenic carbonate usually used for dating and the bulk insoluble organic carbon closer to the continent which is problematic because it may contain old, reworked material. Therefore, information from marine cores in this region are limited and not included in the text here.

L18-18 Not entirely clear that sea ice has these impacts. Reference statements, perhaps rewrite.

A reference has been introduced, the statements have been alleviated:

"Also sea ice in the SO is a key component of the southern high latitude climate system, because an increase in its extent contributes to an increased albedo of the ocean, to a reduced gas exchange, and to decreased ocean mixing (Abram et al., 2013). Sea ice also plays a major role in the formation of deep waters in the ocean, and therefore in global ocean circulation and the carbon cycle (Toggweiler, 1999; Bouttes et al., 2010; Dieckmann and Hellmer, 2010)."

P3325 L 15 well positioned rather well suited. Split up this sentence – too long.

Done:

"The TALDICE (TALos Dome Ice CorE) project provides a deep ice core located at Talos Dome in the Ross Sea sector of East Antarctica in Northern Victoria Land (Frezzotti et al., 2007; Stenni et al., 2011). This core is well-positioned to investigate the regional atmospheric circulation changes and their relationship with the glaciation history and environmental changes in the Ross Sea area for the past two glacial/interglacial cycles based on climate proxy as well as terrestrial and sea salt aerosol records."

L21 aeolian rather than Aeolian

Done.

L29-L4 Rephrase. Not very clear what sentence is trying to convey.

Rewritten:

"The spatial extent of local dust sources can be assessed by analyses of the isotopic composition of strontium ($^{87}\text{Sr}/^{86}\text{Sr}$) and neodymium ($^{143}\text{Nd}/^{144}\text{Nd}$) of the dust in the ice core samples. However, the extremely low dust concentration in ice cores during interglacial climate conditions makes such analyses extremely difficult (Petit and Delmonte, 2009; Delmonte et al., 2013)."

P3326 L22 "is in the following compared" rewrite.

Rewritten:

"The new proxy data from TALDICE based on continuous flow analysis (CFA) techniques is compared to three other East Antarctic ice core records in the following, all covering at least the last 150 ka"

L24-29 put into a table?

These information have been put into a new table together with the accumulation rates given in the discussion paper at page 3331 lines 3-6.

P3327 L2 "aim at complementing" -> "extend"?

Done.

L19 capitalisation

Done.

L24 "5" -> five

Done.

L25-L1 rewrite sentence

Done:

"The longer gaps are due to maintenance and failure of the respective CFA detector, while measurements where continued."

P3328 L9-12 meaning not clear

Rewritten:

"The sample decontamination accomplished by continuously melting the ice core samples during CFA measurements reduces process blanks considerably compared to manual ice sample decontamination for IC measurements. As a consequence, the LOD of CFA are significantly lower compared to IC measurements."

L23 "properly" is redundant

Deleted.

P3330 L14 add a sentence to explain principle of separation

Done:

"In all four ice core records the nssCa^{2+} and the ssNa^{+} fractions, respectively, are calculated from the Ca^{2+} and Na^{+} records according to Bigler et al. (2006), using an empirical Antarctic ice core specific crustal correction for Ca^{2+} and Na^{+} , respectively."

P 3331 L 13 "in" -> "which are of "
Done.

P3333 L1- Would not atmospheric circulation changes also affect particle size distributions?
An effect of atmospheric circulation changes on grain size distribution is indeed expected. In Albani et al., (2012) it can be seen that the size distribution is in fact not constant, but varies over time during the Holocene. There is a maximal shift towards smaller particles around 8 ka BP which might point to weaker contribution of local sources to Talos Dome dust input during that time. This is in line with the hypothesis of atmospheric circulation changes favouring air trajectories over the Ross Sea and thus leading to a bias towards smaller particles in the Talos Dome size distribution record as presented in Albani et al., (2012).

L12 "is likely mainly"
Done.

P3335 L1 To make life easier for readers, could rewrite as "From 40-30... d18O is higher at EDML compared to TALDICE. This could indicate..."
Rewritten.

L15-21 Where has the atmospheric circulation change argument gone?
In this section we discuss the last glacial period, i.e. 115-20 ka BP, while we discussed atmospheric circulation changes during the Holocene in context of a retreat of the Ross Ice Shelf. During the glacial, however, the Ross Ice Shelf is assumed to be very stable and thus ice coverage of the Ross Sea does not change local atmospheric circulation patterns.

L26 Has SSA been defined?
SSA is no longer used as an abbreviation in the manuscript (see comment above).

P3336 L3 Can't start a paragraph in this way. Remove "Only "
Done.

L14 rewrite.
Done.

P3348 L28 Write out in full in the conclusions
Done.