

## ***Interactive comment on “A combined observational and modeling approach to study modern dust transport from the Patagonia desert to East Antarctica” by S. Gassó et al.***

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Response to Reviewer 1

Specific Comments

Reviewer 1:Section 2.2.3, first paragraph: This paragraph includes a description of visibility measurements. Although, visibility measurements have been used as a proxy for dust in the study of source distributions and temporal evolution of atmospheric dust occurrences, it should be noted that visibility is estimated horizontally at eye level by the operator. It is based on the operator's ability to see objects of known distance. It is therefore a measure of dust occurrence close to the surface and must not necessarily

C6783

correspond to satellite derived measures of atmospheric dust (measured vertically). On a similar line, dust at higher levels of the atmosphere may not be 'detected' by horizontal visibility measurements.

Answer. The reviewer is correct. Fortunately, in the case of the station in Tierra del Fuego, the sources were within 10-20 km from the meteorological station. However, as noted in the paper later, there was another much larger source located ~ 100km away and it was not captured in the surface observations. In any case, in this study we purposely avoided using the quantitative value of visibility because the reason noted by the reviewer. However, it should be pointed out that although visibility observations are defined for horizontal conditions, the METOP codes characterize the state of the whole sky (i.e. vertical condition as well as horizontal conditions)

Reviewer 1: Page 13302, line 25-28: A rather complex dust transport path from Patagonia to Antarctica is described here. The paper would benefit from a brief description of the synoptic meteorology that accompanied (or generated) the dust episodes. It may allow for an explanation of the dust transport paths as seen in the model trajectories.

Answer: We debated whether to include a section or paragraph on the synoptic situation that favored the event but for the sake of saving space and the lack of a complete set of observations to corroborate the full transport path, we omitted it. There have been a number of studies on the climatology of cyclones in the southern hemisphere and the transport of moisture towards Antarctica. There are very few similar studies regarding aerosol transport (cited in the manuscript). But for the sake of clarity, we added these lines in section 3.4 to put in context the observations and give references where the reader can expand on the subject. "This transport pattern is common in the high latitude SH where moisture fluxes into Antarctica follow the motion of cyclonic systems (Jones and Simmonds, 1993; Rasmussen and Turner, 2003)." Jones, D.A., and I. Simmonds, 1993: A climatology of Southern Hemisphere extratropical cyclones. *Climate Dynamics*, 9, 131–145. King, J. C. and Turner, J.: *Antarctic meteorology and climate*, Cambridge University Press, UK, ISBN 0-521-46560-5, 1997

C6784

Reviewer 1: One fact which becomes very obvious from the paper is the impact of clouds on the of remote sensing of dust in the SH. Are we able to quantify this impact on dust climatologies such as the ones derived from OMI or the older Nimbus 7 TOMS AI? If not, it should be included in the conclusions as a goal for future studies.

Regarding the comment on impacts of clouds on dust retrievals in this region, it is my opinion (lead author SG) that in principle, the effect on clouds on dust retrievals can be quantified or at least can better constrained. The key is in using a multi satellite approach plus the aid of a transport model. However, the effort can be significant due to the practical limitations of overlapping the different footprints of the satellites plus the relatively fast dilution of the dust cloud as it advects.

Reviewer 1:Technical Corrections.

Answer: All corrections were incorporated.

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