RESPONSE TO REVIEWERS

Note: All reviewer comments are in *italics.* All author responses are in normal format.

Manuscript Title: Understanding the transport of Patagonian dust and its influence on marine biological activity in the South Atlantic Ocean

Reviewer #1

We would like to thank reviewer 1 for his/her comments. We have done our best to address each of the points as detailed below.

General Remarks:

#1. Section 2.2 would require some clarification: the relations linking Fe(leachable) from equation (1), sol-Fe from equation (2) and sol-Fe calculated using GEOS-Chem/DFeS should be made explicit, and Table 1 modified accordingly if necessary. Throughout the paper it is not unequivocal whether the leached Fe from equation (1) has been used for calculations of D[Chl-a]obs plotted in Figures 8 and 9 or just for the uncertainties analysis depicted in Figure 10.

We agree with the reviewer that there was an ambiguity in the text regarding GEOS-Chem/DFeS predicted sol-Fe and Eq. (1) calculated leachable-Fe. Now we explicitly define labile (bioavailable)-Fe = Sol-Fe (atmospheric model calculated) + leachable-Fe (oceanic model calculated). Text, table and equations in the manuscript were changed accordingly.

#2. Section 3.2 and Figure 9: while model/parameterizations uncertainties and SeaWiFS retrievals quality have been discussed, some comment on spatial and temporal variability of Chl-a products in Figure 9 is lacking. Spatial variability looks very high, with many areas where D[Chl-a]obs is largely negative, within the variability range depicted and compared with the positive values. Could you comment on this? What is the area averaged D[Chl-a]obs? In addition, could you give some measure of the background temporal variability (i.e. from the before-storm week, or provide a reference)?

We agree with the reviewer. Discussion regarding the large spatial and temporal variability in remotely-sensed [Chl-*a*] displayed in Figure 9 along with specific calculations of area averaged $\Delta[\text{Chl-}a]_{obs}$ and climatological background temporal variability of $\Delta[\text{Chl-}a]_{obs}$ has been added to the manuscript. We have also included some references that examine the possible reasons for such variability.

Specific Remarks:

#3. Lines 69-71: "Based on positive correlation ... from Patagonian and southern Australian regions ... is controlled by Patagonian dust ..." sounds here a bit contradicting. Please rephrase.

This sentence is rephrased.

#4. Line 112: "resulted" is it a typo for "resulting"?

Changed.

#5. Line 160: add within brackets the value of fFe(leachable), the same way as it is done for the other variables.

Changed.

#6. Lines 233-235: check the chronological consistency between the statement ("... since 2008 ...") and the references cited. In the present form it sounds a bit weird.

This sentence has been adjusted.

#7. Lines 267-268: reading this in combination with line 264, and looking at Figure 3, is it possible that the model simulated (and captured as it seems from CALIPSO data – Figure 3a,b) two (likely spatially) distinct dust outbreaks (with converging plumes) that in the daily-averaging storage resulted in that "v" shape of the simulated dust burden (horizontal plain in Figure 3 plots)? Some supporting information on this can result from comparing MODIS (figure 1a) and CALIPSO timing.

The detailed examination of the "V" shaped dust burden revealed that that the northern portion of the dust plume originated at the same source region as the J23 dust event, but four days (19 January) prior to it. The dust plume was caught in a weak high pressure system with light and variable winds until 23 January, when the low pressure strengthened, transporting the plume to the east/south-east direction. Although the "V" shaped plume was identified by CALIPSO, it was not "seen" by *Terra* (morning) or *Aqua* (afternoon)-MODIS due to presence of extensive clouds and sun glint in the region. The discussion is included in the modified manuscript.

#8. Lines 377-380: not too clear. Does this mean that - within the 8 days after the dust event - the leached Fe, calculated from Eq. (1) assuming a residence time of 30 days in the formula, was about 50% compared to the atmospheric flux of rapidly-released Fe? Please rephrase.

This has been rephrased for clarification.

#9. Table 1: is the reference for sol-Fe just GEOS-Chem/DFeS? Or rather GEOSChem/DFeS + Equation (1) as lines 178-180 in the text would suggest?

Table 1 is the reference for the GEOS-Chem/DFeS calculated sol-Fe. Also see our response to comment #1.

#10. Figure 1: please complete the reference adding the time for satellite imagery. (1a) 18:45 UTC (1b) In addition, I am confused by the units used for column dust concentrations, they look like depositional fluxes. Please check and modify figure and caption accordingly.

Figure caption and units have been changed in the modified manuscript.