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 #2

We would like to thank reviewer 2 for his/her comments. We have done our best to address each of the points as detailed below.

General Remarks:

"Based on a significant positive correlation between the atmospheric delivery of mineral dust and phytoplankton growth in the surface waters of the SO, downwind from the Patagonian and Southern Australian regions (Gabric et al., 2002; Erickson et al., 2003) it was proposed that phytoplankton productivity in the South Atlantic Ocean (SAO) is con- trolled by Patagonian dust deposition (Erickson et al., 2003)." Both of these studies are fatally flawed, so I don't think anybody actually believed them. Gabric used seawifs atmospheric correction, which is known to have biases correlated with chlorophyll. And Erickson just correlated seasonal cycle, which just means that in the summer there is dust and there is chlorophyll: no causation should be attributed.

We agree with the reviewer. In the manuscripts we discuss that the conclusions were based on positive correlation between the atmospheric delivery of mineral dust and phytoplankton growth without clear illustration of causality.

"*Recent modeling studies have shown that due to the pristine nature of this region, the water soluble (or bioavailable) fluxes of Fe (sol-Fe) in mineral dust over the SO could be much lower compared to Northern Hemispheric dust (Meskhidze et al., 2007; Johnson et al., 2010)." But what about the observations which suggest that the dust is highly soluble from Baker et al.? that should be mentioned here, and emphasized more than model results.*

As shown by back trajectory analysis of *Baker et al.* [2006] the air masses sampled during J24 and the initial period of J25 passed over continental South America not long before collection. However, there was no indication that the filter samples were impacted by mineral dust. The only times when samples "had the brown coloration associated with mineral aerosol" was sample J20, characterized by very low Fe solubility. Overall, we believe that the ship measurements of Fe surface concentrations near Patagonia conducted by *Baker A. R. and co-authors* do not suggest that Patagonian mineral dust has high Fe solubility.

However, we recognize that the sentence "fluxes of Fe (sol-Fe) in mineral dust over the SO could be much lower compared to Northern Hemispheric dust" is based exclusively on model results and therefore has been removed from the update manuscript.

"Roughly â˙Lij40% of this mineral dust got deposited to the proposed" replace "got" with 'was'

This has been changed in the updated manuscript.

Figure 3"GEOS-Chem-predicted dust burden (gm-2) with overlaid (a) CALIPSO retrievals of dust aerosol layers, (b) model-predicted vertical cross-section of dust concentration (g m-3) along the CALIPSO orbit track and (c) CALIPSO dust layer AOD at 532nm on 23 January 2009. Model cross-section calculations are conducted along the CALIPSO orbital track beginning at 4:28:59 UTC (V3-01.2009-01-23T04-28-59ZN)." All three panels appear to be the same thing, but the figure caption doesn't tell us the difference?

The figure caption has been adjusted to avoid the confusion.

Figure 9: how does figure 9 deal with the problem that atmospheric dust can be misinterpreted as chlorophyll in the seawifs data?

The discussion has been added to the manuscript. "Past studies have shown that presence of dust may influence optical properties of oligotrophic waters (i.e., [Chl-*a*] $\leq$ 0.1 mg m^{-3}) and cause anomalous readings in retrievals of phytoplankton biomass (*Claustre et al.,* 2002). However, we consider such errors to be negligible for highly productive waters of the SAO."