

Interactive comment on “Emissions from potential Patagonian dust sources and associated biological response in the Atlantic sector of the Southern Ocean” by A. Castagna et al.

Anonymous Referee #2

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This is an article on an interesting topic, but it does not really prove its point and should be rejected. I understand that there is no other way to do the problem, but that doesn't mean one should publish results which don't proof the assertions.

1. dust variability is not well established. “To define the dust source areas within meridional South America we relied on the negative correlation of the AAI with a vegetation proxy, employed as an integrative parameter of two time varying surface properties related to dust emission (Jobbágy et al., 2002; Cropp et al., 2013): (i) the soil moisture content, which influences particle cohesion; and (ii) the abundance and structure of vegetation, which influences the transmittance of the kinetic energy from the wind to the surface (Tegen and Fung, 1994; Mahowald et al., 2005). Together, these pa-
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rameters regulate the threshold wind velocity needed to initiate the dust emission over a specified region. An analysis highlighting areas where AAI increase is related to vegetation decrease could reveal areas of dust emission, provided that areas of biomass burning are excluded.” Why are you adding in the criteria that the NDVI has to negatively correlate in time with the AAI? This assumes that winds don't play a role or are somehow correlated with negative NDVI? I don't understand this criteria or the sensitivity of your final results to this choice. This is not a standard choice: usually just the areas with frequent AAI. Please explain more this unconventional choice and the implications for your study.

The AAI are also correlated with simply the boundary layer heights, so what you are seeing could also just be interannual variability in boundary layer height. Do you have no other data about the dustiness of the region? What about visibility data, precipitation data (which might be used to infer stronger sources), other satellite data? In addition, there is not necessarily a simple relationship between source strength and deposition in the adjacent ocean, and basically no justification for this assumption. So the idea that AAI in one or two locations is automatically a good proxy for deposition downwind is not well presented or defended in the text.

2. Dust correlations with chlorophyll in the satellite data; known bias of the remote retrievals “Combined, these properties minimize the noise added by dust variation, suggesting a negligible effect of dust on biological proxy estimation in this region (e.g., Johnson et al., 2011).” I think you probably need at least an order of magnitude calculation here to show that in this region the interference from the dust absorption in the atmosphere during dust events is small compared to the change in the phytoplankton and the satellite detection. This is a really big issue that is poorly resolved in some papers in the literature.

3. Finally the ‘dustiness’ predictor correlated with the chlorophyll

Figure 3: I don't understand this plot: is it just the mean AAI over south American

sources (e.g. figure 2) correlated with the annual average time series of chlorophyll in each location? Please make sure the figure caption is clear. Please indicate which values are statistically significant. In addition, please include the effects of looking for correlations at so many points (e.g. if you look for statistical significance at a 95% at 100 points, you expect 5% of the points to be significant just because of randomness. Note that physical coherence in your result is not a good argument against this, because you also haven't taken into account the physical correlation between adjacent gridpoints, which would reduce the number of independent points). I just read your response to the other reviewer and do not buy the argument that because statistical approaches are not perfect, you don't have to think about whether you are significant. You have a very short time record, so it's quite likely you are just seeing random effects.

A simple alternative explanation which is not considered, but is also consistent with both the negative and positive correlation space (if they are significant), is that there is a correlation between the 'dustiness' and the ocean response because both are driven by the same meteorological phenomenon. This needs to be explicitly considered in the text.

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