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Interactive comment on "The Southern Annular Mode (SAM) influences phytoplankton communities in the seasonal ice zone of the Southern Ocean" *by* Bruce L. Greaves et al.

Anonymous Referee #1

Received and published: 16 November 2019

In this manuscript entitled "The Southern Annular Mode (SAM) influences phytoplankton communities in the seasonal ice zone of the Southern Ocean", the authors examine the role of SAM on phytoplankton communities in the SIZ of the Southern Ocean. I think the document is not yet ready to be published, although the subject and results are really interesting. The structure of the document is really difficult to follow at the moment. I have listed some improvements that could be made to improve the clarity of the manuscript.

General comments: My main concern is related to the structure of the document, to many subsections, particularly in the sections on results and discussion (8 subsections

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for discussion, and 2 sentences for conclusion, 1 sentence in the section on results (3.1). The document, as it is now, is unbalanced and difficult to read and needs to be reorganized around major themes (seasonal, interannual variability and impact on phytoplankton communities for example for the discussion).

In this paper, the authors examined the role of SAM and seasonal variability on changes in phytoplankton communities, but some key environmental factors are really missing in this study, (1) mixing estimates (by estimating the depth of mixed layers, deriving wind stress) and (2) light measurements (in situ or satellite data)? Because it can be suspected that changes in the intensity of the SAM will directly influence light-mixing regimes, and therefore changes in the composition of phytoplankton communities at the time of sampling? This is particularly important given that the authors mention the interaction between mixing and phytoplankton dynamics in the discussion.

In addition, the authors focused on understanding changes in the relative abundance of the main phytoplankton groups, but we have no idea how phytoplankton biomass could change annually with the SAM. The authors mentioned this briefly in the discussion (5.3), but can you access to any vertically integrated biomass proxies (vertically integrated chlorophyll, PP and satellite-derived estimates)?

This comment is related to the last one, but we have no idea where we stand with respect to phytoplankton phenology. In Figure 1, it would be nice to have satellite-derived time series of chlorophyll a, for example. The problem I see here is that the SAM could perhaps also change the phytoplankton phenology (bloom duration or timing for example). And perhaps what the authors have defined as interannual variability driven by the SAM can simply be related to a sampling of different phenological states. It would be important for me to check this point.

Specific comments: l.186-186: Can you add a table in the paper or in the supplementary materials listing these taxa (the 4 in all the samples, and the 11 in 90% of the samples)?

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Table: Table 1: Long.E is indicated two times as variable, is it an error?

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