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Interactive comment on "Imprint of Southern Ocean eddies on chlorophyll" *by* Ivy Frenger et al.

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The paper provides an analysis of the role of mesoscale eddies in the Southern Ocean on primary production, in terms of chlorophyll anomalies detected by remote sensing associated to them. Methodologically, the paper follows very closely some previous works, in particular Gaube et al. 2014, which were more focused on the global ocean. In respect to previous works, this manuscript has fine tuned the methodology, and discussed the results in the specific context of the Southern Ocean. The main original result in this manuscript is the finding of a strong seasonal signal in the mesoscale imprint on chlorophyll anomalies. This result and other more incremental findings are not surprising, but are very well discussed in terms of the previous literature and in terms of the biogeochemical activity of the Southern ocean (with possibly one direction of improvement which is described below). As a consequence, I find this manuscript as a useful contribution to the understanding of the role of mesoscale eddies on primary

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production in the Southern Ocean, even in its current form. There is however one issue that may improve further the manuscript.

One of the main concept treated by the paper, is stirring, and in particular the imprint of stirring induced by the mesoscale eddies on the mesoscale anomalies of the chlorophyll field. The manuscript explains that the stirring created by a mesoscale eddy can create a local deformation of a pre-existing chlorophyll gradient and I agree with this statement. However, this is not all about stirring. In fact, if I think to the imprint of stirring and chlorophyll in the Southern ocean, the main effect that comes to my mind is not the generation of local chlorophyll anomalies, but the huge plumes of chlorophyll induced when stirring by mesoscale eddies modulates iron delivery in a non-local way, preconditioning the blooms of this region. An analysis of this effect is not in the scope of this paper, and it has been done elsewhere (for instance, d'Ovidio et al. Biogeosciences 12, 2015; Ardyna et al. GRL 44, 2017). Nevertheless, I feel that the submitted manuscript should stress more that what the authors intend here for eddy stirring, is only the local effect of stirring, while other non-local effects of stirring by mesoscale activity also exist, and actually they are a prominent driver of the bloom extension and intensity in the Southern Ocean. In fact, it would be interested to know whether there is a signature of this non-local stirring effect in the analysis presented, for instance by finding stronger anomalies downstream of likely iron sources like the continental shelves present in the region. Or as a possible alternative explanation of the asymmetries in the chlorophyll anomalies.

I am certainly biased in this comment by my own work on the subject, therefore the authors are free to find some other papers instead of the two indicated above to add to their discussion. But in any case, I feel that the discussion on stirring merits to be extended.

Minor comments

timescale of chlorophyll: chlorophyll is just a pigment. Referring to the timescale of a

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bloom, or of phytoplankton demography, should be more appropriate.

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