

Interactive comment on “In situ measurement of the biogeochemical properties of Southern Ocean mesoscale eddies in the Southwest Indian Ocean, April 2014” by S. de Villiers et al

Anonymous Referee #1

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This brief communication presents a data set focused on a few eddies in the Southern Ocean. The data set is easily accessible at the site the authors indicate. I agree with the authors that the data set will be useful and useful for the reasons they suggest. The paper is written clearly. With a bit of tightening up of the presentation, I believe this paper could be made quickly ready for publication as a brief communication.

Suggestions and questions for the authors:

Authors should provide more information on the measurement uncertainties. They indicate precision for some (but not all) measurements, but don't provide overall uncertainty estimates for any. Even just a table of literature estimates from scientists using

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the same methods would be helpful. Consider adding the uncertainty information to the data header.

How “old” is “old?” This would be important information for modeling eddy dynamics. For the three eddies in question, could the authors use SSHA archives to track the eddies back to their emergence, and quantify how long they’ve been around? This would help people using the data, and perhaps help answer whether the cold core eddy once had a colder surface lens before it was warmed up by the atmosphere. . . just as it is argued by the authors the old warm core eddy was cooled. Could the authors collocate the SSHA data with SST data (where available) to determine whether this cooling/warming definitely took place?

The argument that as a warm core eddy ages, it picks up silicate which triggers a diatom bloom seems to be based on two sets of measurements without enough context. Consider that these sets of measurements essentially straddle a biogeochemical front:

<http://www.nature.com/nature/journal/v467/n7315/abs/nature09403.html>

. . . and the position of the Polar Front is relatively variable (the properties in the figures seem to suggest the young warm core eddy is much more consistent with water between the PF and the SAF. . . though it is tough to tell with the saturation of the temperature scale in Fig. 2c). Is there strong evidence that the water in an old warm core eddy south of the PF is the same water in a young warm core eddy found north or at the PF, just moved and altered? My understanding is that eddies can move in either direction, and that anticyclonic eddies move equator-ward more often than not:

<http://onlinelibrary.wiley.com/doi/10.1029/2007GL030812/full>

Alternately, is it more appropriate to think of eddies as a local perturbation in the density structure? In this sense, the silicate being 5 times higher in the water south of the PF could be because all water near the surface has substantially more silicate south of the PF than north of it. If eddies indeed retain most of their passive conservative tracers as

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they move around, it is possible the old warm core eddy formed in an area with higher surface silicate than the young warm core eddy (tracking the eddies back in time with SSHA could answer this)? On the topic of enhanced productivity, could it be that the slightly elevated old warm-core surface temperatures or differences in light/iron are driving the enhanced chlorophyll in the warm core eddy relative to the cold core eddy? Nutrient concentrations are seldom limiting south of the PF, so it would be strange if a redistribution of silicate had much impact here. Also, if silicate is the important piece here, then why does the old warm core eddy have more chl than the cold core eddy (which appears to have more surface silicate?)

Mostly, I'd rethink the final section of the paper, and think how to round out the argument with additional lines of evidence or trim back on any findings that aren't well supported.

Line by line comments: 814-4 which depths are standard depths?

814-10 through 3-15 how were precisions determined?

814-20 through 3-25 precisions/accuracies or uncertainties for nutrient samples?

815-8 through 815-10 references to figures are confusing here. Refer to the CTD data figure in the part of the sentence where the CTD data is mentioned and refer to the SSHA figure in the part of the sentence where SSHA is mentioned.

815-10: Use consistent terminology. "Mature" is used in this sentence whereas "old" is used in Fig 3.

816-2: "with silicate levels almost a fifth... than that in its older equivalent" Suggest: "with silicate levels ~80% lower... than..."

Fig1: Could you add a SSH contour for the PF? This would likely be more informative than the mean PF location. The scale is missing in figure 1b. The map units in 1b are too small (the units in 1a are likely also too small). In the last sentence of the caption, there's a brief foray into past-tense mid sentence.

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Fig2: Consider labeling the red lines so readers can quickly distinguish between the young and the old warm core eddies. Use a larger font size for all of the units. Try to avoid going off colorscale. You can use ODV to make the colorscale non-linear if you have to to preserve details at depth (right click→ properties→ color mapping). The last sentence of the caption is unnecessary if readers read the abstract. Change umol to μmol .

Fig3: Here the old warm core eddy is green. Consider making it green on Fig2 as well. Be consistent about whether there's a space between a latitude and the "S."

Fig 4 and 5: See Fig2.

Interactive comment on Earth Syst. Sci. Data Discuss., 8, 809, 2015.

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