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Interactive comment on "Marine climate change over the eastern Agulhas Bank of South Africa" *by* Mark R. Jury

Anonymous Referee #3

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General comments: The topic is of interest, and the authors do a good job considering many data sources, and doing their best to integrate these pieces together. However, the paper could be introduced better, and some revisions are necessary particularly addressing the possible strengthening of the Agulhas Current.

My major points of revision on the paper regard three issues:

1) There is not very much information on how well these reanalyses simulate the region, particularly the velocity field. Does SODA-3 really simulate the real ocean well enough that we can trust a trend of -0.006 m s-1 y-1? I am doubtful, with the information given, but maybe you can convince the reader otherwise.

2) You discuss at various points a strengthening or acceleration of the Agulhas Current.

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Discussion paper

However, you only compute averages and show figures for the near surface (example: Fig 4c shows top 50 m). A stronger velocity in the upper 50 m does not necessarily imply the Agulhas Current as a whole has strengthen. There could be compensating changes at depth. Please compute trends in Sv yr-1, and state along with your trends in upper ocean m s-1 yr-1 so that the reader can assess whether you are truly seeing a strengthening current.

2) The observational paper which assesses a possible trend in the Agulhas Current volume transport finds no strengthening since 1993, and instead a broadening of the current (Beal & Elipot, 2016). While you do briefly mention this at line 270-273, there is no comparison to your results. Why do you suspect your results are different? Is it due to deficiencies in SODA3? Or due to the specific end years in Beal & Elipot, 2016, or some other methodological difference? If you compute a trend in Sv/yr, over the full depth of the Agulhas Current, over the same time period as Beal & Elipot, what do you get? I also think it would be useful to cite and discuss this paper earlier, possibly either in the introduction or in the paragraph starting at line 166.

Specific comments:

Introduction: A stronger introduction that addresses why the reader should care would be helpful. i.e., fishing industry, weather impacts, climate feedbacks, etc. due to any changes in the region.

Line 39: The Agulhas Current meanders a mean of 1.6 times per year, add citation to Elipot & Beal (2015)

Line 80: Citation or figure to show this?

Line 82: Please give some description of what “transient EOF” is and how this varies from a general EOF

Line 94-96: It would be helpful if you illustrated these regions on one of your maps, perhaps in Figure 1.

Line 112: illustrating the regions on a map would help

Line 160: Please state value from Rouault (2010)

Line 164-165: Do you think this is real? Or are you saying it is an artifact of SODA3 that may not exist in the real ocean?

Line 191: Elipot & Beal (2018) is another useful point of comparison

Line 196: Need to make it clear you are only looking at velocity trends of upper 50 m. This is not necessarily equivalent to an acceleration of the full depth Agulhas Current.

Line 214: Not sure what you mean by "Long-term trend and multi-decadal trends are acknowledged to be additive here". Perhaps you need to explain in more detail

Line 219: State value, even if it is not different from zero considering the error

Line 258-261: I am not sure what these two sentences mean. What is the technology which is reaching consensus?

Line 262: Please show this global analysis in a figure.

Line 272-273: You may want to cite two recent papers presenting data from the ASCA array: McMonigal et al. (2020) JPO, doi: 10.1175/JPO-D-20-0018.1, Gunn et al. (2020) accepted to JPO, no doi yet.

Line 292-295: It is not clear to me how fisheries would benefit from these changes, besides the increased upwelling. But I am not sure what a faster Agulhas Current, drier weather, or increased easterly winds would do to marine productivity. Please describe and/or cite papers.

Line 302: I strongly suggest that you do more comparison of the reanalysis and observational trends within this paper. It does not need to be extensive, but compare your trends to those from previous observational papers and explain why they agree (or why they disagree).

Figure 2: Why are panels d,e,f only shown to 200 m depth? Is there no trend below that?

Figure 3: very unclear that panel c is actually 5 panels.Maybe relabel so it is clear what c refers to

Figure 4: Please include a trend in in Sv yr-1, integrated over full depth, as well as in m s-1 yr-1 in upper 50 m. Otherwise, it is conceivable that your "accelerating" Agulhas is simply more surface intensified, but not actually strengthening.

Figure A1: What are the solid and dashed lines?

Citations: Elipot, S., & Beal, L. M. (2015). Characteristics, Energetics, and Origins of Agulhas Current Meanders and Their Limited Influence on Ring Shedding. Journal of Physical Oceanography, 45(9), 2294–2314. https://doi.org/10.1175/JPO-D-14-0254.1

Elipot, S., & Beal, L. M. (2018). Observed Agulhas Current sensitivity to interannual and long-term trend atmospheric forcings. Journal of Climate, JCLI-D-17-0597.1. https://doi.org/10.1175/JCLI-D-17-0597.1

Technical corrections: Line 97: "reduction to" should be "reduction of". Also unsure what "(Dec-Feb) interval" means.

Line 148: "accelerating 1900-2010" should be "accelerating over 1900-2010"

Line 282: "SST . . . IS warming"

Figure 4c caption: Do you mean meridional current? The Agulhas Current is (mostly) oriented southwards

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