Ocean Sci. Discuss.,
https://doi.org/10.5194/os-2017-85-RC1, 2017

Ocean Science Discussions

Interactive comment on "Moored observations of mesoscale features in the Cape Basin: Characteristics and local impacts on water mass distributions" *by* Marion Kersalé et al.

Anonymous Referee #1

Received and published: 28 November 2017

The manuscript by Kersale et al. is based on the analysis of a unique data set from a mooring array in the eastern South Atlantic in combination with PIES and satellite data. The authors identify four categories of mesoscale eddy events in the data ("cases") and provide an in-depth analysis of these cases. They make use of time series records from individual instruments (MicroCat, ADCP) and also used GEMS reconstructed hydrography information from depth integrating PIES observations.

I have a number of comments below that I think are important to address before the manuscript can be published.

First of all, I think the introduction needs re-writing. It is irritating that so much is

Printer-friendly version

Discussion paper

written about MOC and the different MOC programs in the Atlantic and so little about the problem the study is concerned with. Why do we need to know that there is a MOVE or RAPID when analysing and interpreting TS anomalies in eddies in the Cape Basin? – How does that really is connected to the study here? If it would be I would expect that at the end of the paper I know how this study contributes to the problem. Maybe I overlooked it – but I can't find a contribution of the findings presented here to the MOC. I understand that the complete SAMBA/SAMOC array (full basin width) aims to measure the MOC variability at the respective latitude but really this study is looking into a "local" aspect of hydrography and flow variability in the Cape Basin. It just makes use of the mooring infrastructure/data. I strongly suggest to shorten the AMOC part (to maybe one sentence only) but to expand a lot more on what the study is concerned with (and what is also reflected in the title): A LOCAL study on the structure of eddies (on the mesoscale only) in the Cape Basin. To me this would also mean to expand in the introduction on eddy/eddy interaction (dipole discussion), eddy detecting in mooring data (quite a bit of studies have worked on that), calculation of anomalies (please pay attention to pressure versus density space (see comments below). I would also suggest a brief introduction to GEMS in this set up – I understand that you used the T/S/pressure at the grid points (moored instrumentation) to set the local sound velocity points – the unknown would then most of the water column upward from the ADCP (upper 500m or so) – and which is were likely a lot of warm water (and thus sound speed) variability lies? Do you use satellite SST to give you one sound speed gridpoint at the surface?

Specific comments:

Line 40 to 50: why do we need to know these details? see my general comments above

Line 55-60: if you decide to leave in this part it would be useful to introduce HOW the mechanisms are behind MOC and water mass transformation and how precisely does that link to the analysis of eddies in the Cape Basin?

Line 64: are these "anomalies" similar to the anomalies that will be studies here? or is the first a transport anomaly in the DWBC (western array) and here local anomalies due to mesoscale eddies in the eastern boundary current are studied?

Line 88: I am missing all references to research on the circulation elements along the eastern boundary and in the Cape Basin. Are there undercurrents? Is there a coastal current? Does it connect to the north poleward or south? I would expect that the South Africans and Namibians have worked quite a bit here and know about the local/boundary circulation?

Line 89: Given the discussion later about eddies, dipoles, filaments etc. could you please introduce a bit more general wisdom on eddies and eddy/eddy interaction and inclduing filamentation and how all that links to water mass transformation (isopycnal heave versus water mass anomalies)?

Line 103: the MicroCat's have no pressure? How did you add pressure information? (it is required for calculating salinity). What will be the uncertainty in Salinity? Please indicate that you did not use the oxygen (or did you?)

Line 108: why do you know that the PIES was destroyed if it was lost?

Line 109: different approaches have been used in the past (e.g. creep function) - why linear? and, does it make a difference using other techniques? or maybe it is not relevant for your specific study (if so – make clear).

Line 120: What is the conclusion on accuracy after the calibration? Is it homogeneous across the data sets? How have the Microcats been quality controlled? And what do you expect for their accuracy?

Line 132: Please provide information about ADCP configuration and processing - depth allocation, compass calibration, depth cell length and ensemble lengths, number of bins, burst or spread mode?

Line 134: for my understanding most of the content in this paragraph (3.1.) must be

part of the introduction.

Line 139: is there maybe seasonal or other variability? What drives it? wind, topographic waves? Maybe a connection to the equatorial belt via waves?

Line 155-156: I would expect that to be part of the following chapter (3.2)

Line 156: why is there such a large std on the propagation? Could you add a few words explaining that. Many stationary eddies? interaction with mean flow?

Line 157: please add time period: "in 14?? months we observed....“

Line 169-170: how do you know that this is "usually below the Ekman layer“? what is your critieria for "Ekman layer"? did you compare ADCP shear with geostrophic shear? Did you calculate the Rossby number for the eddies? how important are the non-linear terms (Rossby number)? and how would that impact a conclusion on Ekman layer and other dynamics?

Line 170: is only one (the last?) bin used or a mean over a number of bins (which ones)? has the data been corrected for tidal effects via a tidal model or only through the butterworth filter? what is the bin length? (ADCP configuration should be added to Data and Methods section – see comment above)

Line 189: could you pls provide a depth range here?

Line 195: what do you mean by "dipole"? is that just neighbouring eddies or do the centres need to be at a minimal/critical distance? are there only cyclone/anticyclone dipoles or can there by a anticyclone/anticyclone dipole? more to add to Introduction. . .

Line 197: Referenced to a discussion below in this section: It may be helpful to show the nature of the variability discussed here in the context of the 4 "cases" - also in a T/S diagram of the time series - maybe embedded in the background TS. This would reveal immediately if this is a thermohaline anomaly of simply heave.

Line 198: in which respect "consistent" and "complete"? maybe saying "consistent and

complete picture of the mesoscale dynamics in the Cape Basin"? Even if the basin would be filled with eddies it is not clear that the basin dynamics as a whole is similar to the dynamics of the individual components.

Line 209: you differentiate between propagating (transient?) and "quasi stationary" eddies? what are the thresholds applied for that? or does transient means that the eddy dissolves when crossing the array?

Line 221: what does "associated" mean for you?

Line 227: in this summary you leave out all information about the temperature/filaments you discuss before - why? isn't that the key for the MOC connection?

Line 232: it would be helpful to get an idea about how well the centre of the eddy crossed the mooring. Progressive vector diagram type techniques can help to analyse that (see Lilly, J., and P. Rhines (2002), Coherent eddies in the Labrador Sea observed from a mooring, J. Phys. Oceanogr., 32, 585–598). Very much of your conclusion depends on who well the eddy centre was observed.

Line 251: what is the difference between a "core" speed and the maximum velocity magnitude? at which depth is the maximum velo. found?

Line 253: How much of this decrease is caused by TS anomalies (relative to ambient water) versus the vertical displacement of isopycnals in the eddy caused by rotation (heave)?

Line 257: is this a one-record-only speed? what depth? (this applies to all the numbers presented here (see cases above). with tidal current or not?

Line 266: This is a bit of a water mass zoo – you provide references but you may say in one sentence the origin of MUW? and OSW?

Line 283: in which respect "stabilizes" the SAMW?

Line 287: besides the changes in the vertical structure due to the dynamical adjustment

Printer-friendly version

Discussion paper

of the density field - you need to also consider the movement of the mooring - it can be seen that he mooring moved down by several hundreds of meters - for a cyclone that means that sampling is done at very different isopycnals (as uplift and mooring subduction operate into a similar direction)

Line 291: is that the bottom? or how many meters above the bottom?

Line 294: please give again reference that provides the information why you would expect to find A-AAIW – has it been observed in the Cape Basin before?

Line 309: is the high correlation maybe because you used the data to estimate the GEMs?

Line 313: how is this number estimated and what tells us the number?

Line 320: This looks strange - 0.38% - I guess that is because you use the salinity and not a salinity anomaly. Would also be low for temperature if you use absolute temperature instead of temperature on the Celsius scale. So my question is what we should take home from a 0.38%? to me it first looks like insignificant... You may think of a better way in showing what you want to show. using anomalies??

Line 326: sometimes you give meters (m) sometimes dbar (not db please). Please use either one or the other (convert m in dbar or vice versa).

Line 330: to me this is very confusing - what is uplift, what is real warming? are these anomalies detectable in GEMS if they are only isopcynal heave?

Line 333: again, how much is heave and how much is a real anomaly? In case of an isopycnal heave the "release" of the anomaly in the event of a dissolution of the eddy would have 0 (zero) impact on the environment.

Line 385: uplift of isopycnals has nothing to do with water masses variability - the local uplift of isopycnals in a vertical homogenously stratified fluid (e.g. through a local geostrophic adjustment of the density field) will create an anomaly when looking in

depth/pressure space but no anomaly when looking in density space. This is of fundamental importance when it comes to discussion of transport of water mass anomalies. Water mass anomalies are only "real" when looking in density space. Note, it may be helpful to show the nature of the variability discussed here in the context of the 4 "cases" - also in a T/S diagram of the time series (Figure 5-8) - maybe embedded in the background TS (see my comment above). This would reveal immediately if this is a thermohaline anomaly of simply a heave.

line 393: what does "direct" and "indirect" mean - please precise.

Line 396: Indian Ocean

Line 407: could you please provide reference for the decorrelation scales

Figure 5-8: a TS diagram oft he anomaly and a progressive vector plot to determine how close tot he centre the crossing took place would be helpful.

Figure 11: anomalies versus density would be of more help to show

---

Interactive comment on Ocean Sci. Discuss., https://doi.org/10.5194/os-2017-85, 2017.

Printer-friendly version

Discussion paper