

Interactive comment on “Three decades of research on the greater Agulhas Current” by J. R. E. Lutjeharms

Anonymous Referee #2

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This is a nice clear review of the Agulhas Current by an expert who has studied it more thoroughly and longer than most others. The paper is a summary of a lecture presented at the EGS meeting in Vienna in 2006 and of a longer book-length overview of the Agulhas (in press says the author). Generally it is written well and the figures are good. It would be an excellent way for someone not familiar with the Agulhas to learn about its history and about what is presently known about it. The emphasis is on observations vs theory. I enjoyed reading the paper.

One addition that would be a big help to the reader is to either add another figure with all the place names noted—towns, bights (Natal, Delagoa), banks, Agulhas Plateau, Walvis Ridge, Angoche, Comores Basin, etc. that were mentioned in the text or to add the missing names onto the present figures. Many times I did not know where the

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features discussed were located. I suppose the author knows all the territory like the back of his hand, but I do not and I expect many other readers will not either.

Several times (9) the author uses a question to motivate some answers and at other times (8) to indicate what is not known. In general this works ok, but I did find myself asking whether it would ever end and whether it might be better to use some other wording. If I were going to do this I think I would put the questions at the beginning of the paragraphs instead of at the end of a previous paragraph.

I would like to have seen a little more description about the sources of the Agulhas. Does some come through the Indonesian Seas, and if so how much? Around Australia? And a little more about the origin of the fluctuations in the Agulhas and its headwaters. Some of this information was provided in a recent paper by de Ruijter et al., (2005, Phil. Trans. R. Soc. A, 363, 63-76), which was not referenced and evidently not known by the author.

Some more specific comments:

Abstract (and conclusions). Doesn't part of the "final outflow of the system" water from the Agulhas enter the Atlantic (leakage) and flow north as part of the MOC? P 943. The paper shows nice velocity sections through an Agulhas ring and through the ARC but there is no section through the Agulhas proper. Surely there is a nice looking, informative direct velocity section through the Agulhas that could be shown and with which the ring and ARC sections could be compared. P 944/17, near bottom. I was confused by two sentences: "Not so intuitively Æ ignorance has remained." The paragraph starts about the cont shelf circulation but I think switches to the Agulhas. What direction is the opposite direction to cyclonic eddies—east or west? P 945/13. Reference for persistent eddy? P 947/14-17. Two "in this way"s were used in rapid fire. P 948/17. So which is it, either easterly or westerly? I can't see how you can have both at the same time? P 948. Large section on the Natal Pulse but no labels in the figures showing it. P 948/25. What did Grundlingh do with the meander after

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he captured it? P 949/6. The beginning of the rhetorical questions. Maybe put it at the beginning of next paragraph? P 949/13. What does “it” in “here it needs” refer to? P 949/14. Where does this “offshore eddy” come from? P 950/3. It would be nice to composite several images to get a cloud-free view of the region. The clouds make it hard to see some of the details. P 950. More questions. P 951/20. Suggest eliminating “About this Esection.” P 951/22. The Lee eddy is cyclonic or anticyclonic? Is it the same as a shear eddy? P 953/16. What is the “shorter durability” in months, say? Are these cyclones the same as the lee eddy? P 953/24. Actually wasn’t the pioneering investigation by Gordon and Haxby (1990)? P 953/26. Is the drift to the left of the average surface circulation or the average circulation over the depth of the ring? P 954/14. Aren’t there other sections through rings far from their source such as those by Garzoli et al. (1999) and McCartney and Woodgate-Jones (1991)? P 954/17. Maybe the study by McDonagh et al. (1999) should be mentioned since it pertains to mixing in the Cape Basin? P 954/27. What is a “berg wind?” P 955/12. It looks like the distance per time dashed lines in Fig 12 vary quite a bit, and that some could easily shift and match other ring formations. P 955/20. What is the difference between direct leakage and leakage due to rings? Would any direct leakage break up due to instabilities into anticyclones which would be hard to distinguish from rings? What is the best estimate of (maximum) average Agulhas transport (70 Sv?), average Agulhas leakage transport (17 Sv?). Does all this transport go into the MOC? What is the (maximum) average ARC transport? Do these balance? P 958/4. What about the outflow into the Atlantic– the Agulhas leakage? P 955/23. Maybe add the de Ruijter et al. (2005) reference mentioned earlier? P 960. What are the transports of the sources of the Agulhas through the Indonesian Seas and south of Australia? A few words on this subject would be interesting. Also, a few more words about the sources of fluctuations in this region would be of interest. P 961/4 in Conclusions. “–or believed to be known–” This sounds like part of one of Rumsfeld’s quotes and could be omitted. P 961/20. Can’t one have a western boundary current that consists of a stream of eddies so that a mean consists of a western boundary current? Isn’t the East Australian Current, which

is considered to be a WBC, mainly eddies? P 962/14. “exclusively” Isn’t part of our knowledge of the ARC based on surface drifters (Pazan and Niiler) and floats (Boebel et al.)? P 964. Lots of names and letters summarizing the names are given in parallel here. Do we need both sets? Suggest one or the other. Reference for ASCLINE? P 964/15. Maybe end up on a positive note, something about how the new studies will refine our ideas of the circulation and underlying physical mechanisms. Could it be possible that during the next few decades we will discover how the Agulhas controls the temp and salinity fluxes into the North Atlantic and how Agulhas fluctuations drive climate change there? Fig. 3 doesn’t have Natal Bight labeled. Fig. 4. Why are two area shaded– > 15 and < 2 ? Why is only the area inside the dashed contour shaded? Fig. 12 caption. The ellipses look like circles to me. Fig. 15. Vectors are from ADCP? Fig. 16. If wrong, why show? What is wrong about it? Maybe explain? It would be helpful to add some arrowheads on the double parallel lines indicating flow direction? Fig. 17. Sverdrups. Fig. 18. Doesn’t the ARC have more meanders as shown by Pazan and Niiler and by Boebel et al.? If so, wouldn’t it be good to show them? (This is somewhat similar to a figure shown by de Ruijter et al., 2005; they show more meanders).

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