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Ocean Science Discussions

Interactive comment on "Retroflection from a double slanted coastline – a model for the Agulhas leakage variability" *by* V. Zharkov et al.

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Let me start this review with a hypothetical question. Let's suppose that we take out all land above the 100 below sea level. In this imaginary world all coastlines would have disappeared but everything else would have remained as it is. The question is: would this drastic change eliminate the Agulhas Current or alter in any significant way its dynamics? It seems to me that the answer is not. The existence of the Agulhas Current, and its behavior, does not depend on what is on the top 100 meters of the water column but on what is below it. The continental slope acts as an insulator, preventing the leakage of energy from the large-scale circulation onto the coast. Thus all the energy transported by Rossby waves is accumulated in the continental slope, not in the coast. In other words, the existence and behavior of the Agulhas Current does not depend on

the shape of the coastline but on the shape of the continental slope. The difference might be of academic interest for places where the continental slope runs parallel to the coastline but not here. The "kink" of the African coastline is not mimicked by the continental slope. That is, the Agulhas Current does not follow the coastline; it follows the shelfbreak, a fact that is obvious in Fig. 1. Thus it seems to me that any theory of the AC that is critically dependent on the "shape" of the African coastline should be deemed with some suspicion. This includes the admittedly elegant but still (in my view) unrealistic study of Ou and de Ruijter. The authors can prove me wrong by running the proposed experiment. To that end they will have to abandon their reduced gravity model and use instead a 3-D model (e.g., POM, ROMS, etc).

My major criticism is not really a major criticism. I found this study an interesting and valuable academic exercise. The question of whether changes in the coastline influences the Agulhas Current could be rephrased in terms of whether changes in the shelfbreak or other topographic features orientation produce such changes. This article provides interesting answers to these important questions.

Minor criticisms:

Too many acronyms!

I don't think that there is any definitive (or even convincing) observational evidence that increases/decreases of the Agulhas C. transport influences the leakage. The proposed theory, however, provides an interesting argument to expect such a relationship.

There is no evidence (that I know of) that north/south displacements of the wind stress curl should be followed by similar displacements of the AC. Our own experiments indicate that the AC is sensitive to northward displacements of the wind stress curl but not southward displacements. The anisotropy is explained by the presence of the ACC.

I echo the other reviewer's concerns about the model. It is at least an order of magnitude too viscous.

Are the results robust to changes in the boundary conditions? From the figures it appears that the outflow (Agulhas Return Current) is imposed just to the south of Africa. In reality it is much farther south (the tip of Africa is at about 34ËŽS and the zero of the curl of the wind is at 45ËŽS). How the results would change if the outflow is moved farther south?

Interactive comment on Ocean Sci. Discuss., 7, 1209, 2010.