

## ***Interactive comment on “Transformation of an Agulhas eddy near the continental slope” by S. Baker-Yeboah et al.***

**S. Baker-Yeboah et al.**

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Dear Review#2,

Thanks for your very useful comments and suggestions on the manuscript: Journal: OS Title: Transformation of an Agulhas eddy near the continental slope Author(s): SBY Baker-Yeboah et al. MS No.: os-2009-50 Special Issue: Deep ocean exchange with the shelf.

→Point 1: Page 1824 —OK

→Point 2: Page 1825. Figs 2,3,4 —Although baroclinic instability may be playing a role, it seems clear that the cyclonic vortices C12C14 appear at the edge of the shelf, with no strong cyclones on the opposite side of the main anticyclone. The PIES data

C796

show a very strong signal of the cyclone (Fig 6: C12C14 in thermocline signal, with joint vortex L13 in deep pressure signal). Splitting takes place after this cyclone forms and the incident anticyclone begins to move away from the slope towards the NW propelled by the dipole interaction. To us, it appears that the splitting event is related to the strong mixed baroclinic- barotropic cyclone on the beta-plane as it begins to move towards the SW.

→Point 3: Figure Captions need work. —Fig 2. OK. Added text on AVISO SSH anomaly map. —————new caption "Upwelling on the shelf and deep ocean eddies along the continental slope off of South Africa during 23 July 2003 in AVISO SSH anomaly map."

→Point 3: Figure Captions need work. —Fig 2. OK. Added text on AVISO SSH anomaly map. —————new caption "Upwelling on the shelf and deep ocean eddies along the continental slope off of South Africa during 23 July 2003 in AVISO SSH anomaly map." —Fig 3. OK. Label C12C14 has been shifted over. (UPDATE last two figure panels in Fig.3) —Fig. 4. OK. Caption modified to say that "deep eddy L13 was coupled to C12C14 (see Fig. 6)". The deep eddy field is shown in the PIES data (Figs 6, 7, 8). —————new caption "Translation of cyclone C12C14 in maps of AVISO SSH sea level anomaly. Deep eddy L13 was coupled to C12C14 (see Figure 6))."

→Point 4: Page 1826 —Figures 7-9 show a second case study (A19).

→Point 5: Page 1831 —The "typical" description of Agulhas eddies as "equivalent barotropic" is not that well supported by velocity measurements. The term itself can have several meanings: meteorologists use it for structures with flow which does not reverse with height but which still has substantial shear. In the two layer context, we would use it for flows with no correlated deep signal. In the continuous context, this could correspond to vanishing velocity at the bottom. In our case, the counter-rotating lower layer eddy is not aligned with the upper layer eddy: the observations presented in Figs 7,8,9 show Agulhas eddies and cyclones that cannot be described as "equivalent

C797

barotropic."

The newly formed ring ASTRID in van Aken et al (2003) was not equivalent barotropic in the layer sense: it had co-rotating upper and deep structure and those authors suggest that ring ASTRID was "atypical". Agulhas rings can be different depending on their interaction with the ridge and seamount topography between the Cape and Agulhas Basins (Baker-Yeboah, 2008 and Baker-Yeboah, Byrne, and Watts, in prep 2009). Agulhas eddies do not appear to be EBT in the region of study (Baker-Yeboah, Watts, and Byrne, 2009, in press JTECH Vol 26, No. 12; & Baker-Yeboah, Byrne, and Watts, in prep 2009). Instead the PIEs data shows a range of cases with the deep flow often offset from the baroclinic signal (Baker-Yeboah, 2008; Baker-Yeboah, Watts, and Flierl, in prep 2009).

→Points 5 and 6: Page 1834/1835 —page 13, line 16 The more interesting case for the Agulhas eddies involves an upper layer anticyclone and a lower layer cyclone. —notice that these eddies are not aligned (one directly over the other). —Fig. 6 shows cyclonic lobe formation, which provides slope water with cyclonic vorticity.

→Point 7: —We say that eddy-slope interactions increase the number of c y c l o n e s in the Cape Basin. —The Agulhas Retroflection has much more going on and is a different region of study regarding this manuscript (MS No.: os-2009-50). Thanks for the reference to this recently submitted manuscript by van Sebille et al 2009.

—Even this high resolution model does not show much of the dynamics associated with these rings and thus the Agulhas Leakage. The processes presented in MS No.: os-2009-50 are not included in the van Sebille et al 2009 model study; other processes presented in Baker-Yeboah (2008) and subsequent papers Baker-Yeboah, Watts, and Flierl ( to be submitted in December) and Baker-Yeboah, Byrne, and Watts (to be submitted in December) have not been noted in the model either.

Many thanks, Sheekela

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C798

Interactive comment on Ocean Sci. Discuss., 6, 1819, 2009.

C799