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Comment

***Interactive comment on* “The influence of the Brazil and Malvinas Currents on the southwestern Atlantic shelf circulation” by R. P. Matano et al.**

R. P. Matano et al.

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Received and published: 22 July 2010

We thank Dr. Provost for her comments. We understand that at this stage we have to answer the reviewer comments and queries but cannot submit a revised version of the manuscript until the editor oversees these answers.

General comment: Section 2: A paragraph outlining the major characteristics of in-situ and remote observations will be added to the revised version of the manuscript.

Section 3 “South Brazil Bight” is ONLY model. True, but this deficiency reflects the paucity of observations. To assess cross-shelf exchanges a high-resolution consistent data set is needed. It is impossible to evaluate these fluxes from a few snapshots scattered through space and time. Thus, lacking sustained observations our discussion

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was focused on model results. In previous work we have compared the present model results with observations (e.g., Palma and Matano, 2009, Continental Shelf Research), to assess whether this particular model can be used to infer cross-shelf exchanges. As additional information attached you will find a comparison of the cross-shelf thermohaline structures reproduced by the model and those from the COROAS expedition (Campos et al., 2001, GRL). Model and observations compare well but the value of this comparison is limited. First, and most obvious, because the model was initialized with observations. Second, and most important, because hydrographic snapshots are of limited value to infer cross-shelf circulation patterns. Hydrographic observations are largely dominated by geostrophic equilibrium but most of the processes associated with cross-shelf exchanges are non-geostrophic i.e., second order in nature.

To address the reviewer's comment we will include a discussion of these matters in the revised version of the manuscript.

Section 5 is mostly observations. Yes. There are no modeling studies of the STSF.

Section 6 is only model and processes. It should include perspectives. What is needed
Section 6 is only model and processes. It should include perspectives. What is needed from both modeling and observation points of view? We agree. A discussion of these matters will be added to the manuscript.

I do not find useful to show the unrealistic numerical experiments EXP2 and EXP3 in a review paper. The corresponding figures can be removed. We disagree. Given the steadiness of the Malvinas Current it is not obvious what is its influence over of the Patagonian shelf. The comparison between two process-oriented experiments is one of the simplest and most straightforward ways to evaluate these matters. The result is not trivial and it is relevant to the understanding of cross-shelf exchanges.

Detailed comments: Section 3: P 842 line 10: Winter SSTs, which are not influenced by coastal upwelling, are more homogeneous with values between 20 and 23°C (Fig.2b): This is right except for a coastal patch of colder water (below 20°C) just to the south of

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Cabo Frio, at 23.5°S and 44°W. This patch deserves an explanation. Could the author comment about it? Good observation. This patch is produced by onshore intrusions of the Brazil Current in the bottom boundary layer (shelfbreak upwelling) (see attached figure). In this region the shelf is at its narrowest and therefore more sensitive to the excursions of the boundary current. A clarification of these matters will be added to the text.

The sentence l 26-20 p 843 “As shown in previous work (which one?) the circulation and density structures derived from the numerical simulations correspond well with observations” Palma and Matano (2009). The sentence will be corrected.

Lateral and vertical mixing, bottom friction are key parameters in this circulation simulation. Yet they are not discussed. A comment on the sensitivity of the model results to the choice of parameterization? POM uses Mellor-Yamada turbulence scheme for vertical mixing parameterization and Smagorinsky for horizontal mixing. Thus, mixing coefficients are consistently determined by the model resolution. We have not used other parameterization schemes but we have done ancillary simulations at lower and higher resolution. Although the mixing coefficients were consequently increased/decreased the numerical results proved to be robust. For example, increases of horizontal/vertical mixing (in low-resolution experiments) produce smoother fields, which augment the magnitude of the shelfbreak upwelling (e.g., Matano and Palma, JPO, 2008) but the overall circulation patterns remain unaltered.

Section 4: South of 39S “there is a well-defined jet known as the Patagonian Current” This current is not clear on Fig. 7 where there is a broad flow. It should be labeled on Fig. 1 to help the reader. The suggestion will be followed.

The largest entrainment of deep waters is observed through the Le Maire Strait. Could that entrainment be quantified? Yes, but we decided not to do quantifications until we make an assessment of the robustness of these estimates. The Le Maire Strait is close to the southern boundary of the model and we need to assess whether this proximity

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influences the magnitude of the transports through this region. To do so we need to assess the same results in a larger domain and with a higher horizontal resolution. We are confident that the general circulation patterns are robust because they are consistent with those observed in previous simulations (including the OGCM used for nesting) but the magnitude of the fluxes is likely to be influenced by the depth of the strait and the model resolution. For that reason we decided to focus our discussion on the general patterns of exchanges, which are robust features of the simulations.

Figure 7: the depths corresponding to the upper, intermediate and bottom levels should be explained. Are intrusions from the MC onto the shelf observed in the data around 59°S as shown in fig. 7c? Good suggestion. Upper levels include the first 5 levels of the model, bottom levels the 2 layer levels and intermediate levels all that is sandwiched between them. Since this is a sigma-level the depth spans of these “levels” vary from point to point. The intrusions observed in the model are consistent with those reported from hydrographic observations e.g., Romero et al. (2006, Fig. 8) and Sabatini et al. (2004, Fig. 8), which onshore intrusions of the MC.

P 845: line 16 “The magnitude of the upwelling is proportional to the transport of the MC” Could this be tested with observations? It could, but it would be a challenging enterprise. The transport of the MC could be effectively monitored from altimeter data but to monitor the magnitude of the upwelling is far more difficult. First, because vertical velocities are difficult to estimate and second because these velocities are going to be masked by waves (so long term measurements of vertical velocities would be needed). Indirect measurements, like those used to assess the shelfbreak upwelling in the Middle Atlantic Bight, might be a reasonable approach.

P 846: line 18 : “Imports deeper waters through Le Maire Straits and the shelf break region”. Could these imports be quantified? How large is the import through the narrow and shallow Le Maire Straits? See previous comment.

Part 6: Summary and discussion

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P 849 Lines 22 -27 should be removed. Too far fetched. Agreed.

What are the key issues ? What are the suggested approaches? We obviously need a better understanding of the physical, biological and geochemical exchanges between the southwestern Atlantic shelf and the deep-ocean, as well its impact on the ecosystems of both regions. Only to the extent that we recognize this as an important scientific and societal challenge will be able to address it in a meaningful way. We need to foster extensive discussions on these matters; particularly to identify processes and propose hypotheses. These discussions should help us to formulate international, multi-disciplinary research programs.

We will try to improve our discussion of these matters on the revised version of the article.

Interactive comment on Ocean Sci. Discuss., 7, 837, 2010.

OSD

7, C333–C340, 2010

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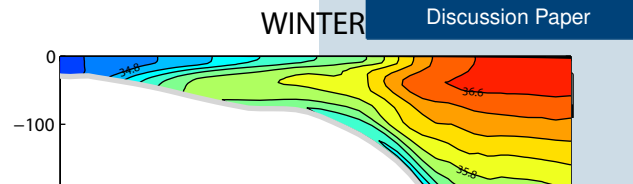
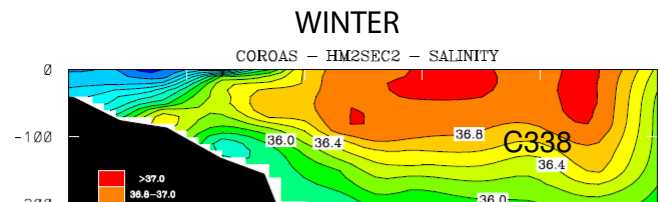
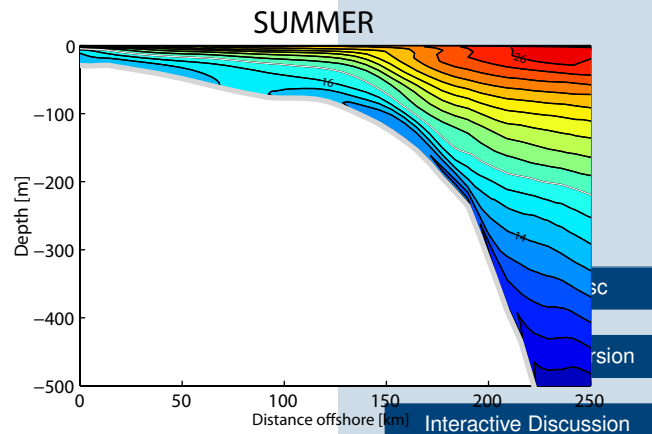
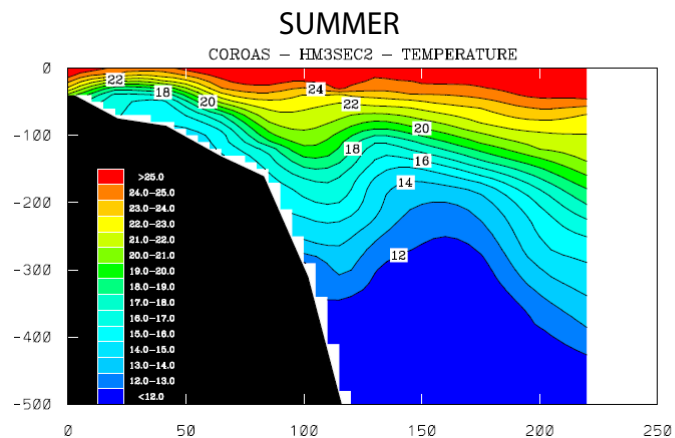
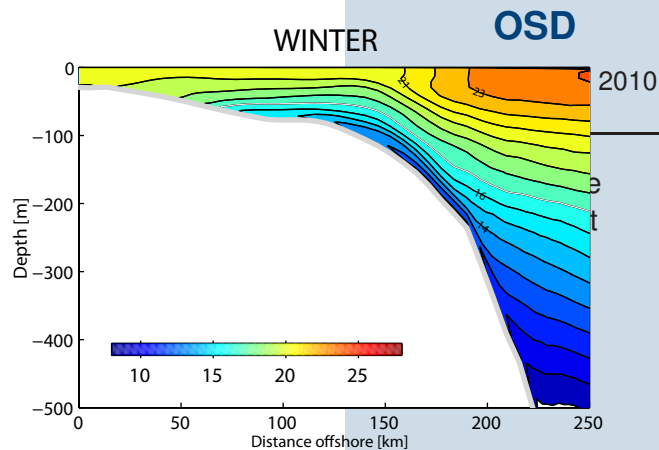
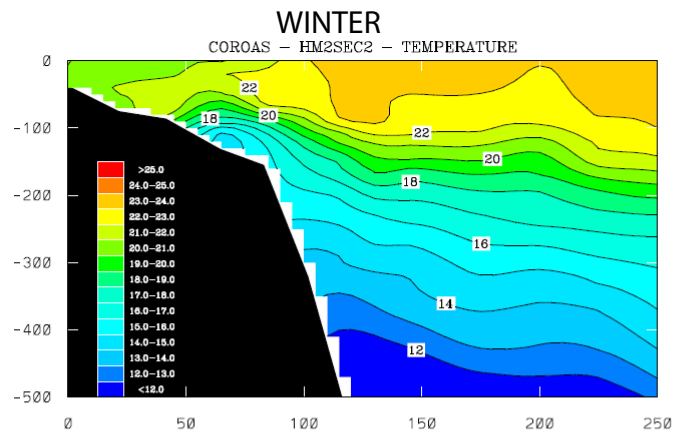
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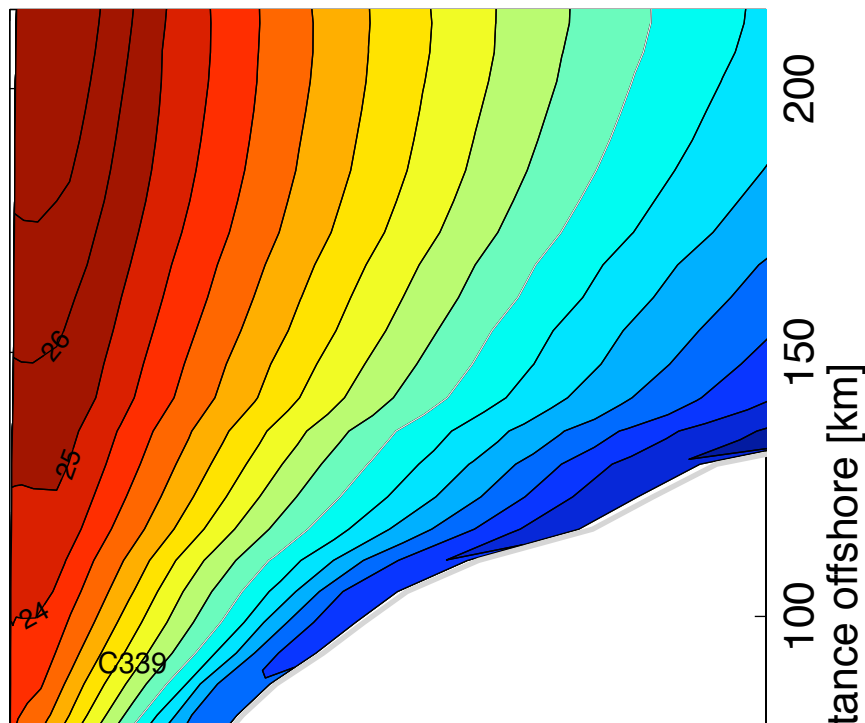
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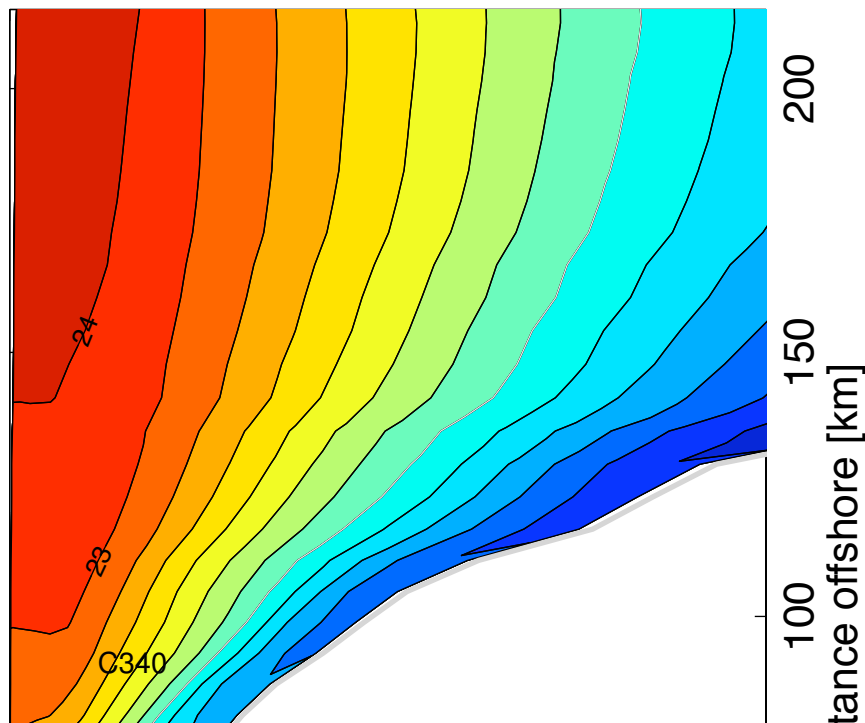
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