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Interactive comment on "Impact of currents on surface fluxes computation and their feedback on coastal dynamics" *by* A. Olita et al.

Anonymous Referee #2

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Review of "Impact of currents on surface fluxes computation and their feedback on coastal dynamics" by A. Olita, I. Iermano, L. Fazioli, A. Ribotti, C. Tedesco, F. Pessini, and R. Sorgente

General comments This paper addresses the role of surface current feedback on the computation of air-sea bulk fluxes in the Mediterranean Sea using the Regional Ocean Modeling System (ROMS). Two short simulations centered around the island of Sardinia are carried out, one with surface current feedback, and the other without. The authors compare the two sets of results with satellite sea surface temperature (SST) data, and conclude that the inclusion of surface current feedback improves the fidelity of the model simulation.

The authors briefly mention similar studies that focus on other regions of the world

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ocean, noting that none have yet considered the Mediterranean Sea.

My main criticism of this work concerns the technical side of the modeling. A general rule of thumb in regional ocean modeling is to put the boundaries far away from the region of interest. This rule is heavily violated by choosing a very small domain with a large island in the center; a consequence is that the authors must then be very confident of the quality of their open boundary procedures. But here there are additional problems: (1) MFS data at 1/16 resolution are used to feed the ROMS model, which has 2km horizontal resolution; this is a borderline grid refinement ratio of about 3.5 (eg, Debreu and Blayo, 2008); (2) MFS uses z-level coordinates in contrast to ROMS sigma coordinates. This makes precise matching of parent and child grids at the boundaries difficult (eg, Mason etal, 2010); (3) Choice of a clamped boundary condition forces the model to adjust to the relatively smooth MFS data, whether the information is incoming or outgoing. The cumulative result of these successive, questionable, choices is seen very clearly in figure 7 in the form of strong rim currents in the mean flow in the south east corner, and to a lesser extent in the north west. (It may be argued that these are manifestations of the Algerian Current and/or Algerian eddies, but the rectilinear patterns we see do conform to rim currents.) These anomalies are avoidable and, in my opinion, are serious enough to put the overall results from this work into question.

In order to recommend publication of this paper in Ocean Science, I ask the authors to rethink their modeling strategy. I strongly encourage you to consider redoing your experiments using a significantly larger domain (say 36-43N, 5-13E), a slightly lower horizontal resolution, a better choice of open boundary condition, and a longer simulation (several years at least). Many of these aspects are covered for ROMS in papers such as Marchesiello etal (2001), Penven etal (2006) and Mason etal (2010).

Specific comments

Section 2 The authors use the ROMS model: Which version, Rutgers or IRD? It would be helpful to readers who might want to reproduce your experiments to state in the

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paper what is the default bulk flux configuration in ROMS, ie, is it with or without relative winds? Is the default the same for the different versions of ROMS? Did you modify the code to switch on/off the relative winds, or is this an option provided in the code? Do you use a sponge? How strong? (Sec 2.2) You explain, correctly, why you are not using data assimilation. Here I would underline that the present configuration (domain, plus external forcing and OBC) is a long way from being ready for the introduction of any sort of assimilation. (Sec 2.3) Can you comment on the fact that the MyOcean SST has a considerably lower resolution than the model data. (Sec 2.3) Do you use the full domain (ie, all the way to the boundaries) for these metrics?

Section 3 Figure 2. It would be interesting to add some snapshots of model SST (BF and BFC) and observed SST at points when there is a good agreement, and also bad agreement.

Technical corrections

The labels on all of the figures are very small, almost impossible to read in some cases. Fig 2. Put the respective metrics from BF and BFC onto the same plots; ie, one column instead of two. Add some comparative SST snapshots here. Fig 3. Tell us what the white areas near the coast are? I recommend a complete revision of the English for frequent but mostly minor errors. As an example, the title should be “Impact of currents on surface flux computations and their feedback on coastal dynamics”.

References Debreu and Blayo (2008) Two-way embedding algorithms: a review. Ocean Dynamics. Marchesiello etal (2001) Open boundary conditions for long-term integration of regional oceanic models. Ocean Modelling Mason etal (2010) Procedures for offline grid nesting in regional ocean models. Ocean Modelling. Penven etal (2006) Evaluation and application of the ROMS 1-way embedding procedure to the central California upwelling system. Ocean Modelling.

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