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Ocean Science Discussions

Interactive comment on "The Sicily Channel Regional Model forecasting system: initial boundary conditions sensitivity and case study evaluation" *by* S. Gaberšek et al.

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The assessment of the forecast skill of the SCRM (initialized and forced from a coarser resolution model with VIFOP) carried out in this paper through experimental validation of the model results for a significant 5-day period is very relevant, despite the low skill found for the current field. The importance of validating an ocean forecast model seems obvious, yet the methodology, the techniques and the experimental data (both in situ and remotely sensed) used in this paper establish a high level standard for skill assessment in regional model studies in the Mediterranean Sea.

Passing to the results, it is not surprising that, among all the variables, the current velocities are those for which the model forecast yields the least skill, as currents can

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react very quickly to wind changes on a daily time scale, so they are very sensitive to the realism of the time integration, while temperature and salinity have a more sluggish response and are not expected to change much over this short period of time. For the latter, therefore, the high skill found is probably almost equivalent to the verification that a good initialization was performed. As for the important mismatch between measured and modeled currents, the brief discussion given at the end of section 4 does not seem satisfactory. It is certainly true that, as observed by the authors, the comparison with measurements taken in points C1 and C2 (the typical positions where current meters are located in the Sicily Channel in order to monitor the LIW flow) is negatively affected by the locally very variable bathymetry, so that small scale (also non-hydrostatic) effects can produce a response that cannot properly be described by the model, despite its high resolution. However this concerns the currents especially below the mixed layer, while the stronger discrepancy refers to the surface currents that are hardly affected by topographic effects.

The causes of the lack of agreement for surface currents have not been satisfactorily analyzed in the paper. On the other hand a simple comparison in C2 between winds (Fig. 10b) and measured (Fig. 10c) and modeled (Fig. 13) surface currents, respectively, seems to suggest that the surface geostrophic current in the model results is largely underestimated, and this may account for part (perhaps a large part) of the discrepancy. Indeed, the modeled surface currents are nearly in phase with the wind forcing and are almost perpendicular (to the right) to it, therefore they must be basically Ekman currents. The real surface currents, on the contrary, are apparently consistent with an almost along-channel geostrophic transport produced by the cross-channel pressure gradient associated with the piling up of water against the Tunisian coast until t˜2 days and against the Sicilian coast afterwards (the Ekman currents are clearly overwhelmed by this stronger geostrophic signal). The phase lag between winds and real currents (Fig. 10b-c) is evidently due to the time needed to achieve the geostrophic adjustment. In conclusion, it seems as if the model were not able to reproduce properly, on these temporal and spatial scales, the sub-surface horizontal pressure gradients

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caused by the horizontal divergence of the Ekman transport. If this is found to be the case, a thorough analysis of this limitation deserves to be carried out.

A final comment concerns a further investigation of the high frequency variability of the barotropic component of the currents that couples the dynamics with the bottom topography. In Figures 10-13 the measured and modeled currents below the mixed layer are so weak compared with the surface currents (according to which the scale of the arrows has been tuned) that mainly the mean flow can be distinguished, but some variability can be appreciated as well, and it might include interesting dynamical features. Modeling evidence was provided some years ago (Pierini, J. Geophys. Res., 101, 6429) that barotropic topographic Rossby normal modes can be supported by the steep and complex bottom topography of the Sicily Channel over periods of few days. An analysis of the along-isobath propagation of rotational motions could reveal the existence of this kind of features, since this model implementation has the ability of reproducing them (note that such waves would not show up in the total volume transport time series of Figure 2, as they would be confined in the interior of the channel). Moreover the specific case study presented in this paper might well include these waves, as they are expected to be excited by the passage of meteorological perturbations such as the one considered here. However, even if these motions were identified within the channel, probably the skill corresponding to this phenomenon in points C1 and C2 would not be high because locally the topography is extremely variable, so, as already noticed, the model may not be able to provide a sufficiently realistic response there.

Interactive comment on Ocean Sci. Discuss., 3, 221, 2006.