

Interactive comment on “Investigation of model capability in capturing vertical hydrodynamic coastal processes: a case study in the North Adriatic Sea” by W. J. McKiver et al.

Anonymous Referee #2

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This paper describes a model intercomparison for the Adriatic Sea. The authors present the results of two regional model simulations. The presented skill assessment is only partially useful as no velocity comparison is provided. A more complete, extensive, and quantitative assessment is suggested. However, the paper provides interesting results that could help understand the dominant processes in the formation of dense water in the region.

Major points:

It seems odd that the wind stress formulations are different for both models. Not only wind stress, but also parts of the heat flux computation are going to be different and

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results like the ones in Figure 9 could be affected. You are introducing differences in the model behavior even at the forcing stage. Please evaluate the resulting difference in forcing.

Also, why don't you conduct the simulations with the two models in similar horizontal resolution? While I understand the benefit of the finite element approach for avoiding excessive resolution in the deeper areas, the process you are trying to characterize is occurring in regions where the horizontal resolution of the FE grid might not be sufficient.

The model solutions are only assessed against temperature and salinity observations. The fact that no velocity observations were available (or used) makes parts of the analysis questionable. As it stands, the paper seems like a model intercomparison. The vertical velocity, being such a fine scale result, requires the horizontal flow to be properly characterized. Without appropriate assessment, the vertical estimates seem an exercise in model behavior, rather than a characterization of the vertical velocities during dense water formation events. While the title of your paper is “Investigation of model capability in capturing vertical hydrodynamic coastal processes”, the results presented do not answer whether the model is capable of capturing vertical motions in a realistic way.

Have you consider comparing the vertical velocity from the two models with results from observations? While direct vertical velocity measurements are lacking, I suggest considering indirect estimates such as the Klein et al. (2009) formulation.

References: Klein, P., J. Isern-Fontanet, G. Lapeyre, G. Roullet, E. Danioux, B. Chapron, S. Le Gentil, and H. Sasaki (2009), Diagnosis of vertical velocities in the upper ocean from high resolution sea surface height, *Geophys. Res. Lett.*, 36, L12603, doi:10.1029/2009GL038359.

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