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Ocean Science Discussions

Interactive comment on "The effect of various vertical discretization schemes and horizontal diffusion parameterisation on the performance of a 3-D ocean model: the Black Sea case study" *by* G. Shapiro et al.

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The manuscript in general fits to the journal Ocean Science but after some revision. The paper is based on the results of a sensitivity study carried out for five types of vertical coordinate of the NEMO ocean model in the Black Sea. The study is carried out for a number of idealized and real Black Sea configuration. The authors show that the "s-on-top-of-z" hybrid scheme with enveloping topography (SZHENV) proposed in this paper combines the advantages of both z- and s-level schemes and minimizes their drawbacks. Another results of sensitivity tests with various horizontal diffusion

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Interactive Discussion

Discussion Paper

formulations show that the mesoscale activity is better captured with a significantly smaller value of Smagorinsky viscosity coefficient than it was previously suggested by Griffies and Hallberg (2000).

There are few comments which authors should take into account, for my mind. From the paper title one can conclude that effects of various vertical discretization schemes are investigated. But authors compare results from versions of NEMO model which differ in their physical properties. For example in the ZCO model the lateral diffusion is pure horizontal diffusion. But SCO model has a lateral diffusion which acts along s=const surfaces. In this case over bottom slope this lateral diffusion makes a considerable contribution to the vertical diffusion. Mainly for this reason the maximum values of spurious currents for SCO is much greater then one for ZCO model, see Fig. 4. To overcame this difference between the ZCO model and SCO model one can write lateral diffusion operator in complex form as was done in INMOM (Institute of Numerical Mathematics Ocean Model) which used as oceanic component for INMCM IPCC model, see for example the paper (Diansky, N.A. Bagno, A.V., Zalesny, V.B., Sigma Model of Global Ocean Circulation and Its Sensitivity to Variations in Wind Stress. Izvestiya, Atmospheric and Oceanic Physics. 38, No. 4, 477–494). It worth to note that the numerical diffusion inherent to the TVD scheme makes a considerable contribution to the lateral diffusion along s=const surfaces in SCO model. The authors should take into account the above reasons.

Technical corrections. The authors use in their paper “real world setting” or “real world setting” and etc. I am not an expert in English but I would like to recommend changing these phrases by “real Black Sea basin (configuration and etc.)”. Line 5 at p. 3644: "hydrid" should be "hybrid". Line 14 at p. 3645: "2002;)" should be "2002)". Line 15 at p. 3651: "describedas" should be "described as ".

Figures 5. A panel “f” is absent.

I guess that after some revision the paper can be resubmitted for the next cycle of the

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reviewing process.

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