Ocean Sci. Discuss., 7, C59–C61, 2010
www.ocean-sci-discuss.net/7/C59/2010/

Ocean Science Discussions

Interactive comment on "On the numerical resolution of the bottom layer in simulations of oceanic gravity currents" *by* N. Laanaia et al.

Anonymous Referee #2

Received and published: 17 March 2010

Comments on 'On the numerical resolution of the bottom layer in simulation of gravity currents' by Laanaia et al.

This paper describes numerical simulations to investigate effects of the vertical resolution in the bottom boundary layer on gravity currents at a slope. Authors used a numerical model with both z-level and sigma co-ordinate. Most experiments were carried out in a two-dimensional form (the authors called it 2.5 D) and a small number of 3D experiments were also carried out. The conclusion seems no surprise - sufficient vertical resolution should be used in the bottom boundary in order to get descent and transport of the gravity current and the Ekman dynamics right. The interesting results are that the refined vertical resolution does not have to be very costly, sometimes, a few more level is sufficient. From this point of view, the paper is worth reading.

Major comments:

My main concern of the paper is if the results and conclusions, under highly idealized conditions, can be useful to many more realistic environments, namely, is the parameter space explored enough. For example, the slope of 1% is quite gentle; what will happen if the slope is much greater; the temperature difference of the gravity current being only 0.2 K.

Minor comments:

P418, line21: 'Oceanic gravity currents are small scale processes, only about 100km . . .' In oceanography sense, I do not think that 100 km is a 'small scale'.

The model: there is not sufficient information about the model. For example, how does it calculate horizontal pressure gradient terms in a sigma coordinate (which is an important issue)?

2.5 D model: I think this is really a 2D vertical section model in oceanography sense. Again, this is a terminological issue, but since this journal is 'ocean science', not fluid mechanics, I think that '2D model' is more appropriate.

p424: Constant vertical viscosity and diffusivity is not consistent with a no-slip bottom boundary condition. This maybe an important issue here since it must be a factor considering vertical resolution in the bottom boundary layer.

Convection adjustment: I found the results with convection adjustment puzzling. In a hydrostatic model, density inversion can occur, but has no physical meaning and contradicts the hydrostatic approximation. It, therefore, should be suppressed. From Fig.2, one cannot visually see the density inversion happening. However, there is a significant difference between fig.2 and fig.4. I personally do not think that the high vertical diffusivity is the correct method to do this. However, it is a practice often being used.

Interactive comment on Ocean Sci. Discuss., 7, 417, 2010.