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Reducing the Numerical Vertical Diffusion in the Ocean: an Arbitrary Lagrangian Eulerian Approach

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In Ocean General Circulation Models using a level vertical coordinate (i.e. non-isopycnal models) a significant part of the vertical velocity field is composed of high frequency oscillatory signals. They are due to high frequency surface motions are internal waves and can generate some numerical vertical diffusion. Its magnitude can be the same or even larger than the one associated with the prescribed background diffusivity. The z^* or s^* vertical coordinate already address this issue for vertical velocities induced by surface motions. Here, the purpose is to generalize this approach to all high frequency vertical motions in the ocean.
We first describe an arbitrary Lagrangian Eulerian vertical coordinate implemented in the Nucleus for European Modelling of the Ocean (NEMO) that allows to absorb the fast varying component of the vertical motions with the layer thickness evolution and only let a slow varying vertical flow through the horizontal grid-cell interfaces. Then we will present preliminary results that show a drastic reduction of the noise in the vertical velocity signal and subsequently a reduction of the numerical vertical diffusion.