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Internal waves generation, propagation and induced mixing in OGCMs

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Recent observations and numerical experiments suggest that energy from the barotropic tides is the main contributor for the deep ocean mixing by the process of internal wave breaking. Here, the process of internal wave generation and propagation is first examined for an idealized configuration (isolated Gaussian topography) using an analytical solution and two numerical models, the HYbrid Coordinate Ocean Model (HYCOM) and the Regional Ocean Modeling System (ROMS). The main goals of this study are: 1) to investigate the internal wave representation in these models as a function of a wide model grid spacing range (500 m to 100 km) and 2) to quantify the spurious diapycnal mixing associated with the transport of density in the fixed coordinate ocean model (ROMS). The results show that the choice of model grid resolution is crucial to properly simulate the internal waves. In the coarser grids, the resulting baroclinic velocities are weaker and critical locations where internal waves are generated can be removed. This leads to inaccuracy in capturing the tidal conversion process and thus misrepresentation of energetic smaller scale motions. The refinement of the grid resolution rapidly converges to the analytical solution from which a grid spacing is determined that provides sufficient accuracy of the numerical solution. Some estimates of the numerically induced vertical mixing in ROMS are provided for these model configurations.