Horizontal Advection/Diffusion in HYCOM

by George Halliwell, 25 August 2001

HYCOM uses the same fundamental algorithms for horizontal advection and diffusion that were used by MICOM. These algorithms are described in MICOM documentation, and also in the review paper by Bleck (1998). This note describes simple modifications of these algorithms for implementation in HYCOM.

When HYCOM is run with isopycnic vertical coordinates (MICOM mode), horizontal advection/diffusion is performed in the same manner as in MICOM. Temperature and salinity are advected and diffused in layer 1. Only salinity is advected and diffused in deeper layers, with temperature diagnosed from the equation of state to maintain constant density in these layers. When HYCOM is run with hybrid vertical coordinates, the user selects whether temperature and salinity, or just salinity, are advected and diffused within the upper n_{hyb} layers that the user declares to be hybrid layers. This option was included because the effects of cabbeling when both temperature and salinity are advected and diffused can lead to problems with the adjustment of vertical coordinates by the hybrid coordinate algorithm, particularly if the user selects to flux both temperature and salinity across the moving vertical coordinates.. (See the separate documentation of the hybrid coordinate algorithm.) When salinity only is advected/diffused, these problems do not appear, but the tradeoff is that temperature is no longer conserved. In low-resolution simulations of Atlantic Ocean climate, the non-conservation of temperature did not have a large influence on simulated fields.