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Comparison of a range of turbulence schemes for thermally stratified lakes

In stratified lakes the vertical mixing processes are small, as evidenced by the small seasonal change in the hypolimnion temperature found in mid- and high-latitude lakes like the Great Lakes. The basin-scale internal wave field appears to be the fundamental control mechanism for the cascade of energy from the wind into mixing and benthic boundary layer (BBL) transport. Mixing in the metalimnion and the BBL is crucial to the vertical flux of nutrients and oxygen. In this talk a comparison of the Massachusetts Institute of Technology General Circulation Model (MITgcm) and the General Estuarine Transport Model (GETM) to an extensive set of time series and spatially resolved measurements of Lake Erie, with particular emphasis on appropriate parametrization schemes for the vertical mixing is discussed. The two approaches for the parametrization of vertical mixing include the K profile parametrization and the Generic Length Scale (GLS) closures. The GLS turbulence closures used for the Lake Erie setup are: the Mellor and Yamada level 2.5, $k-\epsilon$ and, gen a new closure scheme developed by Umlauf and Burchard [2003]. Comparison with observations shows that the models can reproduce the time evolution of the lake temperature reasonably well. This is a joint work with Dr. K. G. Lamb.