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Parameterization of the Effect of Langmuir Circulation in the Ocean Mixed Layer Model Using LES and its Application to the OGCM

Yign Noh (1), Hyejin Ok (1), Eunjeong Lee (1), Takahiro Toyoda (2), and Naoki Hirose (3)

(1) Yonsei University, Atmospheric Sciences, Seoul, S. Korea (noh@yonsei.ac.kr), (2) Meteorological Research Institute, Oceanographic Research Department, Tskuba, Japan (ttoyoda@mri-jma.go.jp), (3) Kyushu University, Research Institute of Applied Mechanics, Kasuga, Japan (hirose@riam.kyushu-u.ac.jp)

Analysis of LES data reveals that Langmuir circulation (LC) induces a significant enhancement of the turbulent length scale and consequently of vertical mixing in the ocean mixed layer (OML), when stratification is weak and MLD is shallow (Noh et al. 2011). Based on the LES results, the OML model (Noh and Kim 1999, Noh et al. 2002) is modified to include the effects of LC, such as the enhancement of the length scale and the inclusion of the wave-force production of TKE. The prediction from the new OML model under the ideal conditions of surface wind stress and heat flux shows a good agreement with LES results, including the evolutions of temperature and dissipation rate. The new OML model is then embedded into the global ocean model MRI.COM with the global estimation of the Langmuir number. The OGCM results are found to improve the reproduction of the upper ocean structure significantly. The new OML model helps especially to produce sufficient mixing in the Southern Ocean during summer, while maintaining a realistic thermocline structure globally.