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Formation of a Seasonal Thermocline Simulated by Large Eddy Simulation

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The formation of a seasonal thermocline is simulated successfully from LES, reproducing various features consistent with observation. The simulation is carried out for 10 days under the constant wind stress and the idealized diurnal variation of the surface heat flux in both tropical ($\phi = 0^o$) and extratropical oceans ($\phi = 40^o$), which reveals that the dynamical process of thermocline formation is radically different depending on latitude. In the extratropical ocean, the downward propagation of heat and momentum is limited to the depth of a seasonal thermocline, which is determined by wind stress, surface heat flux, and the Coriolis force, and the stratification and shear at the thermocline continue to increase with time. On the other hand, in the tropical ocean, the heat and momentum continues to propagate downward indefinitely below the thermocline, and the stratification and shear at the thermocline remain at a certain level. Consequently, much larger increase of SST and its diurnal variation is generated in the extratropical ocean than in the tropical ocean. Time series of TKE budget is analyzed to clarify the difference in the dynamical process. The effect of diurnal variation of the surface heat flux is also investigated by comparing the cases with and without diurnal variation of the surface heat flux. Furthermore, the results are compared with the prediction from the 1-D mixed layer model (Noh & Kim 1999, Noh et al. 2002).