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Impact of parameterizations of vertical mixing on upper ocean simulation of the East Sea

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We investigate effects of vertical mixing parameterization on the East Sea circulation, focusing on the seasonal variations of sea surface temperature (SST) and mixed layer depth (MLD). We employed four different vertical mixing schemes: constant mixing scheme (hereafter, C scheme), Pacanowski-Phillander scheme (PP scheme), Mellor-Yamada scheme (MY scheme), and a new scheme (NEW). NEW scheme, a second-order turbulence closure, has been developed considering recent observational evidences such as the enhancement of turbulent kinetic energy near the sea surface. Model simulations with GFDL MOM1.1 were started from the rest with horizontally-uniform density field, and integrated for 50 years forced by in-out flows and a monthly-mean climatology of Haney-type heat flux and wind stress. During summer C scheme underestimates the SST, while PP and MY schemes overestimate the SST, compared to climatological SST. The summer SST from NEW scheme is much closer to the climatology. During winter all schemes overestimate the SST up to 4ąÉ compared to climatological SST. Vertical profiles of basin-mean temperature show that C scheme produces higher temperature below the thermocline than those of other schemes. The MLD simulated from C scheme is rather large during winter, while the differences in MLD during summer are not significant. Deep mixed layer near Vladivostok associated with the wintertime convection is not simulated properly regardless of vertical mixing schemes, which significantly alters deep water temperature and salinity. The NEW scheme improves significantly the seasonal variation of heat storage in the upper ocean, while the other schemes underestimate it.