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Numerical Investigations of Wave-Induced Mixing in Upper Ocean Layer

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The upper ocean layer is playing an important role in ocean-atmosphere interaction. The typical characteristics depicting the upper ocean layer are the sea surface temperature (SST) and the mixed layer depth (MLD). So far, the existing ocean models tend to over-estimate SST and to under-estimate MLD, due to the inadequate mixing in the mixing layer, which is owing to that several processes related mixing in physics are ignored in these ocean models. The mixing induced by surface gravity wave is expected to be able to enhance the mixing in the upper ocean layer, and therefore the over-estimation of SST and the under-estimate of MLD could be improved by including wave-induced mixing. The wave-induced mixing could be accomplished by the physical mechanisms, such as wave breaking (WB), wave-induced Reynolds stress (WR), and wave-turbulence interaction (WT). The General Ocean Turbulence Model (GOTM) is employed to investigate the effects of the three mechanisms concerning wave-induced mixing. The numerical investigation is carried out for three turbulence closure schemes, say, k-epsilon, k-omega and Mellor-Yamada (1982), with the observational data from OSC Papa station and wave data from ECMWF. The mixing enhancement by various waved-induced mixing mechanisms is investigated and verified.