



Abstract Details

[AOGS 1st Annual Meeting](#) > [Ocean and Atmospheres](#) > **Application of LES to the Understanding of the Mixing Processes** >

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Title: Application of LES to the Understanding of the Mixing Processes

Abstract:

Turbulence is a ubiquitous phenomenon in geophysical flows, and plays critical roles in the atmospheric and oceanic boundary layers, cumulus clouds, oceanic deep convection, etc.. Thus simulating turbulence accurately is a very important task to understand geophysical flows and to improve their models. Recently, thanks to the availability of massive computing power, significant progress has been achieved for the simulation of turbulence by large eddy simulation (LES). One important characteristic of LES is that it reproduces the randomly fluctuating eddies of turbulence, providing us various statistical characteristics of turbulence as in the case of high frequency measurements of turbulence. This makes LES an important tool in verifying and improving parameterizations of turbulence used in larger scale models. Here, LES results of various geophysical turbulence phenomena are presented with the applications to their parameterizations. Using the LES of the ocean mixed layer, we investigated the roles of wave breaking and Langmuir circulation, and the effects of surface heat flux on Langmuir circulation. Further, we examined the parameterizations used in the ocean mixed layer models. Meanwhile, the LES of the motions of a number of Lagrangian particles in the ocean mixed layer helps us to clarify the particle settling process in the upper ocean, which plays an important role in the carbon cycling in the ocean by way of the biological pump. The LES of the atmospheric boundary layer is used to develop a new PBL model, and the LES of open ocean deep convection is used to determine the onset of baroclinic instability.

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1				