New Cartoon of wave-turbulence interaction in the upper Ocean

Ocean waves not only excrete permanent loads on offshore floating and fixed structures, but also have a great influence on air-sea interaction processes such as exchange of heat, momentum, energy, gas, and turbulent processes. Although the critical importance of coupling between waves, currents, and turbulence has led to development of several theoretical, numerical, and observational studies, this integrated system very close to the wavy interface still remain insufficiently resolved due to the wave-induced disturbances and harsh operational conditions. This dissertation aims to improve the gap in our knowledge on the physics of small-scale processes near the wavy air-sea interface with emphasis on theory, numerical predictions, and qualified observations under various sea states and wind conditions.

An autonomous Microstructure Ocean Turbulence System (MATS) has been constructed to collect long time series of turbulent quantities and surface gravity waves at a fixed level below the wavy air-sea interface. Four successful deployments have been carried out, including two periods with storm conditions in the Norwegian Sea. In addition to MATS, a direct covariance flux system was mounted on a moored moving buoy to measure the turbulent heat and momentum fluxes in the marine atmospheric boundary layer approximately 3.7 m above the sea surface during a field campaign at Martha's Vineyard Coastal Observatory, Massachusetts in 2010.

To gain further in-depth understanding of the coupled processes, different parameterizations and scaling of wave interaction with near surface turbulence have been incorporated and implemented in the General Ocean Turbulence Model (GOTM) to include breaking and non-breaking waves, and Langmuir Circulations in the upper ocean. The wave-modified model results are further compared with MATS measured Turbulent Kinetic Energy dissipation rates and some other data from the literature. All model-observation study results support the importance of wave forcing in modulating upper ocean dynamics and the turbulence structure near the sea surface.

Time and place of the trial lecture:

23.06.2014, cl. 10.15, Auditorium 105, Jahnebakken 3 at GFI. Given topic "Surface gravity waves in ice-covered waters".

Time and place for the dissertation:

20.08.2014, cl. 13.15, Auditorium 105 in Jahnebakken 3, Geophysical Institute.

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