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Wave-induced turbulence, and its role in connecting small- and large-scale ocean processes

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In the presentation, wave-induced influences at the ocean side will be discussed. While the role of breaking waves in producing turbulence is well appreciated, the turbulence produced by wave orbital motion at the vertical scale of wavelength – is not. Such mixing, however, produces feedbacks to the ocean circulation at scales from weather to climate. In order to account for the wave-turbulence effects, large-scale air-sea interaction models need to be coupled with wave models. Theory and practical applications for the wave-induced turbulence are reviewed in the presentation.

Analytical approaches for the wave turbulence include viscous and instability theories which appear to be linked. This was verified through direct numerical simulations with fully nonlinear wave model coupled with three-dimensional (LES) model for turbulence. Furthermore, dedicated laboratory experiments and field observations, both in situ and by means of remote sensing, confirmed and validated the conclusions of theory and academic simulations and tests. Finally implementations of the wave-turbulence modules in models for Tropical Cyclones, ocean circulation and sea ice will be demonstrated.