JpGU-AGU Joint Meeting 2017

Kinetic Energy Flux Budget Across Air-sea Interface

*Yalin Fan[1]

1. Naval Research Laboratory

The kinetic energy (KE) fluxes into subsurface currents (EF_c) is important boundary condition for vertical mixing in ocean circulation models. Traditionally, numerical models assume the KE flux from wind is identical to the KE flux into subsurface currents, that is, no net KE is gained (or lost) by surface waves. This assumption, however, is invalid when the surface wave field is not fully developed. When the surface wave field grows in space or time, it acquires kinetic energy, hence, reduces the KE fluxes into subsurface currents compared to the fluxes from wind. In this study, numerical experiments are performed to investigate the KE flux budget across the air-sea interface under both uniform and idealized tropical cyclone winds. The wave fields are simulated using the WAVEWATCH III model under various wind forcing. The difference between the KE flux from wind and that into ocean currents is estimated using an air-sea KE budget model. To address the uncertainty of these estimates resides in the variation of source functions, two source function packages are used for this study: the coupled wind wave model by Moon et al (2004) and the ST4 source package by Ardhuin et al (2010). Simulated KE flux into the ocean currents are found to be consistent with field observations by Terray et al. (1996) and Drennan et al (1996). It is significantly reduced relative to the KE flux input from wind under growing seas. The reduction can be as large as 20%, and the variation of this ratio is highly dependent on the choice of source function for the wave model. Our results also suggest that the normalized KE flux by the friction velocity cube (u_*^3) may depend on both wave age and friction velocity (u_*), and a new parameterization for EF_c is proposed.

Keywords: turbulent kinetic energy, surface gravity waves, high winds

