Abstract Submitted
for the DFD16 Meeting of
The American Physical Society

The response of the Ocean Surface Boundary Layer and Langmuir turbulence to tropical cyclones DONG WANG, TOBIAS KUKULKA, Univ of Delaware, BRANDON REICHL[1], TETSU HARA, ISAAC GINIS, Univ of Rhode Island — The interaction of turbulent ocean surface boundary layer (OSBL) currents and the surface waves' Stokes drift generates Langmuir turbulence (LT), which enhances OSBL mixing. This study investigates the response of LT to extreme wind and complex wave forcing under tropical cyclones (TCs), using a large eddy simulation (LES) approach based on the wave-averaged Navier-Stokes equations. We simulate the OSBL response to TC systems by imposing the wind forcing of an idealized TC storm model, covering the entire horizontal extent of the storm systems. The Stokes drift vector that drives the wave forcing in the LES is determined from realistic spectral wave simulations forced by the same wind fields. We find that the orientations of Langmuir cells are vertically uniform and aligned with the wind in most regions despite substantial wind-wave misalignment in TC conditions. LT's penetration depth is related to Stokes drift depth and limited by OSBL depth. A wind-projected surface layer Langmuir number is proposed and successfully applied to scale turbulent vertical velocity variance in extreme TC conditions.

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Date submitted: 01 Aug 2016 Electronic form version 1.4