Abstract Submitted
for the DFD13 Meeting of
The American Physical Society

Atmosphere-ocean exchanges over slow and fast wave fields QI LI, ELIE BOU-ZEID, Department of Civil and Environmental Engineering, Princeton University, Princeton, NJ, NIKKI VERCAUTEREN, Department of Physical Geography and Quarternary Geology, Stockholm University, Stockholm, Sweden, MARC PARLANGE, School of Architecture, Civil, and Environmental Engineering, École Polytechnique Fédérale de Lausanne, Lausanne, Switzerland — We explore the influence of surface gravity waves on momentum and scalar exchanges between the atmosphere and underlying water surfaces, based on field experimental data sets. The existence of both slow (occurring under active local wind forcing) and fast (swell) waves and their interactions with the atmosphere show unique features compared to flow over fixed walls. While turbulence and fluxes over slow waves surfaces share many features with flow over fixed surfaces, fast moving waves complicate the picture with different ranges of scales transporting momentum in opposite vertical directions. We further show that, especially under fast-wave conditions, the surface waves' phase velocity and directionality influence the form drag at the surface, inducing a misalignment between the surface stress and wind velocity vectors. This improved understanding allows us to re-approach how classic loglaws and their extension to non-neutral conditions (the Monin-Obukhov similarity theory) are formulated and applied over the marine/water surface. Particularly, we show that the appropriate air velocity parameter to use in these laws is the difference between the wind velocity component parallel to the wave propagation direction and the wave phase velocity.

Qi Li
Department of Civil and Environmental Engineering,
Princeton University, Princeton, NJ

Date submitted: 25 Jul 2013 Electronic form version 1.4