Near-surface Characteristics Over the Ocean Affecting Electromagnetic Wave Propagation

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Quantifying surface fluxes and atmospheric vertical profiles are essential to accurate electromagnetic (EM) wave propagation assessment and modeling and was the overall objective of the recent Trident Warrior 2013 (TW13) field campaign. During TW13, a suite of in situ measurements were made near the surface off the coast of Virginia Beach, VA between July 13 and July 18, 2013 using a combination of Unmanned Aerial Vehicle (UAV), rawinsondes, tethered-sondes, and flux buoys. We make extensive analyses of these data, with a focus on measurements from the surface flux buoy to understand the characteristics of surface flux, upper ocean temperature and surface waves, and the near surface atmospheric temperature and moisture variability. Our analyses also extends to a higher level using the low-level measurements from rawinsonde and tethered sonde measurements co-located with the surface buoy.

In this presentation, we will first discuss the validity of the Monin-Obukhov similarity theory in different thermal stability and wind conditions. The adequacy of current surface flux parameterization involving explicit wave parameters, such as wave age or wave slope, will also be discussed using the measurements from TW13. Results from several roughness length parameterizations will be shown where the momentum drag coefficients at 10m height will be obtained using the COARE surface flux algorithm with measured and parameterized bulk wave parameters. Results from our modeling effort on TW13 cases will also be presented using the single column model (SCM) simulations of the coupled Oceanic and Atmospheric Prediction System (COAMPS). This initial modeling effort intends to examine the potential of using SCM prediction at much higher vertical resolution in revealing the fine vertical structure of the marine atmospheric boundary layer for EM propagation study. The extent of its impact on EM propagation from AREPS model will also be discussed. A general scheme of a hybrid approach using SCM and 3-D COAMPS simulations for future study will be discussed.