CASPER - A New Multidisciplinary Research Initiative on Electromagnetic Wave Propagation in the Marine Atmosphere

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An important application of air-sea interaction research is in characterizing marine atmospheric boundary layer properties in order to predict radar and radio communication conditions in the maritime environment. In this presentation, we will give an overview of a new research initiative funded under the Office of Naval Research (ONR) Multi-University Research Initiative (MURI). The project is dubbed Coupled Air-Sea Processes and EM Ducting Research (CASPER). The objective is to fully characterize the marine atmospheric boundary layer (MABL) as an electromagnetic (EM) propagation environment. The emphasis will be on spatial and temporal heterogeneities and surface wave/swell effects, both of which contravene underlying assumptions of Monin-Obukhov Similarity Theory (MOST) used in coupled environmental forecast models and evaporative duct models. Furthermore, coastal variability in the elevated trapping layer atop the MABL presents a challenge to forecast models and also causes practical issues in trapping layer interpolation in EM prediction models. These issues are the target of investigation in this project.

CASPER approach includes theoretical analyses, field measurements, and numerical modeling. The field components have two main campaigns: CASPER-East (Duck, NC, October 2015) and CASPER-West (Southern California, august 2017). These two campaigns will capture ducting along developing internal boundary layers over inhomogeneous regions near the Gulf Stream, evaporative ducts over warm water and affected by wave/swell, and surface-based and elevated ducts near the MABL top under coastal influence. Also unique to CASPER is the concurrent measurements of MABL turbulence, scalar mixing and detailed range-dependent propagation measurements. The data analyses will address scientific questions related to spatial heterogeneity, waves and swell, and novel approaches to EM propagation modeling and signal characterization. A suite of models to be used in CASPER will also be discussed.