EO/IR, RF and mm-Wave Propagation Measurements in the Marine Atmospheric Surface Layer during the CASPER Environment

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The marine atmospheric surface layer (first tens of meters above the surface of the water) is a dynamic medium for the propagation of electromagnetic energy from microwave frequencies through visible light. The effects on the propagation variations in the surface layer are a result of natural fluctuations in the environment driven primarily by meteorological conditions and the interaction between the air and sea. The most dominant effects are refraction by mean gradients and turbulent perturbations, attenuation by both atmospheric gas molecules and aerosols, and scattering off aerosols as well as the sea surface, with the relative importance of each varying with wavelength.

To better understand and quantify the correlation of the propagation with the environment, JHU/APL made several multi-band measurements in the marine atmospheric surface layer during October 2015 off the coast of North Carolina as part of the Coupled Air Sea Processes and Electromagnetic ducting Research (CASPER) program. This JHU/APL portion of the CASPER field campaign consisted of both fixed point-to-point and mobile geometries, all with over-water paths. Additionally, bulk meteorological data were collected to provide the information for validation of various propagation models. Carrier-wave (CW) RF signals in S-band (2.9 GHz), C-band (4.9 GHz) and X-band (10.7 GHz) were measured alongside 36 CW frequencies throughout W-band (75-110 GHz) and infrared measurements from short-wave through long-wave.

This presentation will provide brief descriptions on the setup of these measurements and a few examples of the measured multi-band propagation data. Investigations will focus on the temporal and spatial variability of the propagation, but are limited to surface layer geometries. Background information about the larger CASPER program and its objectives will be covered in other presentations.