Comparison of Measured and Predicted Propagation during CASPER East Field Campaign using Different Methods of Environmental Estimation

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Accurate simulation of the propagation of electromagnetic (EM) waves in the environment at X-band requires detailed knowledge of the refractive environment as well as information about the sea state. There are a variety of ways in which the refractive environment might be estimated including: theoretical models (e.g., Monin-Obukhov similarity theory), direct atmospheric measurement, numerical weather prediction, and inversion approaches. Each of these methods have their own limitations and advantages.

During the CASPER East field experiment performed in October 2015 offshore of Duck, NC, direct measurements of the atmosphere and ocean were performed in support of such EM wave propagation predictions. These measurements were performed from multiple platforms and can be used to estimate atmospheric refractivity and model the ocean surface. Deterministic predictions of conditions were also made using the Coupled Ocean/Atmosphere Mesoscale Prediction Systems (COAMPS). In addition to the environmental measurements, EM propagation measurements were performed with a bi-static radar configuration, whereby transmitters located on a ship and/or pier transmitted to receivers on another ship while it drove out in range yielding EM measurements over range transects.

In this study, we compare propagation predictions using various methods of estimation of the environment, and compare them with the measured propagation. The propagation is modeled using the Variable Terrain Radiowave Parabolic Equation (VTRPE) simulation, which incorporates the effects of atmospheric refractivity as well as a rough ocean surface, and uses the parabolic equation method to simulate the EM wave propagation. Results will include the propagation comparisons as well as discussion of issues that affect these comparisons such as the differing spatiotemporal variability of the different environmental estimation methods and the radar measurements.