Mesoscale Numerical Weather Predictions used for Radio Frequency Propagation along a Low Elevation Over Water Path

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The Navy continues to investigate the use of mesoscale numerical weather prediction as an input to research, development, test and evaluation efforts that support the development of tactical planning and decision aids for use in Navy sensor systems performance evaluations. Efforts to date include the use of the Coupled Ocean / Atmosphere Mesoscale Prediction System (COAMPS®) as a source of mesoscale numerical weather prediction (MNWP) data with many differing measurement sets, most often other meteorology. For this specific study, measurements of radio frequency path loss for a specific static geometry were archived for comparison studies.

This investigation will include the use of COAMPS® MNWP data, gleaned from the Atlantic Range project computed by Fleet Numerical Meteorology and Oceanography Center (FNMOC) as an input to algorithms that calculate radio frequency path loss. This analysis will be configured to match the implementation of a radio frequency transmitter / receiver system located on the Potomac River Test Range (PRTR), Naval Surface Warfare Center Dahlgren Division (NSWCDD). This geometry presents an over water path, just beyond the radio horizon, in a littoral setting influenced by synoptic and mesoscale atmospheric variability to include significant diurnal cycles.

To prosecute the analysis, time dependent radio frequency path loss for a 20.6 km link were calculated using range dependent modified refractivity gleaned from algorithms ingesting COAMPS MNWP data with a grid resolution of 1.67 km. The modified refractivity profiles were blended to the output profiles of the Navy Atmospheric Vertical Surface Layer Model (NAVSLaM) using the NSWCDD Blending Technique in order to include the contribution of the atmospheric surface layer as expressed by an evaporation duct. The resulting range dependent modified refractivity profiles were used as input to the Tropospheric Electromagnetic Parabolic Equation Routine (TEMPER) and the Variable Terrain Radio Parabolic Equation (VTRPE) parabolic equation (PE) models. Path loss values defined by the transmitter / receiver locations and heights were extracted from the PE model outputs. These data were compared to the measured path loss for the transmitter / receiver system operating in the S-band frequency range. This presentation details the methods used to analyze the propagation data and the results of the data analysis.