Range Dependent Marine Atmospheric Boundary Layer Refractivity Profiles Developed by Blending Evaporation Duct Model and Numerical Weather Prediction Model Profiles.

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The effects of the near surface atmosphere on the propagation of electromagnetic energy dominate radar and communications systems performance when considering geometries that sense through the marine atmospheric boundary layer. Two significant factors influencing propagation in the boundary layer are evaporation ducting and surface based ducting. Numerous previous studies have documented methods for estimating the evaporation duct from bulk meteorological measurements. Surface based ducting in the marine boundary layer is caused by a layer of warmer drier air above a layer of cooler moister air and can be documented by vertical meteorological measurements or predicted by numerical weather prediction techniques. Well developed methods for modeling atmospheric phenomena in the marine boundary layer exist. Scientists at Naval Surface Warfare Center Dahlgren Division (NSWCDD) have developed a method of predicting the refractivity profile throughout the depth of the marine boundary layer by combining the results of the Naval Postgraduate School (NPS) evaporation duct model with the refractivity results produced by the Coupled Ocean Atmosphere Mesoscale Prediction System (COAMPS®).

This presentation will describe the results of combining evaporation ducts with numerical weather prediction refractivity profiles at multiple points along an azimuth and within a two dimensional grid. Because each of the improvements in the method focuses on the handling of the evaporation duct, the effort will focus on days when the evaporation duct was a significant contributor to the observed propagation effects. The method has three fundamental differences with previous methods of combing evaporation ducting with refractivity above the surface layer. The method uses the meteorological data predictions from COAMPS instead of bulk meteorological measurements. The height for combining the refractivity profiles is the result of an estimation of the height of the surface layer. And a separate duct height is calculated for each profile on the refractivity azimuth or grid. The effect of each of these differences on the propagation estimation will be discussed.