Coastal Ocean Meteorological Processes Influencing RF Propagation Near the Virginia Eastern Shore

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Near surface microwave propagation in the littoral region is a direct result of the spatio-temporal structure of the coastal atmospheric boundary layer. This thermally and frictionally dominated layer of the earth's atmosphere can introduce horizontal and vertical gradients in temperature and water vapor leading to the spatially and temporally heterogeneous development of evaporation ducts in the surface layer and elevated or surface based ducts dependent on the slope of the thermodynamic gradients across the entrainment layer.

This paper will present the results of a study that seeks to correlate the recorded spatio-temporal structure of the refractivity fields to the structure of the coastal atmospheric boundary layer influenced by the multi-scale atmospheric systems during the Wallops 2000 Microwave Propagation Measurement Experiment.

Advecting synoptic scale meteorological circulations can strengthen or weaken vertical thermodynamic gradients in the coastal atmospheric boundary layer. Vertical mixing produced by low-pressure systems tends to lead to near standard refraction. High pressure produces large-scale subsidence that lowers and strengthens elevated ducts.

Mesoscale circulations like the sea-breeze/land-breeze combination can reverse the direction of temperature advection across a marine surface boundary leading to a diurnal impact on the coastal atmospheric boundary layer and subsequent refractivity structure.

During the multi-agency Wallops 2000 Microwave Propagation Measurement Experiment, a wealth of surface and upper air meteorological observations and direct microwave propagation measurements were collected to document the spatial and temporal structure of the coastal atmospheric boundary layer and the refractivity structure near the Virginia Eastern Shore. Standard, superrefractive, and trapping refractivity conditions were documented.

The synoptic scale forcing during the test period from April 5, 2000 through May 12, 2000 has been documented by archived World Meteorological Organization observations. The mesoscale circulations have been recorded by the Office of Coast Survey Chesapeake Bay Local Analysis and Prediction System. Gridded sea surface temperature fields have been archived by NOAA Coastwatch.