Multi-wavelength Study of Spatio-temporal Radio Frequency Emitter Detection Range Using Numerical Weather Prediction Forecasts of Non-Standard Propagation

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Radio frequency (RF) emitter detection range is enhanced and limited in non-standard refractive environments relative to a standard atmosphere near the surface. Mesoscale numerical weather prediction (NWP) modeled spatio-temporal variations in atmospheric boundary layer thermodynamic structure, height and inversion strength predict RF emitter detection ranges that vary with detector height, azimuth, detector latitude and longitude and time. Propagation skip zones lead to interruptions in RF emitter detection range along some azimuths.

In ducting conditions over water, the range dependent duct strength creates range dependent critical angles that interact with the wavelength dependent multi-path pattern to release emitter energy resulting in wavelength dependent RF emitter detection range. Increasing the height of the detector may enhance RF emitter detection range along part of the azimuth range of view while decreasing the range along other azimuths.

In sub-refractive environments, the RF emitter detection range is generally reduced relative to a standard atmosphere but also characterized by an azimuth dependence. Similarly in super-refraction, the RF emitter detection range is in general enhanced relative to a standard atmosphere but also characterized by azimuth dependence. In all non-standard refractive environments changes in detector height and latitude and longitude result in significantly different RF emitter detection range patterns.

This talk will employ COAMPS© mesoscale NWP data and The Advanced Refractive Effects Prediction System (AREPS) to explore the spatio-temporal structure of RF emitter detection range in standard, surface based ducting, surface ducting, sub-refractive and super-refractive environments over sea and land. Wavelength dependence will be explored at S, C and X-bands.