Investigating the Accuracy of Numerical Weather Prediction Modeling in Subrefractive Environments

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Numerical weather prediction (NWP) has been used frequently over the past several years to predict radio frequency propagation throughout the world. However, meteorological and radio frequency propagation validation datasets outside of the US coastlines are scarce. Interest in funding extensive meteorological and radio frequency (RF) propagation experiments has waned in recent years; as a result, collaboration is necessary in order to continue to expand the validation dataset for this application to different regions of the world. Such a collaboration occurred under a project called Coupled Air-Sea Processes and Electromagnetic Ducting Research (CASPER). CASPER brought scientists from universities and Navy laboratories together to further the scientific understanding of coastal meteorological phenomena, surface layer theory, and the resulting radio frequency propagation.

In the fall of 2015, a field experiment called CASPER-East was conducted off the coast of Duck, NC. Two years later, a follow-on experiment called CASPER-West took place off the coast of Pt. Mugu, CA for four weeks. These test events recorded concurrent meteorological and RF propagation measurements within approximately 100 km of the shoreline. During CASPER-West, frequent subrefraction typically due to fog was measured from the shore site via radiosondes nearly every morning and sometimes throughout the day. This subrefraction was subsequently also noted in the RF measurements of the shore beacons. Historically, NWP has struggled to capture fog events accurately near the coastline. As NWP is used more frequently to predict RF propagation, understanding its accuracy in non-standard conditions such as subrefraction is critical to the users of this data. This brief will compare the radiosondes taken from the shore near Pt. Mugu to the Coupled Ocean / Atmosphere Mesoscale Prediction System (COAMPS), the US Navy's mesoscale numerical weather prediction model, output with a focus on both meteorological and refractive metrics. The resulting impacts on RF propagation and comparisons with measured RF propagation will also be shown.