Investigating Correlation Dropouts of NWP Forecast EM Propagation for TAPS Field Campaign

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The U.S. Navy routinely operates electromagnetic (EM) sensors in the marine atmospheric boundary layer (MABL) for communication, target tracking, search and rescue, etc. Sensor performance is dependent on the refractive index of the atmosphere through which the EM waves propagate. The vertical gradient of environmental parameters such as temperature and humidity affect the refractive environment, and thus the performance of EM sensors. It is desirable for military, commercial, and research applications to accurately forecast EM sensor performance. High resolution numerical weather prediction (NWP) models are useful for forecasting the environmental parameters which affect EM propagation. This study uses the U.S. Naval Research Laboratory's Coupled Ocean-Atmosphere Mesoscale Predictions System (COAMPS) in conjunction with the Navy Surface Layer Model (NAVSLaM) to forecast mesoscale environmental parameters and variability, and seed the Advance Propagation Model (APM) in order to analyze the model prediction of EM propagation (Kammerer et al, 2018).

TAPS (Tropical Air-sea Propagation Study) (Kulessa et al., 2017) was an international field campaign performed near Lucinda, Australia during November and December of 2013. Field measurements of EM propagation and environmental parameters were collected under varying evaporative ducting conditions, in conjunction with near real-time NWP forecasts. Multi-band (X-, Ku-, and Ka-bands) propagation observations recorded during the TAPS campaign are used to validate modeled propagation and provide insight into fidelity of modeled propagation performance.

High correlation between modeled and observed propagation along TAPS range transects are observed for the majority of days in which measurements were taken. However, dropouts in model-observation agreement occur most significantly on November 29-30th and December 4-5th. These correlation dropouts coincide with the lowest observed wind speeds of the field campaign. Causes for decreased correlation and increased error between modeled and observed PL over varying bands are explored in this study.