Sensor Performance Modeling during Navy Exercises using COAMPS

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A recent Navy Exercise took place offshore of Norfolk VA called Trident Warrior 2013 (TW13) which included use of instrumented Unmanned Autonomous Vehicles (UAV) to sample the environment in and around ship operations. One of the primary goals of the exercise was to gain an understanding of how localized measurements can impact high-resolution short-term forecasting specifically with respect to the marine atmospheric boundary layer (MABL) and its gradient structures. The vertical gradient of humidity near the ocean surface is the most important parameter for determining how electromagnetic (EM) energy from ship-board sensors propagates through atmospheric layers and hence how effectively radars will function, communications are maintained, and targets can be detection in a given environment.

Often Naval operations are in challenging coastal settings rich with mesoscale variability. More importantly, the numerical weather prediction (NWP) models that supply the Fleet with environmental information rely upon a very sparse set of 'over-water' observations, specifically lacking in MABL vertical structure. All the observations from measurement platforms such as radio-sondes, buoys, surface weather stations, satellite, ship and aircraft data, are necessary to obtain the most accurate initial state of the environment before the NWP model begins its forecasts. With under-sampling of over-water environments being the norm, TW13 embarked upon the task of determining how UAVs launched by ships could collect local environmental data to assimilate into NWP models and potentially improve short-term forecasting relevant to predicting local EM propagation conditions.

The exercises took place in July 2013 covering a 5-day intensive operations period (IOP) and included special field data around the Research Vessel R/V Knorr from Woods Hole Institute, who collaborated with Scripps Institute of Oceanography (SIO) to operate the UAV Scan Eagle. During the IOP the Navy's mesoscale model COAMPS (Coupled Air-sea Mesoscale Prediction System) was run in parallel with and without assimilated Scan Eagle data. Preliminary analysis of the COAMPS forecasts are shown to be impacted in the sub-refractive region residing above the MBAL, a layer known as a 'radar-hole' in which targets may be invisible to surface ship radars. Examples of the effects of such anomalous propagation will be shown at the conference by combining modeled NWP with the Navy's Advanced Propagation Code.