

Measurement of S-, C-, and X-band Propagation in the Marine Atmospheric Boundary Layer through Observations of Transmitters of Opportunity

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Radiowave propagation in the marine atmospheric boundary layer (MABL) remains a subject of research interest given the potential utility of the ducting propagation mechanism. Ducting propagation is highly dependent on atmospheric conditions, so that experiments that combine propagation measurements with detailed atmospheric characterization can offer opportunities for improved modeling of MABL effects on propagation in the future.

One recent experiment was conducted off the coast of Norfolk, VA from July 13-17, 2013, and included extensive atmospheric characterization under the support of the Office of Naval Research. Atmospheric measurements were conducted from ship, UAV, and surface platforms, including the Woods Hole Research Vessel (R/V) Knorr that was deployed throughout the campaign. The experiment was augmented by shore-based measurements in Virginia Beach, VA of signals received from existing transmitters aboard the R/V Knorr.

Transmissions from the R/V Knorr navigation radars at S- and X-bands were observed, as well as transmissions from a C-band radio system aboard the R/V Knorr. C- and S-band transmissions were recorded using a high gain C-band antenna and standard gain horn antenna, respectively, in conjunction with a spectrum analyzer. X-band signals were recorded using an X-band radar receiver system capable of capturing and recording time domain radar transmissions with 16 bits resolution at 80 MSPS, allowing for full resolution of radar pulses.

While the use of these existing radar and radio transmitters simplifies the system, several challenges remain, in particular that of separating the R/V Knorr radar transmissions from those of other systems operating in the same band. Sample results from the measurements will be presented, along with a discussion of the propagation effects observed and methods developed to identify the R/V Knorr sources.

Future investigation into the marine atmospheric boundary layer includes the design and construction of an X-band phased array system to be deployed in November 2013 aboard the Scripps Institution of Oceanography's platform FLIP. This phased array system will vertically sample the transmission of multiple beacons located aboard ocean vessels, wave buoys, and aircraft. The back end of this array system will use a modified version of the A/D used during the Trident Warrior 2013 campaign.