Correspondence of S- and X-Band propagation loss with predicted values based on observed meteorology

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In September of 2014, a joint U.S. and Netherlands team collected RF and meteorological data in the North Sea adjacent to Den Helder, NL. A continuous-wave (CW) S-band emitter provided by Naval Surface Warfare Center Dahlgren Division (NSWC-DD) was co-located with a land-based X-band radar overlooking the North Sea. The tugboat Rotte was outfitted to: (a) sample the emissions from the CW S-Band emitter, (b) capture pulses from the X-band system, (d) monitor surface layer meteorological parameters, and (c) launch controlled-leak, high-resolution weather balloons. During the exercise, the Rotte collected data along a radial track between (nominally) 5nm and 13nm from the radar. Eighteen runs were completed.

The initial goal of this processing is to determine the consistency between the S- and X-Band observations and the predictions based on meteorology. The NAVal Surface LAyer Model (NAVSLAM) is used to generate evaporation duct profiles from the surface layer measurements and join the profiles to the upper-air profiles obtained from the weather balloons. These data are input to the Advanced Refractive Effects Prediction System (AREPS) to generate modeled propagation loss $L_m(r)$ where r is range and m denotes from meteorology. We then calculate a power referenced to the power at range r_0 by $P'_m(r) = L_m(r_0) - L_m(r)$. Likewise, the observed power at S-band (P_{obs}) is referenced to the observed power at r_0 via $P'_{obs}(r) = P_{obs}(r) - P_{obs}(r_0)$. Quantities are compared in the space of referenced power. When the data are plotted, it is clear that the difference between the observed power and that based on meteorology corresponds to a difference of about 1-2 meters of evaporation duct height, a relatively small difference.

The pulse collections performed on the emissions from the X-band radar required more quality control processing. We report on the progress of analyzing that data.