

EM Propagation System for CASPER East Coast Campaign

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Coupled Air-Sea Processes and Electromagnetic-ducting Research (CASPER) is a multi-university research initiative (MURI) project that explores the effects of environmental conditions in the marine-atmospheric boundary layer on low altitude EM propagation, ducting in particular, for naval applications. The East Coast Intensive Operations Period (IOP) is a large experimental campaign that will be conducted off the coast of Duck, NC, during October-November of 2015.

Researchers from The Ohio State University will deploy three systems during the IOP. The first EM measurement system consists of a number of 11 GHz beacons emitting up to 1 watt continuous wave (CW) signals placed on various mobile platforms. These include a research vessel (R/V Sharp), a wave glider, a controlled towed vehicle (CTV) towed from a Twin-Otter airplane. The CW signals are spaced about 5 MHz so that all beacons may transmit simultaneously. The receiving system is an array of 5 vertically spaced antennas from 3 to 15 m above mean sea level deployed on a stationary research vessel (R/V Atlantic Explorer). Each antenna will be connected to a USB spectrum analyzer through a low-noise amplifier (LNA) and the data will be recorded for all beacon frequencies from all 5 receivers simultaneously. This system allows for the measurement of the one-way propagation loss between the emitters and receiver as a function of range as the mobile platforms move towards and away from the Atlantic Explorer. The measured signal will be used to invert for the evaporation duct refractivity profile and compare to the profile inferred from concurrent meteorological and oceanographic measurements. The system will be tested during the pilot study in April 2015 and preliminary results will be presented here.

The second system is part of the Lower Atmospheric Propagation System (LATPROP) and is composed of an ultra-wideband transmitter and a receiver system from 2-18 GHz. The transmitter will be deployed on the R/V Sharp and the receiver will be deployed on the R/V Atlantic Explorer. This system will be able to sweep the frequency domain and record the variation of propagation loss with frequency under ducting conditions.

The final system (also part of LATPROP) will be a commercial 25 kW Koden radar operating at 9.41 GHz, exploring the possibility of performing Refractivity from Clutter (RFC) measurements and be used as a source of opportunity for ship-based passive receivers. This system will be deployed at the Field Research Facility pier, Duck, NC.