CASPER Science Objectives Review and Monin-Obukhov Similarity for Evaporative Duct Characterizations

Qing Wang[1], Robin Corey Cherrett[2], Denny Alappattu[1,3], Kyle Franklin[1], Ryan Yamaguchi[1], Richard Lind[1], John Kalogiros[4]
[1]Meteorology Department, Naval Postgraduate School, Monterey, CA
[2]Meteorology and Oceanography, US Navy
[3]Moss Landing Marine Laboratory, Moss Landing, CA
[4]National Observatory of Athens, Athens, Greece

The Coupled Air-Sea Processes and Electromagnetic wave (EM) ducting Research (CASPER) is a multi-university research initiative (MURI) sponsored by the Office of Naval Research (ONR). In this presentation, we will first provide an overview of the CASPER scientific objectives and major activities in the past two years as well as plans for the remaining years. Some of the coordinated measurements in CASPER East will be reviewed to provide the broad community an overall picture of the type of data available from CASPER and our major accomplishments.

Since one of the major objectives of CASPER is to explor the Monin-Obukhov Similarity Theory (MOST) based surface layer models for quantifying evaporation duct (ED), we will further discuss two aspects of the evaporation duct from the perspective of MOST. First, we will examine atmospheric surface layer parameters directly affecting evaporation duct properties, namely evaporation duct height (EDH) and strength (EDS). In this regard, it is desirable to relate the EDH and EDS to variables describing surface layer thermodynamic and wind conditions. Most commonly used quantities as independent variables include air-sea temperature difference (ASTD) for thermal stability, relative humidity (RH) for water vapor amount, and wind speed. We will demonstrate that these variables are not adequate to describe the EDH and EDS dependence. Instead, we advocate to use bulk parameters such as the near surface moisture difference from two levels, referred to as moisture depression, and bulk Richardson number. We will demonstrate this concept using a large amount of buoy measurements as input to the evaporation model and relate the model derived EDH and EDS to the proposed bulk parameters. Second, we will examine the adequacy of the MOST in generating evaporation ducts. Directly observed EDH and EDS based on the Naval Postgraduate School tethered balloon measurements during the CASPER project will be used for this purpose. We will also examine the sensitivity of propagation loss to small deviations of the measured M-profile from the MOST derived profiles. Efforts will be made to seek modified relationships between EDH/EDS and the identification of key parameters.