Evaporation duct profiles from the Tropical Air-Sea Propagation Study AP-S/USNC-URSI Joint Symposium

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Evaporation ducts are a manifestation of moisture and temperature gradients that exist immediately above the water surface where evaporation occurs. The accurate prediction of duct properties is fundamental to the understanding of radar propagation patterns, and is therefore of significant value to the Royal Navy (RN). The UK Met Office has developed an evaporation duct model that is currently in operation with the RN for the prediction of evaporation duct profiles using ship-based observations or Numerical Weather Prediction (NWP). This model has not been validated in a tropical, littoral environment until now. Here we present preliminary findings based on kitesonde observations collected during the Tropical Air-sea Propagation Study (TAPS).

The Tropical Air-Sea Propagation Study trial took place off the coast of Queensland, Australia in Nov-Dec 2013 with the aim to measure the atmospheric conditions affecting radar propagation. As part of the trial, explicit observations of evaporation duct profiles were made by winching a kitesonde through the marine surface layer. The noisy nature of the retrieved data, due to the inherently turbulent surface layer, makes it imperative to develop a technique to obtain 'ground truth' evaporation duct heights from all gathered observations. The focus of this work is to develop a method to reliably fit measured evaporation duct profiles in order to extract the key parameters in a repeatable and robust way.

We fit the kitesonde observations to the often used log-linear form in addition to a four-parameter profile suggested by Zhang et al (J.-P. Zhang, Z.-S. Wu, Q.-L. Zhu, and B. Wang. Progress in Electromagnetic Research, 114:353–368, 3 2011) in order to understand the robustness and reliability of retrieved evaporation duct heights for the purposes of validating the evaporation duct model. The effect of using different fitting algorithms was also explored. We find the evaporation duct profiles are best represented using the four-parameter modified refractivity profile providing the fit is performed using orthogonal distance regression.