An outline of the proposed Tropical Air-Sea Propagation Study (TAPS 2013)

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Accurate radio-wave propagation predictions depend on an accurate specification of the atmospheric refractive index. At radio frequencies, the refractive index is directly dependent on atmospheric water vapour pressure, air temperature and pressure. These quantities vary in space and time and also depend very much on surface and climatic conditions that define the region of interest. They can be modeled by solving the equations of thermo-hydrodynamics, as done by numerical weather prediction (NWP) codes. Mesoscale models are most appropriate because in many applications it is desirable to predict propagation over distances of the order of 10 to 100 km.

Recent NWP model inter-comparison studies for maritime environments have revealed differences in the ability of each model to predict non-standard refractive index profiles. There is a marked degree of difference in the performance of models when it comes to predicting inversion layers that produce both surface and elevated ducts, highlighting the need for not only further mathematical development but also experimental validation. Propagation prediction is achieved by using both mesoscale NWP models and propagation models and so the propagation models must also be validated. Modeling propagation effects in clear air usually involves parabolic equation methods (PEM) or hybrids of the PEM and approaches based on geometric optics.

The Tropical Air-Sea Propagation Study (TAPS) is an experimental campaign currently being planned. It will focus on the validation of mesoscale NWP models in a tropical littoral environment and also on the validation of clear-air propagation models for transmissions covering S, X, Ku, Ka and W bands over distances ranging from 10 to 100 km. TAPS will take place off the northern coast of Queensland, Australia in November 2013. In tropical waters, evaporation ducting is common and may even be the dominant ducting mechanism. There is a need to develop reliable surface layer refractivity models and techniques of blending surface layer refractivity profiles with NWP refractivity results. One of the aims of TAPS will be to provide good surface layer data which will include high resolution data from instrumented towers, buoys and airborne measurements. Upper boundary layer meteorological data will be obtained from aircraft and radiosonde measurements. Over water, propagation experiments will include beyond line of sight communications, MIMO, matched field processing and target detection.

The TAPS experimental campaign will involve the participation of scientists and engineers from Australia, United States, New Zealand, the United Kingdom and France.