# A comparison of evaporation duct models for tropical seas

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During the Tropical Air-Sea Propagation Study (TAPS) Experimental campaign which took place off the North Eastern Australian coast, in the vicinity of Ingham and Lucinda, Queensland, in the late spring of 2013, there was a concerted effort to measure refractivity profiles to almost the sea surface. The measurements were carried out using a range of temperature, humidity and pressure probes mounted under one of the wings of Airborne Research Australia's Eco-Dimona aircraft VH-OBS. The aircraft's instruments included the Best Air turbulence probe (BAT) together with the fast response FUST temperature probe and LiCor IRGA for atmospheric water content measurements. The BAT probe provided fast response three dimensional readings (u,v,w) of the wind field. With this suite of instruments, the aircraft had the capability of measuring atmospheric fluxes as well as bulk parameters. In addition to this, a kitesonde fitted out with standard radiosonde package meteorological equipment as also operated off the back of a small vessel. Both measurement techniques were suitable for profiling the atmosphere. In the case of the aircraft, refractivity profiles were achieved by a series of saw tooth flight patterns with the aircraft descending to heights as little as 3 m above the sea surface, on occasion. The measurements carried out by the kitesonde were achieved by tethering the kite to the boat, flying at or below 400ft and slowly retracting the tether. This permitted good measurements to be taken to heights between 1 and 2 m above sea level.

Measurements from these two platforms were complemented by an instrumented tower that was fixed at the end the Lucinda sugar loading terminal, a 6 km long jetty located nearby the aircraft and kitesonde area of operations. The tower provided turbulent flux data as well as bulk atmospheric data. The aircraft also provided flux data when flying a straight and level pattern. This data supplemented the jetty data during occasional down times on the jetty and also for regions distant from the jetty throughout the TAPS campaign.

We compare the measured evaporation duct profiles and also compare the data with several evaporation duct models. The TAPS campaign was dominated by thermally unstable atmospheric conditions and we present five evaporation duct models that use stability functions based upon Monin-Obukhov similarity theory. Some of these models formulate the necessary scaling factors by direct flux measurements while others use bulk atmospheric parameter measurements to first estimate the turbulent fluxes.

Recently, Salamon *et al*. proposed an equation to model the refractivity profile in a thermally unstable atmospheric surface layer. We also compare our refractivity profile data and our algorithmic evaporation duct models with this new model.