The effect of coral lagoons on evaporation duct structure

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Evaporation ducting relies on turbulence and pockets of warmer sea surface can favor buoyantly driven turbulence which in turn can affect the shape of the duct profile. Sea surface temperature differences in regions such as the north eastern Australian coastline can vary dramatically due to the extensive network of coral lagoons which form the Great Barrier Reef, (GBR). The lagoons vary in size, with the larger ones being typically around 20km across. Inside a lagoon, the daytime sea surface temperature can be several tenths of a degree higher and at times such differences may be sufficient to enhance convective processes. It is therefore prudent to incorporate the details of refractive index structure within lagoons for any assessment of long propagation paths which traverse the GBR.

During the Tropical Air-Sea Propagation Study (TAPS) 2013 field campaign in north eastern Australia, extensive measurements of sea surface temperature, surface layer moisture, heat and momentum flux as well as measurements of bulk surface layer parameters were made across a 14 km section of Trunk Reef. Similar measurements were also made over the waters in the neighborhood of the reef. The measurements were made using a low flying small aircraft fitted with fast response humidity, temperature and pressure probes and an IR sea surface temperature sensor. The data was obtained by flying straight and level at three nominated heights within the surface layer.

These data have now been applied to the ASLM and PIRAM evaporation duct models. A description of the measured marine surface layer together with the resulting evaporation duct profiles is presented. Comments on clear-air radio-wave propagation over coral lagoons are also presented. In discussing propagation coverage, attention is focused on radiowave propagation at frequencies in the SHF band, for which beyond line-of-sight transmission in the tropical evaporation duct is optimized. All propagation calculations have been carried out using a scheme based on the Parabolic Equation Method, where inclusion of two dimensional refractive index profiles is straightforward.