# Model evaluation of evaporation duct height in the Indian Ocean using INDOEX observations

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The performance and reliability of microwave communication and radar systems is degraded by the so-called evaporation ducts over the sea-surface. The duct height is the parameter that enters into the software that optimizes the performance of the operational systems. The statistics on evaporation duct height from realistic models can help in designing reliable ship-to-shore and ship-to-ship marine communications. In this paper, the morphology of evaporation duct height is obtained from the two-point measurements of (a) sea-surface temperature and (b) air temperature, relative humidity, pressure and wind speed at the deck level of 4m made onboard the NOAA Ship Ronald H. Brown during the INDOEX cruise over the Indian Ocean. The INDOEX data set consists of rawinsonde soundings made from the deck level of 4m during the period 24 February to 30 March 1999. Further, twelve rawinsonde flights are chosen where the meteorological measurements are also available at the first level of less than 40m or so, in addition to the deck level measurements. The duct height is again calculated by treating the first level as the deck level. The duct height is calculated by using the recent Babin-Young-Carton (BYC) model, which uses the international COARE bulk air-sea algorithm that is valid under a wide range of geographical and oceanic conditions. The duct height is also calculated by the much used Paulus-Jeske (PJ) model, which is strictly valid over colder oceans, but preferred by system engineers due to its simplicity. The salient features of the present study are the following. (i) The duct height using the BYC model, in general, is higher over the Bay of Bengal (around 13m) than over the Arabian sea (around 11m), both during the daytime and nighttime. (ii) The duct height is higher during the daytime (around 13m) than during the nighttime (around 11m) in the northern latitude range of 0 to 10ºN. (iii) In the northern latitude range of 10ºN to 20ºN , the duct height increases (around 15m), both during the daytime and nighttime. (iv) The duct height, both during the daytime and nighttime, shows a broad maximum (around 15m) in the southern latitude range of 0 to 10ºS for longitudes beyond about 70ºE. The role of ITCZ at these latitudes and longitudes is being studied. (v) The duct height during the daytime tends to increase with increase in the level of the second point of measurement; the first point being the sea-surface measurement. In the chosen INDOEX data set the second point of measurement varies from about 15m to 40m. The corresponding duct height increases from about 13m to 15m, respectively. This increase in duct height is fictitious, only. The duct height calculated with the second point being the deck level of 4m remains roughly constant at around 13m. Apparently, the deck level measurements could be made up to some 15m, since both the temperature and relative humidity profiles are logarithmic in nature. (vi) The nighttime values of duct height, with the limited data set, decrease with the increase in the second point of measurement. (vii) The duct heights calculated with the PJ model are almost double than those calculated with the BYC model. It is argued in the detailed paper that validation of the BYC model vis-à-vis PJ model is required over the warmer tropical oceans.