Climatology of radar anomalous propagation over West Africa

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A comprehensive examination of 5 years of European Centre for Medium-Range Weather Forecasts (ECMWF) data to determine ducting conditions over West Africa and the computation of statistical distributions of the vertical gradient of refractivity determined from 2 years of radiosonde data over Dakar (14.41°N, 17.26°W), Douala (4.00°N, 9.70°E) and Niamey (13.35°N, 2.03°E) were carried out. It is found that diurnal and seasonal variations of the refractivity of the atmosphere are influenced by air temperature and water vapor pressure fluctuation. Refractivity gradients lower than 0.157 m-1 often result in spurious returned echoes and misinterpretation of radar images such as erroneous precipitation detection. The results obtained show that the local climate has an appreciable influence on the vertical profile of refractivity, especially the seasonal north-south movement of the Inter Tropical Discontinuity which is associated with the alternance of wet and dry seasons over the region. It is found that most of ducts occur in the night, morning (0000, 0600 UTC) and late afternoon (1800 UTC). The occurrence probability of abnormal propagation events, such as ducts, can provide some valuable information about the propagation of electromagnetic waves over West Africa.