

Rainfall Attenuation on Earth-Satellite Microwave Link in a Tropical Environment.

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Abstract:

Rainfall is a major impairment to radiowave propagation at centimeters and millimetre wavebands, moreso in the tropics because of the intensity, frequency of occurrence and presence of large drops in tropical rainfall. In order to determine the vertical extent of rain (rain height) in the tropics, the characteristics of 0°C isotherm height have been studied using radiosonde data collected at three stations in Nigeria for three years at each station. One year rain rate data collected at Ile-Ife using an electronic rapid response rainguage have been analysed in order to obtain the cumulative rain rate distribution.

The existing rainfall attenuation prediction models have been examined. Three attenuation models viz: CCIR, Global and SAM, have been utilized to predict slant path attenuation at Ile-Ife from the one-year rain rate distribution. Cumulative distributions of predicted attenuation were obtained for different frequencies, earth station's elevation angles and polarizations. Attenuation distributions from the three models have been compared.

The result obtained shows that 0°C isotherm height during rainy season decreases from the southern to the northern part of Nigeria. A mean 0°C isotherm height of 4.8 km for the rainy season has been obtained for Nigeria. The rain intensity exceeded for 0.01% year at Ile-Ife was obtained to be 87 mm/h. The differences in the attenuation values predicted by the three remodels vary for different percentages of time, frequencies, elevation angle and polarizations. The results obtained in this work could be used for providing necessary fade margin in satellite link budgets in Nigeria and other similar tropical environment.

Keywords: Radiowave/ rainfall/ wavebands/ isotherm/ rainguage/ attenuation/ tropical environment

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