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Performance and Evaluation of Eight Cloud Models on Earth—Space Path for a Tropical Station

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Chapter

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Abstract

This is a review of eight cloud models and a statistical analysis of radiosonde data and cloud cover data in order to obtain attenuation distributions and cloud cover statistics for a tropical location, Ota (6.70N, 3.230E) at a computed elevation angle of 56.180 to an Astra 2B satellite located at 31.50E. Cloud models are mathematical algorithms scientifically designed to predict cloud attenuation impact on propagating electromagnetic signals in the troposphere, using data on each model's required parameters such as temperature, pressure, cloud height, cloud occurrence and liquid water content of clouds. The station's cloud cover statistics, namely average amount of cloud, cloud base height, and frequency of occurrence were computed from extracted cloud data to obtain their monthly and seasonal variations. The results show that minimum attenuation values were predicted by both the Gun and East and the ITU-R models, while the Liebe and Slobin models predicted consistently maximum values of attenuation for all the cloud models tested. Cloud attenuation statistics computed for each of the models show that at 0.01% exceedance probability, the averages of the predicted cloud attenuation for uplink and downlink at Ota, ranges between 0.45 dB and 0.44 dB for Ku, 1.85 dB and 0.75 dB for Ka, and 3.50 dB and 2.50 dB for V bands. At 0.1% the averages are between 0.30 dB and 0.27 dB, 0.95 dB and 0.47 dB, 2.45 dB and 1.51 dB at Ku, ka and V bands for both uplink and downlink respectively.

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