Cloud-Cover Statistics and Cloud Attenuation at Ka- and V-Bands for Satellite Systems Design in Tropical Wet Climate

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Abstract: Cloud-cover statistics, low cloud base height, frequency of precipitation, 0°C isothermal height, and integrated cloud liquid water and cloud attenuation have been obtained for the tropical rain forest climatic zone of Africa. The cumulative distribution of integrated cloud liquid water content shows a departure from the ITU-R model. A comparison of cloud attenuation at Ka-and V-bands show that the ITU-R model underestimates the attenuation up to about 1.7 and 2.3 dB at 30 and 50 GHz, respectively. View less

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I. Introduction

Attenuation due to cloud is often ignored for high-availability satellite links, and rain is considered to be the most important attenuator. In modern systems design at Ka- (30/20 GHz) and V-bands (50/40 GHz) especially for tropical wet climate with high frequency of precipitation and annual total cloud cover (>70%), cloud attenuation may no longer be a secondary effect. Rain can be traced to the formation of clouds. Therefore, for low-availability satellite services (such as VSAT and USAT) at Ka- and V-bands, deep fades may occur due to higher probability of occurrence of cloud cover in the tropical wet climate [1]. Many experimental studies have been conducted on millimeter-wave atmospheric attenuation. Based on the studies, researchers with some confidence can estimate losses due to cloud attenuation up until about 200 GHz [2]. This letter reports cloud-cover statistics from 1971–1996 and cloud attenuation for the African tropical rain forest climatic zone covering latitude 7.5°S–7.5°N and longitude 12.5°W–32.5°E.

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