

Title of Article: Cloud attenuation studies of the six major climatic zones” of Africa for Ka and V satellite system design.

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Abstract: Cloud cover statistics, cloud base and top height, cloud temperature, frequency of precipitation, freezing height, total cloud liquid water content (TCLWC) and cloud attenuation data have been obtained for the six major climatic zones of Africa. The present results reveal a strong positive correlation between the monthly distribution of low cloud cover, cloud top height, cloud temperature, and frequency of precipitation in the six zones. The cumulative distribution of the TCLWC derived from radiosonde measurement in each climatic zone shows a departure from the TCLWC recommended by the ITU Study Group 3 data, with an exceedance percentage difference of 32% to 90% occurring 0.01% to 10% of the time. The underestimation of the TCLWC is greatest in the tropical rain forest. A comparison of the cloud attenuation cumulative distribution in the Ka and V bands reveals that the International Telecommunication Union – Region (ITU-R) is an intergovernmental organization that develops rain model based on collected data around the world. This model underestimates the cloud attenuation in all of the six climatic zones by 2.0 dB and 4.7 dB for the arid Sahara desert, 1.3 dB and 3.0 dB in semi-arid North Africa, 1.3 dB and 1.5 dB in savannah North Africa, 2.0 dB and 3.6 dB in the tropical rain forest, 1.3 dB and 2.9 dB in savannah South Africa and 0.9 dB and 2.6 dB in semi-arid South Africa, respectively, at 30 and 50 GHz. Overall, the cloud attenuation in the tropical rain-forest zone is very high because of the high annual total cloud cover (98%), high annual frequency of precipitation (4.5), low annual clear sky amount (8%), high cloud depth (10,937 m), high 0°C isotherm height (4.7 km), high TCLWC (4.0 kg/m² at 0.01%) and low seasonal cloud base height (356 m).