In this paper, a time-varying rain characterization and diurnal variation in the Ku-band satellite systems simulated with synthetic storm techniques (SST) over a tropical location in Nigeria has been presented. Three years rain rate time-series data measured by a raingauge located inside the Federal University of Technology Akure, Nigeria were utilized for the purpose of this work. The analysis is based on the CDF of one-minute rain rate; time-series simulated annual/seasonal and diurnal rain rate, rain attenuation statistics and fade margins observed over four time intervals: 00:00-06:00, 06:00-12:00, 12:00-18:00 and 18:00-24:00. In addition, comparison was also made between the synthesized values and rain attenuation statistics, at 12.245 GHz for a hypothetical downlink from EUTELSAT W4/W7 satellite in the area.

It could be observed that at 99.99% link availability, the fade margin as higher as ~32 dB may be required at Ku band frequency bands in this area. We also predicted that the communication downlinks working in the early morning and early to late in the evening hours must be compensated with an appropriate Down-Link Power Control (DLPC) for optimum performances during severe atmospheric influences in the region.

**Key Words:** Diurnal and Seasonal variation, Ku-band frequencies, TRODAN Data, synthetic storm technique, optimum data links, tropical location.