Numerical Analysis of the Measured Temporal Rainfall Rate and Rain Attenuation in a Tropical Location

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Abstract
Document Sections

- I. Introduction
- II. METHODS AND DATA

III.

RESULTS AND DISCUSSION

IV.

CONCLUSION

Authors
Figures
References
Keywords
Metrics

Abstract:
Extreme weather condition is one of the major challenges observed in the troposphere due to meteorological weather parameters such as rainfall. Rainfall causes severe attenuation to satellite communication at Ku band. This paper studied the numerical relationship between the calculated rain attenuation and the observed rain rate at Ku band for the tropical station based on a 12-month data measurement. This paper aims at presenting the proportional variation between rain rate and rain attenuation in the locality of interest. A tipping bucket rain gauge is used to obtain and analyse rain rate data. One-minute signal strength measurement were obtained and analysed. The 12-month data were obtained from January till December 2015. The result shows an average rain rate of about 237.0 mm/hr, 114.0 mm/hr, 38.0 mm/hr and 3.0 mm/hr and attenuation of 4.74, 4.25, and 3.59 and 2.66 dB/km at 12.245 GHz, respectively, for 0.001 %, 0.01% and 0.1% and 1 % of the time respectively for the combined values of rain rate and rain attenuation statistics. The result indicates a corresponding direct proportionality between the rain rate and rain attenuation.
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I. Introduction

The tropics is known for intense rainfall which is one of the many tropospheric weather parameters that have unfavorable effect on the propagation of electromagnetic signals resulting in poor and unreliable communication [1]-[2]. Widely accepted prediction rain attenuation models have not worked perfectly well in the tropics as a result of the difference in the rainfall intensity observed in temperate regions [1]-[2]. Hence, the study of the cumulative rain rate distribution derived from the ground measurement of precipitation in any locality is essential.

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