This article presents the data analysis of daily rainfall rate events experienced in Ota, Southwest Nigeria, a tropical station. The meteorological data were measured using a tipping bucket rain gauge mounted at the roof top of the College of Science and Technology, Covenant University, Ota. The data analysed is from April to December 2012. Descriptive statistics were used to show the daily variations in rainfall rate. Hence, the daily variation for rain rate shows variation in the minimum and maximum value within each of the months considered which varies from 0.8 mm/h to 230.4 mm/h. The results from this data will help microwave communication experts have a proper understanding of rainfall rate in this locality. This will assist to ensure a proper and efficient design and planning of radiowave propagation and satellite communication systems in Southwest Nigeria.

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The meteorological data for this article were measured at Covenant University, Ota, Southwest Nigeria for year 2012. The measurement of the meteorological data was based on one-minute integration time to produce the daily average data and consequently to acquire the monthly data. This helps to understand the daily, monthly, yearly and seasonal variation of Rainfall rate as shown in the tables and figures. The descriptive statistics gives the summaries of the duration of rainfall rate as presented in Table 1. While, the bar charts show the summaries of the daily distribution of rainfall rate as presented in Figs. 1–9. Rain rate is the measure of the rate at which rain is falling in a locality. According to [1], precipitation estimates from global maps do not agree with those obtained over Nigeria. Hence, an appropriate distribution of rainfall rate at 1-min integration time is needed for the proper prediction of accurate rain attenuation for the location under consideration. The power law relationship between specific attenuation and rain rate as given in Eq. (1) [2].

\[ A = kR^a \]  

1. Data

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k and \( a \) are regression coefficients which depends on drop size distribution, temperature, frequency of propagation and polarization of the radiowave.
### Table 1
Daily duration of rainfall rate in 2012.

| Days/Months | Apr | May | Jun | July | Aug | Sep | Oct | Nov | Dec |
|-------------|-----|-----|-----|------|-----|-----|-----|-----|-----|
| 1           | 105 |     |     |      | 67  |     |     |     |     |
| 2           | 158 | 110 |     |      | 160 | 30  |     |     |     |
| 3           |     |     |     |      | 24  |     |     |     |     |
| 4           |     |     | 172 |     | 38  |     |     |     |     |
| 5           |     |     |     | 238 | 53  |     | 22  |     |     |
| 6           |     |     |     |     | 25  |     | 48  |     |     |
| 7           |     |     | 78  |     | 17  |     | 21  |     |     |
| 8           |     |     |     | 79  |     | 120 |     | 70  | 35  |
| 9           |     |     |     |     | 21  | 21  |     | 16  | 107 |
| 10          |     |     |     |     |     |     |     | 198 |     |
| 11          |     |     |     |     |     | 25  |     | 157 |     |
| 12          |     |     |     |     |     | 81  | 64  |     |     |
| 13          |     |     |     |     | 17  |     |     |     | 55  |
| 14          |     |     |     |     |     |     | 49  |     | 17  |
| 15          |     |     | 17  |     |     |     | 322 |     | 149 |
| 16          |     |     | 44  |     |     |     | 30  |     |     |
| 17          |     |     |     | 18  |     |     |     |     |     |
| 18          |     |     |     |     |     |     |     |     |     |
| 19          |     |     |     | 137 | 27  | 27  | 79  |     | 220 |
| 20          |     |     |     |     |     |     |     |     |     |
| 21          |     |     | 126 | 17  | 81  |     |     |     | 28  |
| 22          |     |     |     | 114 | 168 | 69  | 289 |     |     |
| 23          |     |     |     | 28  |     |     |     |     |     |
| 24          |     |     |     |     |     |     |     |     |     |
| 25          | 133 | 215 | 42  |     |     |     |     |     | 79  |
| 26          |     |     |     |     | 33  | 90  | 89  |     |     |
| 27          |     |     |     |     | 215 |     | 287 |     |     |
| 28          |     |     |     |     | 391 |     | 98  |     |     |
| 29          |     | 37  |     |     |     |     | 287 |     |     |
| 30          |     | 89  | 29  |     |     | 47  | 17  | 39  |     |
| 31          |     | 116 | 110 |     |     |     |     |     |     |

**Fig. 1.** The daily variation in rain rate with time in April 2012.
Fig. 2. The daily variation in rain rate with time in May 2012.
Where

\[
\log_{10} k = \sum_{j=1}^{4} a_j \exp \left[ - \left( \frac{\log_{10} f - b_j}{c_j} \right)^2 \right] + m_k \log_{10} f + c_k
\] (2)

and

\[
\alpha = \sum_{j=1}^{5} a_j \exp \left[ - \left( \frac{\log_{10} f - b_j}{c_j} \right)^2 \right] + m_\alpha \log_{10} f + c_\alpha
\] (3)

where \( f \) is frequency, \( k \) is either \( k_H \) or \( k_v \) and \( \alpha \) is either \( \alpha_H \) or \( \alpha_v \).

The data can be used to analyse the percentage of exceedance of the rain rate to show the specific threshold level recorded and exceeded over a period of time.

Fig. 3. The daily variation in rain rate with time in June 2012.
1.1. The summary statistics of the data in 2012

The summary statistics of the data measured in April–December 2012 is presented in Table 1. The data was also presented in a bar chart in Figs. 1–9. The bar chart is a representation of the descriptive statistics which reveals the variation of rainfall rate for some of the months in the year.

2. Experimental design, materials, and methods

The measurement was conducted at Covenant University, Ota, (6.67° N, 3.23° E), Southwest Nigeria. The in-situ precipitation measurement started in April 2012 and is ongoing. The data used for this analysis is of a period of 9 months. The data logger (Davis instrument Weather Link) employed for capturing and harvesting the data is connected to a personal computer (PC) for data harvesting. The rainfall data was analysed by sorting and classifying the rainfall rate into four different categories, namely: the drizzle rain type (below 5 mm/h); the widespread rain type (between 5 mm/h and 10 mm/
Fig. 4. The daily variation in rain rate with time in July 2012.
h); the shower rain type (between 10 and 40 mm/h) and the thunderstorm rain type (above 40 mm/h). Although, both rainfall and non-rainfall measurements are ongoing by some researchers in Nigeria [3–13]. Some descriptive statistics data measurement was also used by [14,15]. Moreover, this research

Fig. 5. The daily variation in rain rate with time in August 2012.
Fig. 6. The daily variation in rain rate with time in September 2012.
Fig. 7. The daily variation in rain rate with time in October 2012.
Fig. 7. (continued).
Fig. 8. The daily variation in rain rate with time in November 2012.
work is one of the few in Southwest Nigeria. The data will serve as a great tool for the analysis and prediction of rain attenuation and the extent of its impairment on communication signals in the tropics.

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Conflict of interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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