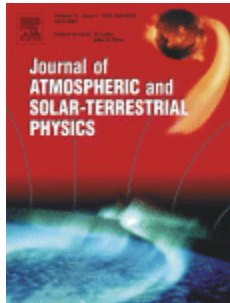


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One-minute rain rate distribution in Nigeria derived from TRMM satellite data

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Abstract

Data from the Tropical Rainfall Measuring Mission (TRMM) satellite sensors, the Microwave Imager (TMI, 3A12 V6) and other satellite sources (3B43 V6) have been used to derive the thunderstorm ratio β , total rain accumulation M , and 1-min rainfall rates, $R_{1\text{min}}$, for 37 stations in Nigeria, for 0.001–1% of an average year, for the period 1998–2006. Results of the rain accumulations from the TRMM satellite (1998–2006) were compared with the data collected from 14 ground stations in Nigeria for the period 1991–2000. The two data sets are reasonably positively correlated, with correlation coefficients varying from 0.64 to 0.99. Deduced 1-min rainfall rates compared fairly well with the previous ground data of Ajayi and Ezekpo (1988).

Development of climatic maps of rainfall rate and attenuation for microwave applications in Nigeria. The Nigerian Engineering 23(4), 13–30) with correlation coefficients varying from 0.17 to 0.97 in all 37 stations. The agreement was much better when compared with the International Telecommunications Union Radio communication Study group 3 digital maps with correlation coefficients varying from 0.84 to 0.98 in 23 locations; however there were negative correlation coefficient (of 0.2 in 7 stations) in the Middle Belt and a weak positive coefficient (of 0.09 in 6 stations) in the South South. Regionally the inferred mean annual 1-min rainfall rates are the highest in the South-East region with values between 111 and 125 mm/h throughout the 9 years, followed by the South-South region (105–124 mm/h). The lowest rainfall rate and rainfall accumulation occur in the North-West region (60–86 mm/h) followed, in ascending order, by the North-East (66–95 mm/h) region, the Middle-Belt region (76–102 mm/h) and the South-West region (77–110 mm/h). The present results were also compared with 9 tropical stations around the world and there was positive correlation between the results. The present results will be very useful for satellite rain attenuation modeling in the tropics and subtropical stations around the world.

It is useful to note that one country, particularly one as large as Nigeria, can have significant variations in its rainfall characteristics for a variety of reasons, and this is borne out by the results presented.

Keywords

- TRMM satellite;
- Stratiform and convective rainfall accumulation;
- One-minute rain rate;
- Thunderstorm ratio

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