In situ investigation of Rain drop size distribution (DSD) using Micro Rain Radar Data and its effect on microwave radio signals in tropical region

[1]Tomiwa, A. C. [2]Ojo J. S and [3]Ajewole, M. O.
[1]Department of Physics and Electronics, Adekunle Ajasin University, Akungba akoko, Ondo State, Nigeria E-mail: tomiwaakinyemiclem@gmail.com. or akinyemi.tomiwa@aaua.edu.ng [2, 3]Department of physics, Federal University of Technology, Akure. P.M.B. 704, Akure, ondo State Nigeria. E-mail: josnno@yahoo.com, oludareajewole61@yahoo.com

ABSTRACT

Four years (2008, 2009, 2010 and 2014) data of Rain drop size distribution and some associated rain parameters such as the rain rates (R), radar reflectivity (Z), liquid water content (M), and the falling velocities (W) were observed and analysed using a vertically pointing Micro Rain Radar (MRR) at the Department of Physics, Federal University of Technology Akure ($7^o15'N$, $5^o15'E$), a tropical location in Nigeria. The parameters were measured from the ground level to a height of 4.8 km above sea level with a vertical resolution of 160 m and over a total of 30 range gates with 1-minute integration time. Data collected from the monsoon period were used to determine the vertical profile of Z-R relationship for all the rain types. The study established relationships between all the parameters and the results shows typical values for negative exponential rain drop size distribution (DSD) similar to that of Marshall-Palmer for both stratiform and convective rain. At 0.01% of time, the measured rain rate was underestimated by 35% when compared with the ITU-R recommendation for this region and it was observed that over 85% of the total rainfall in this part of the world is stratiform while the remaining 15% are convective except for the month of October which is the peak of the rainy season in the year where a high number of convective rain is observed. The results of this study may assist to improve the design and planning of terrestrial and satellite radio communication system in this location, this may also be useful for understanding rain structures over this region. Results of radar reflectivity versus rain rate indicate that the exponent is lower and the intercept is higher for stratiform rain types than in the convective classification.

Keywords: Micro rain radar, Rain microstructure, Drop size distribution, Stratiform and Convective.