

Understanding the Classification of Rain Microstructure and Estimation of Z-R Relationship using a Micro Rain Radar in Tropical Region

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Abstract : Tropical regions experience diverse and complex precipitation patterns, posing significant challenges for accurate rainfall estimation and forecasting. This study addresses the problem of effectively classifying tropical rain types and refining the Z-R (Reflectivity-Rain Rate) relationship to enhance rainfall estimation accuracy. Through a combination of remote sensing, meteorological analysis, and machine learning, the research aims to develop an advanced classification framework capable of distinguishing between different types of tropical rain based on their unique characteristics. This involves utilizing high-resolution satellite imagery, radar data, and atmospheric parameters to categorize precipitation events into distinct classes, providing a comprehensive understanding of tropical rain systems. Additionally, the study seeks to improve the Z-R relationship, a crucial aspect of rainfall estimation. One year of rainfall data was analyzed using a Micro Rain Radar (MRR) located at The Federal University of Technology Akure, Nigeria, measuring rainfall parameters from ground level to a height of 4.8 km with a vertical resolution of 0.16 km. Rain rates were classified into low (stratiform) and high (convective) based on various microstructural attributes such as rain rates, liquid water content, Drop Size Distribution (DSD), average fall speed of the drops, and radar reflectivity. By integrating diverse datasets and employing advanced statistical techniques, the study aims to enhance the precision of Z-R models, offering a more reliable means of estimating rainfall rates from radar reflectivity data. This refined Z-R relationship holds significant potential for improving our understanding of tropical rain systems and enhancing forecasting accuracy in regions prone to heavy precipitation.

Keywords : remote sensing, precipitation, drop size distribution, micro rain radar

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