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Understanding the Variability of Z-R Relationships Caused by Natural Variations in Raindrop Size Distributions (DSD): Implication of Drop Size and Number

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ABSTRACT
In the issue of rainfall estimation by radar through the necessary relationship between radar reflectivity Z and rain rate R (Z-R), the main limitation is attributed to the variability of this relationship. Indeed, several pre-vious studies have shown the great variability of this relationship in space and time, from a rainfall event to another and even within a single rainfall event. Recent studies have shown that the variability of raindrop size distributions and thereby Z-R relationships is therefore, more the result of complex dynamic, thermody-namic and microphysical processes within rainfall systems than a convective/stratiform classification of the ground rainfall signature. The raindrop number and size at ground being the resultant of various processes mentioned above, a suitable approach would be to analyze their variability in relation to that of Z-R relation-ship. In this study, we investigated the total raindrop concentration number NT and the median volume di-ameter D0 used in numerous studies, and have shown that the combination of these two ‘observed’ parame-ters appears to be an interesting approach to better understand the variability of the Z-R relationships in the rainfall events, without assuming a certain analytical raindrop size distribution model (exponential, gamma, or log-normal). The present study is based on the analysis of disdrometer data collected at different seasons and places in Africa, and aims to show the degree of the raindrop size and number implication in regard to the Z-R relationships variability.

KEYWORDS
Raindrop Size Distribution, Radar Reflectivity Factor, Rain Rate, Median Volume Diameter, Total Number of Drops Per Unit Volume, Z-R Relationship, Convective Rain, Stratiform Rain, Squall Lines, Thunderstorm

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