DETERMINATION OF Z-R RELATIONSHIP FOR RADAR-BASED QUANTITATIVE PRECIPITATION ESTIMATION (QPE) USING IN-SITU MEASUREMENTS IN METRO MANILA

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ABSTRACT

Weather radar is an effective meteorological tool that gathers high spatial and temporal data through the detected backscattered energy called reflectivity (Z). Radar-based quantitative precipitation estimation (QPE) is a key feature of weather radars that converts reflectivity (Z) to precipitation rate (R) by means of the Z-R relationship ($Z = aR^b$). The aptitude of radar rainfall conversion using the empirical equation varies in time and space; hence, the determination of geographically best fit Z-R relationship is important. In this study, the operational use of Marshall-Palmer (MP) Z-R equation ($Z=200R^{1.6}$) in Tagaytay radar QPE has been evaluated using rain observation data by annual and seasonal (JJAS, NDJF, MAM) approach with the application of *wradlib* python module preprocessing techniques (i.e. static clutter, attenuation correction) and varying grid resolution sampling (i.e. 1x1 km, 3x3 km, 5x5 km, 7x7 km, 9x9 km). This study determined alternative radar reflectivity to rain rate equations from using the same sampling and test method of preprocessed radar dataset, reckoning fifteen (15) total equations. The derived Z-R relationship has been assessed against Marshall-Palmer radar reflectivity to rain rate conversion skill such that the radar rainfall estimates must equal or closest to in-situ measurements. The validation result of Marshall-Palmer Z-R relationship rainfall estimates showed below 50% correlation using whole dataset in all data type input and grid size sampling; while noise corrected data inputs displayed increase of QPE confidence which entails the highest correlation equal to 0.88 during MAM period. The verification result of the new Z-R relationship surpassed the ability of MP radar-based rainfall estimation throughout the test groups with optimum correlation *(equation)* equivalent to 0.759 ($Z=310R^{2.55}$) in 1x1 km grid size, 0.986 ($Z=410R^{4.65}$) in 5x5 km grid resolution, and 0.986 ($Z=420R^{4.70}$) in 5x5 km grid network using raw reflectivity, clutter removed, attenuation corrected radar data, respectively. Finally, the use of noise corrected radar data and the newly derived Z-R relationship in no distinct grid size had presented an advancement of radar-based quantitative precipitation estimation compared to existing equation currently used by PAGASA.