

# Uncertainty Analysis of Quantitative Rainfall Estimation Based on Hydrological and Meteorological Radar

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## **(a) Purpose of study or research hypothesis**

Several sources of biases are involved at each stage of the quantitative radar-based rainfall estimation process because the hydrological and meteorological radar measures the rainfall amount indirectly.

## **(b) Key issue(s) or problem(s) addressed**

The conventional methods seldom present the total uncertainty in a quantifiable manner and compare the relative uncertainties between different stages. This study proposed three new methods (Maximum Entropy Method (MEM), Uncertainty Delta Method (UDM), and Modified-Fractional Uncertainty Method (M-FUM)), which could present total uncertainty, level of uncertainty increase at each stage, and the percentage of uncertainty at each stage.

## **(c) Methodology or approach used**

To test the applicability of the three new methods, this study carried out a radar-based rainfall estimation process for a Korean basin, which consisted of two quality control algorithms, two rainfall estimation methods, and two post-process rainfall bias correction methods in 18 rainfall events on summer seasons of 2012.

## **(d) Results or conclusions derived from the project**

For the uncertainty quantification results by applying MEM, UDM, and M-FUM, although the final uncertainty was reduced rather than the initial uncertainty, uncertainty also increased in the rainfall estimation stage, which implies that the radar-based rainfall estimates and its corresponding uncertainty can be different depending on which rainfall estimation method is applied. Therefore, through use of the three new uncertainty quantification methods of this study, the following can be done for radar-based rainfall estimation. First, uncertainties can be quantified for the total assessment and for each stage. Second, the percentage that the uncertainty of each stage takes in light of the total uncertainty can be shown. Last, the uncertainty propagation process can be identified at each stage of the process.

## **(e) Implications of the project relevant to congress themes**

With the new methods, the major reasons that generate uncertainties in radar-based rainfall estimation will be better identified and more effectively reduced.

**Keywords :** radar-based rainfall, uncertainty quantification, uncertainty propagation, maximum entropy, delta method, fractional uncertainty method