1.33 AUTOMATIC IDENTIFICATION OF MELTING LAYER BASED ON FUZZY LOGIC AT OPERATIONAL S-BAND DUAL POLARIZATION RADAR

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The accurate identification of melting layer (ML) and the study on ML characteristics are important for radar QPE, rain and snow microphysics, and hydrometeor classification. For sing-polarization radar, ML was usually identified using vertical profile of reflectivity. Dual-polarization capability allows to more robust and accurate identification than single-polarization radar. Specially, linear depolarization ratio (LDR) shows extraordinaire performance to identification of ML. However, use of LDR for identification of ML is extremely limited for operational polarization weather radar because most of operational polarimetric weather radar operated at STAR mode cannot provide LDR with other polarimetric observations simultaneously. Most of studies on ML detection has been conducted based on RHI mode, not for PPI mode of operational polarimetric radar. In this study, we proposed automatic fuzzy logic algorithm for real-time identification of ML at every PPI mode of operational S-band dual-polarization radar.

S-band dual-polarization radar were utilized for fifteen rainy cases from April 2015 to September 2016. The top, bottom, and peak of bright band (BB) were identified by the combination of the suggestion of Rico-Ramirez and Cluckie (2007) and Quasi-Vertical Profile (QVP) of polarimetric observations. The seven feature parameters and their weights were then computed at BB and non-BB region: 1) radial smoothed Z_H, 2) radial smoothed Z_{DR}, 3) radial smoothed ρ_{hv}, azimuthal textures of 4) Z_{DR}, 5) ϕ_{DP}, 6) ρ_{hv}, and 7) height. The membership functions (MFs) are then determined from the normalized frequency distributions (NFD) of feature parameters over BB and non-BB region. The identification of ML at PPI mode was done by fuzzy logic classifier consisting of the predetermined MFs and their weights. If total membership values obtained from the classifier would be greater than threshold, the radar gate will be identified as BB. By comparing to traditional ML identification based on vertical profile of polarimetric observation, the identification performance was evaluated using skill scores such as POD, FAR, and CSI. To determine optimal value of threshold, we developed the additional technique based on vertical profile of membership values.

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