Improvement of the Downburst Detection Algorithm using Single-Doppler Radar Data in South Korea

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A downburst is a density current originated from precipitation-caused dragging force and evaporative cooling at the mature stage of a convective storm. The wind shears (the rapid change in wind speed and direction) in the low altitude occurred by microburst endanger in the airplane safety during takeoffs and landings. Downburst is one of the most difficult weather phenomena to be detected and predicted considering its nature of being developed and dissipated in short time (in an hour). The algorithm of Automated Microburst Detection Algorithm (AMDA) was developed using Airport Surveillance Radar 9 (ASR-9) focusing on the microburst in the airports. AMDA was applied to Weather Surveillance Radar (WSR-88D) recently to detect downbursts in any other regions including residential areas. AMDA detects wind-shear segments out to 70 km range from single WSR-88D by combining features from reflectivity and radial velocity fields. AMDA further modified to be applied to the Korean Doppler radar network as DownBurst Detection Algorithm (DBDA).

In this work, enhanced DBDA (eDBDA) developed to improve DBDA by extracting and combining downburst characteristics in the lowest two elevation angles. The features of downburst in plan position indicators (PPIs) were overlapped to obtain the spatial confirmation. Detected downburst is expressed as probabilities. Detections can support forecasters to determine downbursts using different probabilities as thresholds. The performances of eDBDA and DBDA were evaluated by the statistical scores of Probability Of Detection (POD), False Alarm Rate (FAR), and Critical Success Index (CSI) based on 28 scans (including downbursts). The accumulated statistical results showed improved results of eDBDA compared to that of DBDA.

Keywords: microburst, S-band radar, wind shear

