Thunderstorm Identification Algorithm Research Based on Simulated Airborne Weather Radar Reflectivity Volume Scan Data

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Airborne weather radar is an important part of the atmospheric detection system and an important guarantee for safe flight. However, unlike ground-based radars, most of the existing airborne weather radars do not have scanning capability. Even if a small part has, very limited. The obtained meteorological echo information is insufficient by these radars. This paper proposes an airborne weather radar with a new scanning strategy, which adopts a volume scanning method. The radar scans a total of 31 elevation angles (resolution is 1 angle) from low elevation angle to high elevation angle in sequence in the fan-shaped area ahead of the flight, so that it can obtained enough echo information with high resolution. Firstly, by simulating the detection process during the flight, we establish a three-dimensional reflectivity volume scanning data simulation model based on X-band ground-based radar reflectivity data. And then, we use the simulated reflectivity data to study a thunderstorm identification algorithm. Among the existing thunderstorm identification algorithms, Storm Cell Identification (SCI) algorithm uses seven reflectivity thresholds to identify thunderstorms, which can reflect the three-dimensional structure of thunderstorm cells and obtain their attributes. Therefore, this paper is based on SCI algorithm and considering the severe attenuation of X-band and the life process of thunderstorm cells to study a thunderstorm recognition algorithm, which have improvements of identifying thunderstorm cells in development stage. Finally, this paper gives an identification example of an airborne weather radar reflectivity volume scan data to prove that this algorithm can identify thunderstorm cell in mature stage and thunderstorm cell in certain scale development stage in the detection area by combining with attributes analysis, which is helpful for flight security and has important significance for future meteorological researches.

Keywords: airborne weather radar, volume scan, thunderstorm identification, SCI algorithm