

Radial Interference Echo Identification Algorithm Based on Fuzzy Logic for Chinese Single-Polarization Weather Radar

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When the radar signal processor is abnormal, the antenna is aligned with the sun or the signal is subject to external electromagnetic interference, the radar observation will have strip-shaped interference echoes along the radial direction. This kind of echoes may prevent weather radar from retrieving meteorological information in the affected azimuth areas and be mistaken for actual atmospheric observations. Such non-meteorological echoes must be identified and eliminated before quantitative applications such as radar precipitation estimation.

The original operational quality control algorithm has poor recognition and elimination effect on radial interference echoes. A new algorithm is needed to improve the data quality. Meanwhile, in order to adapt to the current volumetric data and the upcoming single radial stream data for operational application in China, a new radial interference echo recognition algorithm based on fuzzy logic is proposed.

Precipitation echo data and radial interference echo data in 2017 were collected and analyzed. It is found that the radial interference echoes can be divided into two categories. The horizontal texture of one kind is very smooth, but the horizontal texture of the other kind is very rough. On this basis, the characteristics of two kinds of radial interference echoes and precipitation echoes are analyzed. The characteristic parameters only on the radial direction are extracted. The membership functions are established, respectively, and the weight of each parameter is set. Finally, a value that measures the probability of each bin affected by radial interference echo is get.

The algorithm has been evaluated and the results show that it can distinguish radial interference echoes from precipitation echoes very well. Compared with the original operational algorithm, it can significantly improve the accurate identification of radial interference echoes and reduce the false elimination of precipitation echoes. It has been implemented in the real-time nationwide data quality control operation system for nearly a year. It has robust operation ability and performs well. What's more, it has a positive contribution to the quantitative applications (such as quantitative precipitation estimation, hail identification).

Keywords: Radial Interference Echo, Fuzzy Logic, Single-Polarization Weather Radar