# Techniques of Severe Convective Weather Comprehensive Monitoring

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## Abstract

The convective weather forecasting is based on its monitoring. The Severe Weather Prediction Center of National Meteorological Center constructed an operational system of severe convective weather comprehensive monitoring based on the multi-source data (including conventional observation data, automatic weather station data, lightning data, radar data and satellite data). The convective weather monitoring include: cumuli, high temperature at surface, thunders, cloud-ground lightning, hail, tornadoes, high winds, thunder high winds, short-term heavy rain, radar reflectivity, convective storms (based on radar data), deep convective clouds, mesoscale convective systems (MCS, based on the IR satellite data). The system gives the different distributions of different convective weather in different periods. The techniques used in the system include: the quality control of automatic weather station (AWS) data, the extracting information and statistical technique of convective weather, CTREC (Cartesian Tracking Radar Echoes by Correlation), TITAN (Thunderstorm Identification, Tracking, Analysis, and Nowcasting), identification of deep convective clouds, identification and tracking of MCS, and lightning density monitoring. The system of monitoring convective weather automatically runs regularly, fully compatible with the MICAPS platform. The monitoring system at National Meteorological Center played an important role in real-time convective weather forecasting.

The quality control technique of hourly high wind and heavy rainfall data from AWSs is developed. Because of higher temporal and spatial resolution of AWS data, the TBB data from FY-2 geostationary satellite, the cloud-ground lightning data and the conventional observation data are used to do the quality control.

The different extracting information techniques are applied in the system for different convective weather, and different statistical methods are also performed for the different convective weather in different periods.

The lightning frequencies are higher and the convection is more severe. So the positive, negative, and total CG lightning density in different periods is calculated and monitored.

CTREC vectors are calculated based on the mosaic radar reflectivity in the whole China. CTREC is an abbreviation for "Cartesian Tracking Radar Echoes by Cross-Correlation". This algorithm separates the reflectivity field to some small "areas", then calculates the cross-correlations of small "areas" between the present reflectivity field and the previous to find the most correlated "area", and gets the motion vector of each "area".

TITAN is an abbreviation for "Thunderstorm Identification, Tracking, Analysis, and Nowcasting". TITAN uses a single threshold within reflectivity field to identify storms and utilizes a combinatorial optimization method to match the two storm sets across successive scans. The 35dBZ threshold is generally used to identify the storms.

The deep convective cloud identification is based on the infrared window (IR) and water vapor (WV) channel data from FY-2 geostationary satellite. Simultaneous observations of deep convective clouds in the IR and the WV absorption band from satellite show that the equivalent brightness temperature in the WV channel can be larger than in the IR channel. So the brightness temperature difference between this two channels can be used to identify the deep convective clouds.

MCSs are identified using the different IR brightness temperature thresholds, such as -32、-52℃, based on the IR satellite data. The automated tracking method is based on the overlapping between MCSs in successive IR images.

The above convective weather monitoring techniques also need to be further improved in future.

**Key Words**：Convective weather, multi-source data, comprehensive monitoring, operational system