

2.34 MESOCYCLONE DETECTION AT MÉTÉO-FRANCE

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Supercells are particularly long-lived thunderstorms known for their capacity to produce damaging weather phenomena such as large hail, heavy rain, severe wind gusts or tornadoes. They are characterized by the presence of a deep and persistent rotating updraft called mesocyclone, whose diameter ranges from 2 to 10 km. The rotation can be seen as a symmetric dipole of inbound/outbound velocities in the radial storm-relative velocity field of Doppler weather radars. Several mesocyclone algorithms have been developed in the past (e.g. Zrníc 1985, Stumpf et al 1998, Entschgebek et al 2017) for operational nowcasting.

At Meteo-France, the Doppler information from the radar network is used to produce a wind-shear mosaic (Augros et al, 2013) that provides to forecasters an estimation of the maximum horizontal wind shear detected in low levels (between 0 and 2 km AGL). This product is suited for the detection of gust fronts, or strong convergence areas inside thunderstorms but is not well adapted for the detection of azimuthal shear that characterizes the mesocyclones in radial velocity images.

The aim of the study presented in this paper is to develop and evaluate a dedicated mesocyclone algorithm for the Meteo France radar network. Following the “pattern vector approach” from Zrníc et al (1985) and applied by Entschgebek et al (2017), the algorithm looks for sequences of azimuthal shear grouped in one-dimensional “pattern vectors”, which are combined to two-dimensional “features”. Adjacent “features” in consecutive elevation angles are then merged into 3D mesocyclone objects. The adaptation of the algorithm to the specificity of the 3-PRT scheme used at Meteo France to measure Doppler velocities unambiguously at maximum range will be presented and discussed. A few case studies will be shown to illustrate the performance of the algorithm.

References

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