Detection of atmospheric rotation by means of the DWD weather radar network

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The radar network of the Deutscher Wetterdienst (DWD) provides 3D-Doppler data in high spatial and temporal resolution, thus supporting identification and tracking of dynamic small-scale weather phenomena. The scan pattern comprises 10 sweeps with elevation angles from 0.5° to 25° and is repeated every 5 minutes supplying reflectivity and radial velocity. A dual PRF unfolding error correction is applied to the radial velocity sweep data giving a sound basis for shear calculations in follow-up algorithms.

Within the mesocyclone detection algorithm rotation signatures (features) found in the azimuthal shear matrices derived from the radial velocity sweeps of all radar sites are evaluated. Features with similar coordinates are merged into the same mesocyclone objects, which are ranked according to a severity metric taking into account properties like shear, momentum and VIL and made visible to the forecaster at DWD by means of the NinJo meteorological workstation system.

Meteorologists can judge the significance of mesocyclone detections using the severity scale as guidance and applying persistency and consistency checks (track of mesocyclone detections, additional occurrence of typical weather features e.g. hook echoes). A further means to validate a mesocyclonic rotation is given by the rotation and rotation-track products. The rotation product is created by averaging the azimuthal shear in the vertical. This procedure suppresses random noise while amplifying the azimuthal rotation signature and better reveals the regions of rotating updrafts. Then, the maximum rotation is accumulated over a time interval of 3h to yield a rotation-track-product where persistent rotation shows up as line structure.

The mesocyclone detection and rotation track algorithms in its current implementations will be introduced and the performance will be discussed by means of selected weather cases.