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Some special derived radar parameters and their development during the life cycle of different thunderstorm types

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Data from a C-Band Doppler Radar – located in Southwestern Germany - was used to track different isolated thunderstorms in order to investigate their 4-dimensional developments. This study concentrates especially on the development of some bulk properties, which were calculated from the reflectivity data points that are supposed to represent the thunderstorm.
In order to separate the reflectivity data of the investigated thunderstorm from the background and to obtain this data in subsequent datasets the tracking algorithm TRACE3D was used. TRACE3D thereby identifies thunderstorms as continuous regions of strong reflectivities and tracks them in time, giving access to the total life cycle of observed storms.
For a further investigation of the development of the storms we defined - next to 'often' used properties like the total volume, the maximum reflectivity, the velocity of a storms' reference point, the total liquid water content and others - some abstract properties like a 'reflectivity mass' as a reflectivity weighted volume, the height of the center of gravity of the thunderstorms' volume and reflectivity mass and some special ratios. These last parameters are also evaluated in relation to some specific, the convective environment representing heights like the level of free convection (LFC), the 0°C and the -10°C level, which were extracted from data of operational upper air rawind soundings.
In this presentation the development of the special derived radar parameters of a strong multicell storm and a damaging hail developing supercell are compared. The track of the multicell storm lasted 130 min. and covered a distance of 65 km, whereas the examined track of the supercell lasted for 170 min. and covered a distance of 109 km.
Especially the parameters, that are related to the levels of isotherms (0°C, 10°C) as well as to the LFC showed distinct differences. It was found, for example, that for the supercell thunderstorms the height of the center of gravity of the thunderstorms' volume and reflectivity mass were located during the entire period above the 0°C level and showed just a slight oscillation. In the case of the thunderstorms' volume the height was even located above the -10°C level for a considerably long period (after which – by the way - large hail was reported). The multicell thunderstorm on the other hand indicated a pronounced oscillation of the parameters over significantly greater distances and only relatively short crossings of different levels of isotherms by a new updraft pulse within the regular multicell life cycle. It thus seems that the height of the center of gravity above a specific level and the time it remains there can serve as a distinction between the storm types and indicate a short-term development.