2.8 EVALUATING THE DEVELOPMENT STAGE OF THUNDERSTORMS BY USE OF 4D RADAR DATA-PARAMETERS

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Thunderstorms undergo several development stages (cumulus stage, mature stage and decaying stage, c.f. Byers and Braham Jr, 1948) which are in a specific case more or less pronounced and/or extended. Whether a location is affected by severe weather or not depends on the stage and on the development of the stage.

In this study we carried on the examination of the development of thunderstorms using single pol radar volume data. We used TRACE3D (Handwerker, 2002) to identify and track individual thunderstorms, applying a constant reflectivity threshold of 40 dBZ. For each thunderstorm we calculated bulk and specific descriptors which are supposed to describe the stage of maturation or to be indicators of different external and internal processes which occur during a life cycle.

Next to "often" used properties - like the total volume, the maximum reflectivity, the velocity of a storms reference point and others the calculated parameters include a "reflectivity mass" as a reflectivity weighted volume, the height of the centre 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, the 0°C and the -10°C level, which were extracted from data of operational upper air rawind soundings.

For a further evaluation we then compared the evolution of these parameters and their physical meanings with the current conceptual models of the thunderstorm development.

Special emphasis was laid on the updraft strength, which is an integral part of the thunderstorms development. In addition, we tried to obtain an evaluation of the severity of internal processes, which in turn gives information about the organization of the thunderstorm.

We investigated the temporal evolution of the storms center of gravity with respect to the different convective levels in order to evaluate whether the storm is still top heavy (and capable of a further development) or whether the storm is already foot heavy and in the decaying stage of at least the actual life cycle) .

Our results fit quite well with the conceptual models of the different storm types. One can discover a meaning and a pattern behind the development of the parameters and maybe also infer a short term forecast value for the further development of the cell.

Next to the evolution and differences of the characteristics of single cell, multicell and supercell storms, we will also present a case of an unusual split. The derived parameters early suggested, that the "left" daughter cell would undergo a stronger further development, whereas the "right" daughter exhibited no strong potential of

further development, although the wind field pattern supported according to the classical conceptional models - a dominant “right” daughter.