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Conference on European Tornadoes and Severe Storms

Investigation of the interrelation between lightning evolution and internal thunderstorm dynamics for the 21 July 1998 E U L I N O X supercell storm event

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During summer 1998 the European field campaign EULINOX aimed at an improved understanding of NOx produced by lightning and its large-scale transport in the troposphere. During the special observation period in July 1998 combined measurements in and around thunderstorms werde made near the DLR site at Oberpfaffenhofen in southern Germany. These included repeated thunderstorm anvil penetrations by research aircraft, polarimetric radar (POLDIRAD) as well as dual Doppler radar observations. In addition, lightning flashes were detected by several means:

- lightning positions were inferred from an LPATS network which shows the two-dimensional distribution of positive and negative cloud to ground (CG) and intra-cloud (IC) lightning.
- VHF-sources were measured by the ONERA interferometer (ITF). These ITF data give two- as well as three-dimensional information on the position of VHF sources within thunderstorms. These data from different sources can be combined to give a detailed view on the relation between the evolution of lightning flashes in space and time and various polarimetric radar data.

The presentation will focus on one particular event during the EULINOX special observation period: the thunderstorms near the DLR site in the evening hours of 21 July 1998 for which all mentioned data sources are available. Thunderstorms had formed over the structured terrain of the Allgaeu Alps

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and one storm split into two separate cells which approached the experimental area of the EULINOX campaign.

Due to the veering environmental winds the right-flank storm soon exhibited clear supercell characteristics such as a radar echo overhang and a bounded weak-echo region. The left-mover evolved into a multi-cellular storm and decayed very rapidly after the storm splitting. The supercell-like right-mover showed some peculiarities concerning the lightning flash activity:

- a remarkably large frequency of positive CG flashes was observed, at some instants three times as large as for the negative CG flashes.
- the flashes were mainly located downshear of the main updraft core, indicating an influence of the interaction of supercell dynamics, environmental shear and microphysical processes of charge separation.
- for the highest flash rates of both positive and negative CG flashes the three-dimensional VHF sources peak at a low level of about 4 km AGL, while beforehand and in the decaying phase of the storm the VHF peak level was located in 5 to 6 km AGL.

The inclusion of additional VHF data obtained by the ONERA's ITF network will aid in uncovering the underlying interaction of thunderstorm dynamics as seen by polarimetric Doppler radar and the observed electrical discharges. s so local forcing will be presented.