EXAMINATION OF TWO SEVERE THUNDERSTORM EVENTS IN SOUTHERN GERMANY

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I. INTRODUCTION

Various severe thunderstorm events affected central Europe in the past few years. Some occurred in the typical environment of strong wind shear and high instability, where long-lived and organized thunderstorms are common. Others developed in an environment, where both the behavior and the strength of those thunderstorms were not expected. Two case studies will be discussed on the poster, one of a severe hailstorm and another one of a bow echo event over southern Germany. The information about the behavior of those thunderstorms was gathered by a combination of the polarization diversity Doppler radar (POLDIRAD) at DLR, Oberpfaffenhofen, the high resolution weather forecast model data from the DWD (COSMO-DE, horizontal mesh grid width is 2.8 km) and remote sensing data.

II. PRESENTATION OF RESEARCH

Two case studies are discussed on the poster. First a severe hailstorm over southeast Germany on 22 August 2008 and then a severe bow echo over southern Germany on 26 May 2009. The first point of study was the occurrence of typical patterns on radar, like the three-body scatter spike, the chronological evolution of an hail core and the signatures of a mature bow echo, like a rear inflow notch. It was of interest to understand the mechanisms, that resulted in a symmetric, progressive bow echo event. In that event, another point of interest was the performance of the COSMO-DE in this situation. An example can be seen in Fig. 1, where the model forecast (15h) and real time measurements are overlaid. Finally, it was compared how well severe thunderstorm forecast parameters captured the particular situation. The magnitude of those values was compared to observations done in North America (Przybylinski (1995) or Davis et al. (2004)).

III. RESULTS AND CONCLUSIONS

COSMO-DE did an outstanding job on the bow echo event, as it forecast the bow in time and space correctly. Wind speed shear values in the mesoscale model were similar to real time radar measurements for example by POLDIRAD and the same was seen in the model's precipitation forecast. Typical features for mature bow echoes, including rear inflow notches, a sharp reflectivity gradient and an intense cold pool were all captured by POLDIRAD and local surface weather data measurements. A combination of strong shear below 3 km and a rapidly developing cold pool all caused the bow echo to acquire the strength to produce hurricane-force wind gusts and persist for hours. The hailstorm on 22 August 2008 featured supercell characteristics like a persistently rotating updraft and a

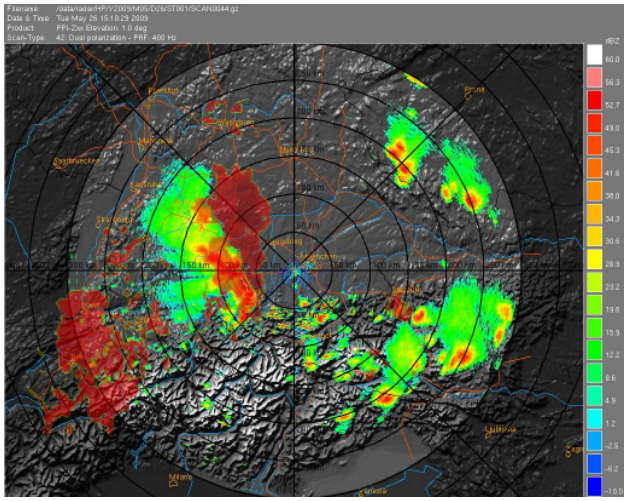

FIG. 1: Comparison between COSMO-DE and POLDIRAD. The PPI (colorbar) and COSMO-DE output (area, shaded in dark red) are from 1510 UTC. In COSMO-DE, reflectivity values less than 40 dBZ were cut off.

bounded weak echo region. This thunderstorm was a powerful hail producer with the hail core being tracked throughout the most serious phase of this supercell by different polarimetric measurements of POLDIRAD. Despite the more unidirectional wind shear, the increasingly deviant storm motion to the right of the 0-6 km background bulk wind speed shear vector caused storm relative helicity values to increase significantly. COSMO-DE did forecast an environment, supportive for organized thunderstorms but the model failed to forecast the discrete nature of this thunderstorm and the deviant storm motion. Therefore it underestimated the final strength and longevity of this supercell. This is an example, how internal dynamics in a thunderstorm can alter the local conditions in a positive or negative way for the particular thunderstorm.

IV. ACKNOWLEDGMENTS

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V. REFERENCES

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