A CASE STUDY OF TWO SEVERE HAILSTORM EVENTS OVER SOUTHERN AND EASTERN GERMANY

Helge Tuschy[1,2], Christoph Gatzen[3], Pieter Groenemeijer[4,2], Oscar van der Velde[5], Johannes Dahl[6], Jan Hoffmann[7], Angel Dimitrov

1 .Institut für Meteorologie und Geophysik, Leopold-Franzens Universität Innsbruck, Innrain 52, A-6020 Innsbruck,Österreich, mesoscale_2@hotmail.com
2. European Severe Storms Laboratory, Oberpfaffenhofen, Germany.
3. MC-Wetter, Berlin, Germany
4. Institut für Meteorologie und Klimaforschung, Forschungszentrum/Universität Karlsruhe, Karlsruhe, Germany
5. Laboratoire d'Aérologie, Université Paul Sabatier, Toulouse, France.
6. Deutsches Zentrum für Luft- und Raumfahrt e.V., Oberpfaffenhofen, Germany.
7. Institut für Meteorologie, Freie Universität Berlin, Germany

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I. INTRODUCTION

Severe hailstorms are expensive and dangerous thunderstorms, especially when they affect densely populated areas. In June 2006, severe hailstorms struck two cities in Germany, resulting in extensive damage and many injuries. On June 28th, more than 120 people were injured by hailstones with diameters up to 12 cm in the city of Villingen-Schwenningen, situated in the Black Forest of southwest Germany. This hailstorm caused more than 300 million US$ in total (Munich Re Group , press release on December 28th ,2006)

Less than two weeks earlier on June 16th, four people were injured in a severe hailstorm that moved over the city of Leipzig and that caused millions of Euros of damage. This event could have been much worse, because football matches of the FIFA World Cup were carried out in Leipzig during that summer. Two days before the hailstorm struck, more than 43 000 people were watching the games in and around the stadium of Leipzig and could have been injured by hailstones with diameters of 5 and locally up to 10 cm had the storm occurred during the game.

On the poster, the respective convective storms are shown to be supercell storms, that developed in an environment known to be favourable for their development. The two cases discussed are investigated in more detail and questions about their predictability are raised and the quality of ESTOFEX forecasts for those events are being evaluated.

II. SUPERCELL HAILSTORMS

Although each somewhat stronger thunderstorm will be able to produce hail of a few centimetres in diameter, the most devastating hail reports are in conjunction with supercells (Doswell, pers. communication).

A supercell is a convective storm that possesses a deep, persistent mesocyclone (Doswell, 1996). Storm structure is strongly dependent on the magnitude of vertical wind shear and instability, although rigid threshold values beyond which supercells invariably occur do not exist. The key to the severity of supercell storms lies in their longevity and especially in the extremely high vertical velocities that can develop in their up- and downdraughts.

III. THE LEIPZIG HAILSTORM (JUNE 16TH 2006)

On June 16th atmospheric conditions appeared favourable for an outbreak of severe thunderstorms over eastern Germany and western Poland and ESTOFEX (Dahl et al., 2004) had issued a threat level 1 for tornadoes, hail and wind gusts. A combination of steep lapse rates and strengthening deep-layer shear indicated a threat for large hail. Storms evolved during the early afternoon hours and remained discrete (i.e., they did not merge into a more or less continuous linear system) for a rather long period of time.

The thunderstorm that affected Leipzig exhibited typical supercell characteristics both on Doppler radar that indicated a strong mesocyclone (see FIG. 2) and also on photos shot by citizens of Leipzig.

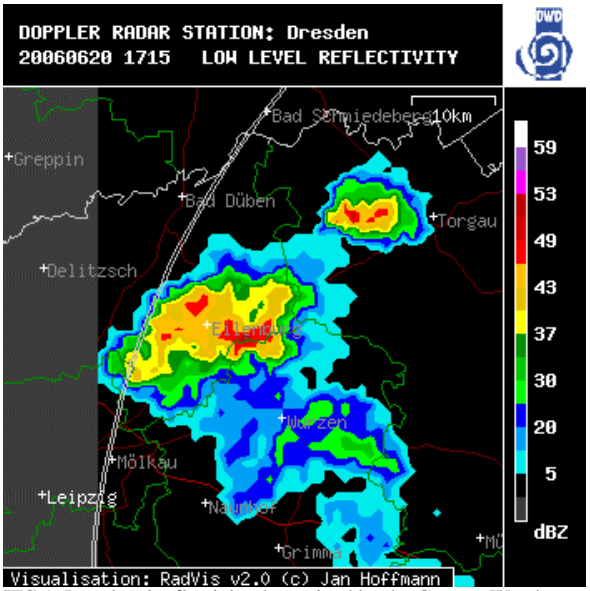

FIG 1. Low-level reflectivity determined by the German Weather Service (DWD) Doppler radar in Dresden. Compare with the location of the mesocyclone shown in FIG. 2.

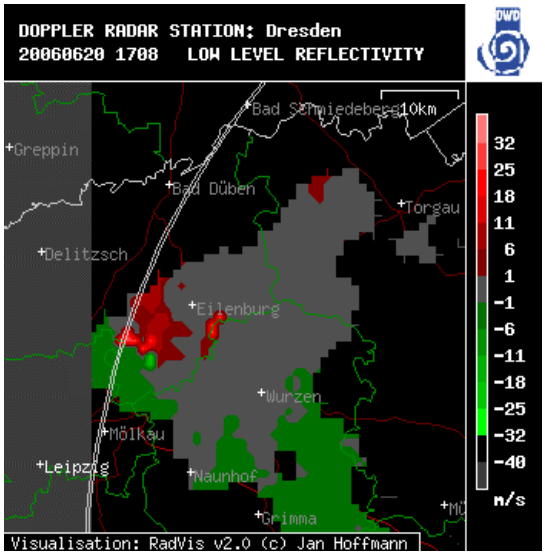

FIG 2. Radial velocity determined by the DWD Doppler radar in Dresden. The red-green couplet represents the supercell's mesocyclone.

IV. The Villingen-Schwenningen Hailstorm (June 28th 2006)

Atmospheric conditions on June 28th were favourable for severe thunderstorms. The parameters indicated that the main threat was likely to be large hail, with the threat area extending from eastern France all the way up to Poland. The investigated storm system developed during the early evening hours over the southern Black Forest. This case was very interesting, because the large-scale environment displayed only moderate 0-6 km vertical bulk shear of around 15 m/s. However, a more detailed analysis shows that locally, wind shear was larger and instability was strong.

V. Results and Conclusions

Both thunderstorms were classic, cyclonically rotating supercells which evolved in an environment favourable for organized thunderstorms. Steep lapse rates, strong instability, i.e., a quantifier for the parameters you use in the favoured hail growth zones but also 0-6 km bulk shear and 0-3 km storm relative helicity indicated that the development of significant hail was likely on both cases. The ESTOFEX forecasts indicated a threat for large hail for the respective areas, but only a level-one threat had been issued, whereas hail larger than 5 cm diameter requires at least a level-two-threat according to ESTOFEX's forecasting scheme. The reasons for the underestimation of the actual hail threat will be topic of the poster.

IV. Acknowledgments

The authors would like to thank all the volunteers who provided data and information about this severe weather event.

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V. References

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