AN F3 DOWNBURST IN AUSTRIA – A CASE STUDY WITH SPECIAL FOCUS ON THE IMPORTANCE OF REAL-TIME SITE SURVEYS

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I. INTRODUCTION

On March 1st of 2008, the powerful late winter cyclone "Emma" caused widespread damage over Central Europe. Embedded in the synoptic-scale storm field, deep convection along the cold front resulted in a significant enhancement of gusts in some places, peaking in an unusually strong downburst in a sparsely populated area near Braunau (Austria).

Only a site survey revealed the extraordinary intensity of this downburst that vividly contrasted with its sparse media coverage. This study aims to elaborate how the assessment of this case would have taken a significantly different outcome without the accomplishment of this site survey.

II. PRESENTATION OF RESEARCH

Cyclone "Emma" formed near Newfoundland and travelled eastward over the Northern Atlantic Ocean on the last days of February 2008, where it encountered an increasingly favourable environment for intensification until it reached its minimum central pressure and its maximum strength over Southern Scandinavia on March 1st. As its cold front raced south-eastward over the Netherlands and Germany in the morning hours of this day, it was overrun by a dry intrusion, a process well-known to favour the formation of a convective line along the cold front as it creates potential instability which is ready to be released by the forced ascent of cyclonic vorticity advection (CVA).

Extremely dry stratospheric air is visible by the purple colour in the Meteosat "airmass product" image at 08 UTC in Fig. 1. The arrival of this dry intrusion and the superimposed forced ascent of a strong CVA maximum caused the cold front to obtain a "split front" character (Schipper et al., 2008), with a dissolving high cloud shield and incipient cooling of the upper troposphere ahead of the surface cold front which is hence marked by an intensifying convective line, showing an unusual high amount of lightning as it moved over Germany towards the Czech Republic and Austria. Evaporative cooling caused by the falling precipitation encountering dry environmental air provoked the formation of a strong cold pool immediately behind the surface front (Fig. 2), further increasing the temperature and pressure gradient and thus accelerating the propagation of the convective line that was accompanied by severe wind gusts in many places. The series of downbursts finally culminated in the Braunau event at 09:46 UTC.

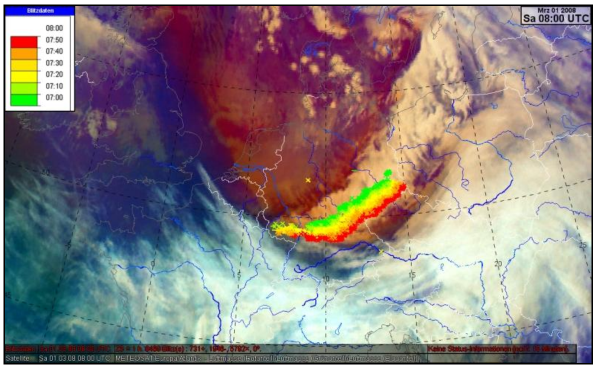

FIG. 1: MSG RGB "airmass product" image at 08:00 UTC on March 1st of 2008, and detected lightning within the last hour (Schipper et al., 2008).

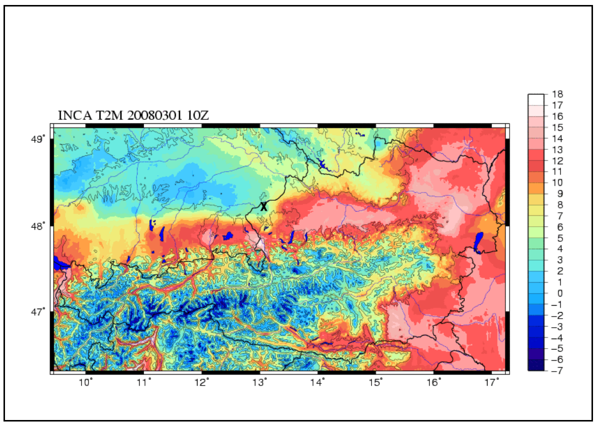

FIG. 2: "INCA" temperature analysis (Haiden et al., 2009) at 10:00 UTC, March 1st of 2008, when the cold front has just entered Northern Austria. Location of Braunau is denoted by the black "x".

The circumstances enabling the formation of this extraordinary local storm can be regarded as a coincidence of supporting factors over a wide range of scales, from the synoptic scale (i.e., the presence of a strong frontal zone) via the mesoscale (i.e., the interaction between the dry intrusion and the cold front) to small scales, whose processes determined the final position and strength of this downburst event while remaining mostly concealed even to the most alert meteorologist's eye. The authors of this study encountered a similar scale-cascade while moving their attention from the confusing and widespread synoptic-scale storm damages via mesoscale areas of even more pronounced downburst signs to the remote but incredible marks of this “king storm” near Braunau, strikingly closing the circle between storm synthesis and storm analysis.

The accomplishment of the site survey was not only based on meteorological ambition and supportive arrangements but also on (too much of) chances and luck: if this downburst had not hit and severely damaged the infrastructure of a large electricity supplier, the means and ways to perform a thorough site survey would never have unfolded, leaving this case rather buried in oblivion than finding its way into scientific literature.

FIG. 3: Examples of the storm damage as seen from the helicopter (top) and at the surface (bottom).

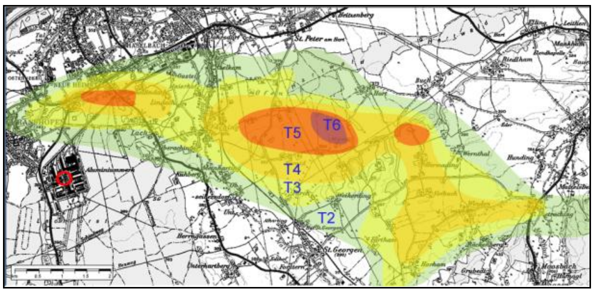

FIG. 4: Damage map of the affected area; colour shades represent the damage extent according to the T-scale. The legend bar in the lower left shows a distance of 2 kilometres. The red circle (above legend bar) denotes the automatic station of Ranshofen that was closely missed by the downburst and recorded a maximum gust of only 104 km/h.

The deeper the investigations got, the higher the estimations of the damage had to be raised. Two days’ systematic field mapping, photographic documentation, interviews with eye-witnesses and a helicopter flight finally revealed that the damage extent in the core of this downburst reached T5 and locally even T6 intensity (Hubrig, 2004), corresponding to upper F2 and locally lower F3 intensity on the Fujita scale (Fig. 3). Thus, even the most conservative valuation of the involved wind speed yields maximum gusts of at least 200 km/h, turning this event into the strongest downburst ever documented in Austria (Fig. 4).

III. RESULTS AND CONCLUSIONS

Embedded in the synoptic-scale storm field of the powerful late winter cyclone “Emma”, an F3 downburst occurred near Braunau (Austria) on March 1st of 2008. Only a thorough site survey revealed the nature, the whole extent and extraordinary intensity of this event that received little attention in the media as it affected a sparsely populated area and was dwarfed by superficially more spectacular damage events occurring within cities, disrupting major traffic routes and / or causing injuries and even fatalities. However, as this downburst by mischance severely damaged the infrastructure of a large electricity supplier, its aftermath turned out to be far-reaching in a more subtle way, by not only evoking the scientific interest in a downburst event close to the very peak of its known probability distribution, but also showing the vulnerability of power supply and other implicitnesses of modern life. Thus, this case has proven valuable in further raising the awareness of extreme (convective) storms in the meteorological community as well as in risk management circles, by providing a reference “worst-case scenario” for both points of view.

This presentation aims to be not only a case study of a severe weather event but also a plea for the importance of near real-time site surveys to capture the dimensions of a (convective) storm event and properly classify it. Hopefully, this storm event will turn out to be another small but important step on the path towards a more systematic investigation of severe weather events.

IV. ACKNOWLEDGEMENTS

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V. REFERENCES

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