OVERVIEW OF ESSL RESEARCH ON SEVERE STORMS CLIMATOLOGY

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I. INTRODUCTION

The European Severe Storms Laboratory (ESSL) was founded in 2006 as a non-profit research organisation. Legally, the ESSL is a registered association (*eingetragener Verein*, e. V., under German law) with primary purposes:

- fundamental and applied research on severe weather;
- development / quality-control of the ESWD database;
- support of the European Conferences on Severe Storms.

Further information on the ESSL and its development is available from its websites **www.essl.org** as well as **www.eswd.eu** and **www.ecss.eu**.

II. ESSL AND ESWD DATABASE

ESSL's development status as well as its research planning for the next years includes the involvement in EU-funded research projects and initiatives. However, here we focus on a comparison of ESWD reports to ESTOFEX forecasts and DWD warnings in a European severe weather episode from 26-31 July 2005 (cf. Dotzek et al., 2006).

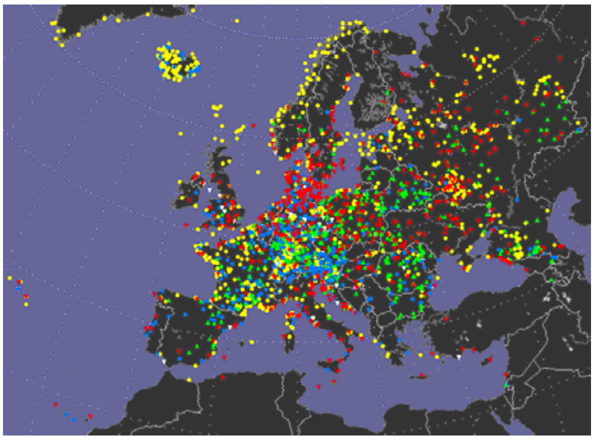

FIG. 1: All 3042 ESWD reports for the year 2006. Red: tornadoes, yellow: damaging wind, green: large hail, blue: heavy precipitation.

The main goal of the ESWD database (Groenemeijer et al., 2004, 2005) is to collect and provide detailed and quality-controlled information on severe convective storm events over Europe using a homogeneous data format and a web-based user-interface where both collaborating national meteorological and hydrological services (NMHS) and the public can contribute and retrieve observations.

ESWD development was motivated by the fact that severe convective weather events strongly depend on micro- and mesoscale atmospheric conditions, and in spite of the threat that they pose to life and property, they usually escape the meshes of existing operational monitoring networks. Besides, such events are often embedded in systems acting on a larger scale, and even if damage is local, severe weather can continue for hours or days and affect more than one European country during its lifespan.

When dealing with severe weather events, researchers and forecasters need to know when and where these events have taken place on a European scale to evaluate numerical and conceptual models or theories, and to verify forecasts, nowcasting and warnings. Moreover, the only way to obtain a robust and homogeneous climatology and risk analysis of severe local storms in Europe is to carry out a systematic collection of observations of severe atmospheric phenomena or of the damage they caused.

After two years of test operations, 2006 was the first year with operational ESWD service. Fig. 1 provides an overview of the ESWD reports in 2006 (well in line with Dotzek, 2003). Currently, three NMHS are collaborating: DWD, INM and ZAMG, and the following categories of severe weather are included in the ESWD: Straight-line winds, tornadoes, large hail, heavy precipitation, funnel clouds, gustnadoes, and lesser whirlwinds. Extending both the number of collaborating NMHS and the range of covered phenomena are further ESWD objectives.

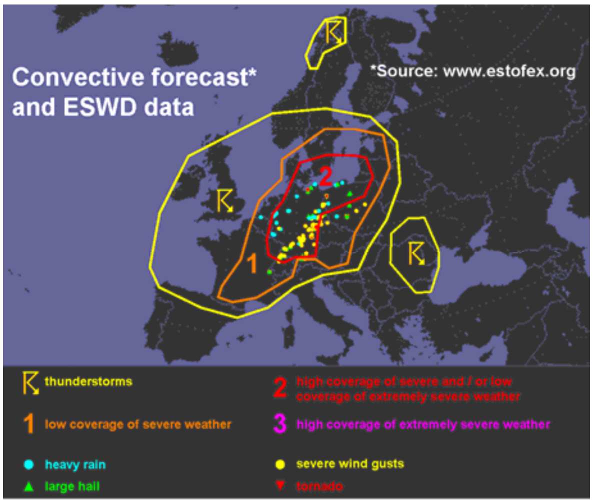

FIG. 2: ESTOFEX threat-level forecast verification using ESWD reports for 29 July 2005.

Fig. 2 shows daily ESWD reports from 29 July 2005 (still within the ESWD test phase): The peak of a severe weather episode which lasted from 26-31 July. On 27 July, mostly damaging winds and a few tornadoes occurred in Germany to the west and north of Frankfurt. On the 28th, damaging winds and heavy precipitation concentrated over northern Germany, while in the UK, the F2-Birmingham tornado occurred (Marshall and Robinson, 2006). 29 July brought SW-NE-oriented corridors of heavy precipitation from the Benelux to the Baltic Sea, and of damaging winds, hail and some tornadoes from the French and Swiss Jura to western Poland. On this day, also a low-precipitation (LP) supercell producing very large hail in the Chemnitz region in eastern Germany was well-documented by storm chasers.

The ESWD reports in Fig. 2 reveal that the risk-level forecast by the ESTOFEX network (www.estofex.org) captured the areas with actual severe weather occurrence rather well. In a further step, a comparison of DWD severe weather warnings and ESWD reports for 27 and 29 July was made by Dotzek et al. (2006). DWD's severe weather warnings in Germany generally showed that in most cases of severe convective storm events, a severe thunderstorm warning was prepared, issued, and active. In 2005, DWD did not yet operationally provide dedicated tornado warnings. Instead, any tornado threat was subsumed in the warnings of thunderstorms capable of producing damaging winds, hail or heavy precipitation. For the selected severe weather period, however, a DWD warning of thunderstorms in the affected county existed in all tornado cases reported to the ESWD.

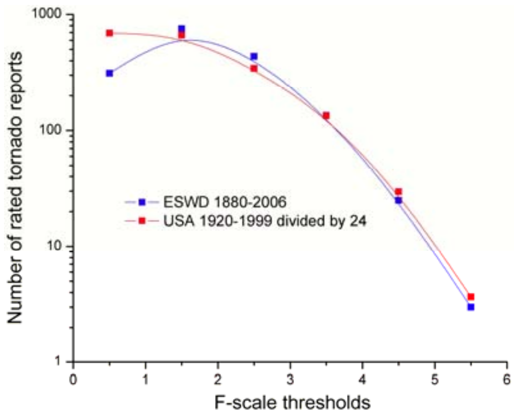

FIG. 3: Tornado intensity distributions over F-scale based on 1667 of 2776 tornadoes in the ESWD (blue, lower number of F0 reports) and for the USA from 1920-1999 (red, actual numbers divided by 24 for comparison to the European numbers).

Climatological results from a subset of the pan-European ESWD data have been presented by Bissolli et al. (2007). Another evaluation is shown in Fig. 3: The tornado intensity distribution over F-scale of all rated tornadoes in the ESWD is compared to that of the USA in the time span 1920-1999. The long period of the US reports includes decades in which mainly strong (F2, F3) or violent (F4, F5) tornadoes have been reported, up to the 1990s in which detection efficiency had become so high that the vast majority of reported tornadoes were weak (F0, F1). This mixture of reporting efficiencies resembles the currently still inhomogeneous tornado reporting in Europe.

Fig. 3 illustrates that the present intensity distribution of tornadoes in Europe is very similar to that in the USA, except for the F0-tornadoes for which a strong underreporting appears to persist. First, the consistency of both intensity distributions is in line with the global analysis by Dotzek et al. (2005). Second, judging from the US-experience over the last decades, we can expect the number of reported F0-tornadoes to strongly rise in the future, as public awareness levels and reporting standards will become more homogeneous all over Europe.

III. CONCLUSIONS

One year has passed since founding the ESSL, and the following résumé of actions and results can be given:

- The ESWD provides pan-European coverage of severe thunderstorm reports in a homogeneous data format.
- Since 2006, the NMHSs DWD, INM, and ZAMG are cooperating, and run their local installations of the ESWD software. Additional collaboration of more European NMHSs with the ESWD is highly welcome.
- The collaborating NMHSs perform quality-control (QC) for the ESWD data gathered by them in their countries. For the public severe weather reports entered on the main ESWD site eswd.eu, the ESSL is to perform the ESWD 3-level QC.
- A severe weather episode in Central Europe in July 2005 showed that ESWD reports can be applied to verify severe weather forecasts, watches or warnings as issued by NMHSs.
- The ESWD data can successfully be applied in climatology / risk analysis (e. g., Bissolli et al., 2007).

In addition to main site www.eswd.eu, the ESWD development is documented at essl.org/projects/ESWD/.

IV. ACKNOWLEDGEMENTS

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