Potential benefits for pan-European forecasting of severe storms from the establishment of a "European Storm Prediction Centre" according to the US model

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1. Motivation

Annual losses from severe storms in Europe are substantial: Severe thunderstorms cause 5-8 billion € per year, while winter storm "Kyrill" caused about 10 billion €, both from its large-scale wind field and embedded severe thunderstorms. Research on and forecasting of such events has been gaining momentum in Europe recently. European initiatives in this context encompass the ESSL with its ESWD database (www.essl.org/ESWD/, cf. Fig. 1), EUMETNET's recently launched warning system (country to county-level) meteo**alarm** (www.meteoalarm.eu), and the volunteer forecasting initiative ESTOFEX (www.estofex.org, cf. Figs. 1a and 2) which already practices daily EU-wide risk-level forecasts following the NOAA-Storm Prediction Center (SPC) operations in the USA. In this context, the question of establishing a professional European Storms Prediction Centre (ESPC) has been raised.

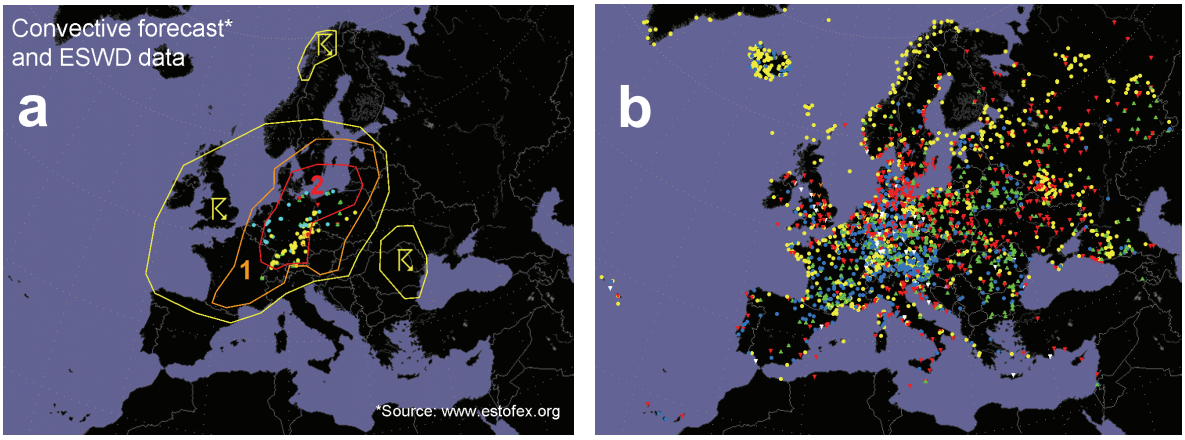

Figure 1: (a) Convective forecast as provided by ESTOFEX for 29 July 2005 with the risk levels "thunderstorms" (yellow), "low coverage of severe weather" (level 1, orange), and "high coverage of severe or low coverage of extremely severe weather" (level 2, red). ESWD severe weather reports provided by ESSL are underlain for verification. (b) All ESWD reports in 2006 (n = 3010). Red: tornado or waterspout, yellow: straight-line winds >25 m/s, green: hail >2 cm diameter, white: funnel clouds, and orange: lesser whirlwinds.

2. Background

The SPC has nationwide responsibility for severe convection forecasts in the USA. Their staff consist of only about 35 persons; cf. www.spc.noaa.gov/staff/. Prior to 1997, they were located in Kansas City, somewhat isolated from meteorological research centres, and especially numerical modelling facilities. The NOAA-National Severe Storms Laboratory (NSSL) in Norman specialises in applied severe weather research. In 1997, the SPC moved to the NSSL facility as a means of promoting collaboration between severe weather researchers and practitioners (forecasters, cf. Doswell, 2007).

The forecasting-research environment there allows for dedicated quasi-operational periods ("spring programs") aiming at specific forecasting problems or questions of warning decision training or verification of forecast phenomena and watch areas. The collaboration experience of SPC and NSSL led Kain et al. (2003) to conclude: "*In the right setting, mutual interests between motivated forecasters and researchers can blossom into a productive and rewarding collaboration.*"

Forecasters acquire a deeper understanding of the capabilities and characteristics of numerical forecast models or of the effects different convective parameterisations can have of forecast output and its significance. Researchers gain direct feedback on the applicability of their models in operational forecasting, and on the specific needs which forecasters have in their daily operational application of model output in forecasting severe storms. Likewise, climatologists benefit from the forecasters'

experience concerning the regional predictability of severe storms, and forecasters profit from direct climatological feedback on the threat of specific severe weather phenomena in a given synoptic setup.

3. The ESPC vision

Adopting the SPC practice from the USA, the purpose of an ESPC could be to issue operational pan-European severe weather forecasts and early warnings (watches) with a lead time of up to ~24 h. Actual issuing of national or regional warnings should remain in the responsibility of the National Meteorological and Hydrological Services (NMHS), i. e. EUMETNET. In this way, the ESPC could best strengthen the link between severe storms research and operational forecasting.

The ESPC watch areas should be based on meteorological hazard, not on political boundaries. There should be a discussion by the responsible forecaster on the synoptic situation and risk level decision. This can already be illustrated by the voluntary ESTOFEX operations in Figs. 1a and 2.

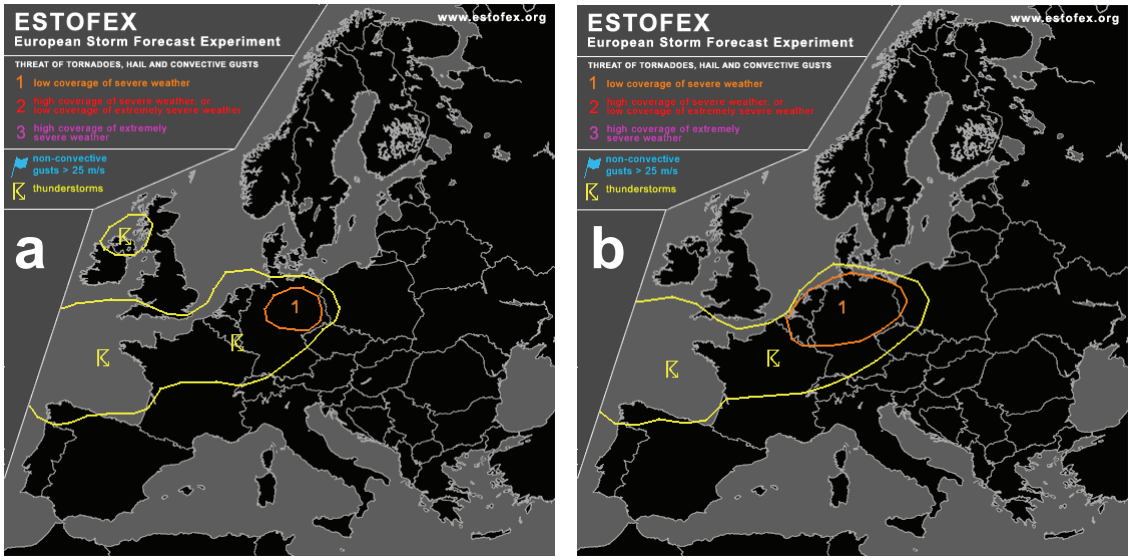

Figure 2: Panel (a) ESTOFEX forecast of 26/03/06, 1828 UTC, valid Mon 27 Mar 0600 to Tue 28 Mar 0600 UTC. Panel (b) forecast update of 27/03/06, 1421 UTC, valid Mon 27 Mar 1400 to Tue 28 Mar 0600 UTC.

Fig. 1a showed the risk level forecasts for 29 July 2005 and the ESWD-based verification (Dotzek et al., 2006). Fig. 2 gives the two issued forecasts for 27 March 2006, a day with several tornadoes in northern Germany, of which an F2 in Hamburg killed two people. While the initial forecast in Fig. 2a had placed a small level-1 area in northern Germany, an update enlarging the level-1 area was issued, based on incoming Doppler radar and surface wind observations. Consequently, the ESTOFEX forecasters Tuschy and Groenemeijer added to their original Synopsis and Discussion:

"*Benelux, N and W Germany, N France: ... couple of strong storms, some of which likely contain rotating updrafts, have developed over the Netherlands and Belgium and move into NW Germany. ... In the next 3 hours, more storms are expected to develop across N and central Germany, the Benelux and N France ... Some threat of tornadoes will exist where low-level winds have backed ahead of mesoscale troughs to produce rather high amounts of storm-relative helicity. ... At this moment, relatively backed winds over central Niedersachsen and an ongoing supercell storm near Meppen indicate that an enhanced potential for tornadoes probably exists there as well.*"

Verification based on ESWD storm reports (not shown) was as favourable as in Fig. 1a and justified the update of the original forecast. Thus, 27 March 2006 provides a very good example of how a professionally run ESPC could fill an apparent gap between operational weather forecasting (ECMWF, NMHSs) and national-to-county level warnings (meteo**alarm**, NMHSs) in Europe.

The ESPC's role could be to become an important new institution on the European level. It should be initiated and operated by the European NMHSs or EUMETNET, ensuring not to double existing efforts. Instead, the ESPC may rely on information provided by ECMWF or NMHS data and model runs, and should deliver its output in return to NMHSs for their local (early) warning decision management, to meteo**alarm**, and to the general public, cf. Fig. 3.

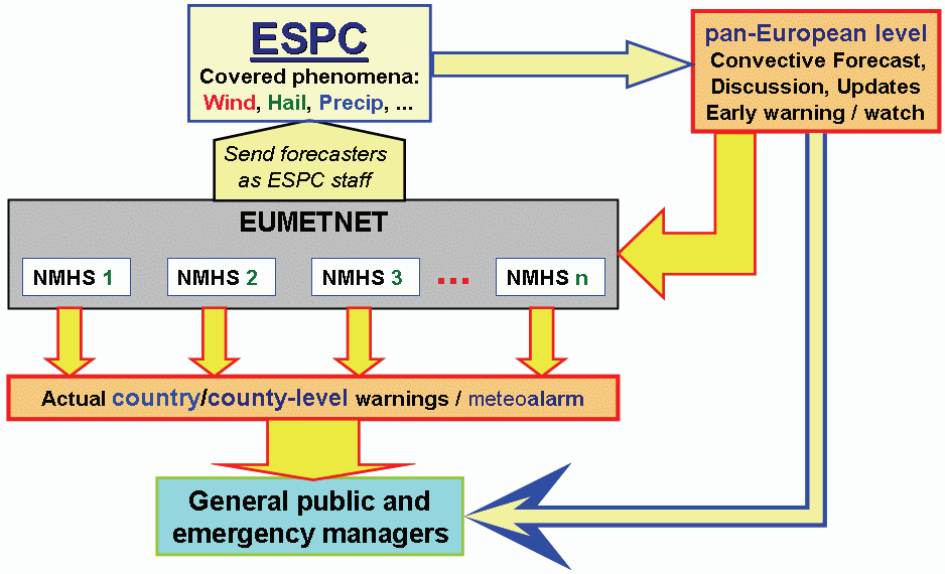

Figure 3: Proposed procedure of ESPC implementation and the resulting information flow contributing to the present warning system by the NMHSs within EUMETNET and meteo**alarm**.

Similar to the SPC, the ESPC would only require a relatively small number of staff to be delegated from the NMHSs (cf. Fig. 3) and be replaced by young weather forecasters there. Furthermore, the following practice has proven to be beneficial in the USA: (i) To enable an optimal exchange of experience, bring the necessary number of forecasters to one real centre, instead of creating a network of small groups of dedicated forecasters at a number of involved NMHSs; (ii) Forecasters recruited to the ESPC should be the most experienced and skilful professionals in severe weather forecasting from the European NMHSs; (iii) By issuing severe weather forecasts for all over Europe, the ESPC forecasters will gain specific EU-wide expertise much more quickly than on a national level, as the likelihood to have to deal with a complex and hazardous severe weather situation is much higher on the pan-European level. (iv) ESPC forecasters returning to their NMHSs after a number of years can effectively share and spread their experience there; (v) Collocating the ESPC to a severe weather research centre is highly advisable. The ESSL developing the ESWD as a pan-European verification and climatology database would welcome the opportunity to collaborate with an ESPC.

4. Conclusions

An ESPC could significantly advance European severe storm forecasting, early warning, and research,

- strengthening and complementing ongoing pan-European actions on warnings and dissemination, e. g. meteo**alarm**, and improving homogeneity and quality of European early warning;
- integrating the most skilful severe weather forecasters from NMHSs all over Europe to prepare and issue severe weather forecasts and watches.

A roadmap to creating an ESPC is to evaluate the option of a COST Action like for the ECMWF (COST 138/71, cf. Bengtsson, 1984) and to establish a core group of stakeholders and decision-makers to review NMHS feedback on an ESPC – and to adequately address any open political issues.

References

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