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Evaluation of ESTOFEX convective outlooks from 2007 to 2021. Part 2: climatology and reliability of threat level polygons

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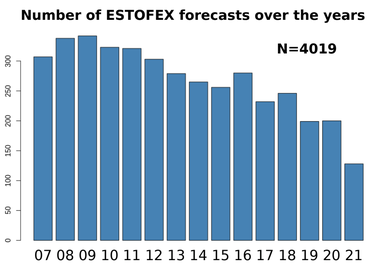
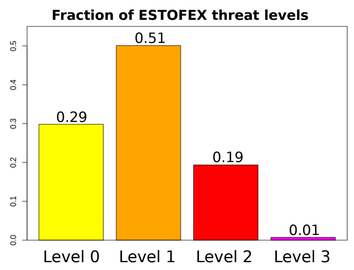
INTRODUCTION

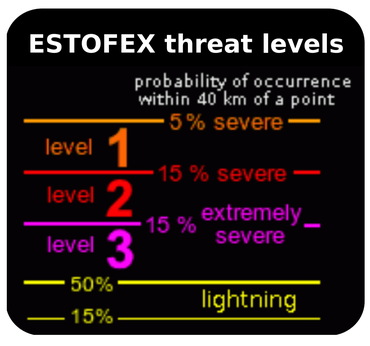
The European Storm Forecast Experiment (ESTOFEX) is a team of volunteer forecasters that have been providing experimental convective outlooks for Europe since 2002. Probabilistic storm forecasts issued by ESTOFEX address threats posed by severe convective storms, i.e. lightning, large hail, severe wind gusts, tornadoes and excessive precipitation. While not official, ESTOFEX products have been widely used by national meteorological services, severe storm communities and the public. Goal of this work is to test the reliability and spatiotemporal patterns of issued threat level polygons, i.e. for a low and high probability of lightning, and an increasing probabilities of convective hazards: level 1, 2 and 3.





DATA

In this work we evaluate 4019 convective outlooks issued by ESTOFEX forecasters since 2007 (gridded to 0.5° boxes) and compare them with lightning data from ATDnet network and ESWD severe weather reports. Observations are converted to Practically Perfect Hindcasts (PPH; Gensini et al. 2020). Forecasts are then compared to PPH to check if they meet ESTOFEX's threat level criteria.

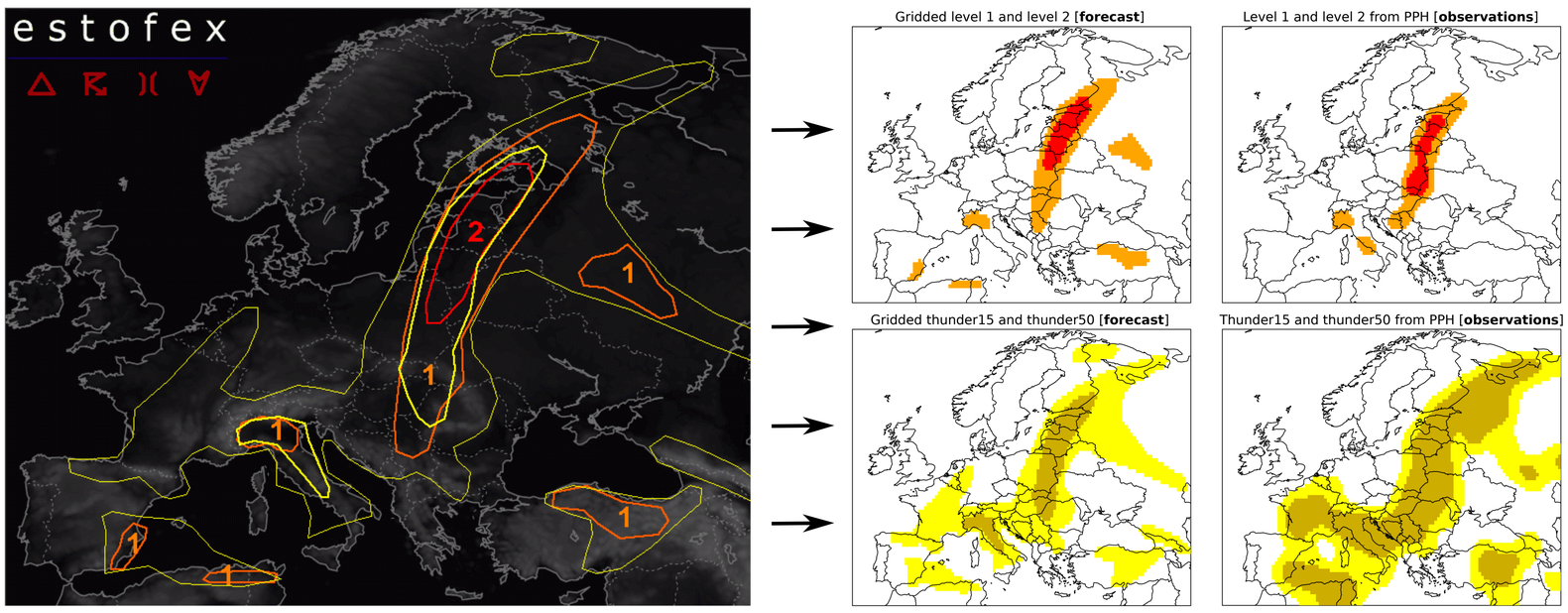


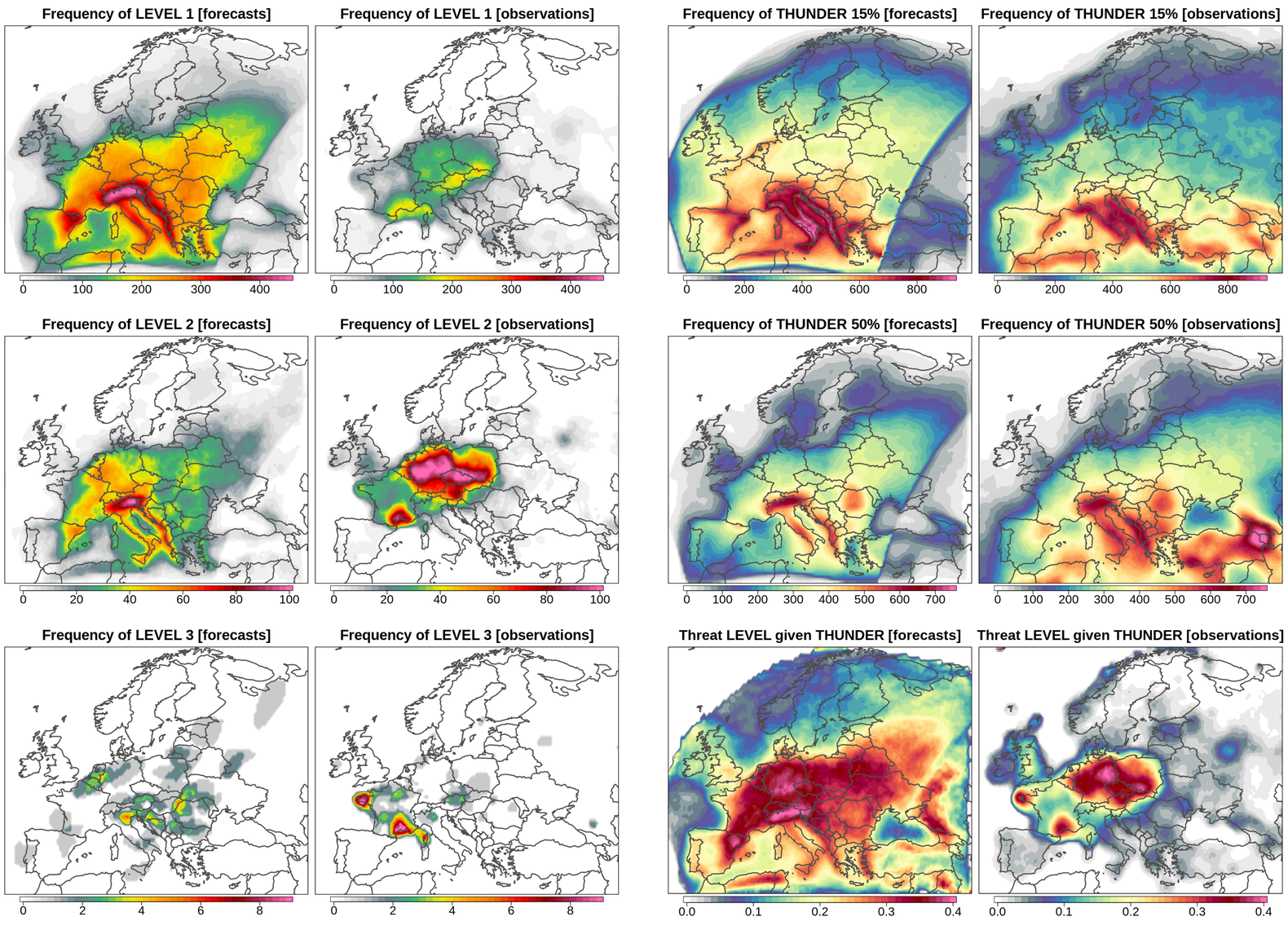
Gensini, V. A., Haberlie, A. M., & Marsh, P. T. (2020). Practically perfect hindcasts of severe convective storms. Bulletin of the American Meteorological Society, 101(8), E1259-E1278.

RESULTS

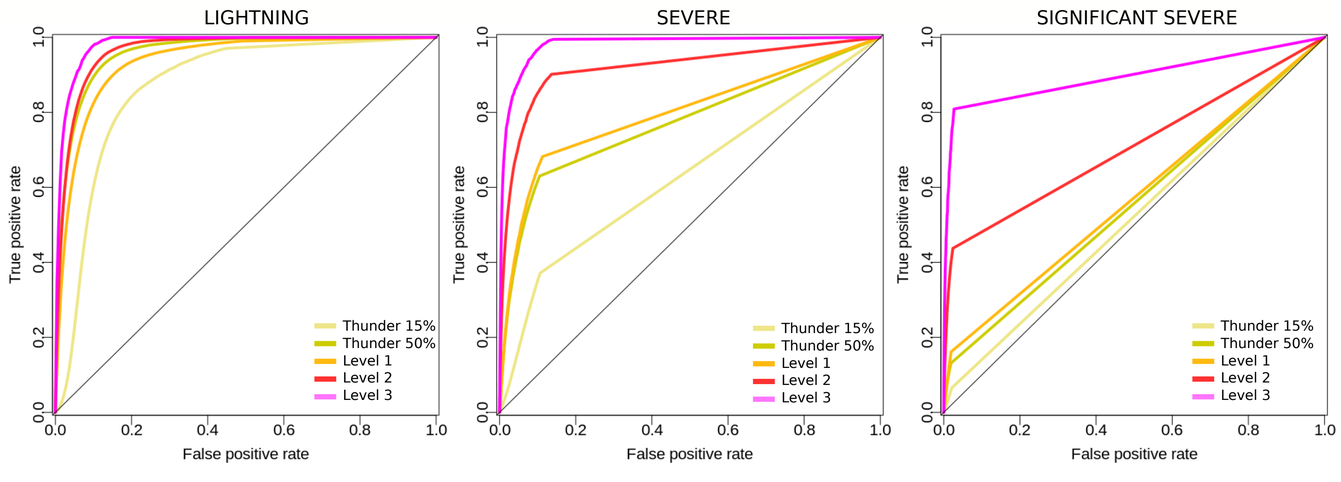
Results indicate that products issued by ESTOFEX over the last 15 years have been consistent with convective climatologies based on reanalyses and lightning detection data. However, we note that forecasters tend to issue outlooks relatively more often for severe weather outbreaks across western and central Europe. We found that while ~95% of the issued lightning probability areas fulfilled the required criterion of coverage, this was only true for ~40% of the severe weather probability areas. One reason is that while lightning observations are relatively homogeneous across the forecast domain, the same cannot be said about severe weather reports. These are lacking in regions such as southeastern or eastern Europe, while forecasters calibrated themselves to the higher observed coverage in western and central Europe. The reliability of ESTOFEX forecasts increased over the time, but we found underestimation of lightning probabilities over southern Europe and an overestimation of lightning probabilities over British Isles and Scandinavia. ROC curves and fractional coverage of observed convective hazards indicate that forecasters were successful in grading risk from level 0 to 3.

Process of gridding forecast polygons and combining with observations using Practically Perfect Hindcasts
(forecast by GROENEMEIJER for 08 Jun 2020)

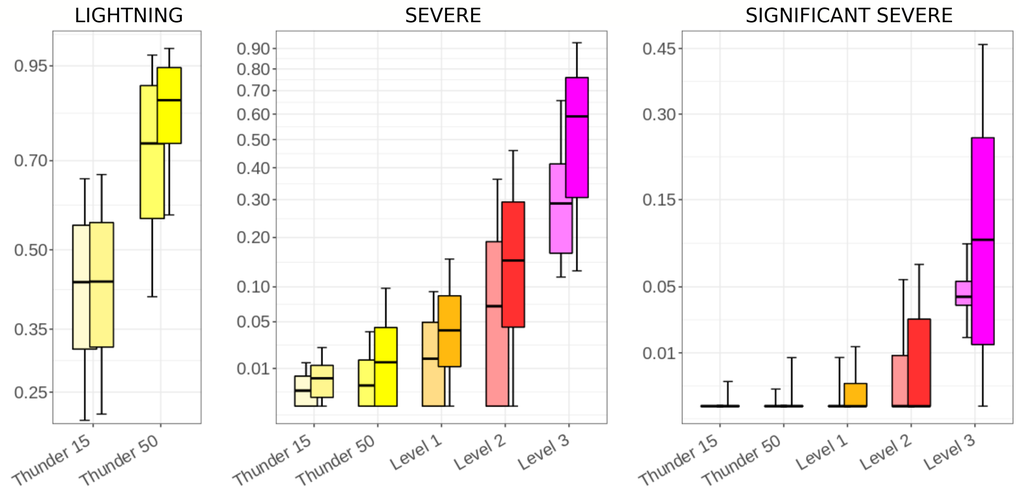




Receiver Operating Characteristic (ROC) curves comparing ESTOFEX forecast polygons with observed hazards
(boolean forecast grid points vs values of PPH - only for Western and Central Europe)



Fractional coverage of ESTOFEX forecast polygons with observed hazards
(left box: 2007-2014 vs right box: 2015-2021)



Reliability of threat level forecast polygons over the years (fraction of forecasts meeting ESTOFEX criteria)