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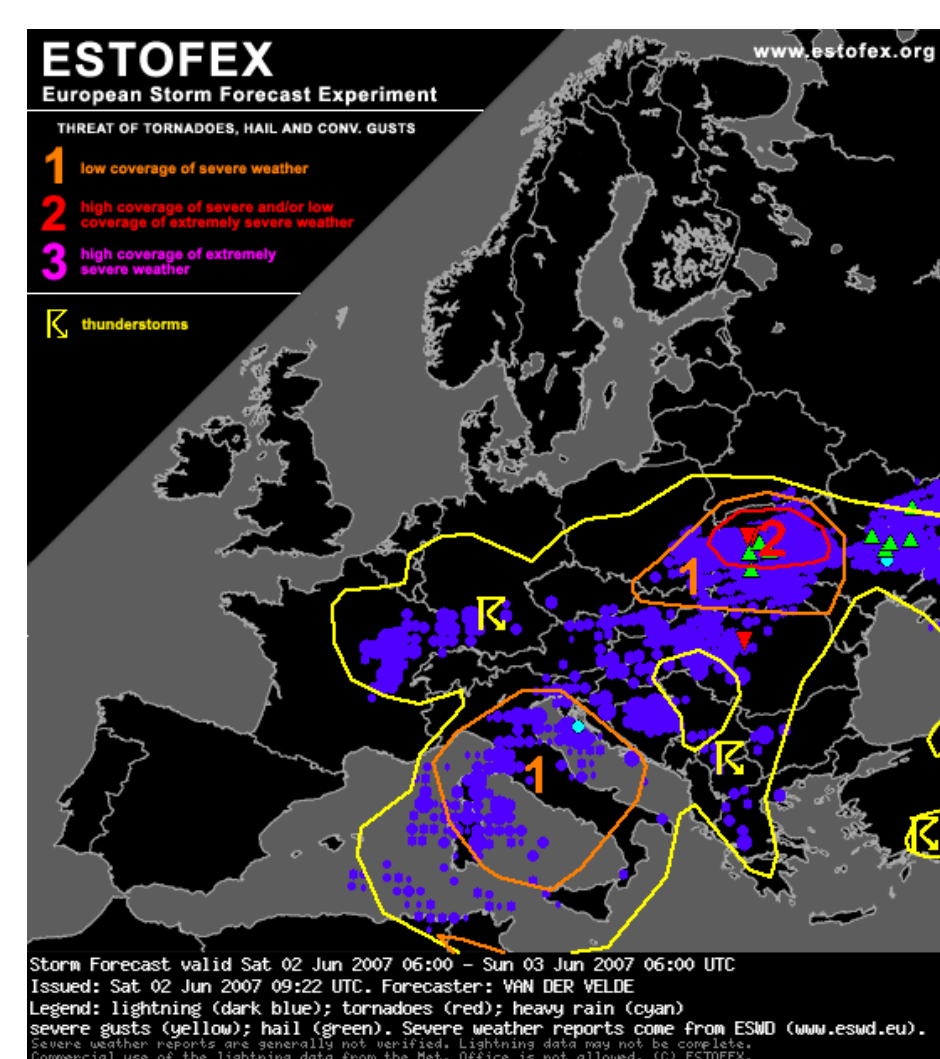
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What is ESTOFEX?

The European Storm Forecast Experiment (ESTOFEX) is an initiative of a team of European meteorologists, meteorology students and trained enthusiasts, who intend to learn how to forecast severe convective storms in Europe. The forecasts resemble the categorical Storm Prediction Center forecasts, with a general thunder line and three levels of threat. Their goals are to issue daily forecasts of convective weather in Europe, improve understanding of European severe weather, use the new European Severe Weather Database (ESWD) (Dotzek et al. 2009), and verify their forecasts using lightning data and ESWD reports. See <http://www.estofex.org/> for more information and their daily forecasts.

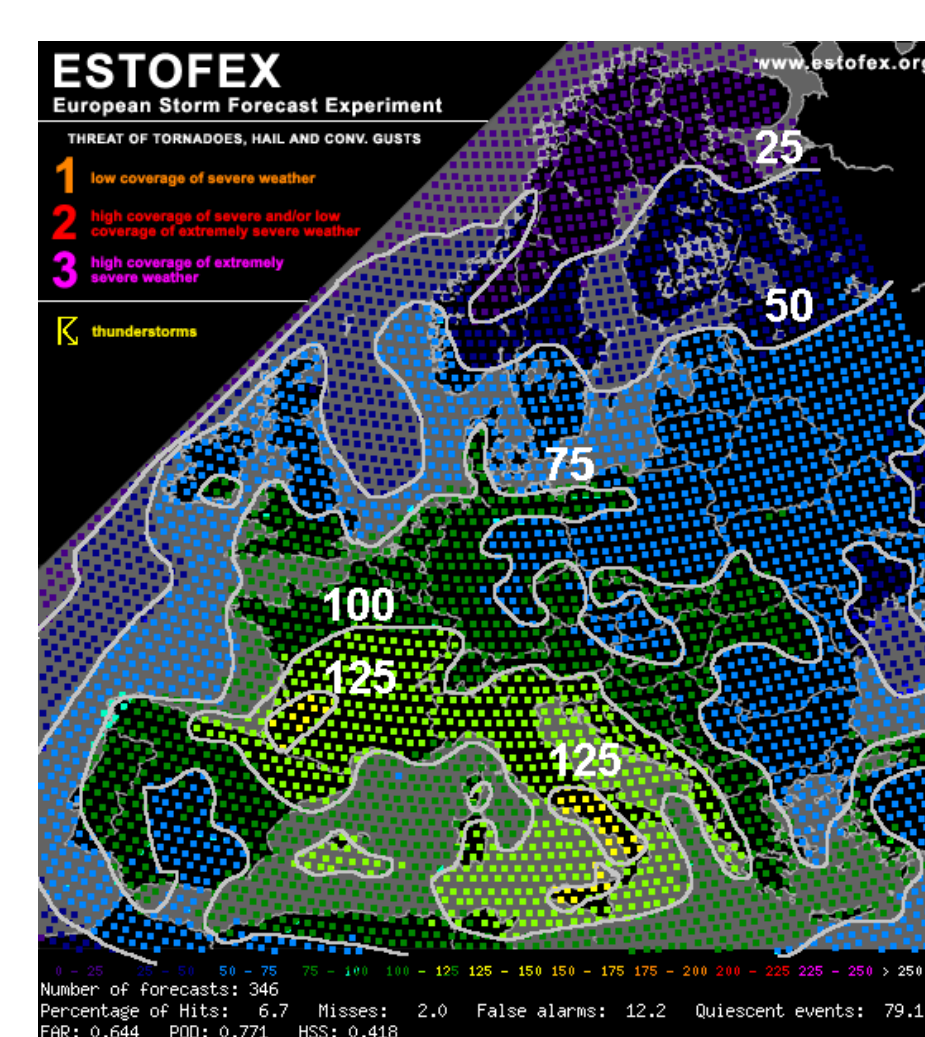
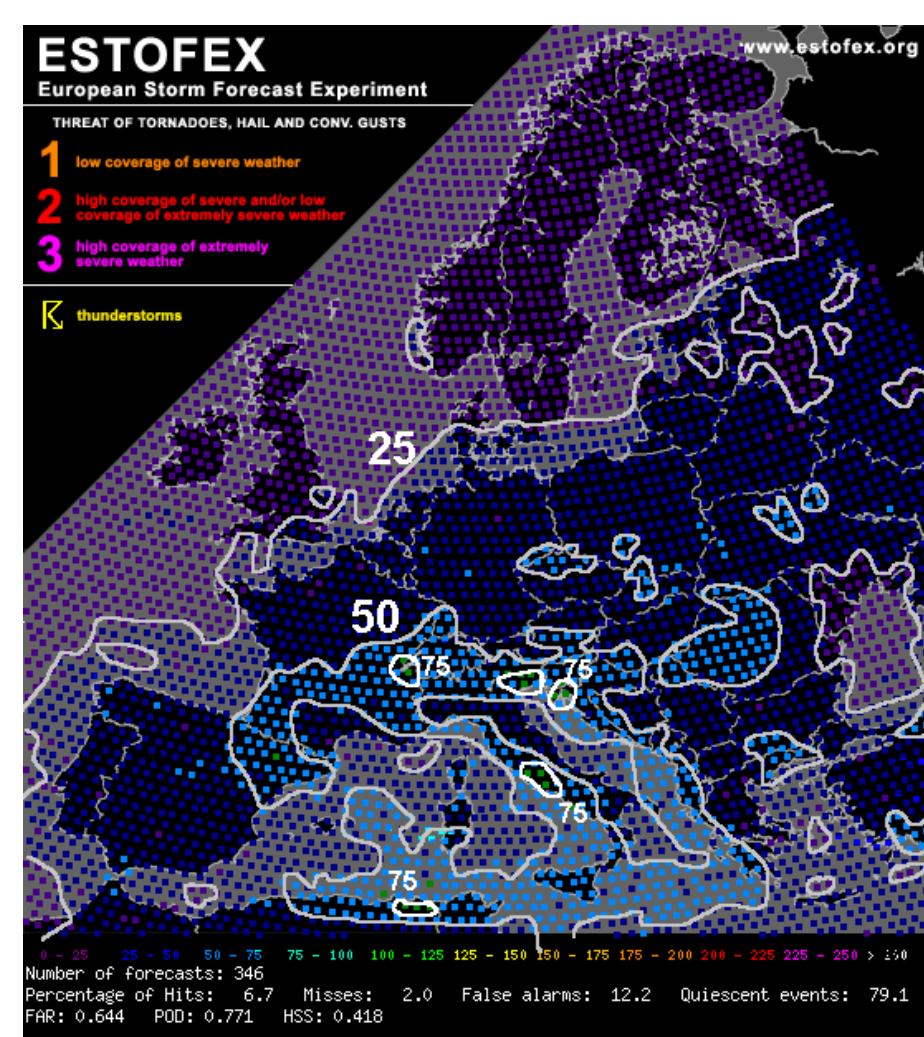
ESTOFEX Forecasts and Data



An example of an ESTOFEX forecast is shown at left. The forecast period covers 24 hours, starting at 06 UTC, and the forecast is usually created the evening before. The yellow contour indicates general thunder and the brown and red are level 1 and level 2 threats. Blue dots indicate the location of lightning strikes and the other symbols indicate severe weather reports from ESWD. Lightning data come from the UK Met Office. Although ESTOFEX had location data for every reported strike, we were given number of strikes on a 0.5x0.5 lat/lon grid every 30 minutes.

The ESTOFEX forecasters provided us with 553 days of forecasts from late April 2006 to December 2007 made by 5 different forecasters. On occasion, updates to the original forecast were issued. We chose to use only the first outlook. Also, in a small number of cases, two forecasters' names were listed on the forecast. We gave credit to the first forecaster listed. From the 30-minute lightning data, we aggregated to 24-hour periods. Here, we considered any strike during that period on a grid location as an event. The far northeastern corner of the forecast domain does not have lightning detected and the issue of variable detection in regions is beyond the scope of this work.

Previous Results

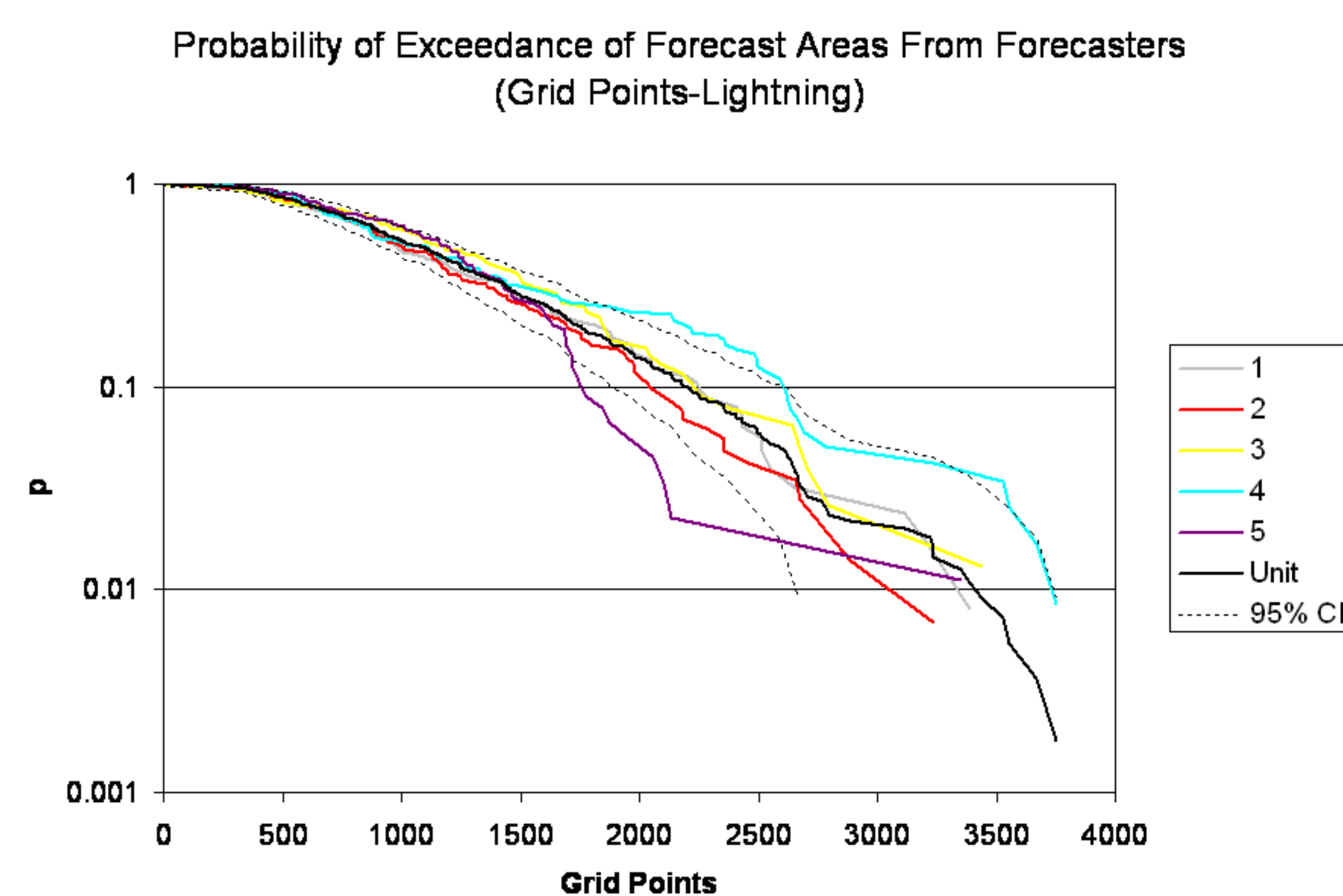


Groenemeijer et al. (2009) carried out preliminary work on the verification of the lightning forecasts. They showed the frequency of lightning occurrence (above left) and forecasts (above right) over their domain from September 2006-August 2007. The forecasts show a reasonably good spatial pattern, but also show an overforecasting bias. In general, lightning is more frequent over the land area near the Mediterranean between Spain and Greece.

Big Questions

1. Can we qualitatively say anything about the forecasts?
2. Are the forecasters different or do they act like a unit?
3. Can we see changes during the period of the forecasts?

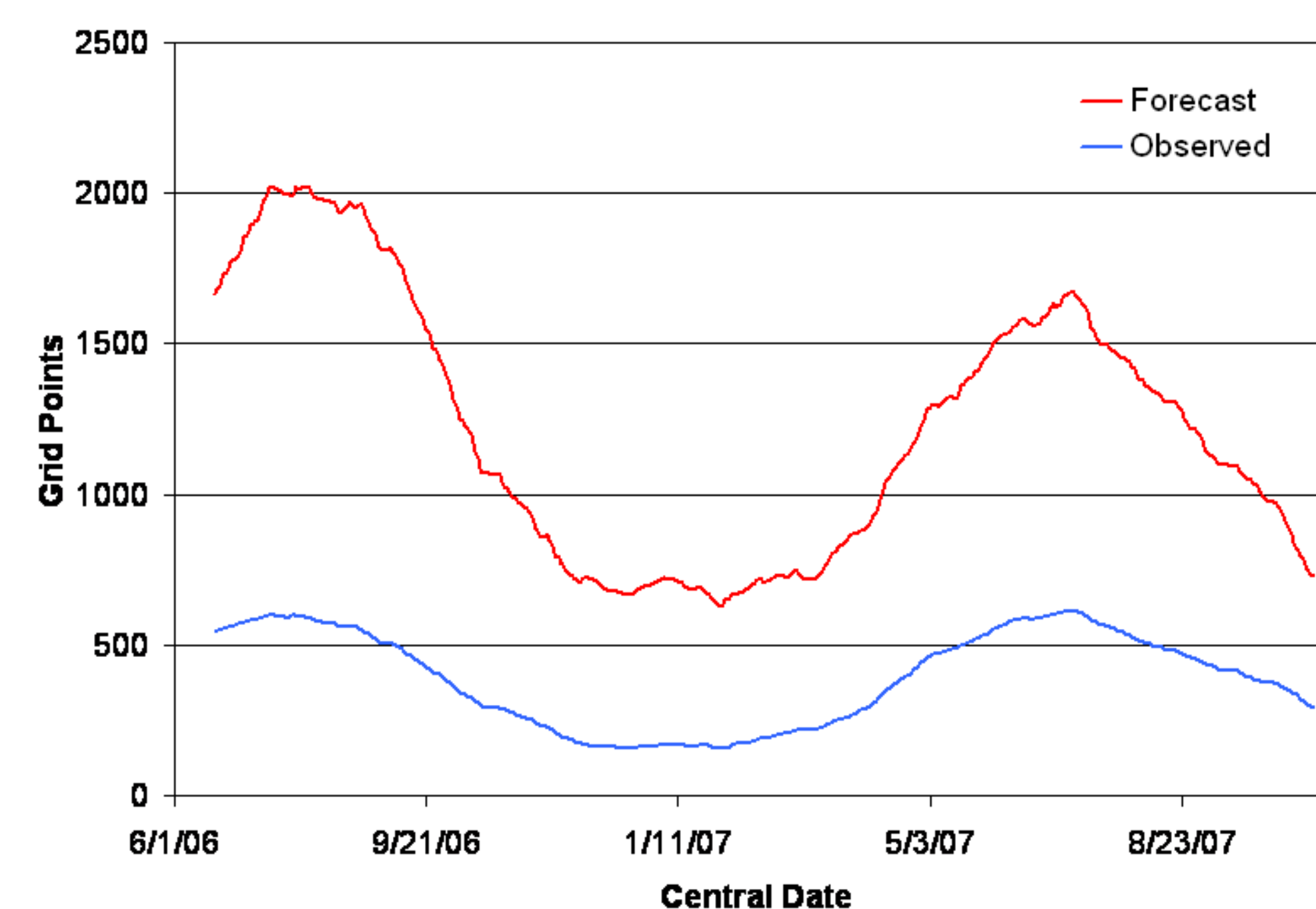
Forecast Areas



The figure above shows the distribution of forecast areas from the five forecasters, as well as the unit average. The dashed lines are an estimate of the 95% confidence interval on the unit distribution, assuming that the forecasters worked the same distribution of days. As a result, it is likely an underestimate of the true variability. The distribution for each forecaster falls in or near this distribution, offering support to the notion that the forecasters are much more like a unit than separate forecasters.

Below, we see a 91-day (roughly provide a continuous look at the season) running mean of forecast and observed lightning coverage. The big signal is the annual cycle of lightning, with greater coverage in the warm season. Note that the two warm seasons have similar observed coverage, but that the 2007 warm season forecast areas were smaller, leading to a smaller forecast bias.

Running 91-Day Mean Lightning Coverage



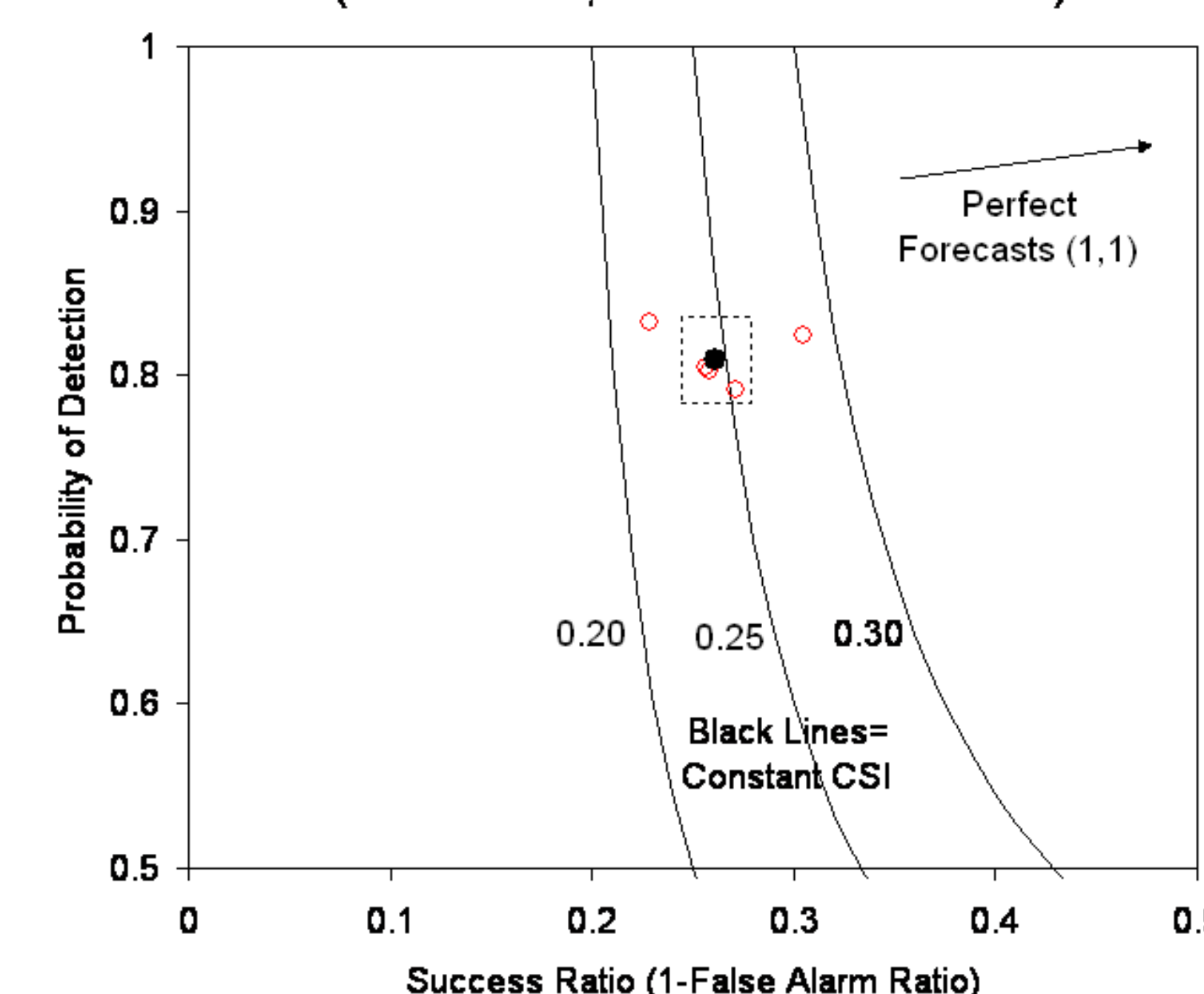
Dichotomous Evaluation

The lightning forecasts lend themselves to dichotomous evaluation since they are yes/no forecasts of an event that either occurs or does not occur. Evaluation of the 2x2 contingency table is a logical approach. For graphical descriptions, we present the new method of Roebber (2009) that depicts the Probability of Detection (fraction of events with a yes forecast) versus the Success Ratio (fraction of yes forecasts with a yes event), which is also 1-False Alarm Ratio. Perfect forecasts have POD=SR=1. Constant Critical Success Index (CSI) values show up as hyperbolae and straight lines emanating from the origin are constant bias lines, with higher values toward the upper left.

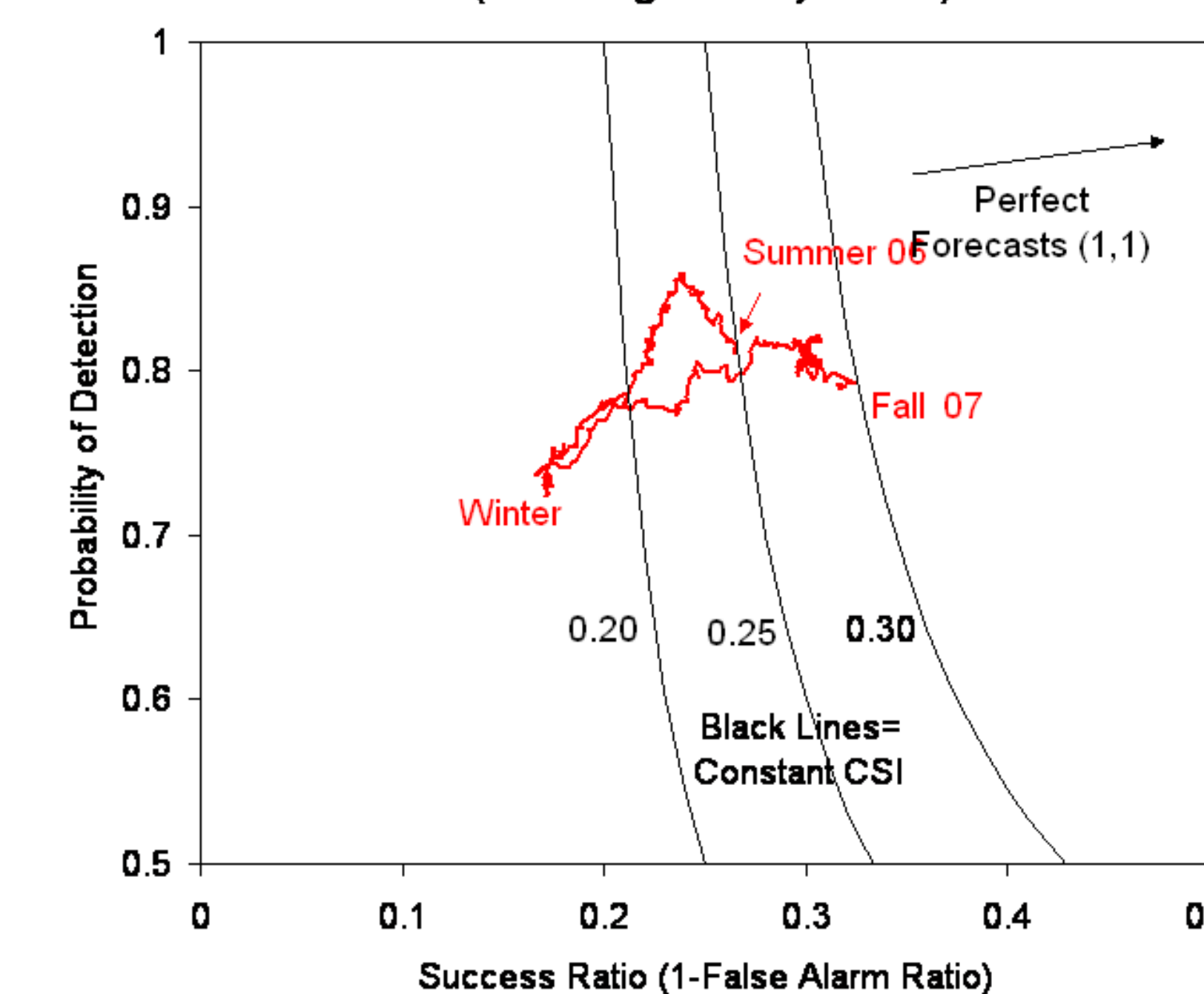
Below, individual overall forecaster performance is shown as open red circles in the left panel, with the black dot showing the unit performance. The dashed box is the 95% CI, again assuming forecasters worked the same distribution of days. The underestimate of uncertainty means it is likely that there is little difference in the forecasters.

The running mean performance is shown on the right. In general, forecasts got worse from the warm to cool season, but in the second warm season, they had a better SR with the same POD as in the first season. This is consistent with the lower forecast bias seen before.

Lightning Forecast Performance (Forecasters, Dashed Box=95% CI)



Lightning Forecast Performance (Running 91-Day Mean)



Results

1. Forecasts are of a reasonably high quality
2. Little difference in performance between forecasters
3. Forecasts were better in the 2007 than in 2006

ACKNOWLEDGMENTS

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References:

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