

Quantifying and Predicting the Accuracy of Radar- Based Quantitative Precipitation Forecasts

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McGill

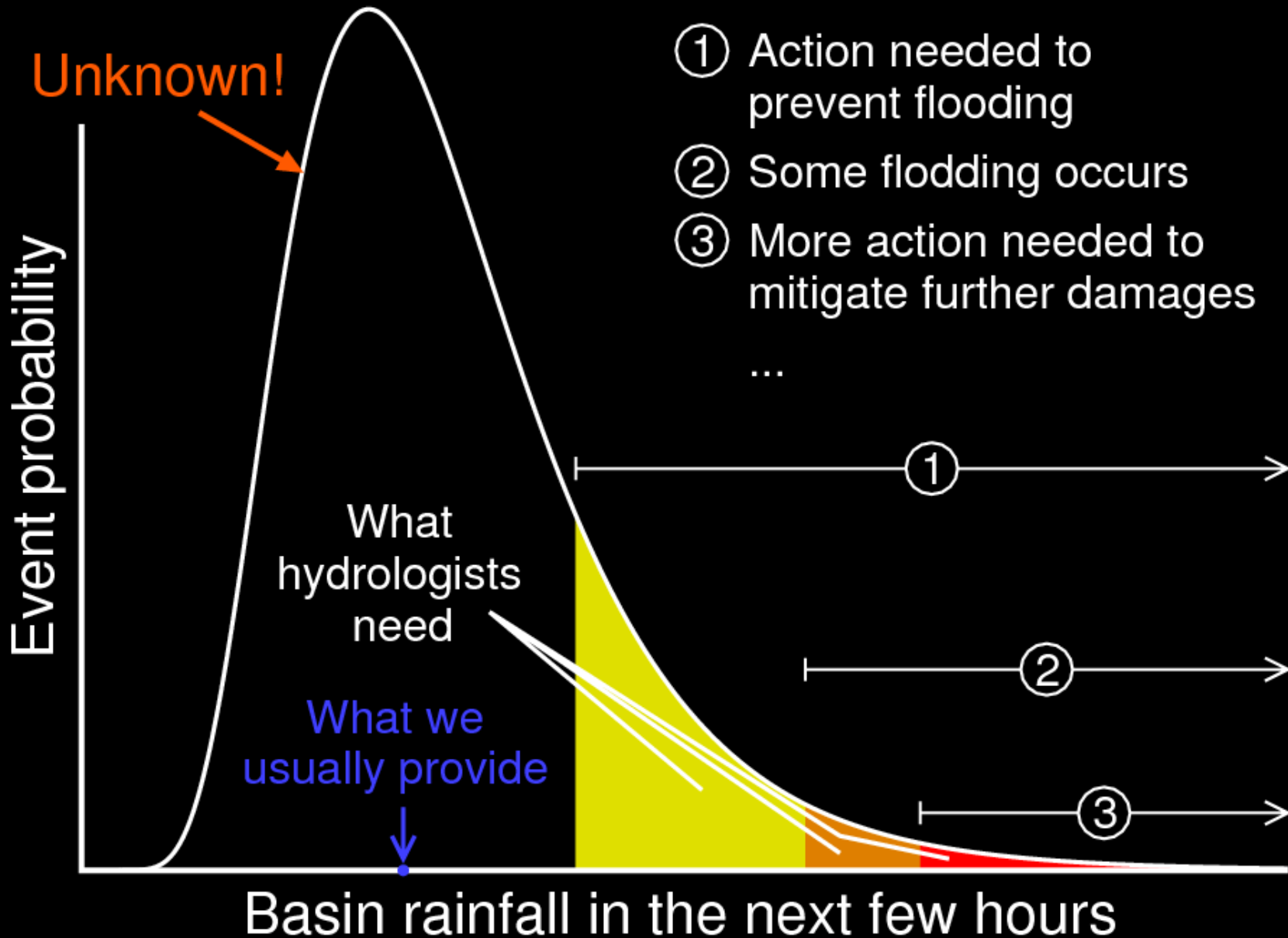
Montreal, Canada

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The Issue



The Task

- Quantify the PDFs of forecast accuracy as a function of:

[Not sexy but needed]

- Forecast time
- Basin size
- Forecasted rainfall intensity

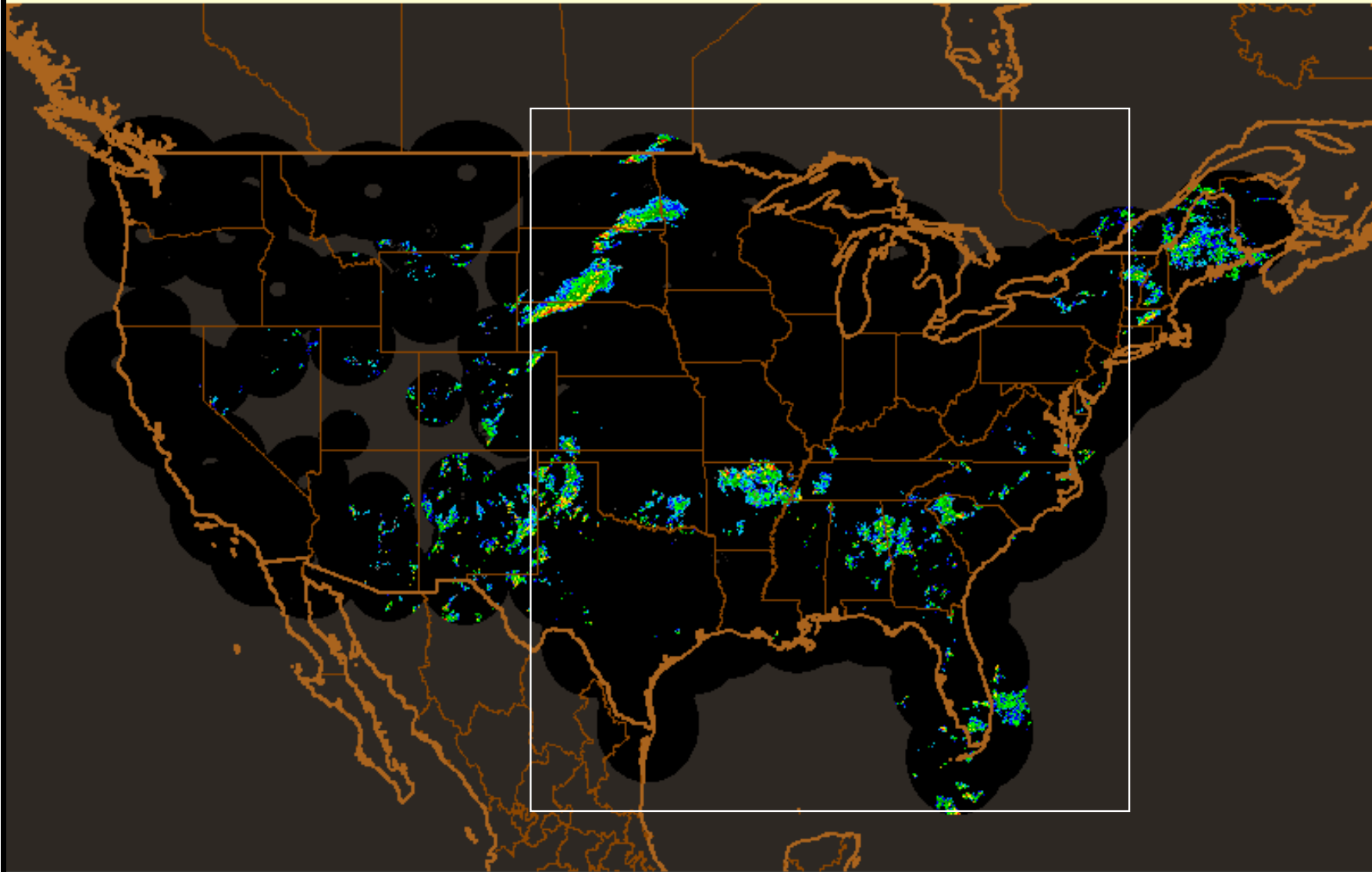
[The fun stuff]

- Can we refine our estimates of forecast uncertainties using “predictors”?

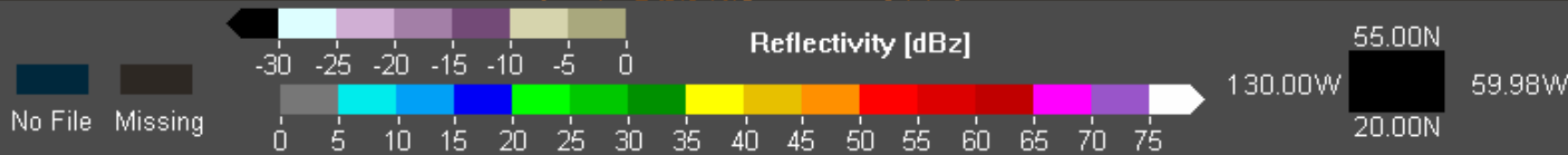
The Tools

Mosaic3D - 4000 m Level

08/21/2006 0000Z



Two weeks of the 3-D radar mosaic over the central US (late August 2006)

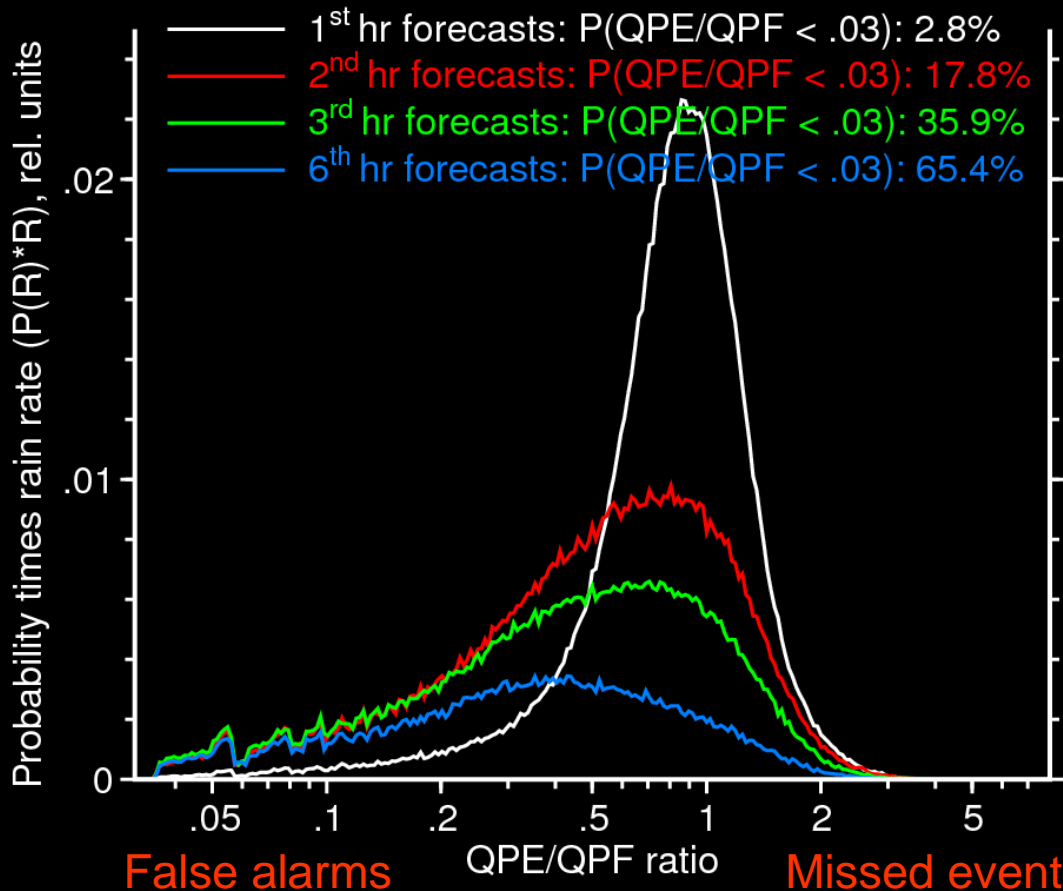


The Process

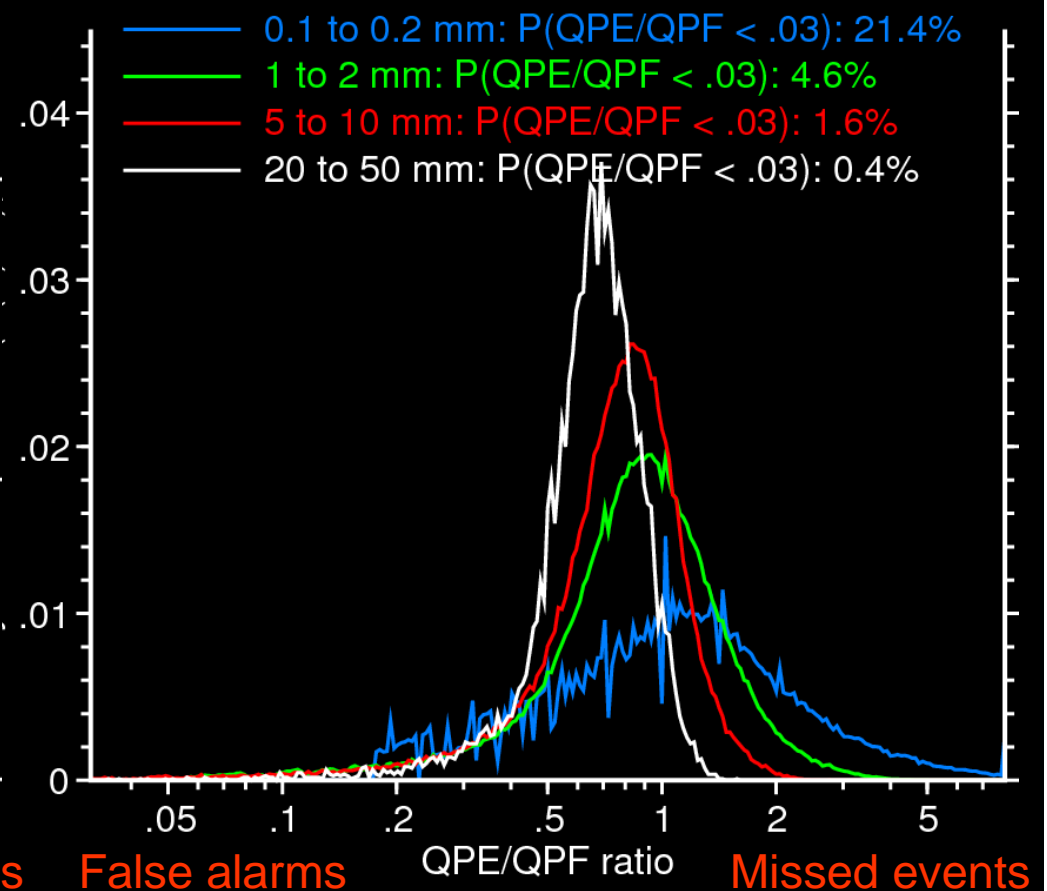
- Every 30 min, generate six hourly forecasts (hour 1 to hour 6) for all “square basins” from 5*5 km to 160*160 km over 2/3rd of the continental US using a standard nowcasting tool;
- Quantify the forecast accuracy using the radar data observed at a later time;
- Make sense of all the results (>100 M of non-zero forecasts).

Some of the Many Results

Baseline forecast accuracy
10-km * 10-km basins; 2 mm < QPF < 5 mm



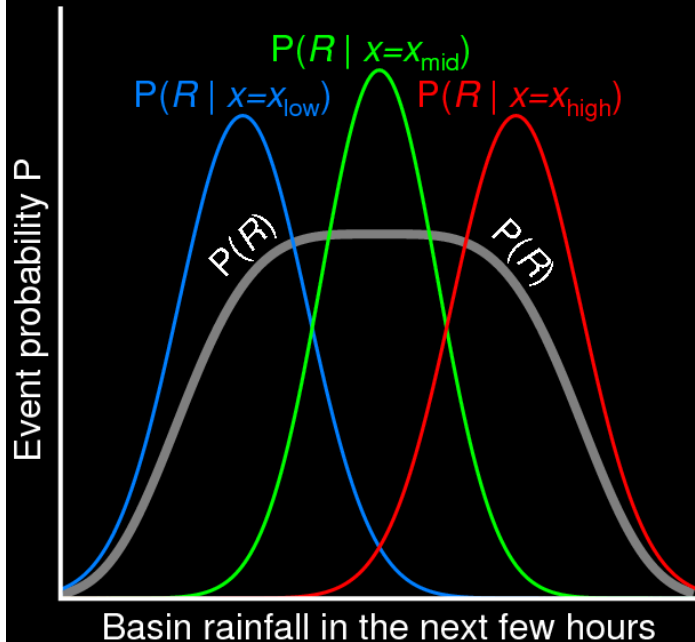
Baseline forecast accuracy
1-hr forecasts; 10-km * 10-km basins



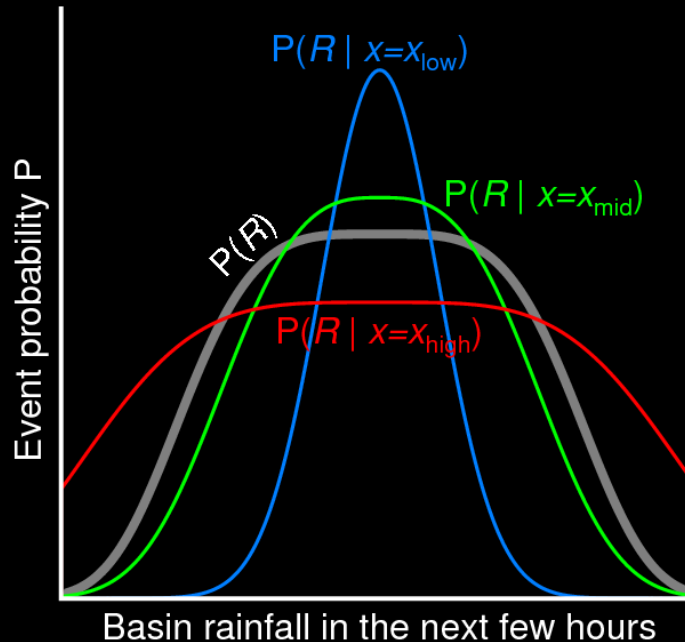
Uncertain forecasts and those of heavy rain generally overestimate event severity.

What Makes a Good Predictor?

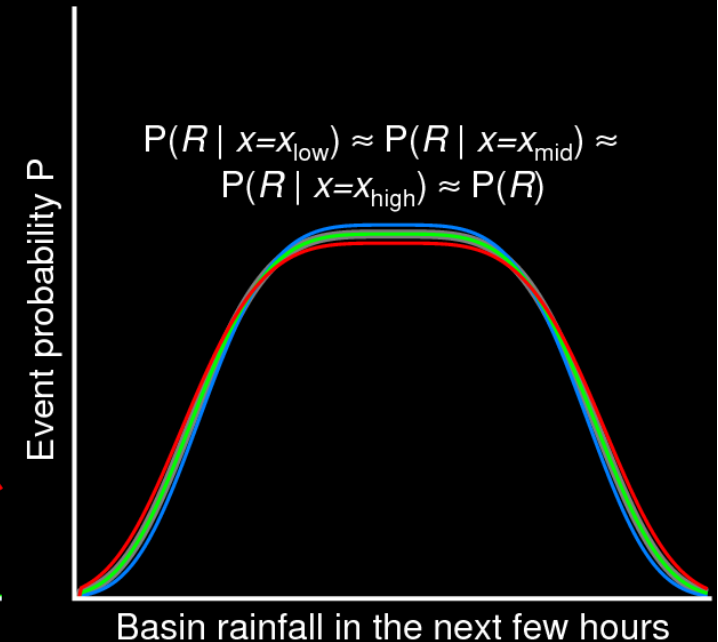
A: Predictor x is useful to separate outcomes and to reduce uncertainty



B: Predictor x is useful to separate certain from uncertain outcomes



C: Predictor x has no skill

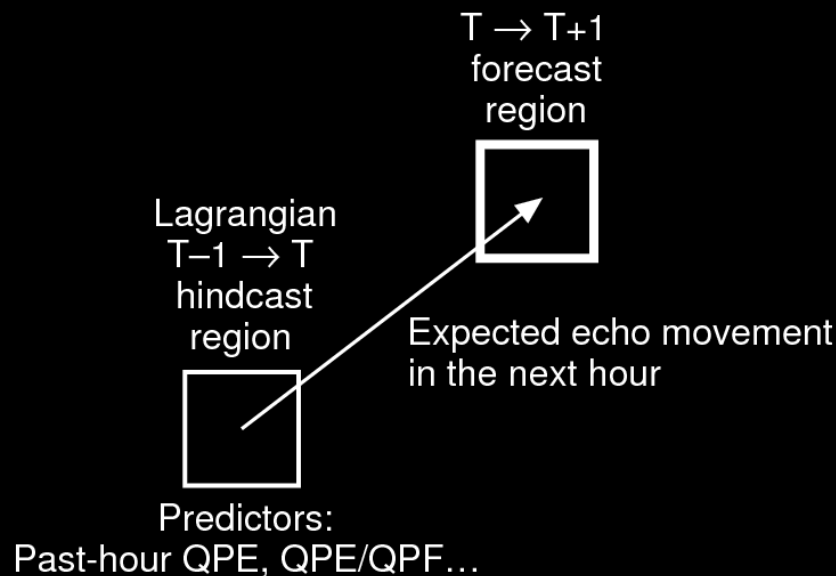


- It improves the forecast, and/or
- It refines our estimate of forecast uncertainty.

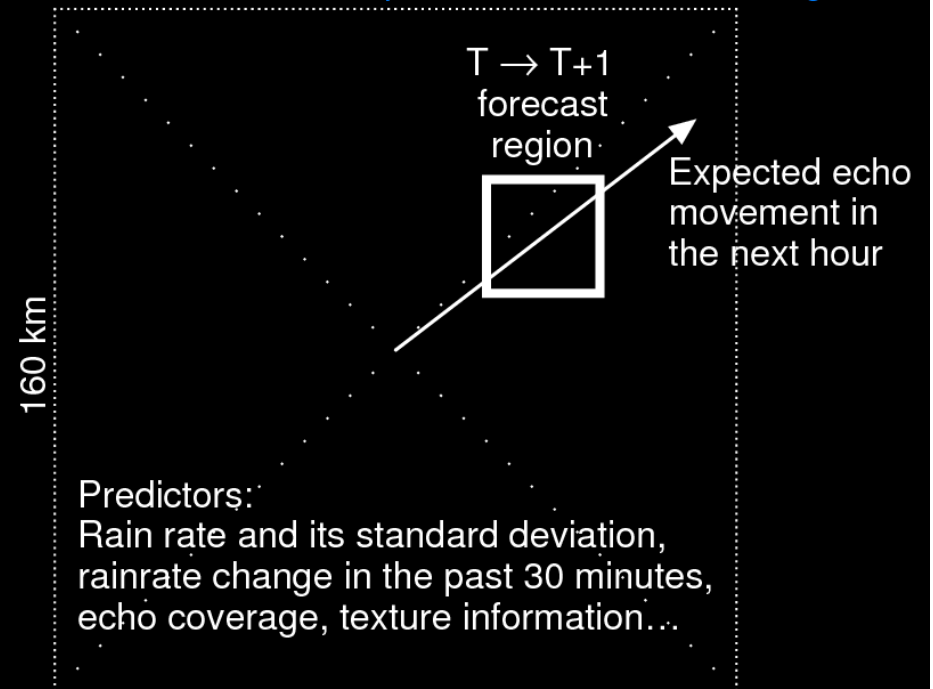
What Kinds of Predictors?

Information obtainable from the radar data itself:

Approach 1: Use of advected past performance information from the corresponding basin one hour upstream

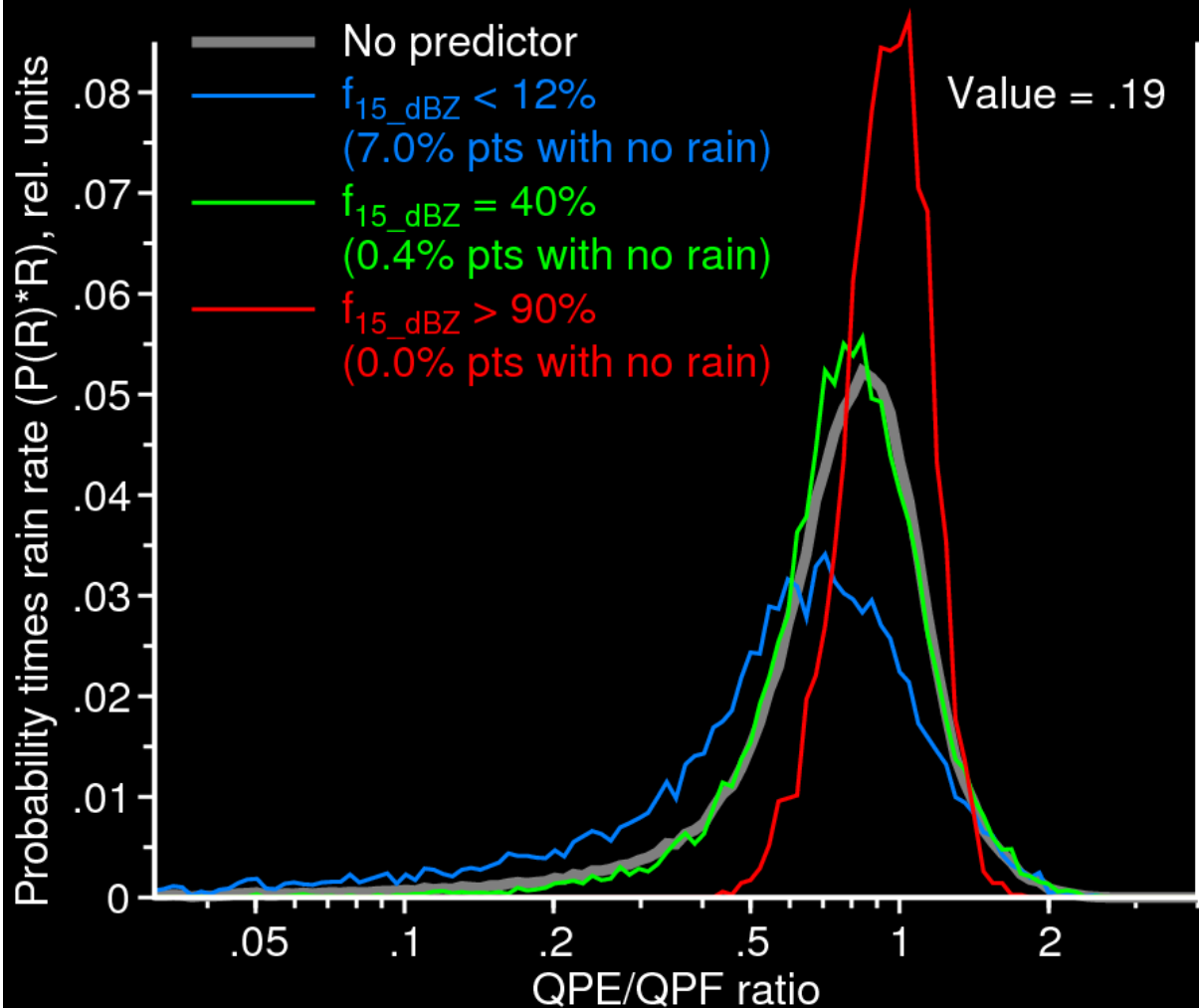


Approach 2: Use of Time T regional echo characteristics half an hour upstream of the forecast region



Usefulness of Predictors

Predictor: Raining fraction over 25600 km²
1st hr forecasts; 5 mm < QPF < 10 mm; 10 km basins



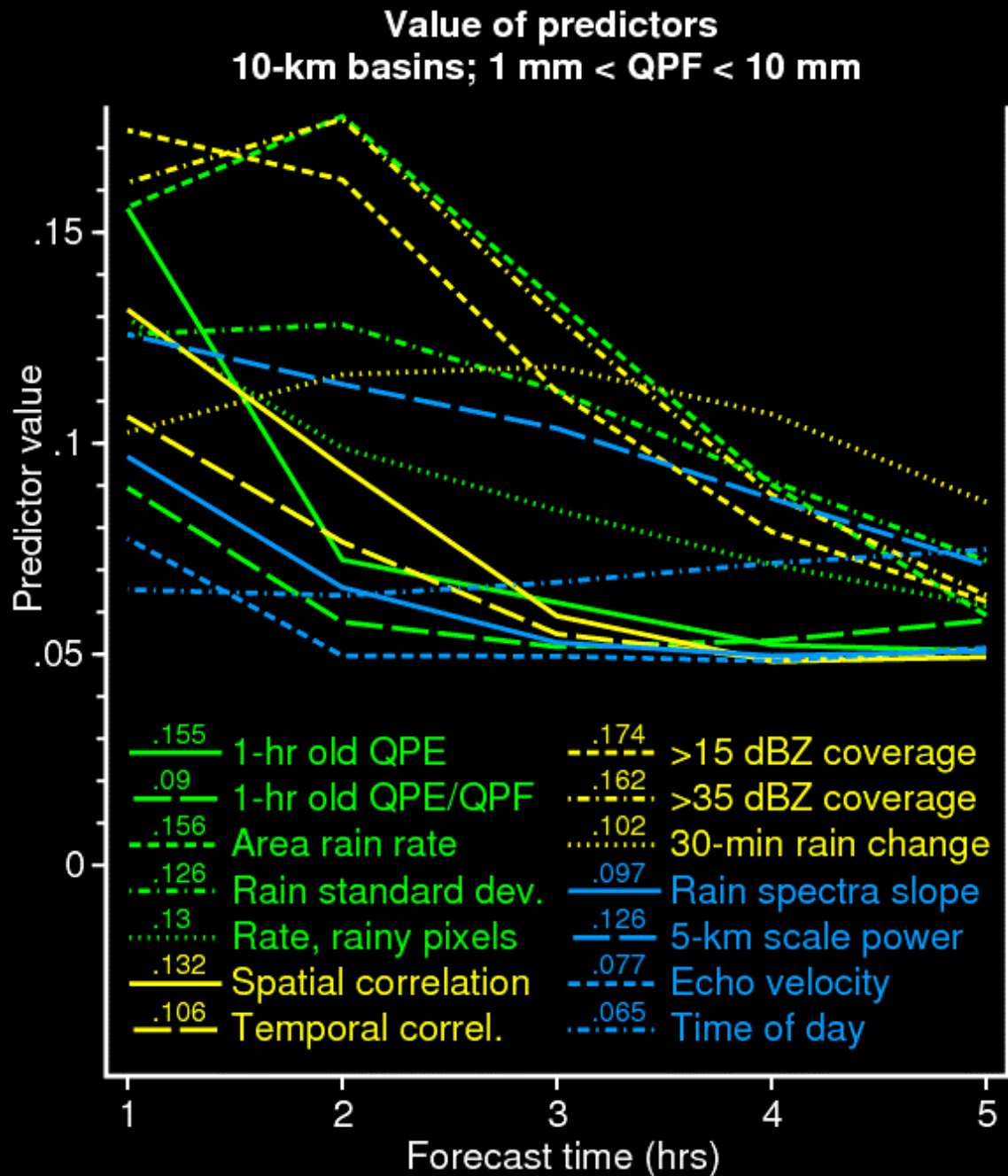
Minor but noticeable gains (no magic bullet).

Value = $f(\text{time and space scales})$. Best predictors:

- Fractional echo coverage;
- Area rainrate (best for small basins);
- 30-min R change (best for longer forecasts).

We haven't touched the issue of the (in)dependence of predictors.

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