

Preliminary verification of ensemble precipitation forecast over South America

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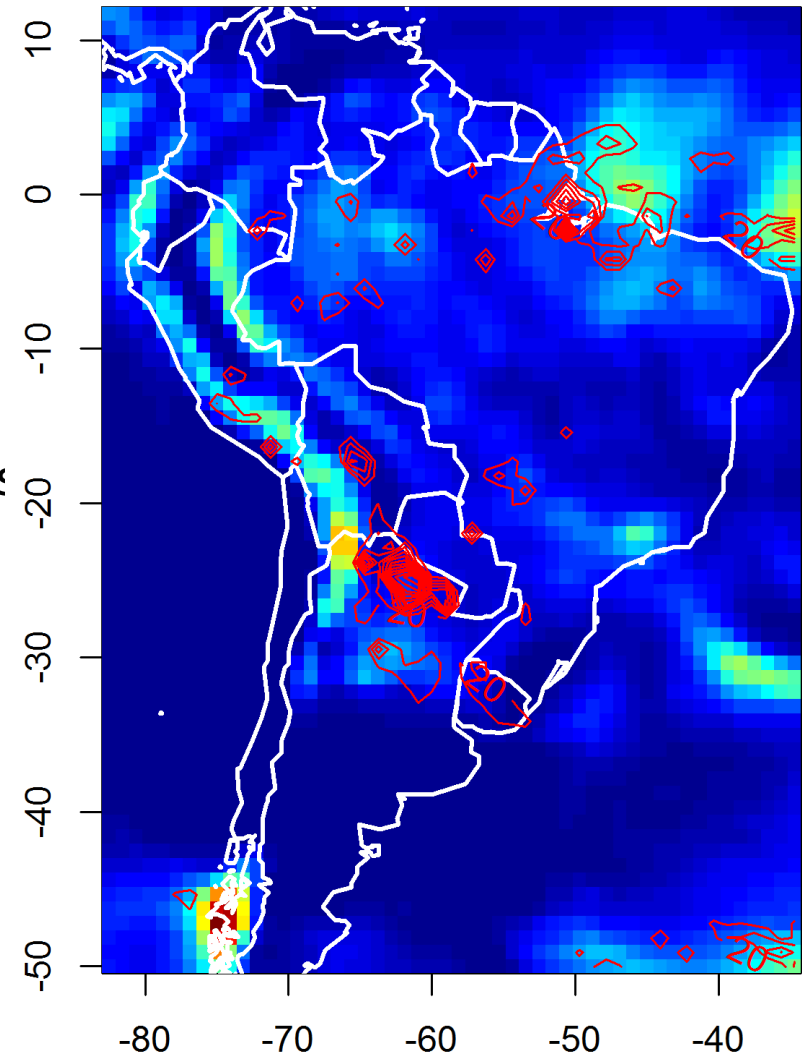
Dataset

CPTEC/INPE's EPS

- 100 km resolution
- Forecasts for 15 days
- 15 members (including control)
- Initialization time at 12 UTC
- Output at every 6 hr * 4x = 24 hr (obs)
- 52 x 67 spatial grid
- 89 days in rain season (2015-12 to 2016-02)

Observation

- MERGE (station+satellite)
- 20 km resolution \square 100 km (model)
- 24-hr accumulated precip at 12 UTC



Goal

Verify the precipitation
predictability limit in
the
rainy season over
South America.

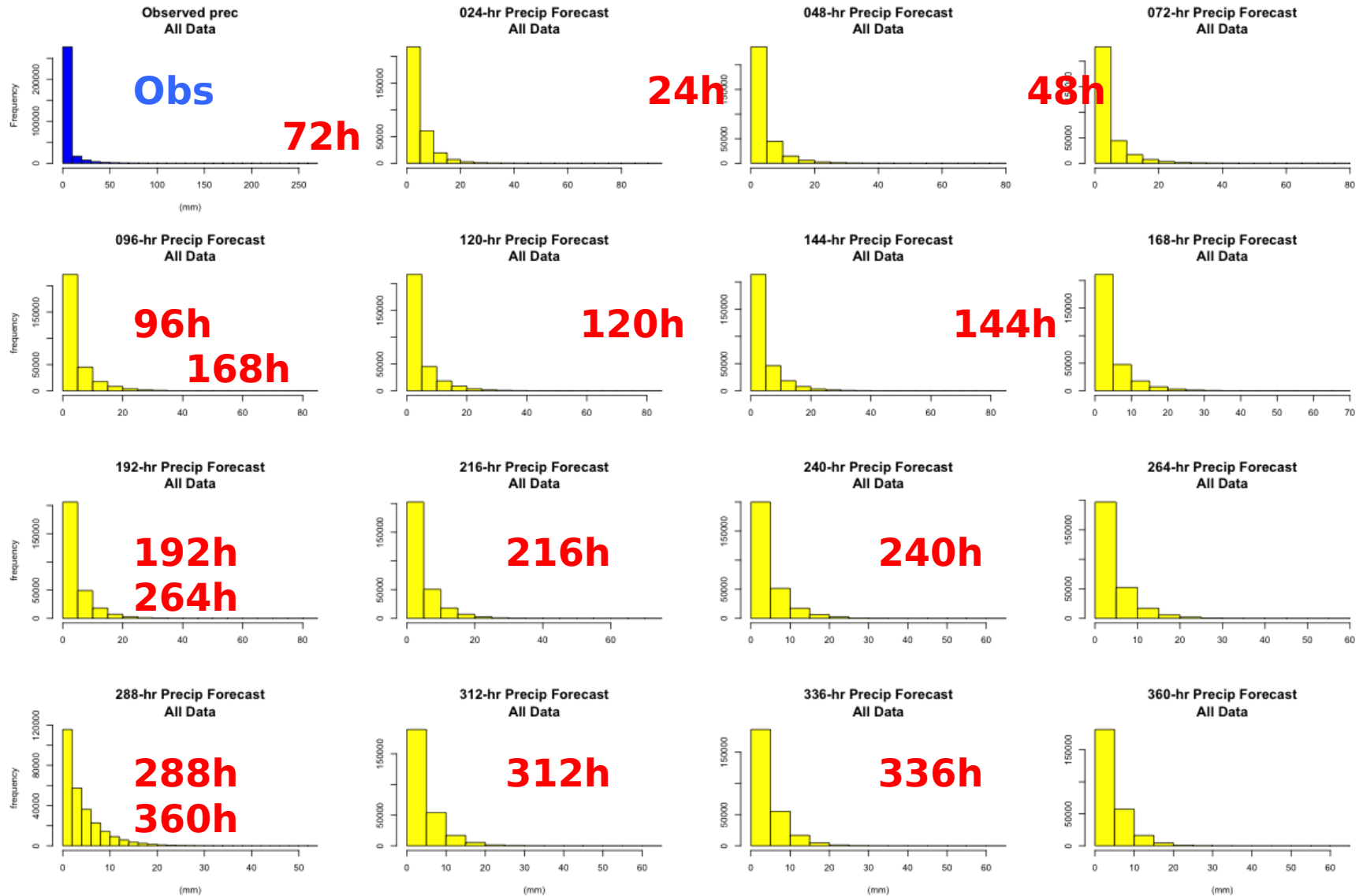
Goal

Identified components are:

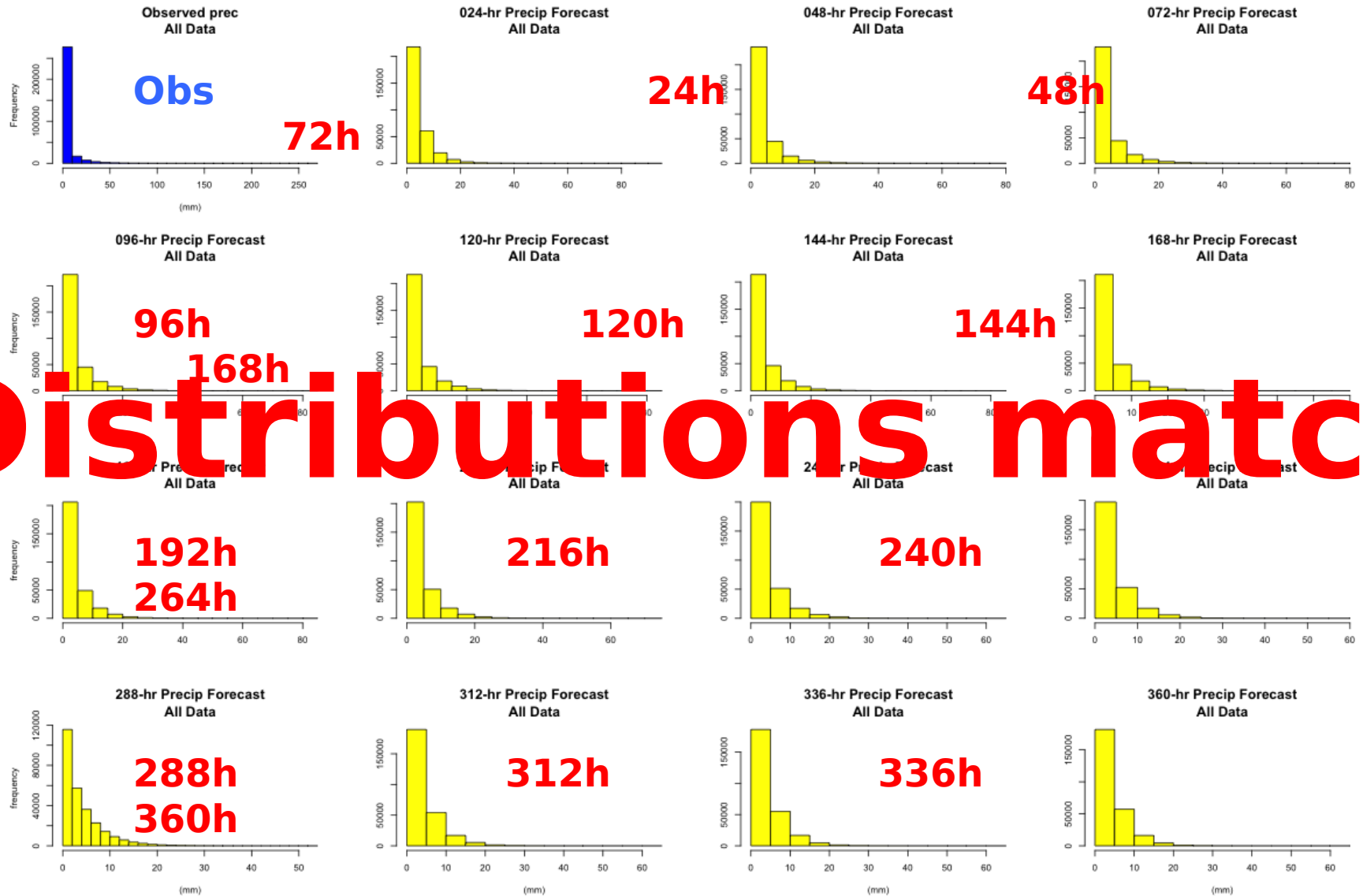
Verify the precipitation **Element**
predictability limit in
the

Temporal domain rainy season over
South America. **Spatial domain**

Marginal distribution - Histogram

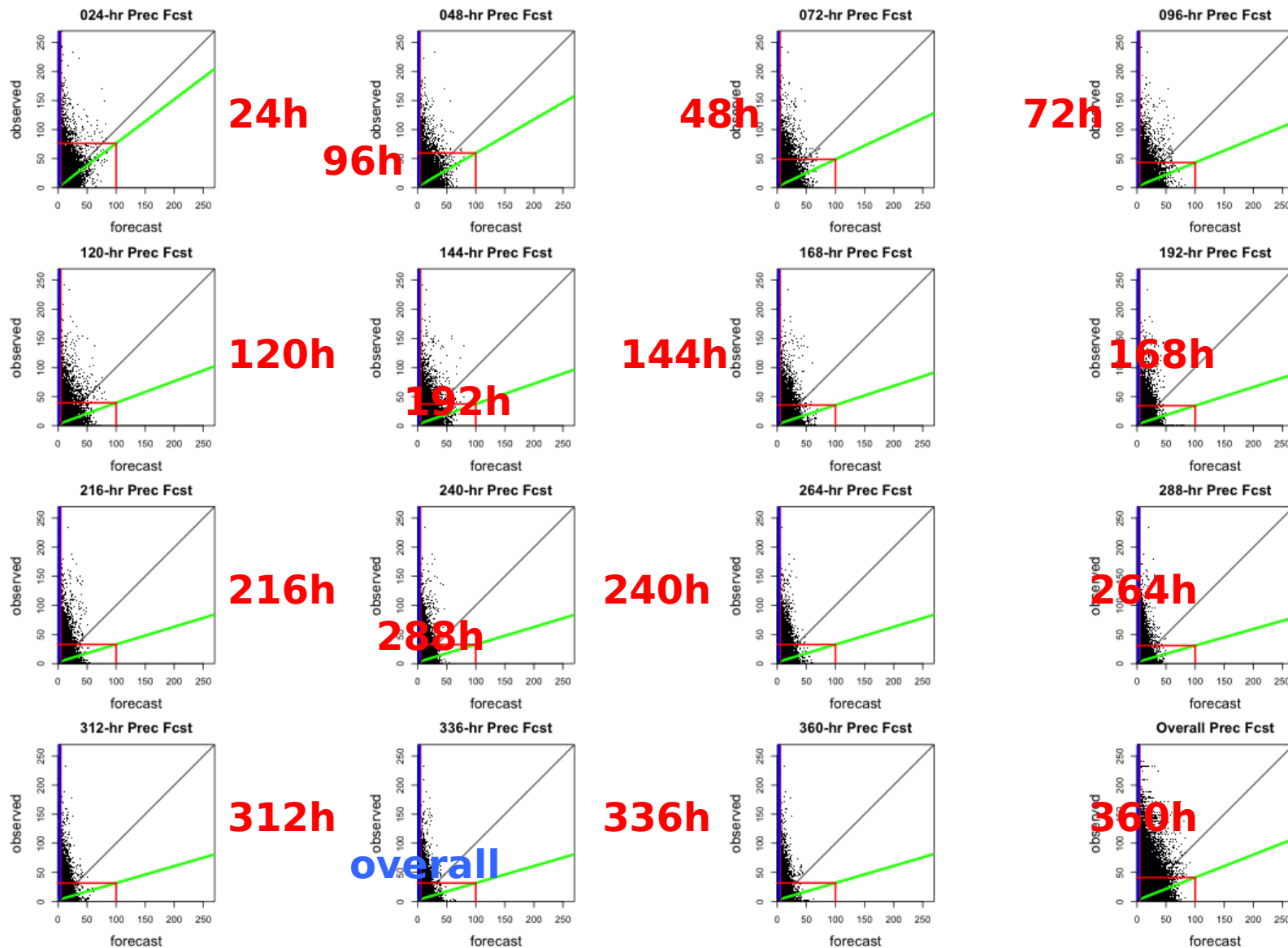


Marginal distribution - Histogram



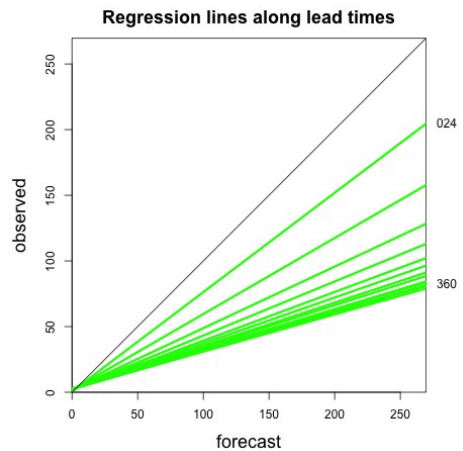
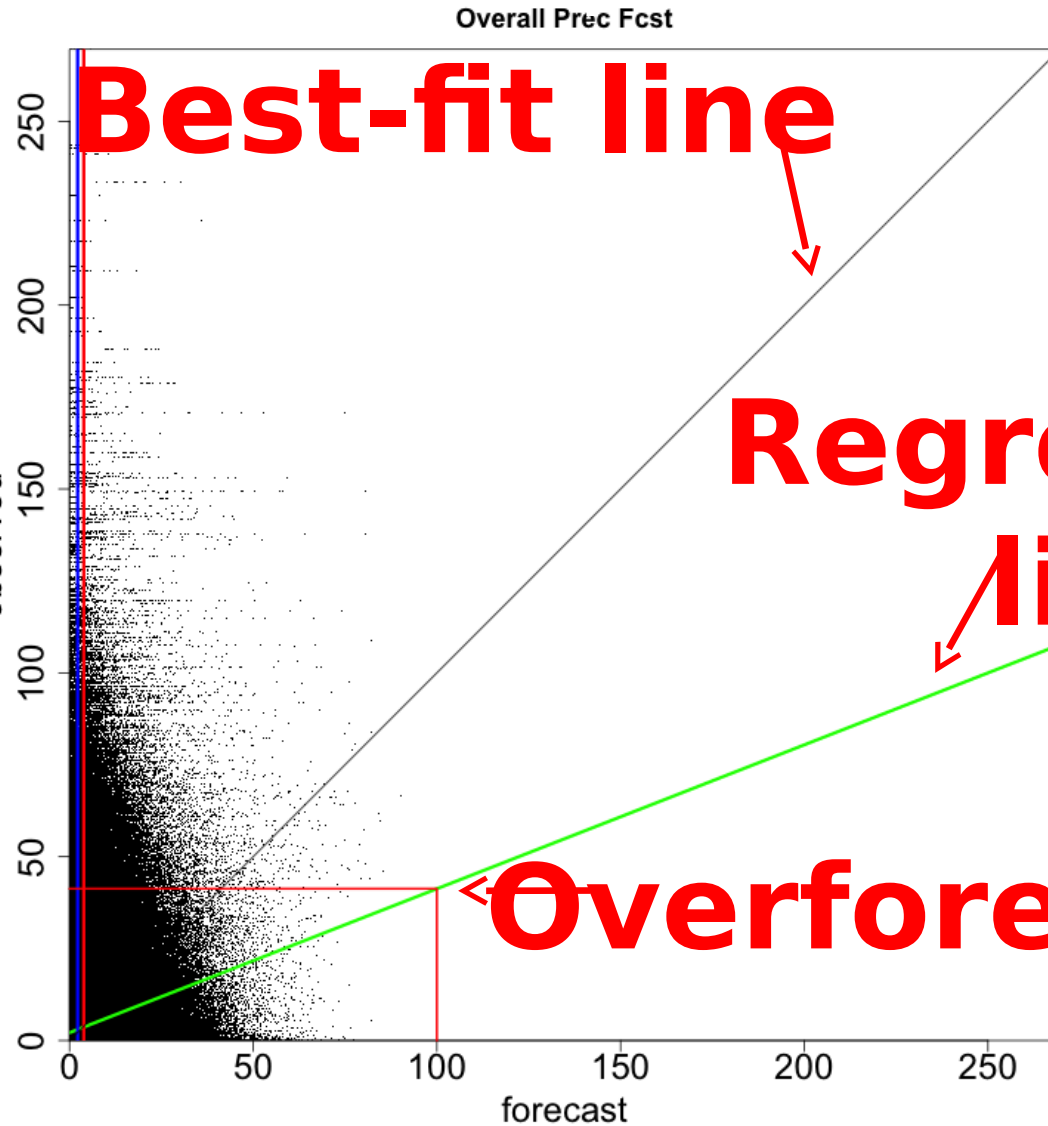
Distributions match

Joint distributions - Scatterplot



Joint distributions - Scatterplot

**Tendency
to
become
uncorrel.
(no skill)**



Verification – Continuous variables

Magnitude of the error

No direction

Higher are weighted more

Average of the magnitude of errors

- No direction

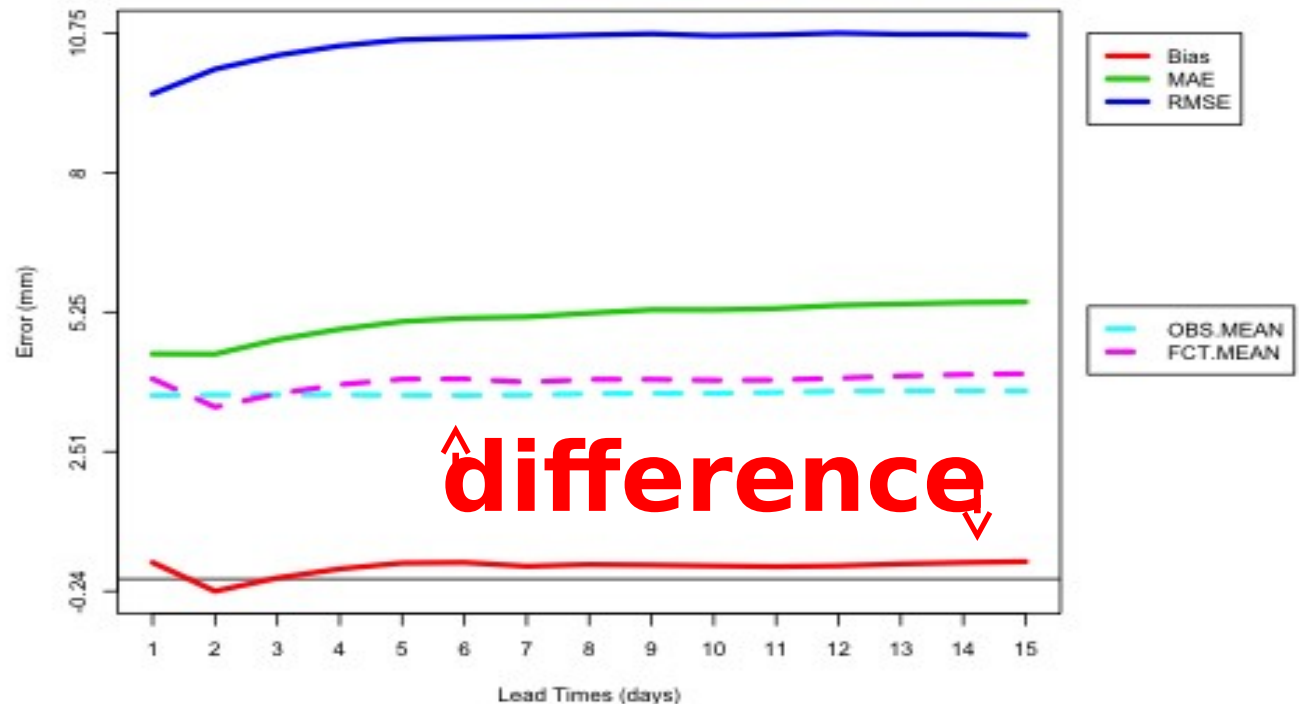
Average of the errors

No magnitude

Direction:

+ = overfcst

- = underfcst

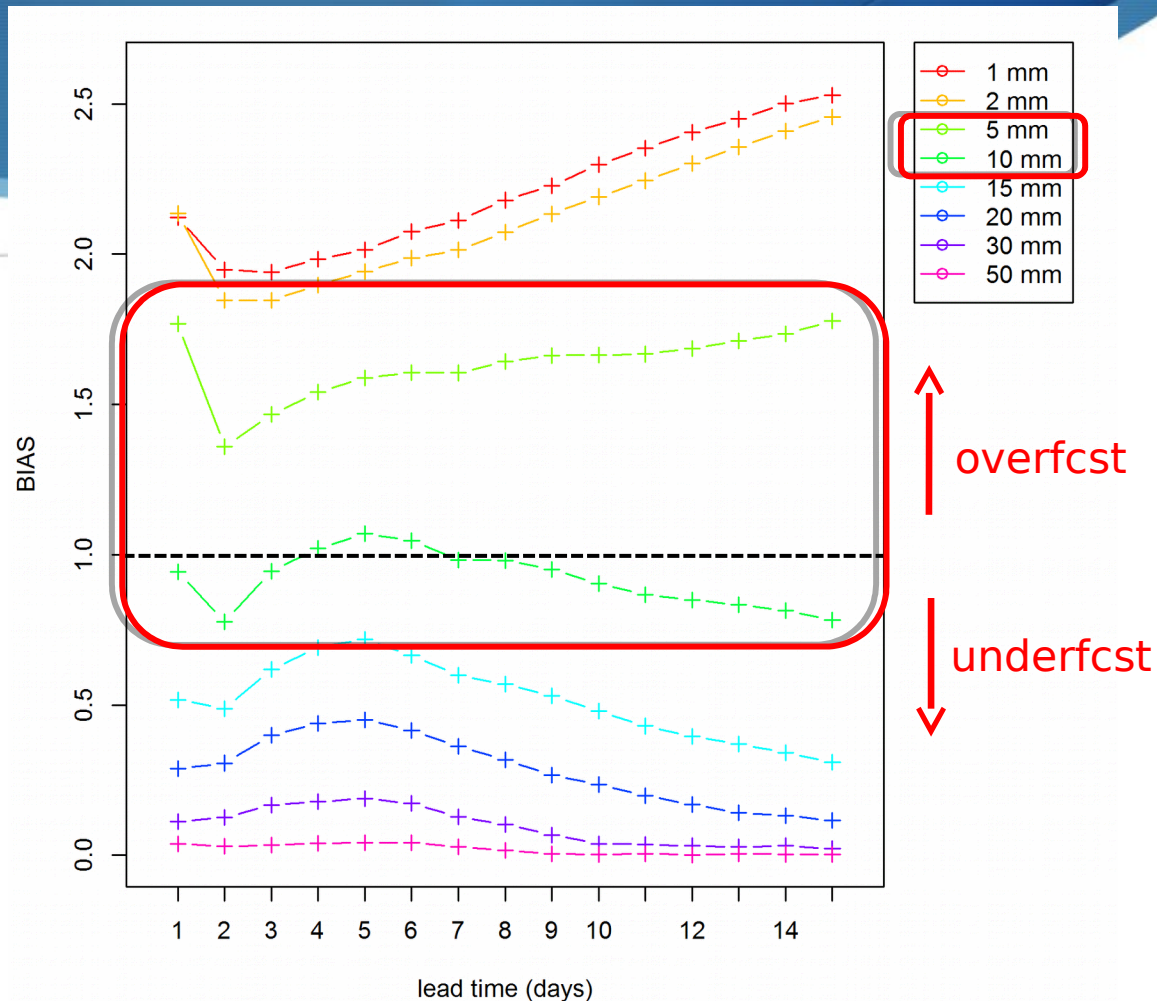


Verification – Categorical variables

HITS <i>a</i>	FALSE ALARMS <i>b</i>	Total Events Forecast <i>a+b</i>
MISSED EVENTS <i>c</i>	CORRECT NEGATIVES <i>d</i>	Total non-events Forecast <i>c+d</i>
Total Events Observed <i>a+c</i>	Total Non-Events Observed <i>b+d</i>	Sample size <i>T=a+b+c+d</i>

$$BIAS = \frac{a + b}{a + c} \quad (\text{best}=1)$$

Frequency bias:
whether distribution are similar in the category
(Reliability)

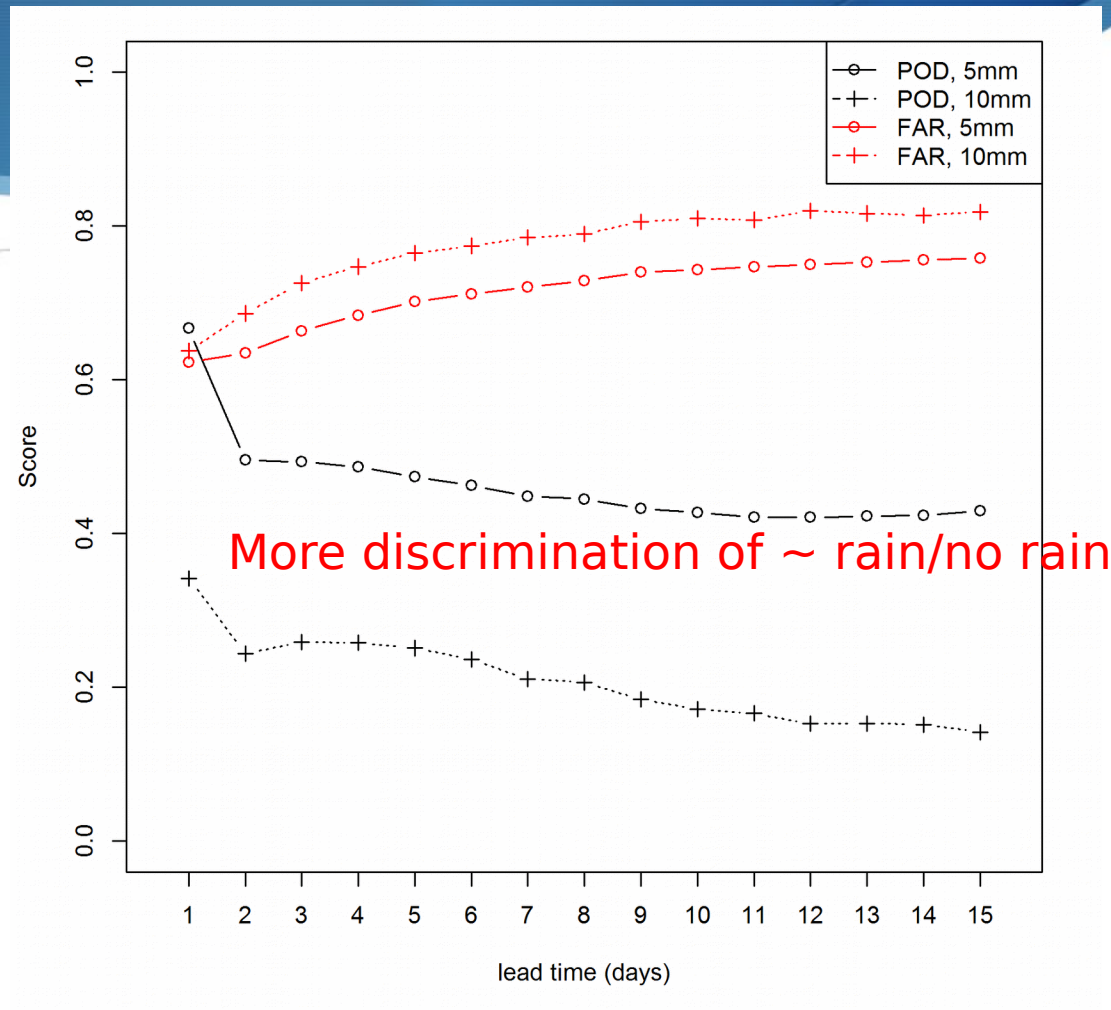


Verification – Categorical variables

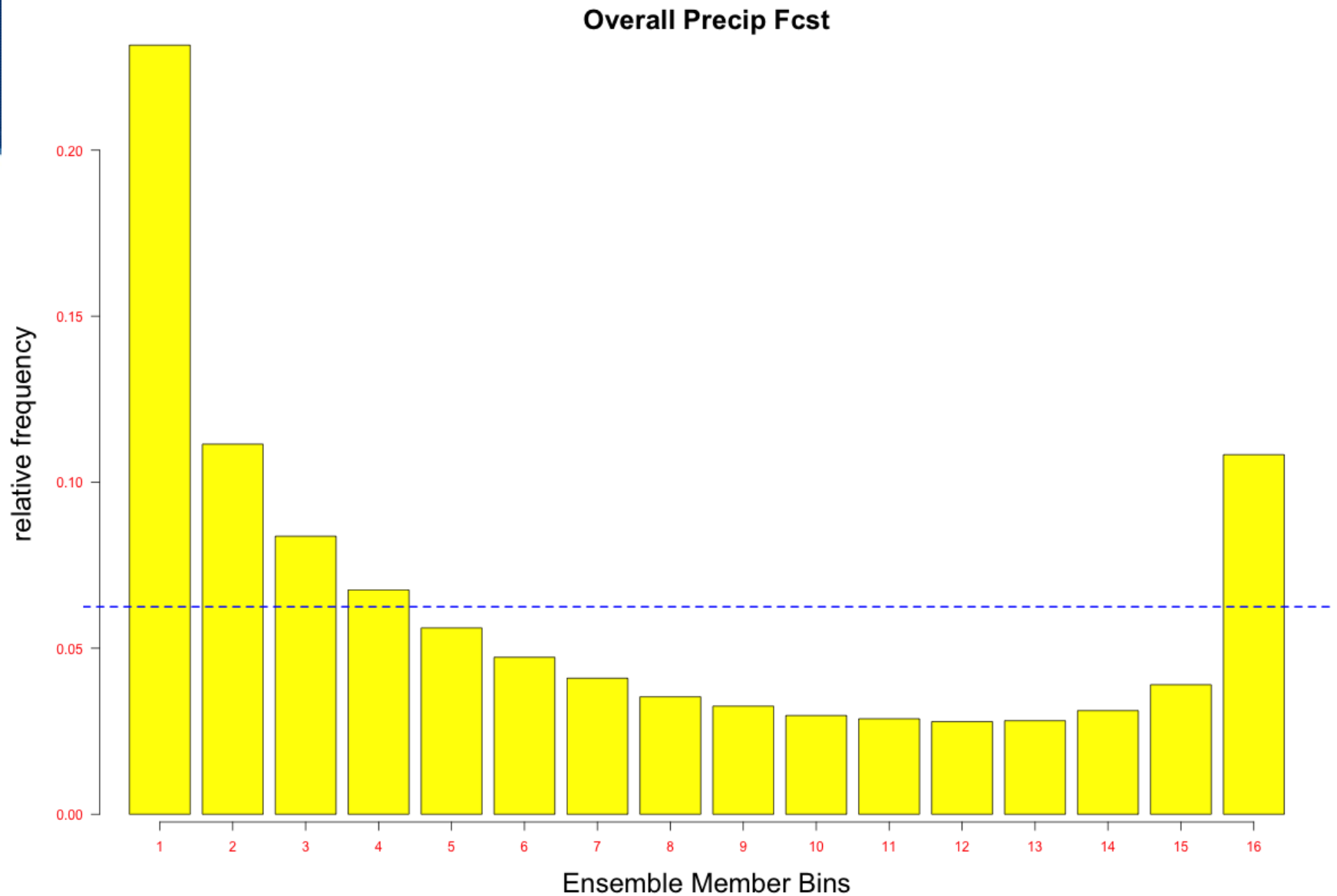
HITS <i>a</i>	FALSE ALARMS <i>b</i>	Total Events Forecast <i>a+b</i>
MISSED EVENTS <i>c</i>	CORRECT NEGATIVES <i>d</i>	Total non-events Forecast <i>c+d</i>
Total Events Observed <i>a+c</i>	Total Non-Events Observed <i>b+d</i>	Sample size <i>T=a+b+c+d</i>

$$POD = \frac{a}{a+c} \text{ (best=1)}$$

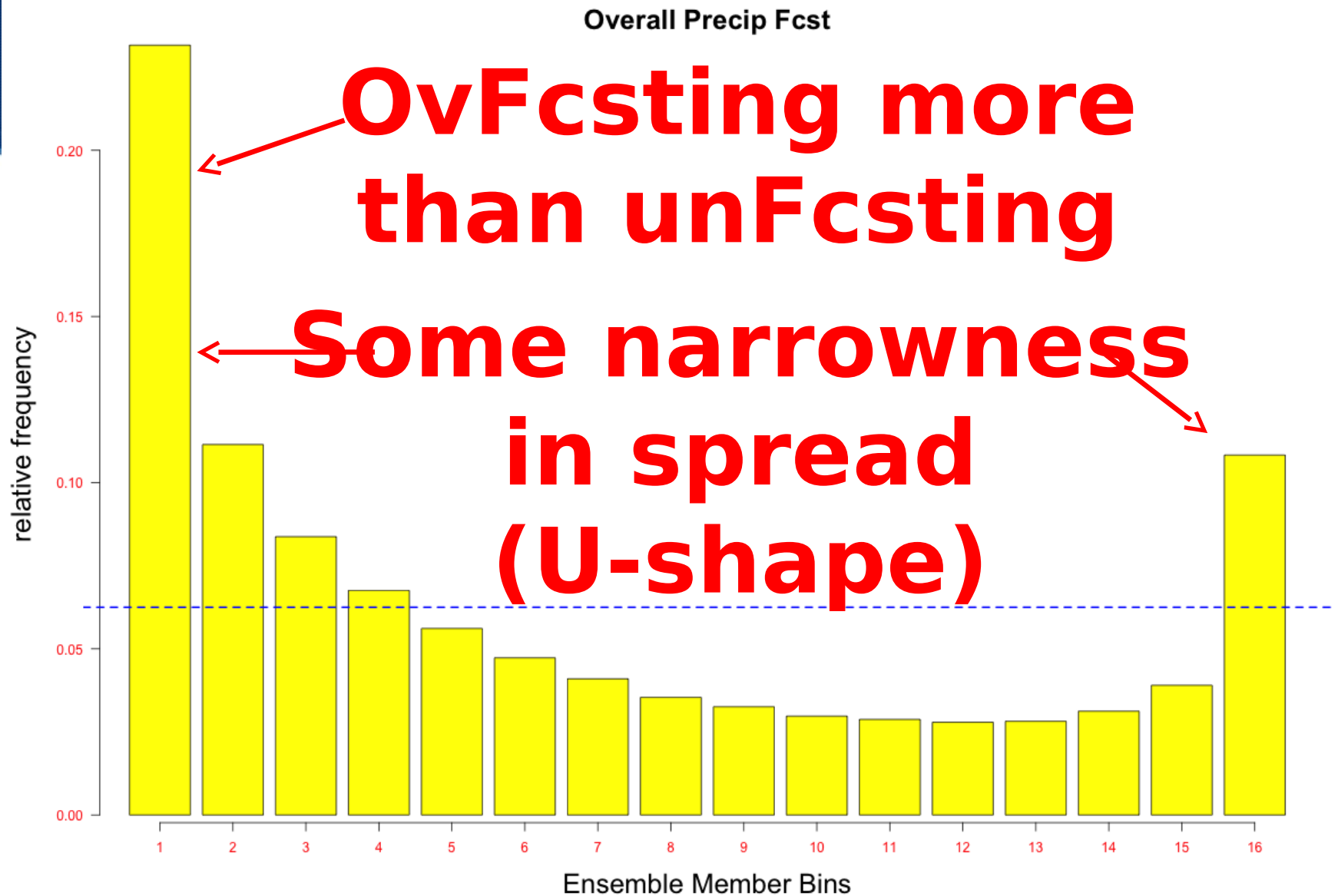
$$FAR = \frac{b}{a+b} \text{ (best=0)}$$



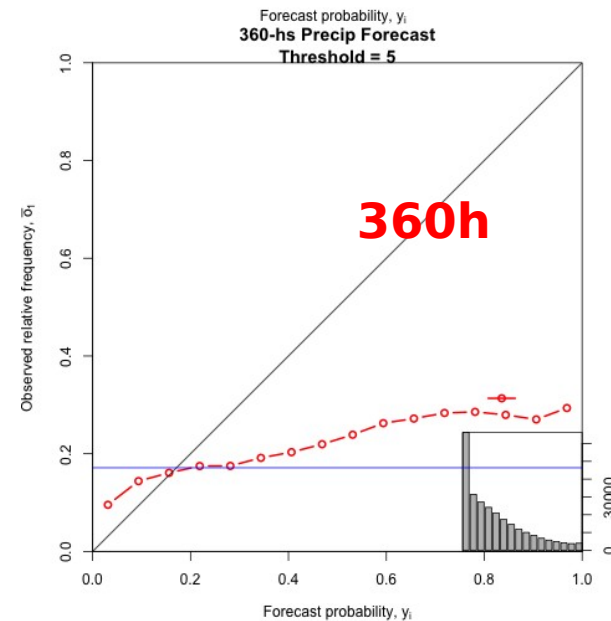
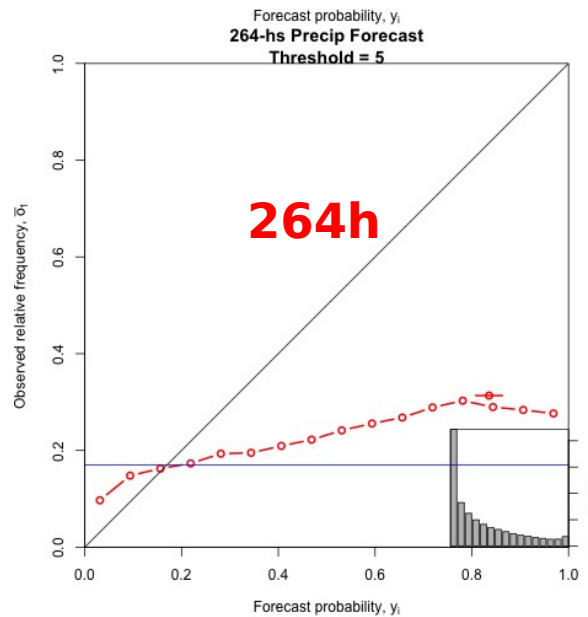
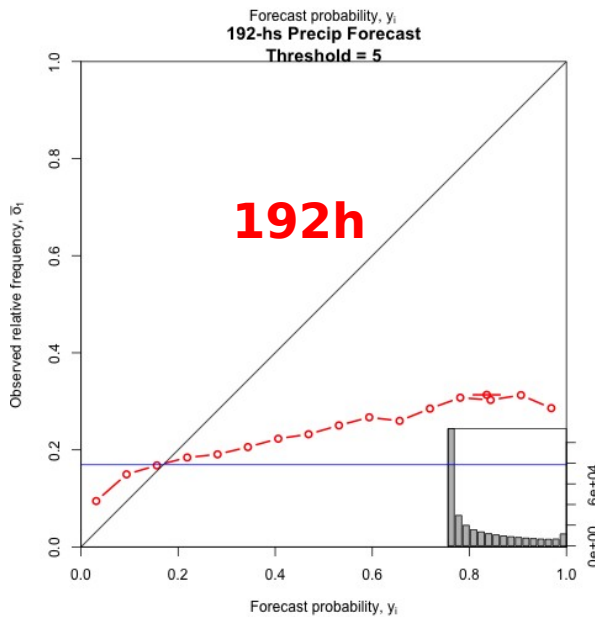
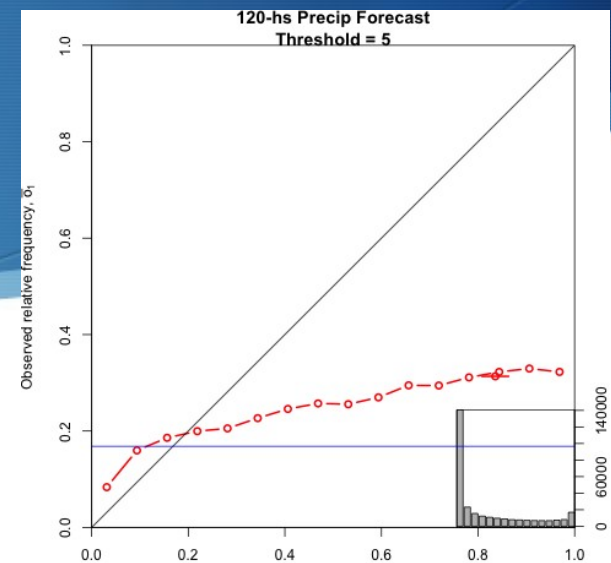
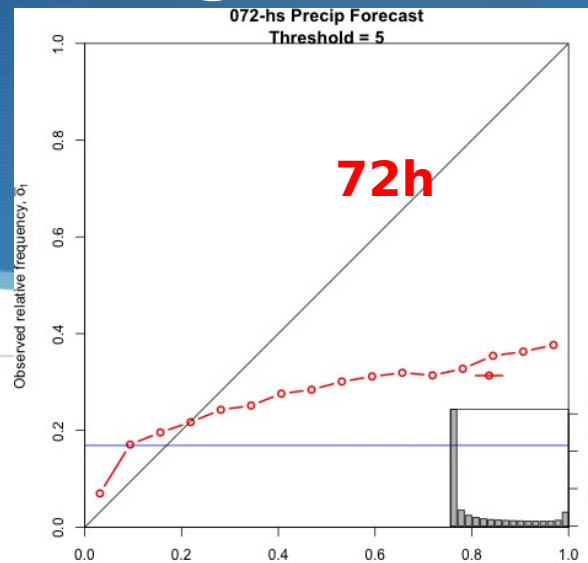
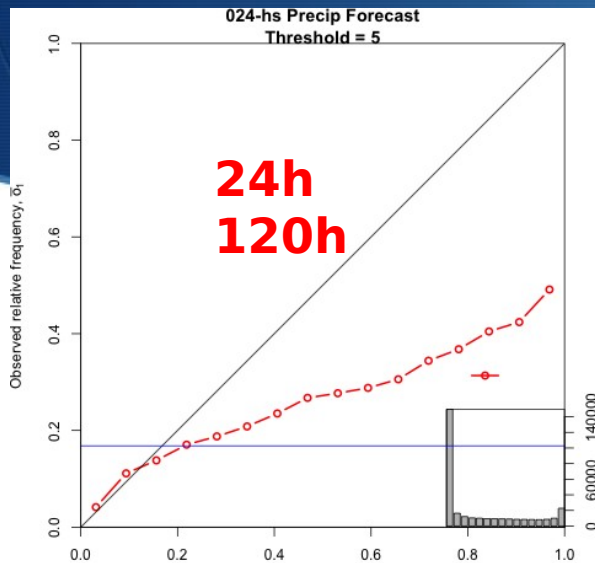
Verification - Ensemble spread



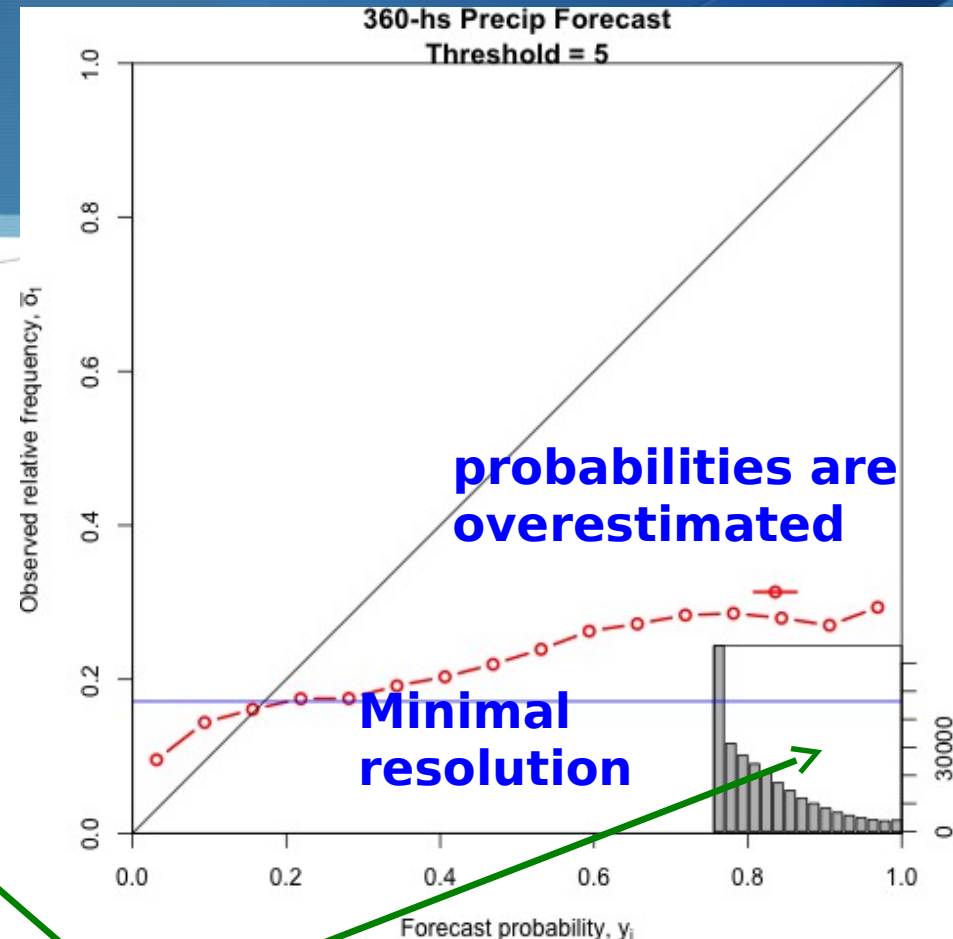
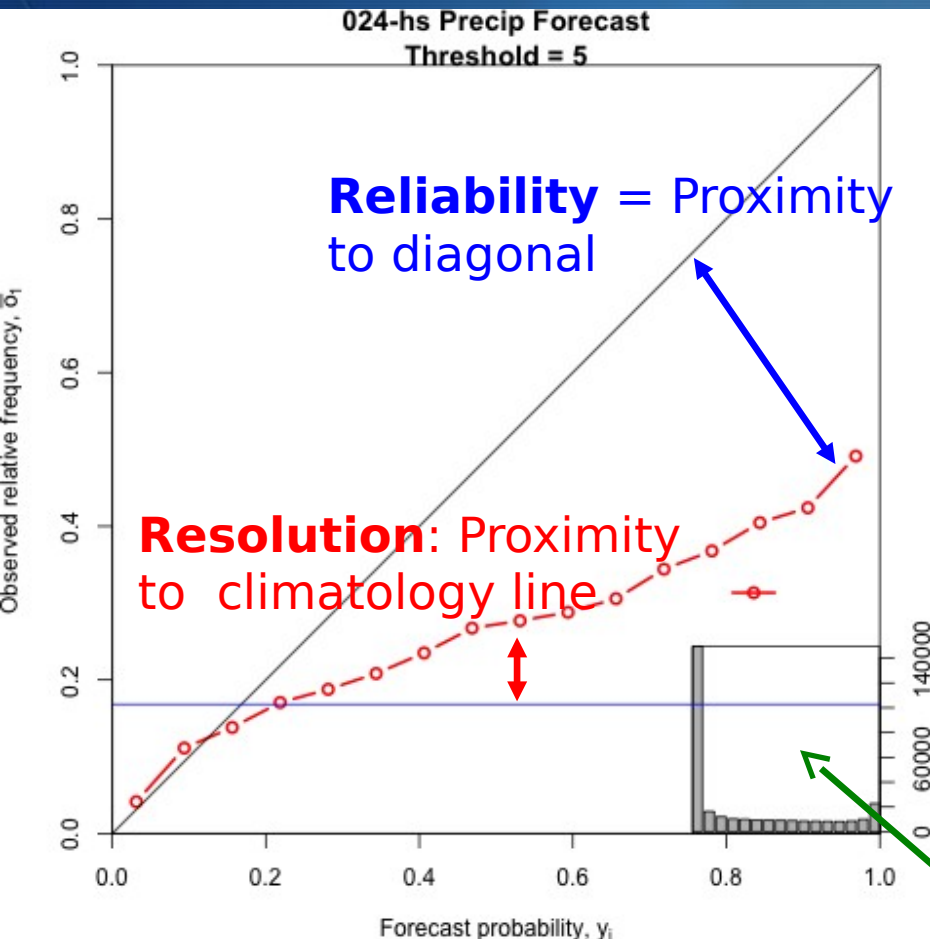
Verification - Ensemble spread



Reliability Diagrams – Probability 5mm



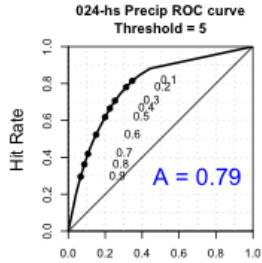
Reliability Diagrams – Probability 5mm



Sharpness refers to the spread of the probability distributions

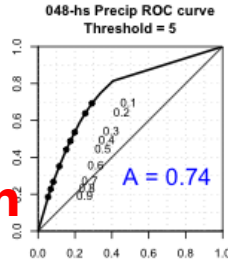
Verifications – Probability

5mm

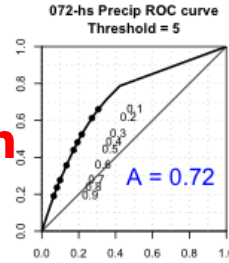


24h

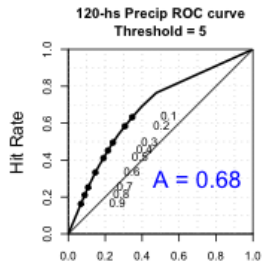
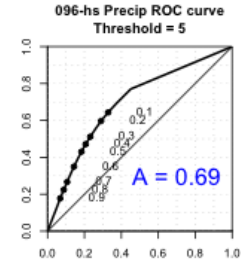
96h



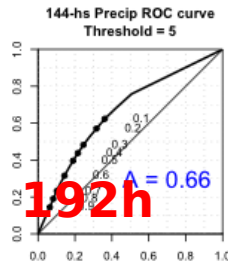
48h



72h

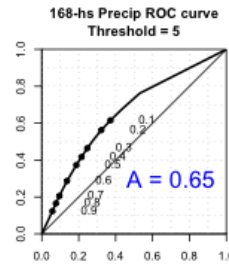


120h

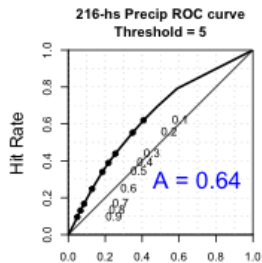
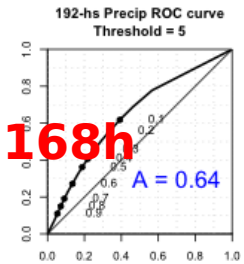


144h

192h

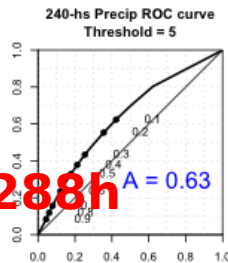


168h

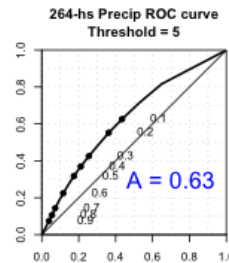


216h

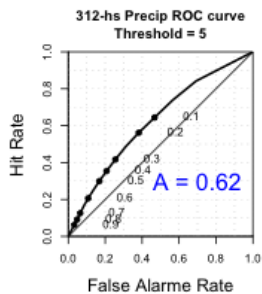
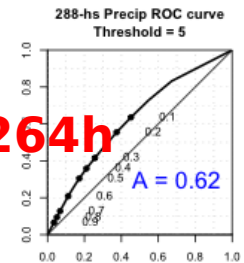
288h



240h

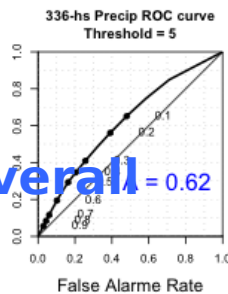


264h

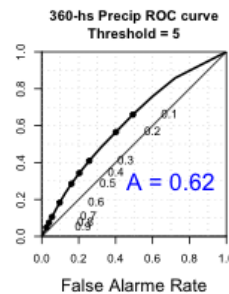


312h

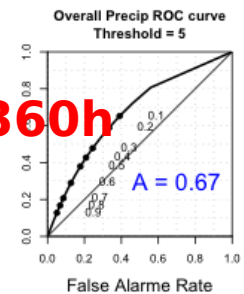
overall



336h

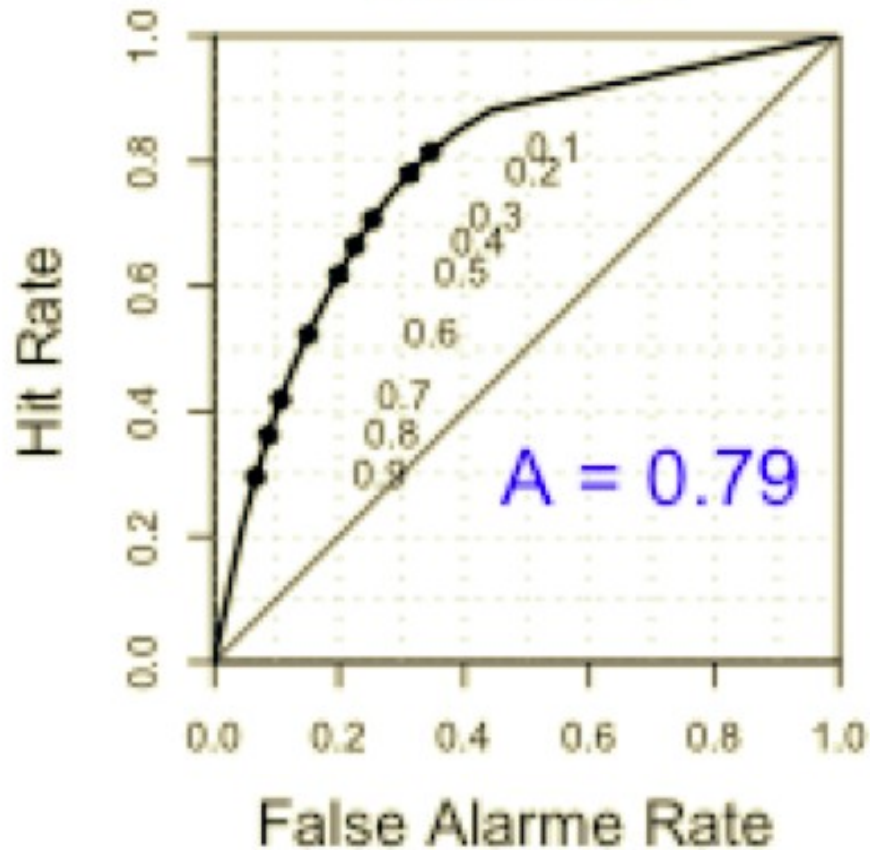


360h

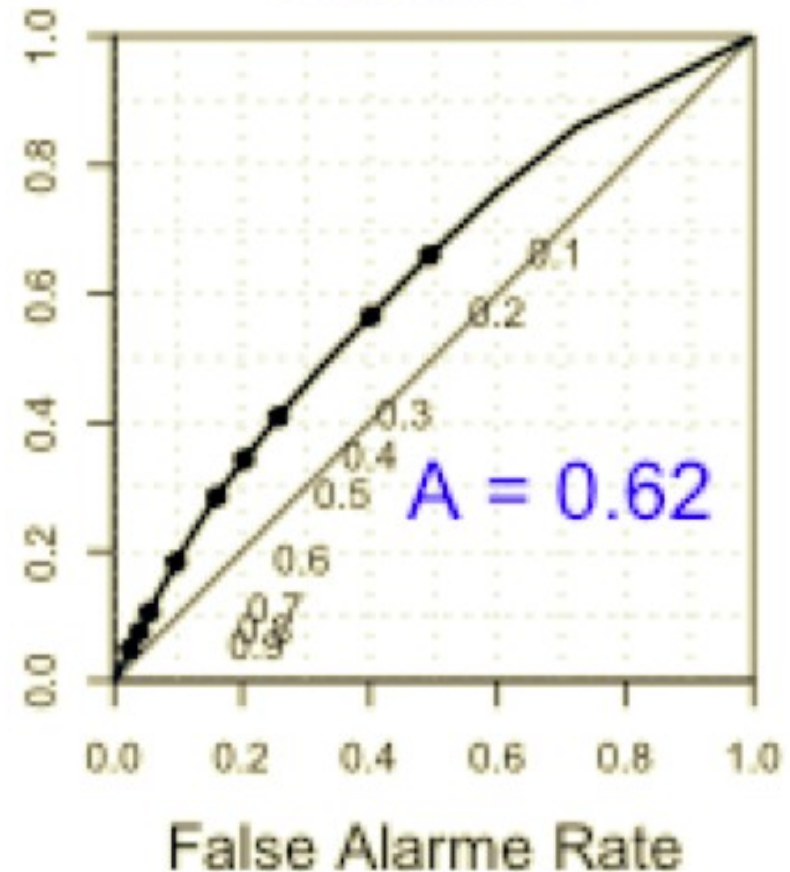


Verifications – Probability 5mm

024-hs Precip ROC curve
Threshold = 5



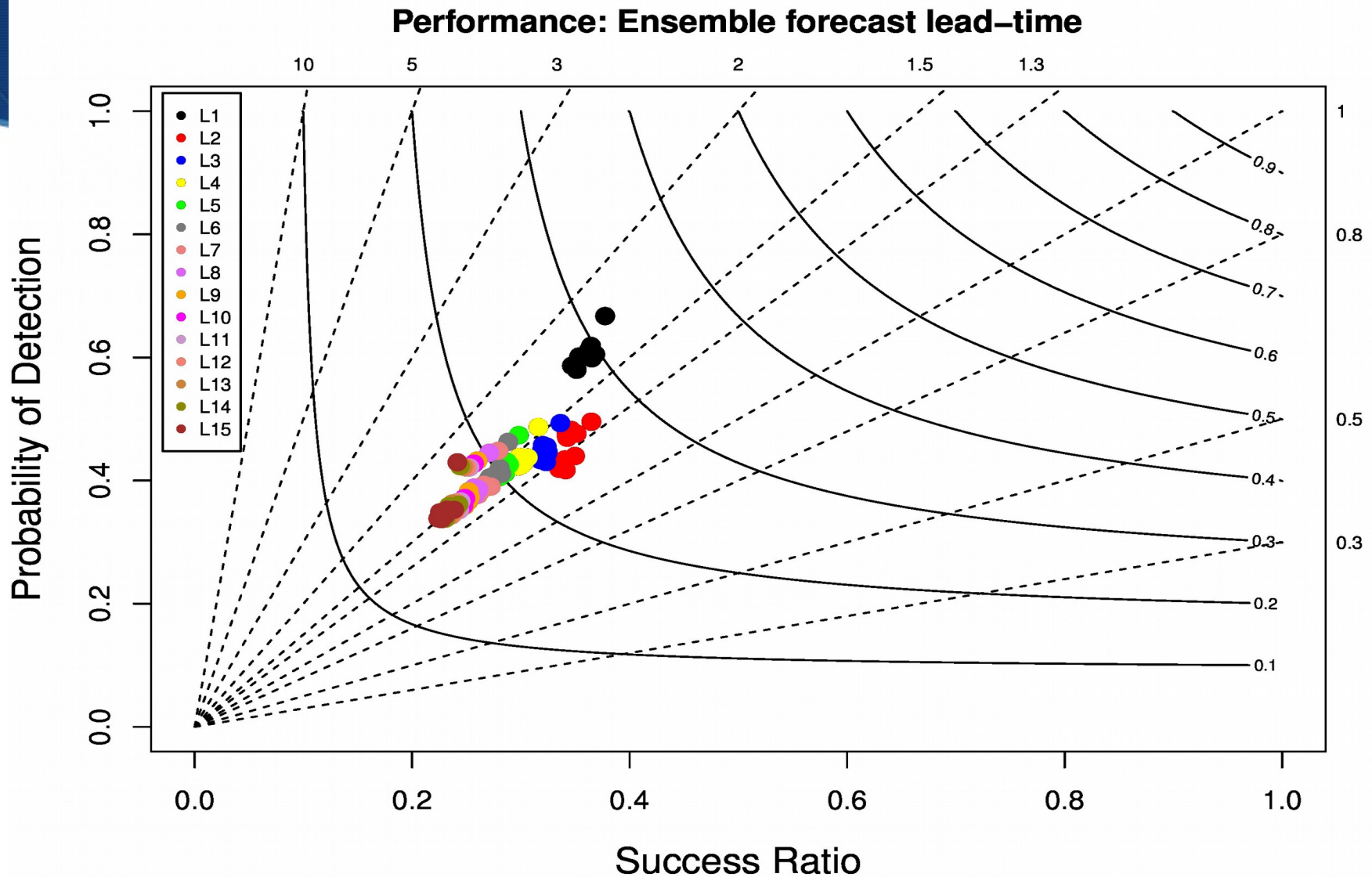
360-hs Precip ROC curve
Threshold = 5



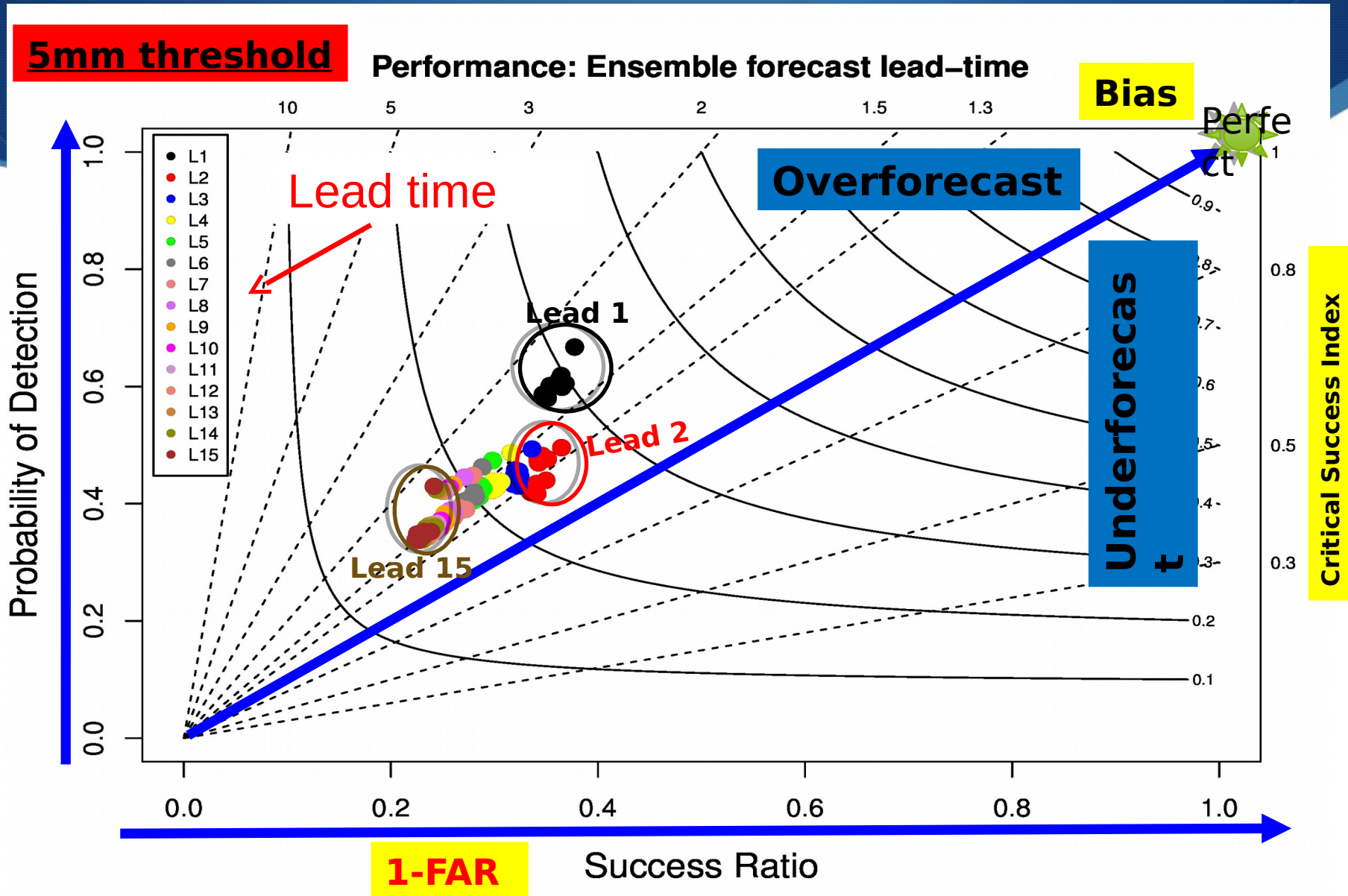
99% prob of successfully distinguishing
5mm event from non-event

0.5 = no skill

Performance verification in brief...

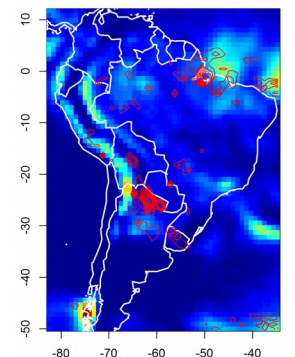
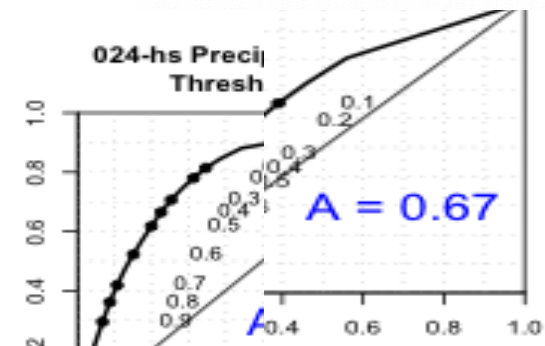
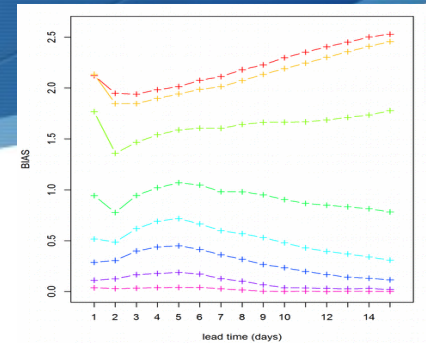
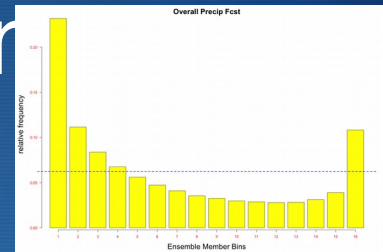


Performance verification in brief...



What the verification is showing

- Mostly over-forecasts.
- Very sensitive to chosen threshold (overforecasting weak events, underforecasting strong events) □ Is it possible to have a dynamic calibration?
- The model can discriminate between events and non-events until very high lead times.
- But for high thresholds □ scores tend to be the worst.
- Bad reliability/scores might result from



Conclusion

What is the predictability limit in the rainy season over South America?

- No final conclusion can be made, it is just a preliminary study!
- Possible reasons for bad scores:
 - The spatial shift □ Consider spatial verification
 - Bad data preparation □ review temporal and spatial matching