

Group Project: Verification of PoP Forecasts for Hong Kong

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Objective:

To evaluate the quality of PoP forecasts generated from the ECMWF EPS for Hong Kong

Verification Questions:

What is the quality of the PoP forecasts?
Are the PoP forecasts skilful?



Data

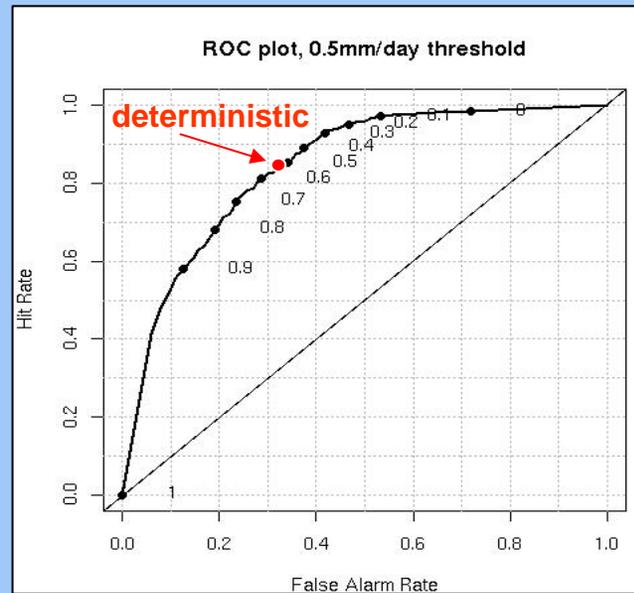
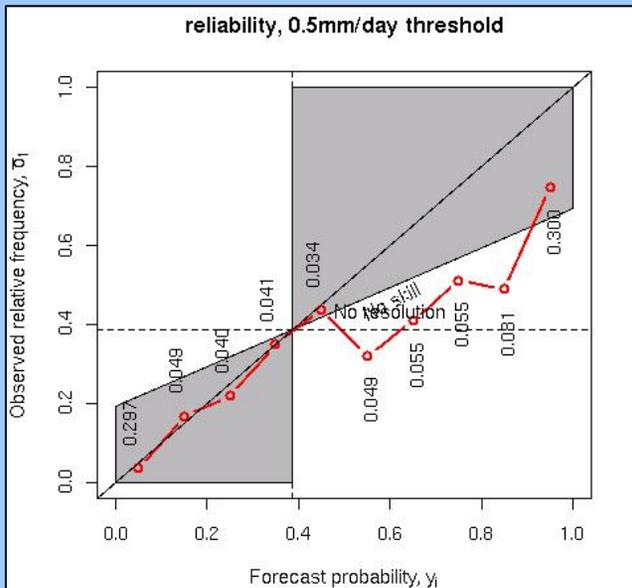
- Forecast data:
 1. ECMWF EPS data (1 control + 50 ensemble members) for daily precipitation from May 2004 to November 2006 (forecast lead-time 4-7 days).
 2. ECMWF deterministic forecast for daily precipitation for the same period.
- Observation: Observed daily rainfall in Hong Kong, average of 7 representative rain-gauges.

Choice of Verification Method

- Verify the probability forecasts for rainy days (i.e. $> 0.5\text{mm/day}$); heavy rain (i.e. $>20\text{mm/day}$).
- Verification scores and methods chosen:
 1. Reliability diagrams (bias)
 2. Brier Score (reliability, resolution)
 3. ROC score (potential skill)



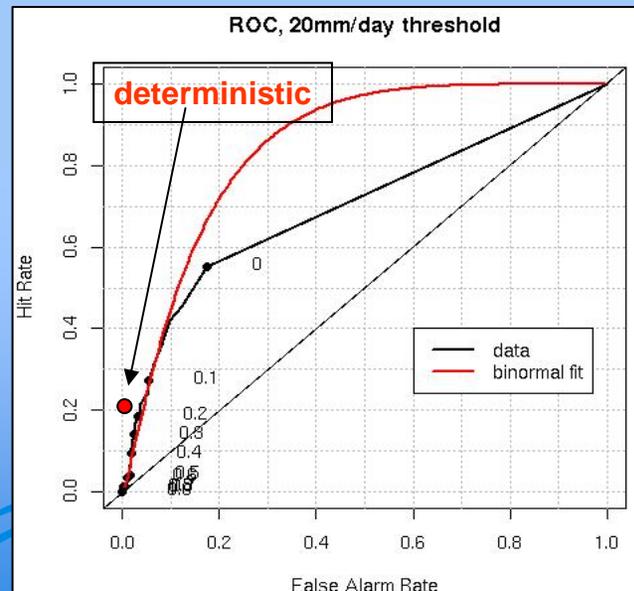
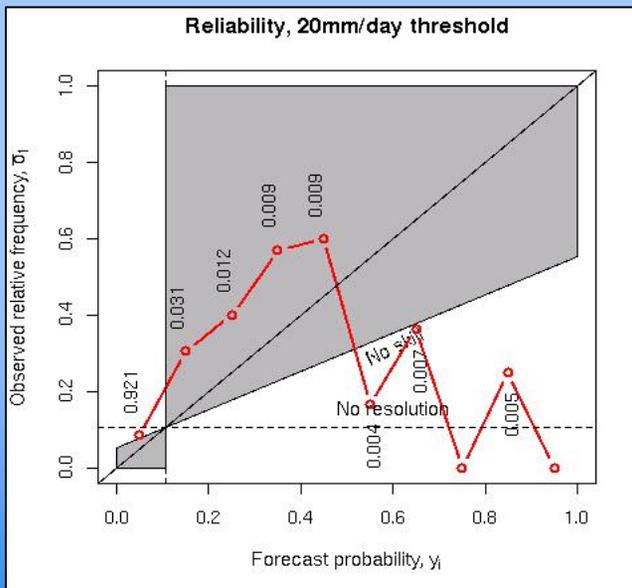
4-day lead-time



ROC-area = 0.84

0.5 mm/day

- BS = 0.19
- BS - bas = 0.24
- BSS = 0.21
- Rel-BSS = 0.03
- Res-BSS = 0.08
- Unc-BSS = 0.24



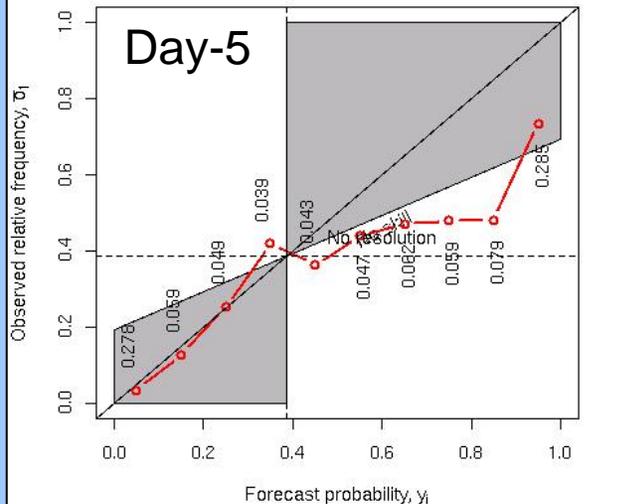
ROC-area = 0.70

20 mm/day

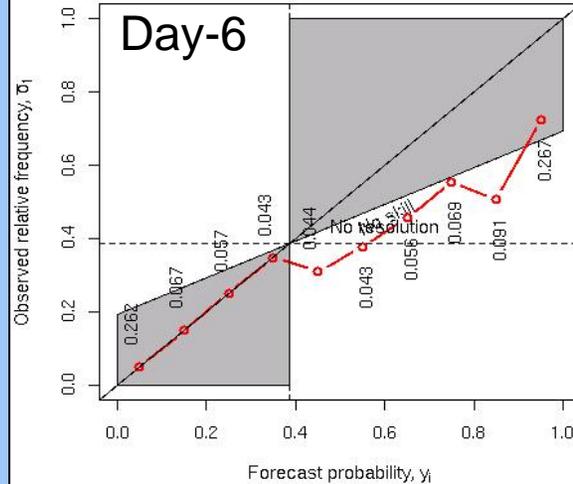
- BS = 0.095
- BS - bas = 0.09589
- Skill Score = 0.006
- Rel-BBS = 0.007
- Res-BBS = 0.0075
- Unc-BBS = 0.096

Day-5 to 7 forecasts, rainy day (>0.5 mm/day)

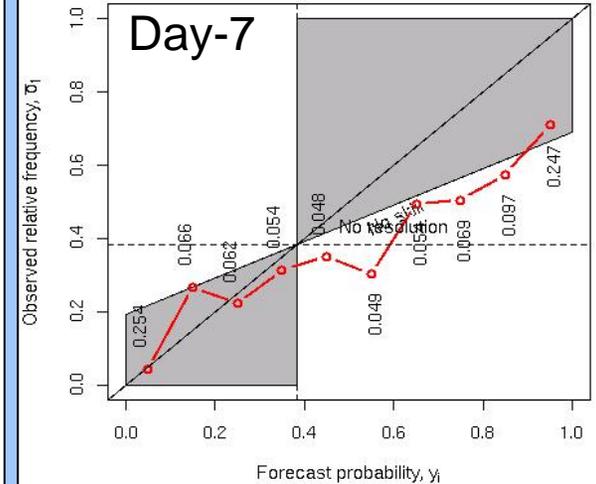
Reliability, 0.5mm/day threshold, day-5 forecast



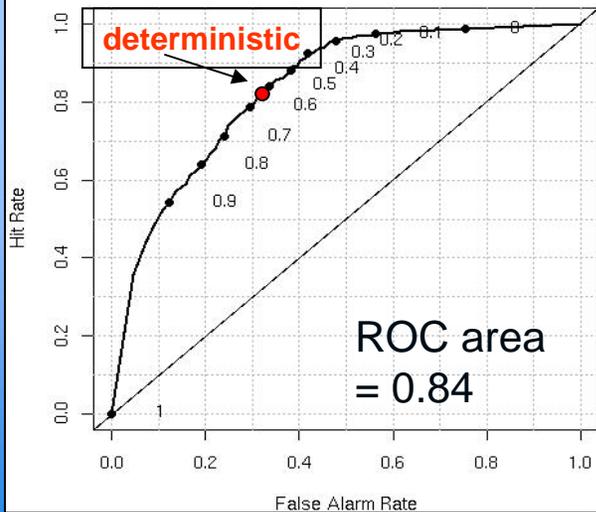
Reliability, 0.5mm/day threshold, day-6 forecast



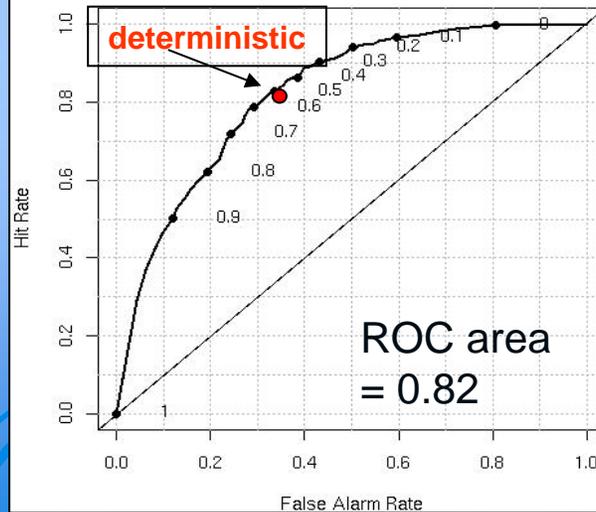
Reliability, 0.5mm/day threshold, day-7 forecast



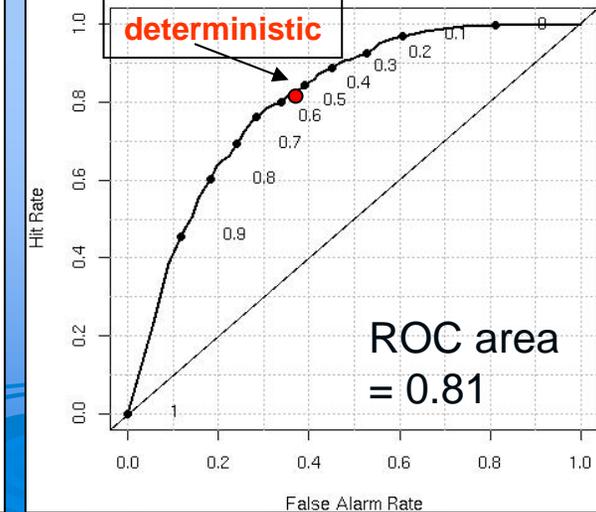
ROC plot, 0.5mm/day threshold, day-5 forecast



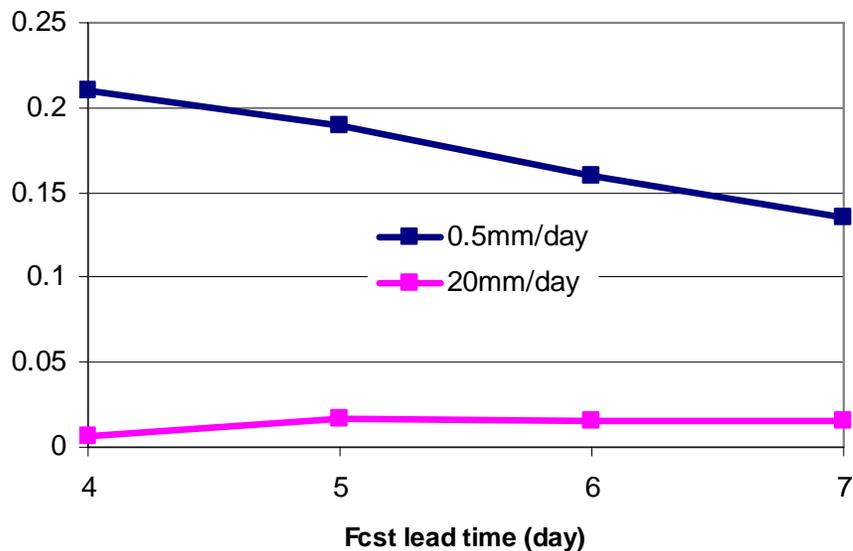
ROC, 0.5mm/day threshold, day-6 forecast



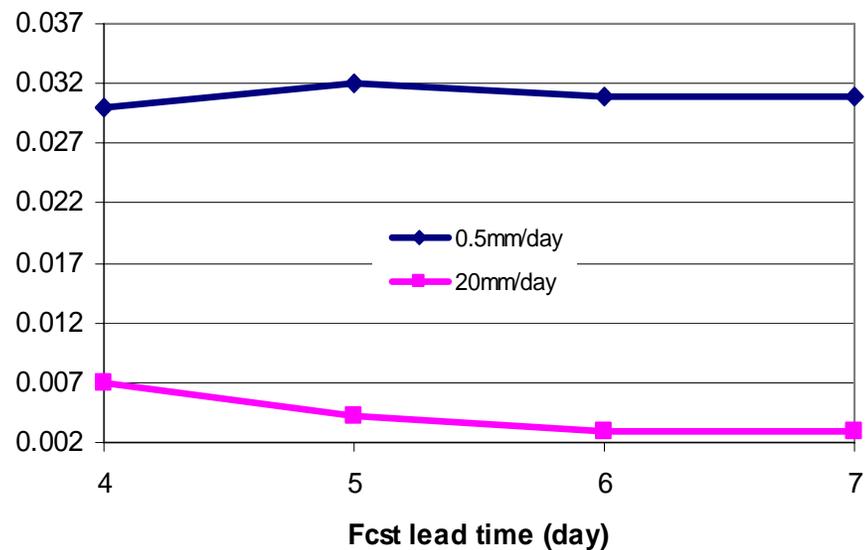
ROC, 0.5mm/day threshold, day-7 forecast



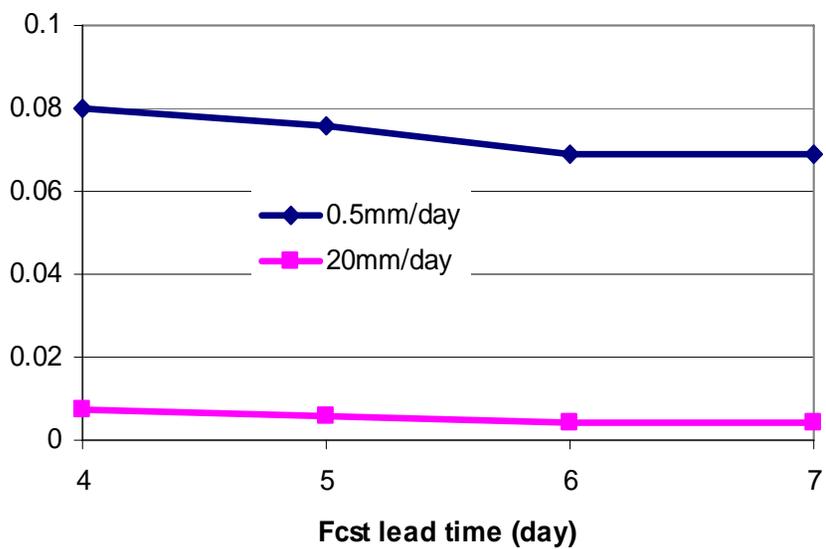
Brier Skill Score



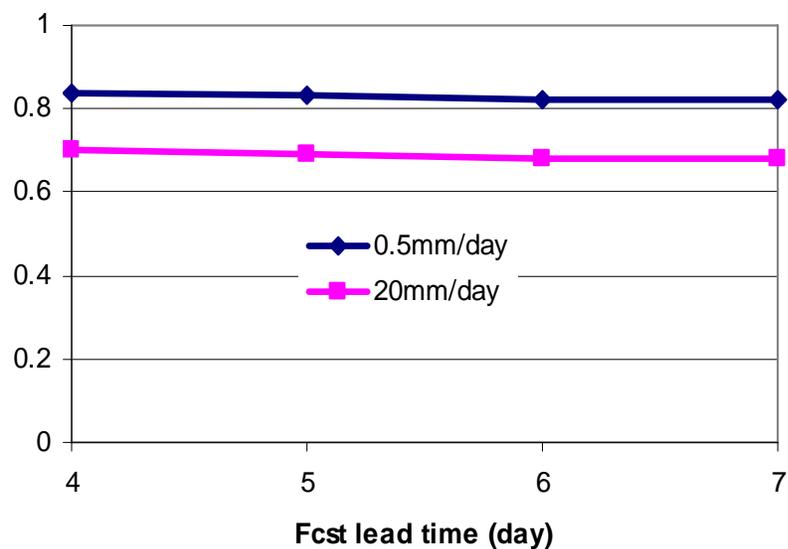
Reliability



Resolution

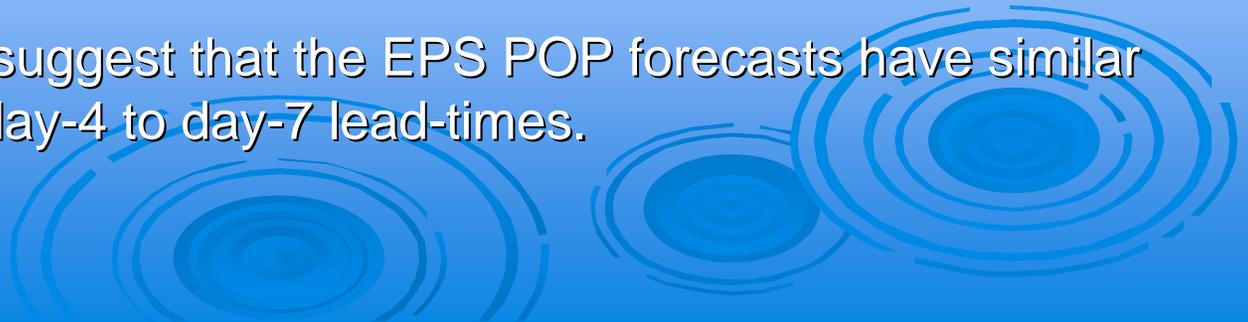


ROC area



Conclusions

- The POP forecasts tend to over-forecast the occurrence of rainy days (i.e. $>0.5\text{mm/day}$)
- Brier skill scores (BSS) indicate that the POP forecasts are in general skilful compared to sample climatology.
- The BSS decreases (i.e. quality degrades) with increasing forecast lead-time. The decrease is mainly due to the reduction of resolution component, corresponding to the fact that the EPS forecasts become similar to the climatological distribution with longer lead-time
- The ROC curves suggest that the EPS POP forecasts have similar potential skill for day-4 to day-7 lead-times.



Thank You!



Summary

4-day lead time

0.5 mm/day

- BS = 0.19
- BS - bas = 0.24
- BSS = 0.21
- Rel-BSS = 0.03
- Res-BSS = 0.08
- Unc-BSS = 0.24
- ROC-area = 0.84

20mm/day

- BS = 0.095
- BS - bas = 0.096
- Skill Score = 0.006
- Rel-BBS = 0.007
- Res-BBS = 0.0075
- Unc-BBS = 0.096
- ROC-area = 0.70

5-day lead time

0.5 mm/day

- BS = 0.19
- BS - bas = 0.24
- BSS = 0.19
- Rel-BSS = 0.032
- Res-BSS = 0.076
- Unc-BSS = 0.24
- ROC-area = 0.835

20mm/day

- BS = 0.094
- BS - bas = 0.096
- Skill Score = 0.017
- Rel-BBS = 0.0043
- Res-BBS = 0.006
- Unc-BBS = 0.096
- ROC-area = 0.69

6-day lead time

0.5 mm/day

- BS = 0.19
- BS - bas = 0.24
- BSS = 0.16
- Rel-BSS = 0.031
- Res-BSS = 0.069
- Unc-BSS = 0.24
- ROC-area = 0.82

20mm/day

- BS = 0.094
- BS - bas = 0.095
- Skill Score = 0.016
- Rel-BBS = 0.003
- Res-BBS = 0.004
- Unc-BBS = 0.095
- ROC-area = 0.68

7-day lead time

0.5 mm/day

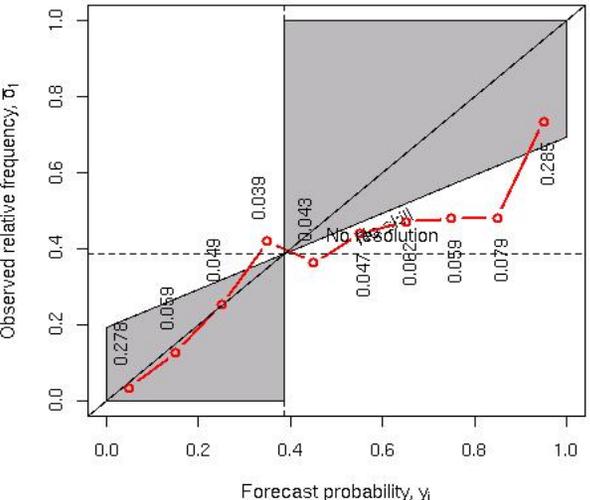
- BS = 0.20
- BS - bas = 0.24
- BSS = 0.135
- Rel-BSS = 0.032
- Res-BSS = 0.064
- Unc-BSS = 0.24
- ROC-area = 0.81

20mm/day

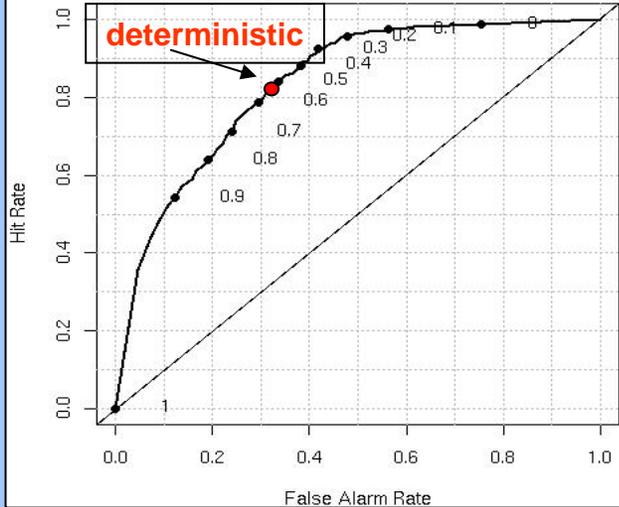
- BS = 0.094
- BS - bas = 0.095
- Skill Score = 0.016
- Rel-BBS = 0.003
- Res-BBS = 0.004
- Unc-BBS = 0.095
- ROC-area = 0.66

5-day lead time

Reliability, 0.5mm/day threshold, day-5 forecast



ROC plot, 0.5mm/day threshold, day-5 forecast

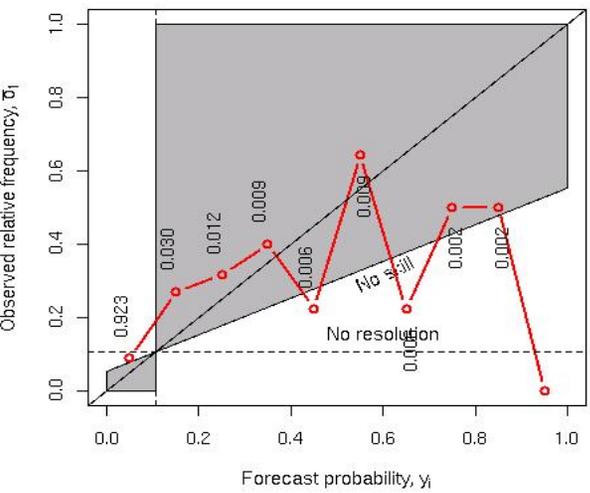


ROC-area = 0.835

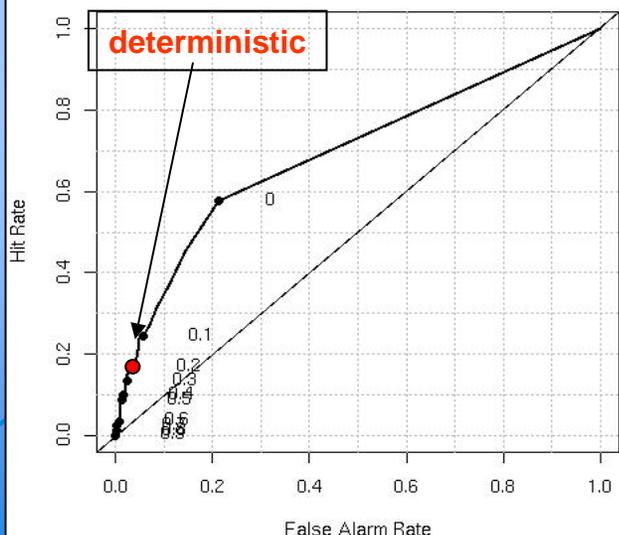
0.5 mm/day

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Reliability, 20mm/day threshold, day-5 forecast



ROC, 20mm/day threshold, day-5 forecast



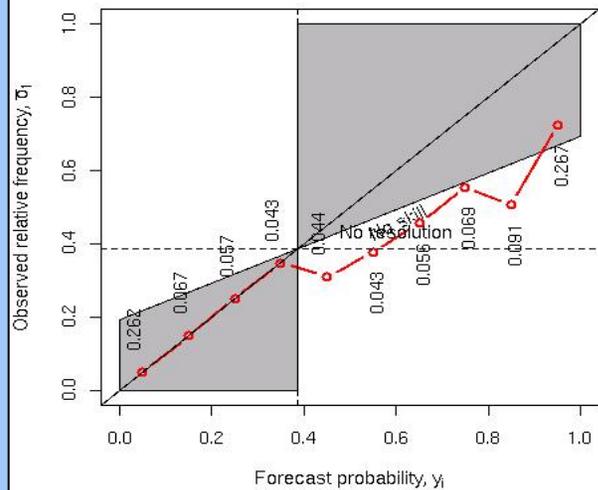
ROC-area = 0.69

20mm/day

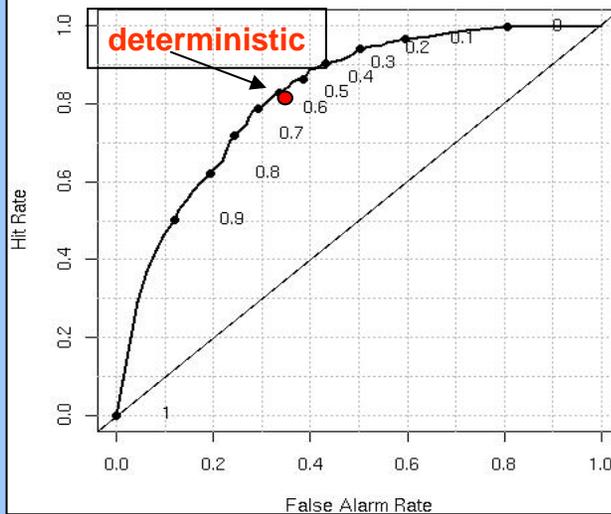
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- Rel-BBS = 0.0043
- Res-BBS = 0.006
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6-day lead time

Reliability, 0.5mm/day threshold, day-6 forecast



ROC, 0.5mm/day threshold, day-6 forecast

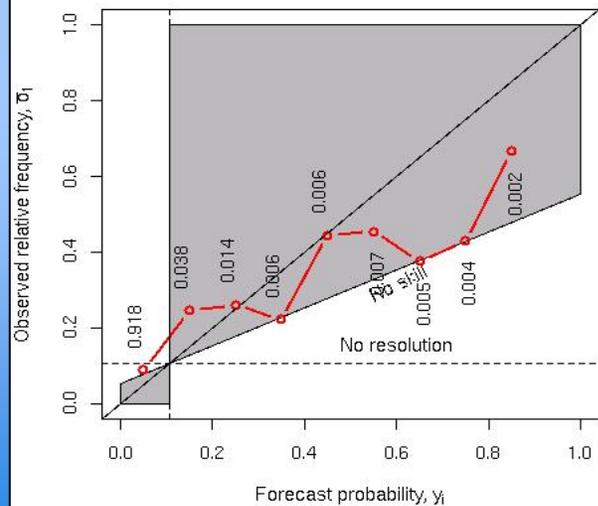


ROC-area = 0.82

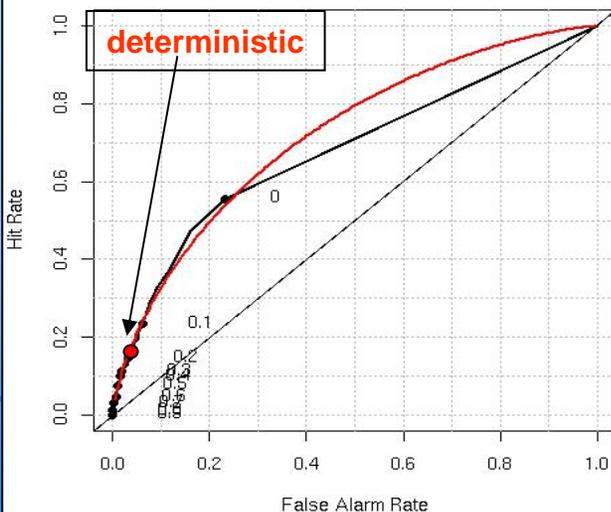
0.5 mm/day

- BS = 0.19
- BS - bas = 0.24
- BSS = 0.16
- Rel-BSS = 0.031
- Res-BSS = 0.069
- Unc-BSS = 0.24

Reliability, 20mm/day threshold, day-6 forecast



ROC, 20mm/day threshold, day-6 forecast



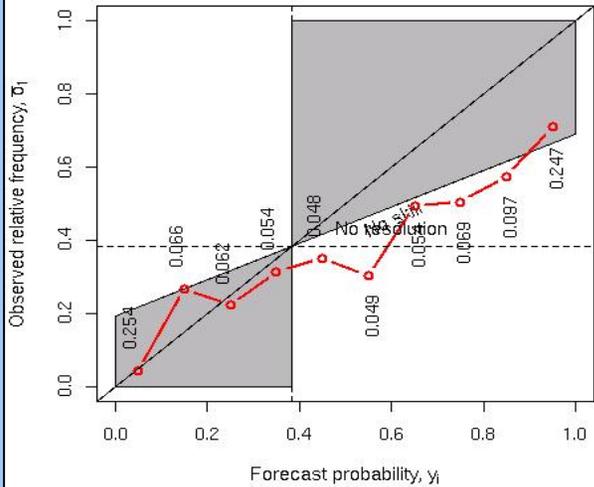
ROC-area = 0.68

20mm/day

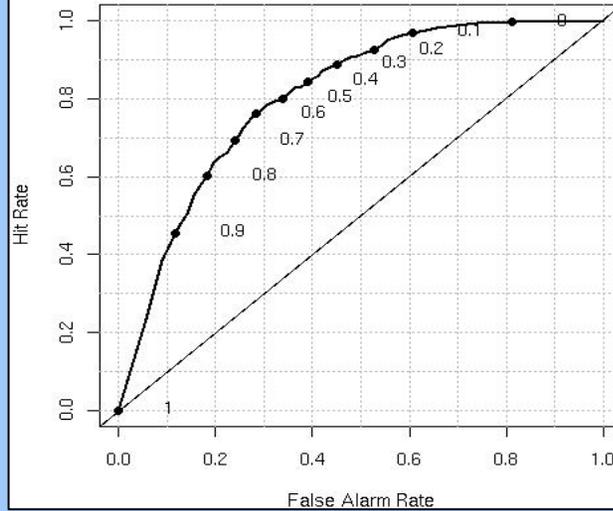
- BS = 0.094
- BS - bas = 0.095
- Skill Score = 0.016
- Rel-BSS = 0.003
- Res-BSS = 0.004
- Unc-BSS = 0.095

7-day lead time

Reliability, 0.5mm/day threshold, day-7 forecast



ROC, 0.5mm/day threshold, day-7 forecast

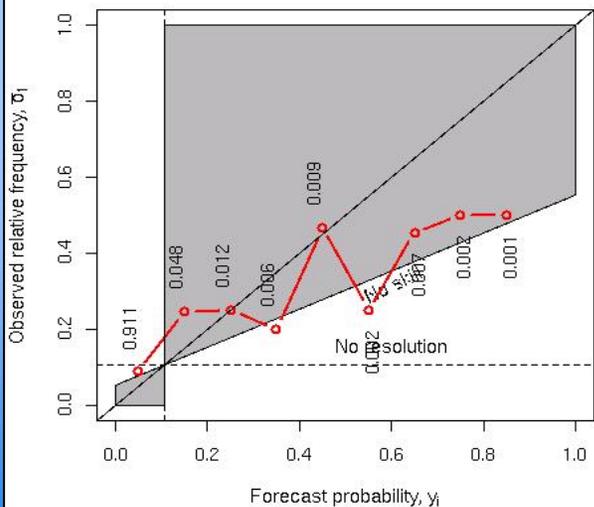


ROC-area = 0.81

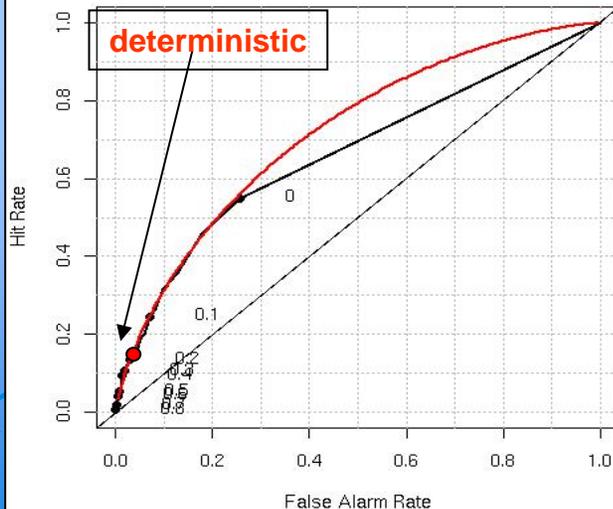
0.5 mm/day

- BS = 0.20
- BS - bas = 0.24
- BSS = 0.135
- Rel-BSS = 0.032
- Res-BSS = 0.064
- Unc-BSS = 0.24
- ROC-area = 0.81

Reliability, 20mm/day threshold, day-7 forecast



ROC, 20mm/day threshold, day-7 forecast



ROC-area = 0.66

20mm/day

- BS = 0.094
- BS - bas = 0.095
- Skill Score = 0.016
- Rel-BBS = 0.003
- Res-BBS = 0.004
- Unc-BBS = 0.095
- ROC-area = 0.66