Using Combined Prediction Systems to Forecast Rainfall

Quantitative Precipitation Forecasting and Hydrology
4-8 June 2006
Boulder, Colorado, USA

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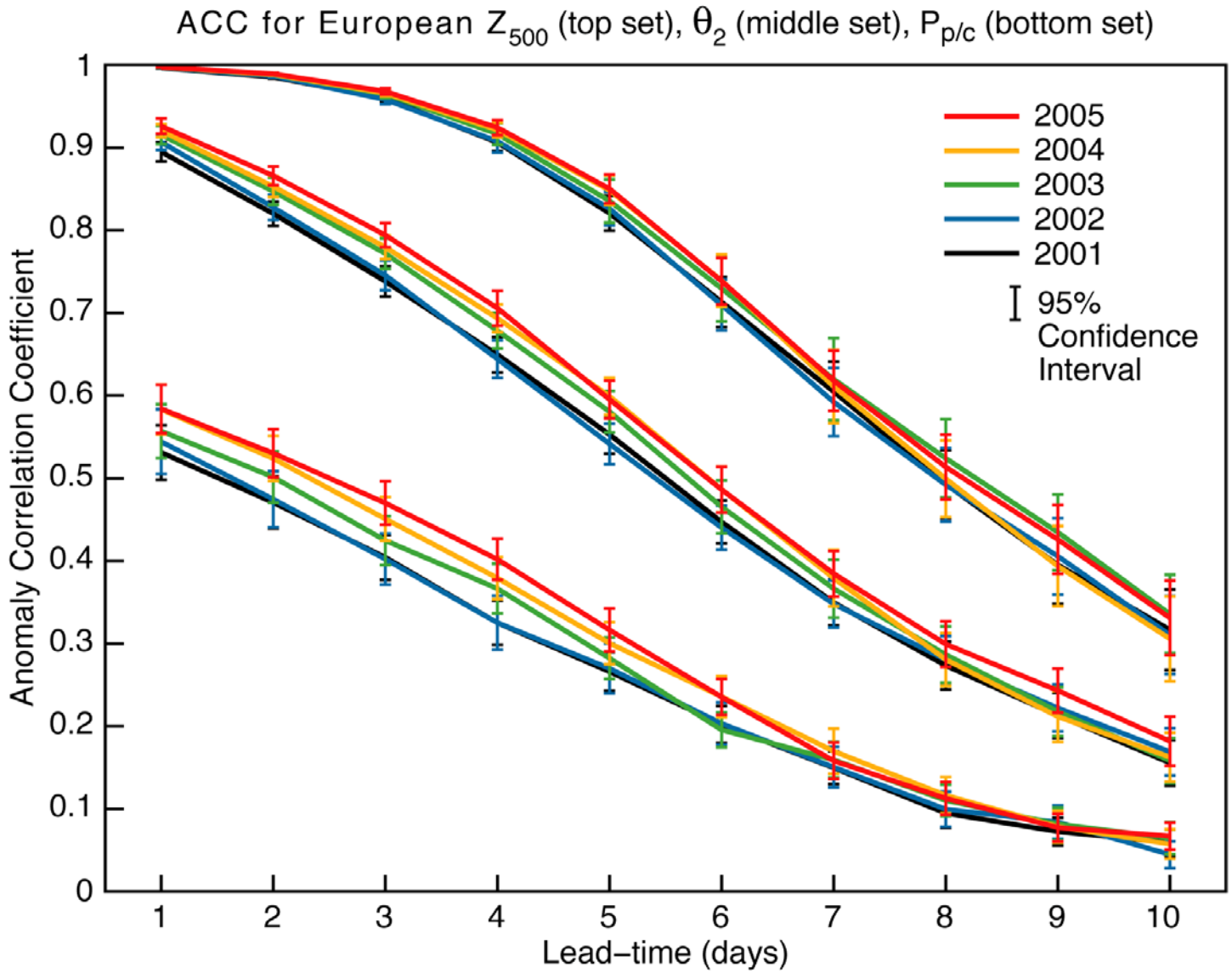
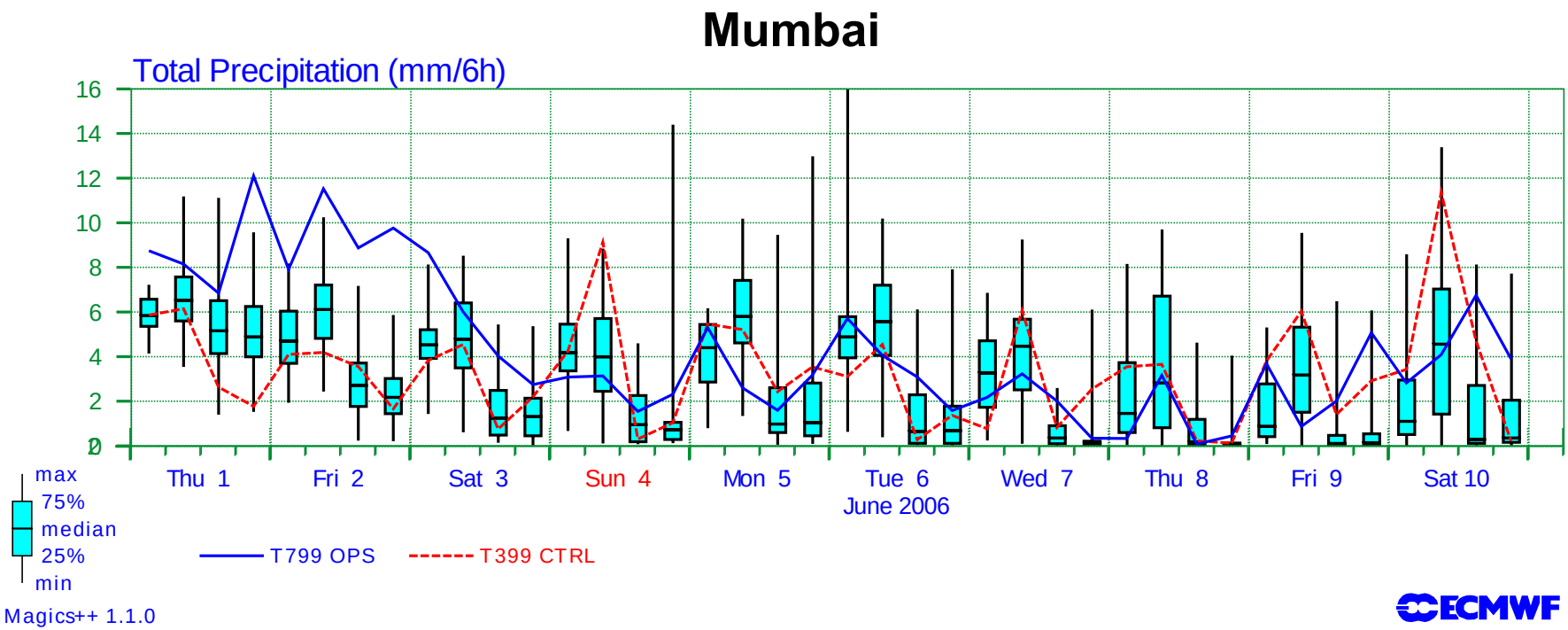
6 June 2006

Precipitation – Improvements Possible



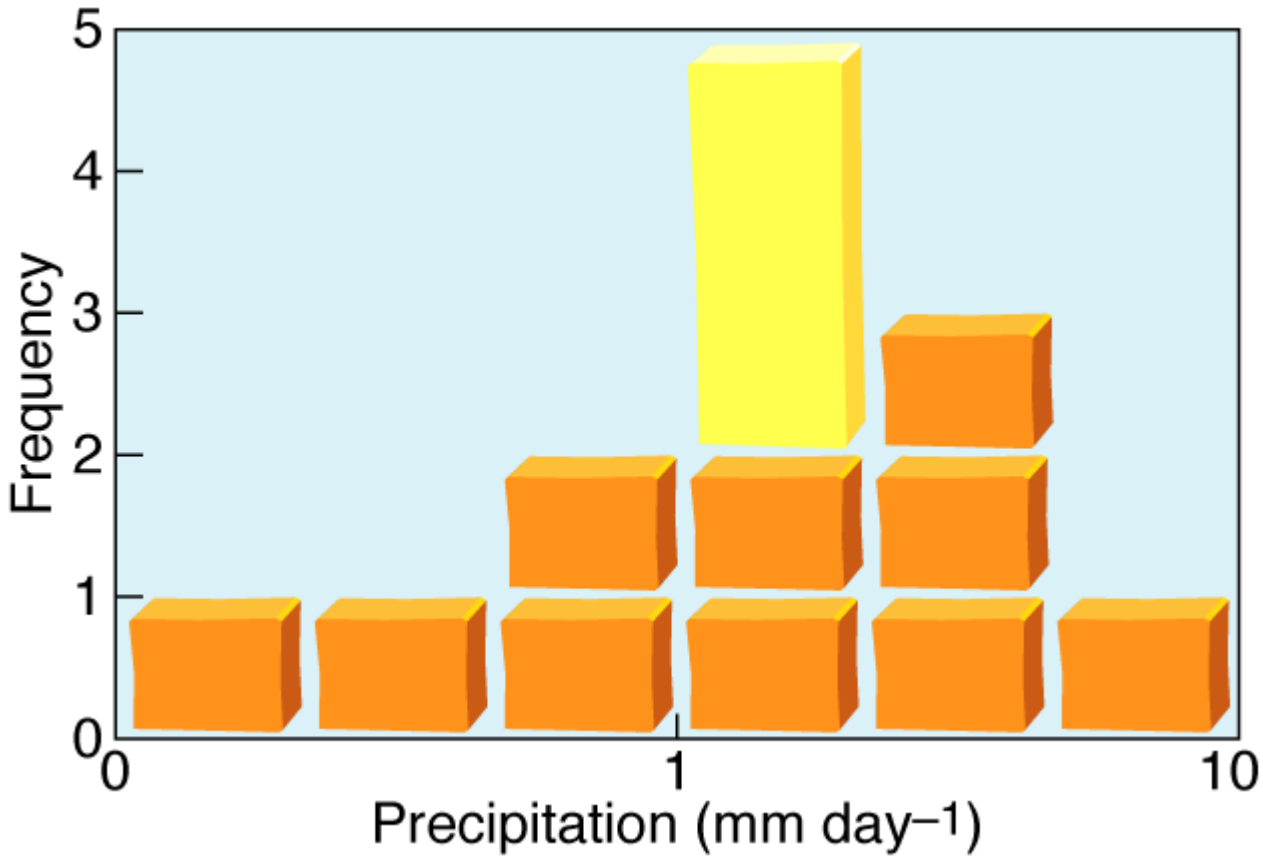
CPS - Motivation



Highly useful product but…

- **What should I believe?**
  - **At D+2**
  - **At D+5**

CPS – Concept



Combining a 10-member ensemble of equally likely members (orange squares) with a single more accurate forecast (yellow rectangle)

CPS - Theory

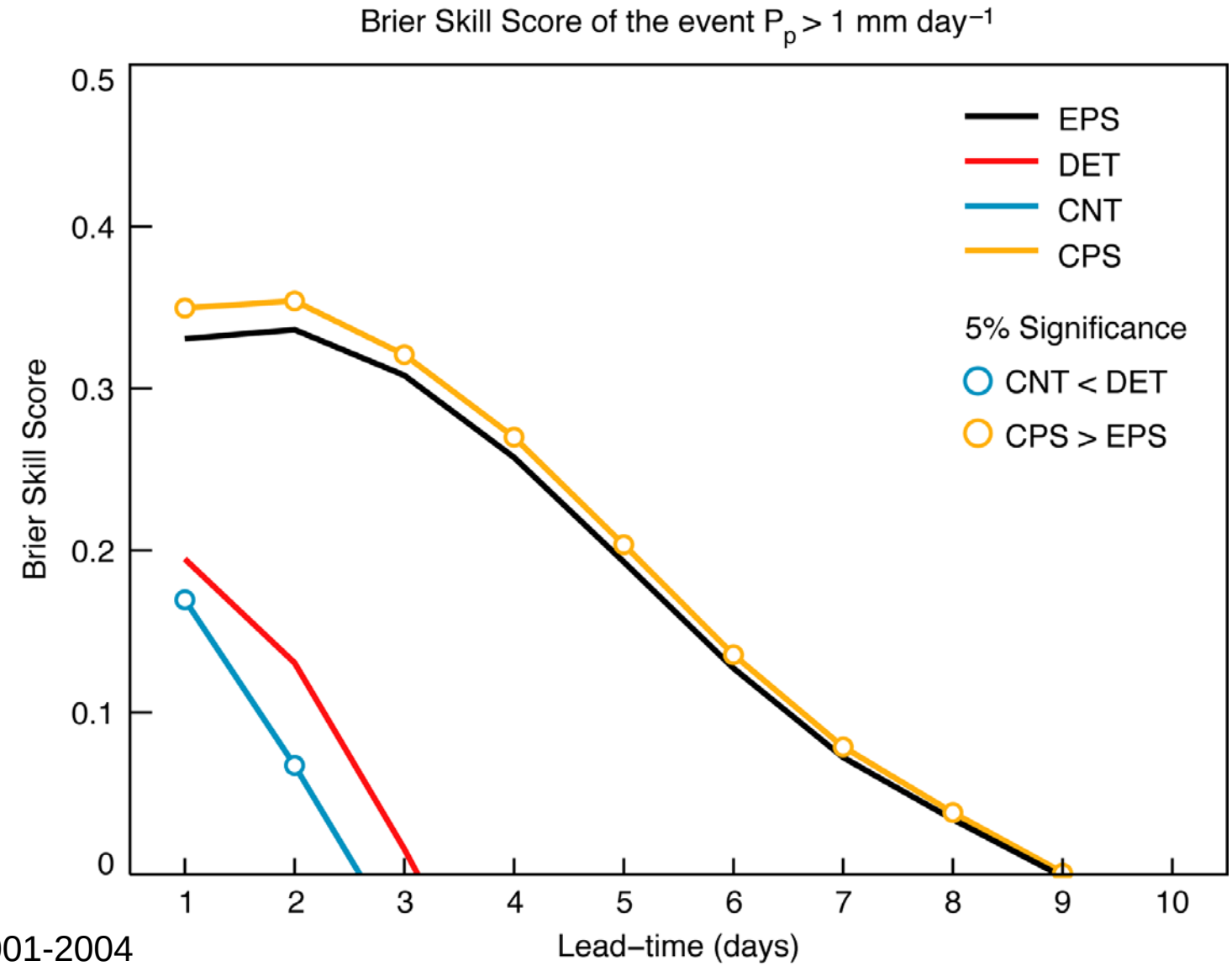
$$B = 1 - \frac{1}{n}\sum_{j=1}^{n}\left\{\frac{1}{m_j}\sum_{i\in M_j}\frac{\left(p_{ij} - v_{ij}\right)^2}{b_{ij}^{\text{clim}}}\right\}$$

B = Brier Skill Score averaged over all stations
n = number of dates
M_j = set of stations reporting on date j
m_j = number of stations in M_j
p_{ij} = CPS probability
v_{ij} = verification (0 or 1)
b^{clim} = b^{clim}(location,month) (from climatology)

$$p_{ij} = \sum_{k=1}^{K} w_k p_{ijk}$$

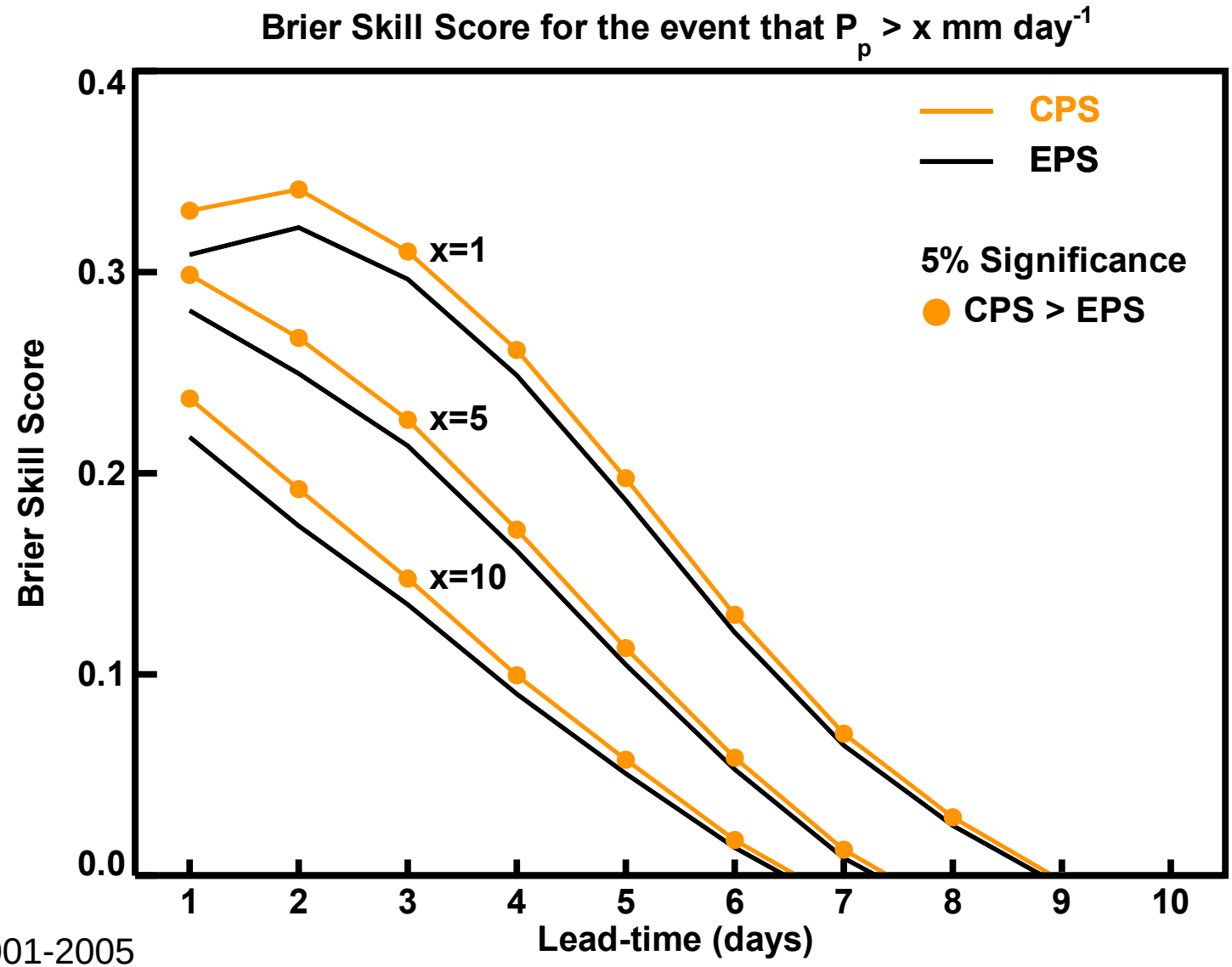
K = number of forecast systems ($K \leq 3$ here)
w_k is the weight applied to system k (independent of location)
Find weights that maximize Brier Skill Score
Apply in cross-validated mode (date for year y applied in year y+1)

CPS – Results



2001-2004

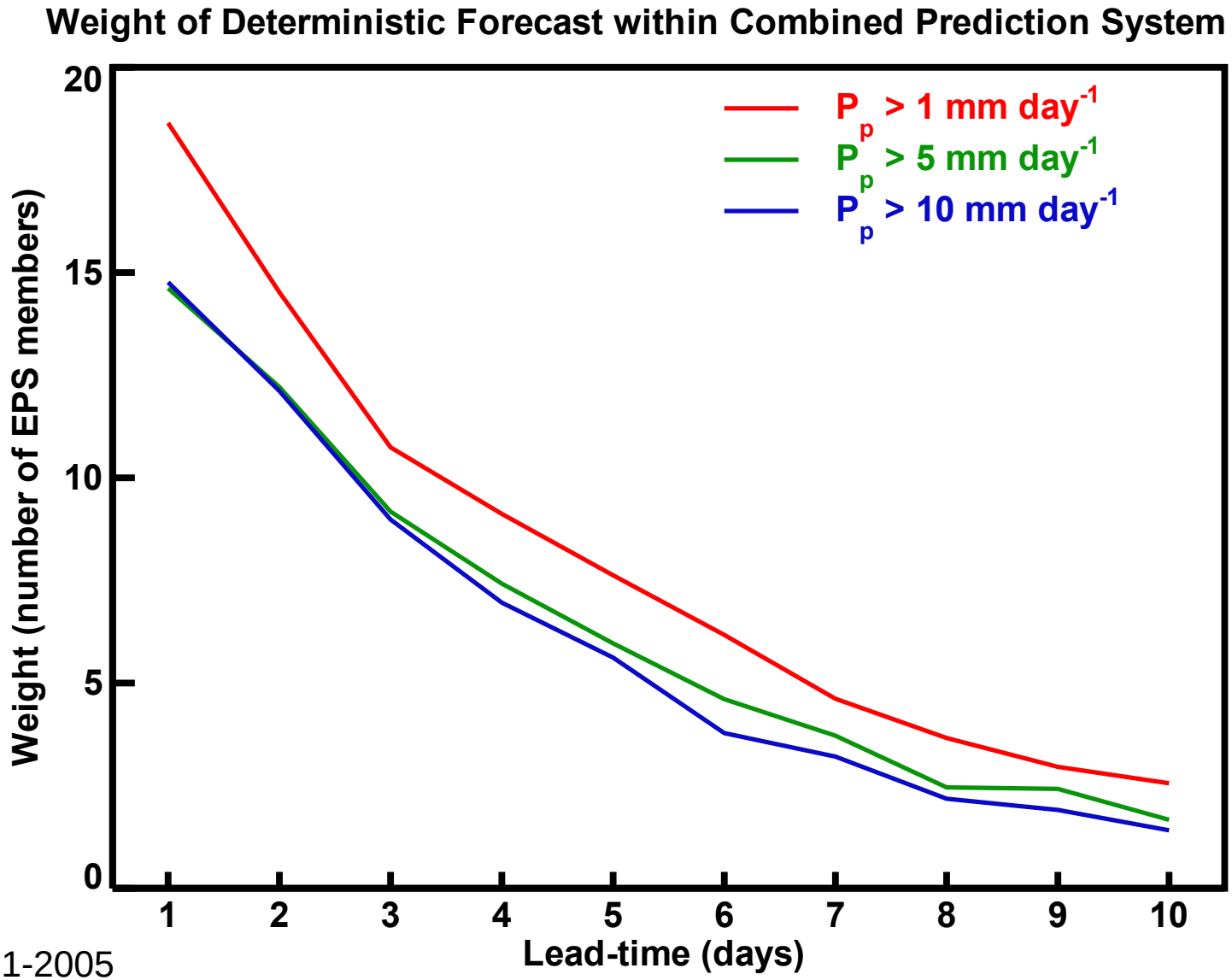
CPS – Results



2001-2005

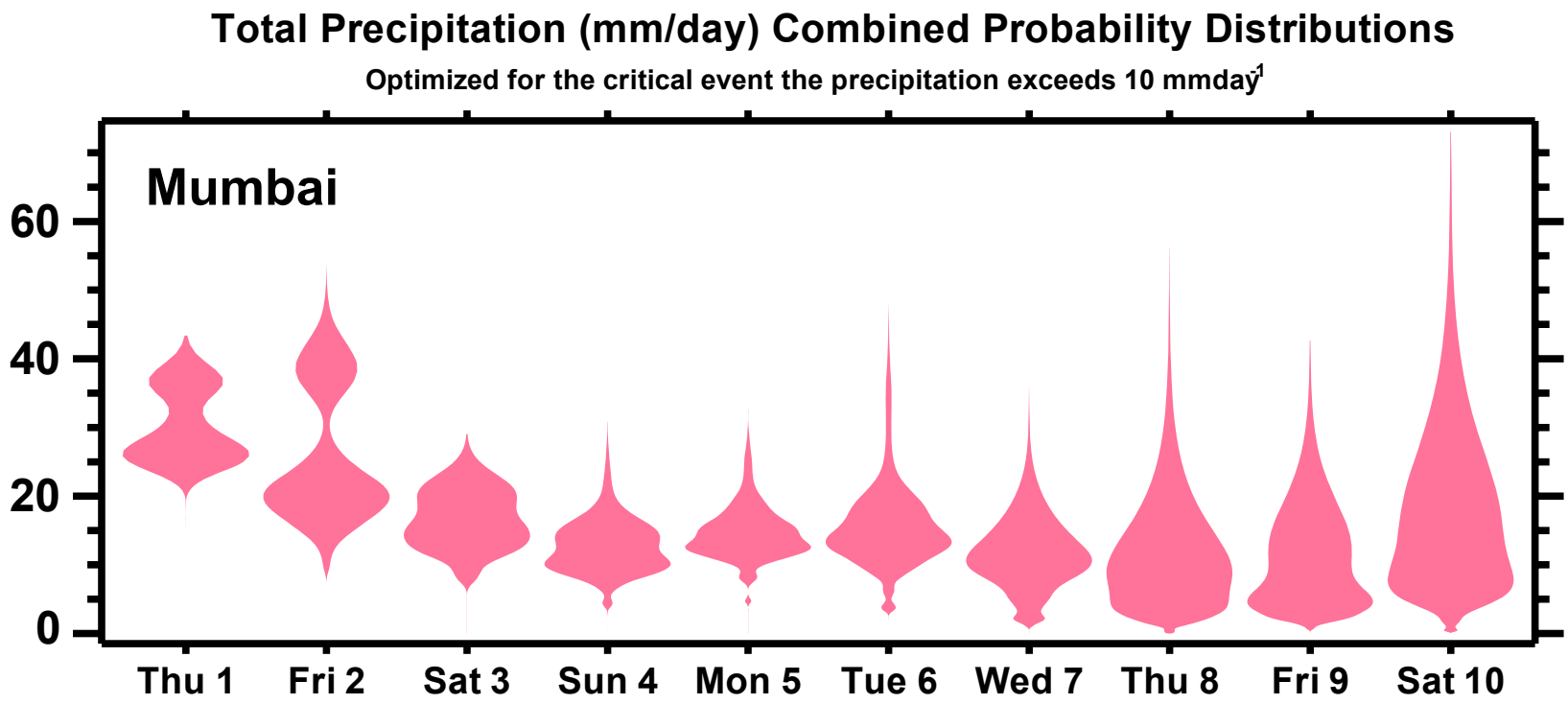
ECMWF

CPS – Weights



2001-2005

CPS – Meteogram



Prob > 10 mm/day	100	98	91	70	90	81	45	27	27	43
Brier Skill Score	23	19	14	9	5	1	0	0	0	0

CPS - Conclusions

- **Alternative meteograms with CPS pdfs only**
  - **Could seamlessly combine limited area, global high resolution, global ensemble, lagged, monthly, …**
  - **Thresholds to use? Scores to optimise?**
  - **Understandability for users?**
- **Use of system weights as a diagnostic tool**
  - **Aid to forecast system configuration**
  - **Resolution vs Number of ensemble members**

Deterministic Comparison