Different types of verification results required by different users
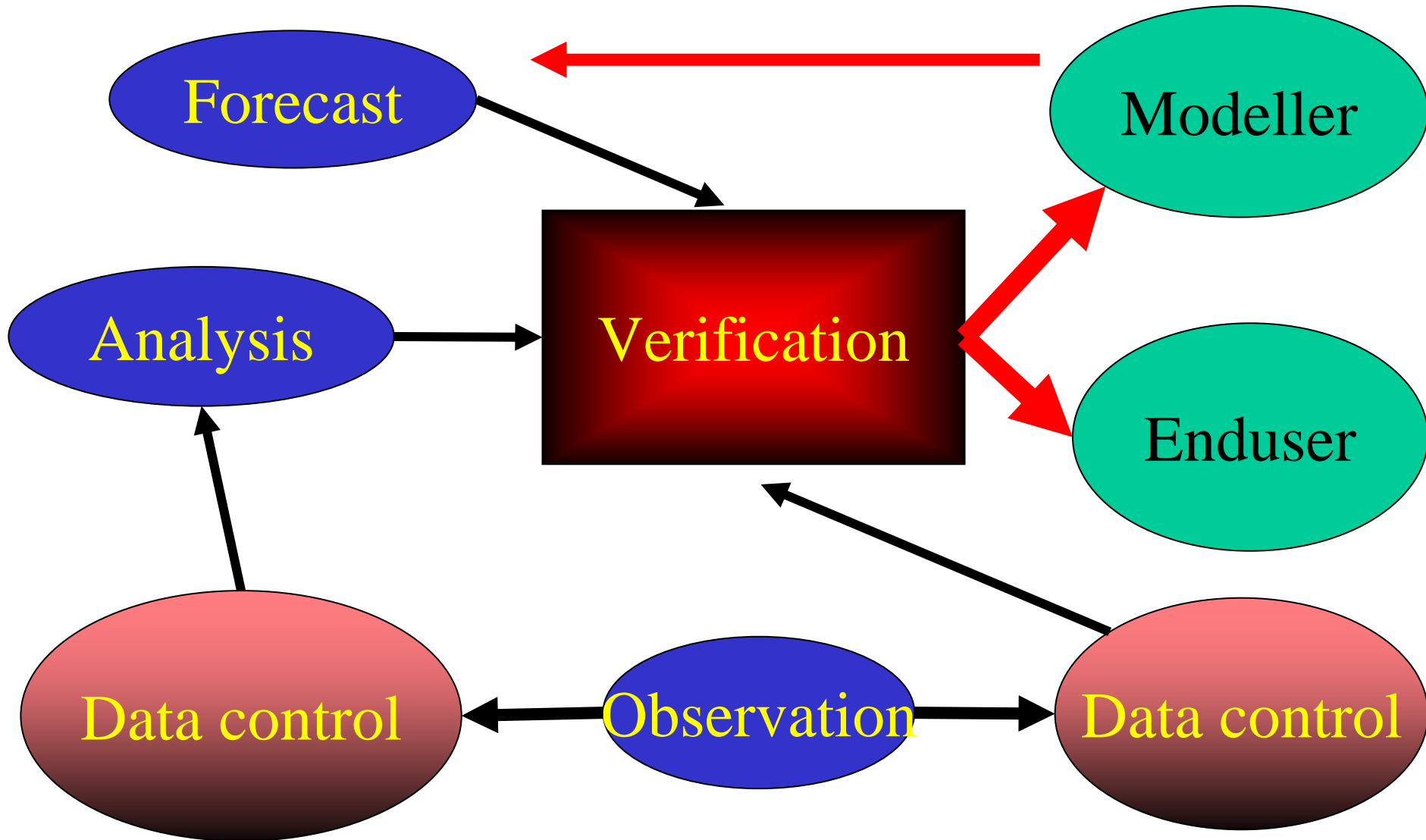
Ulrich Damrath,

Barbara Brown,

Pertti Nurmi

Deutscher Wetterdienst

NCAR

FINNISH METEOROLOGICAL INSTITUTE

Outline

- Interests of different users

- Examples of verification results for users with special interests

- Requirements for a verification system

Course of verification on principal

Types of users
- Definition by Brier & Allen (1951), Wilson (2001)
(a bit extended)

- Administrators

- Modelers

- Meteorologically educated users

- Meteorologically not educated users

Interest of administrators

- Did and does the development of accuracy of forecasts justify investigations?

- Description of progress in terms of highly aggregated information
(smoothed time series, information like UK-NWP indices, ...)

ECMWF medium range forecasts and products

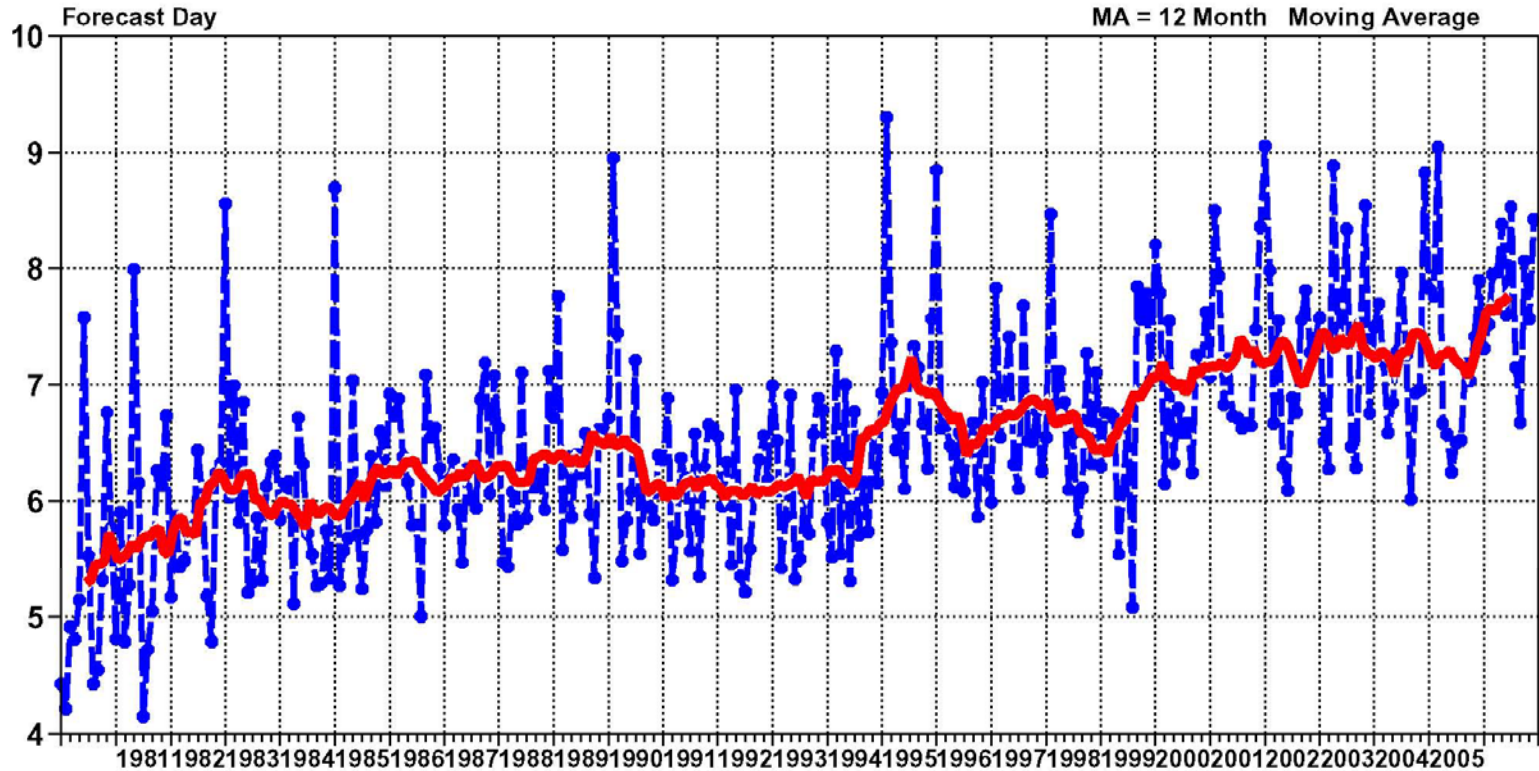
ECMWF FORECAST VERIFICATION 12UTC
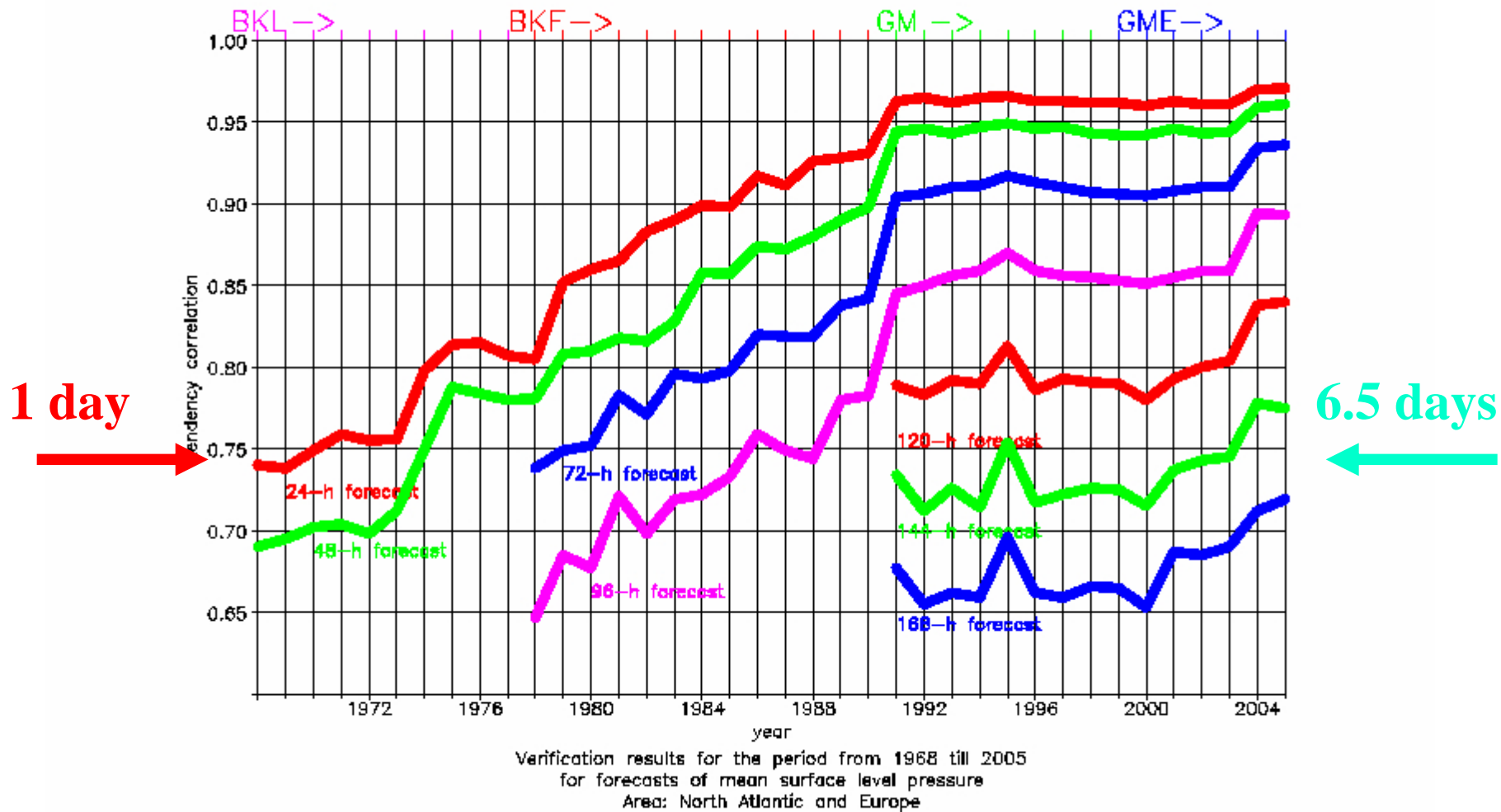500hPa GEOPOTENTIAL
ANOMALY CORRELATION FORECAST
EUROPE LAT 35.000 TO 75.000 LON -12.500 TO 42.500

SCORE REACHES 60.00
SCORE REACHES 60.00 MA

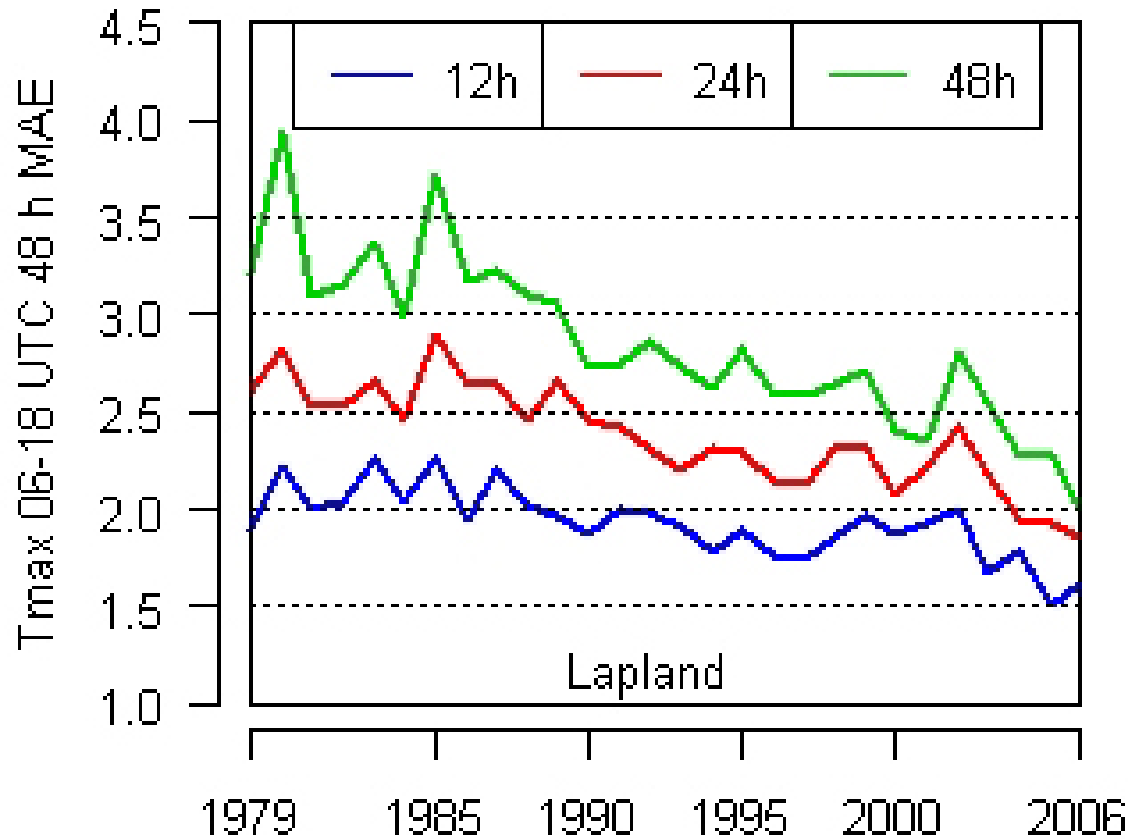Forecast Day
MA = 12 Month Moving Average

Evolution of forecast quality at DWD for surface level pressure

Verification results for the period from 1968 till 2005
for forecasts of mean surface level pressure
Area: North Atlantic and Europe

# Evolution of <u>End Product</u> forecast quality of Tmax (case Northern Finland)


MAE

Interests of modelers

- Monitoring of operational forecasts
- Find out reasons for systematic and other forecast errors
- Development of new model versions
  - ▶ Identify needed model improvements
  - ▶ Show verification improvements compared to operational or other forecasts?
  - ▶ Are these improvements reliable?
- ▶ Predictability of events depending on the type of event and forecast time

Example for comparison of two model versions

LM2MO: 01.10.2006 00 UTC – 18.12.2006 00 UTC (exp. run routine: nearest gridpoint
lm2mo: 01.10.2006 00 UTC – 18.12.2006 00 UTC (exp. run LME_p LON: –3. till 20. de
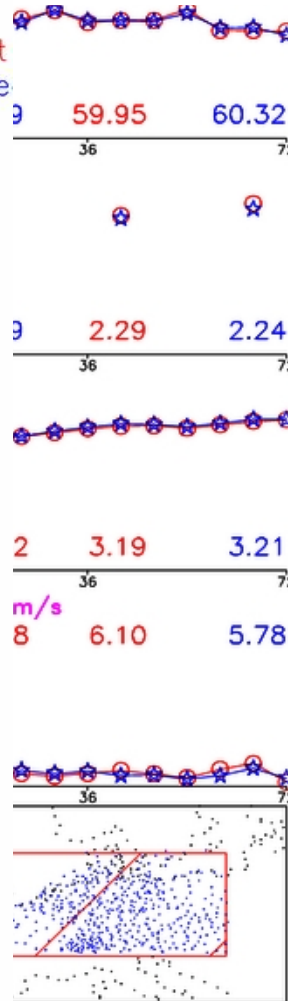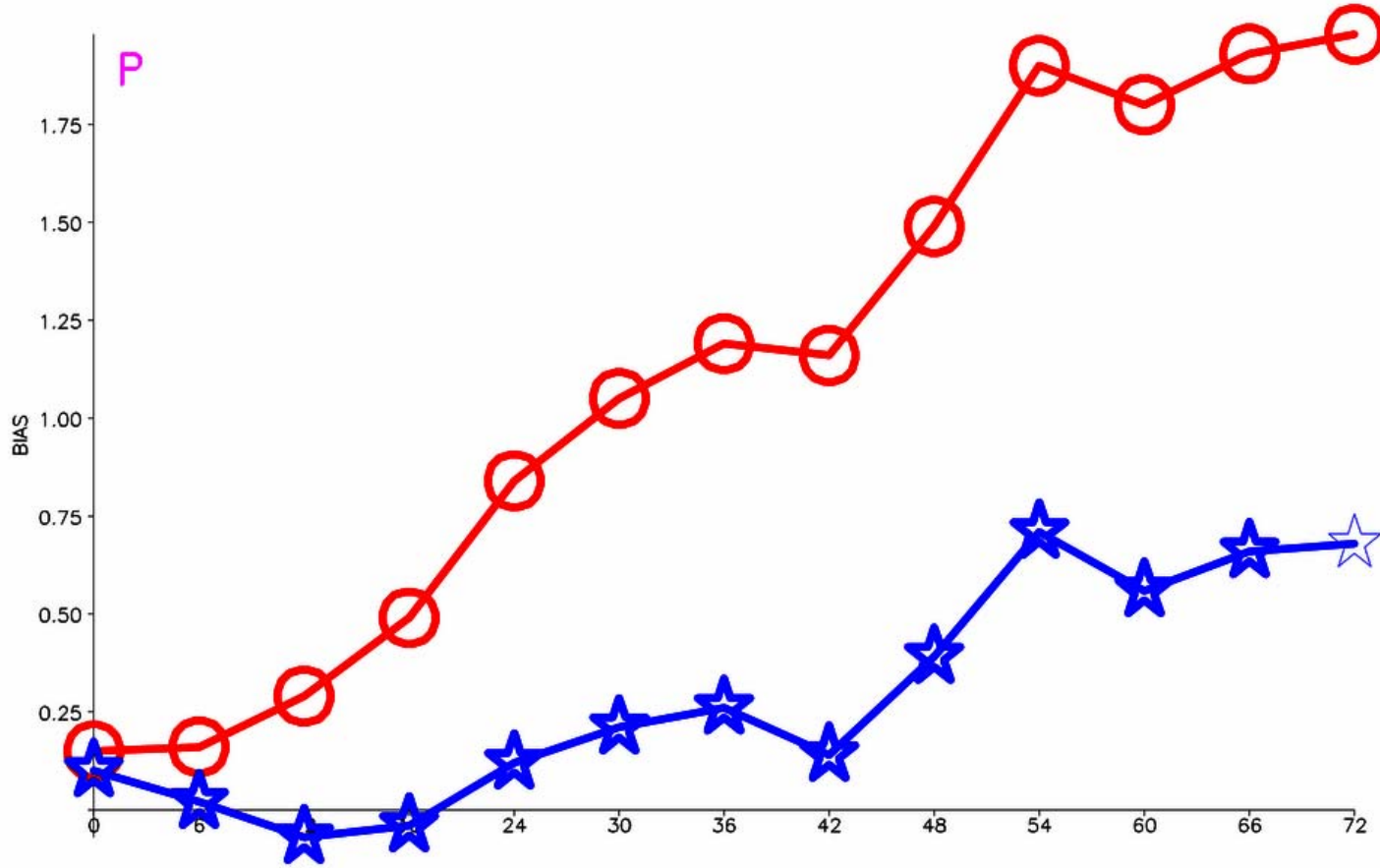
Results of verification of forecasts for local weather elements at surface weather stations
frequency bias for cloud covers (–: 0–2/8, – –: 7–8/8) and precipitation T–1 till T, mean error for other elements
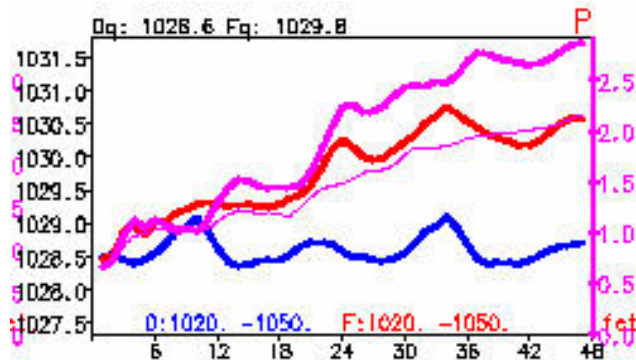all stations

Example for conditional verification
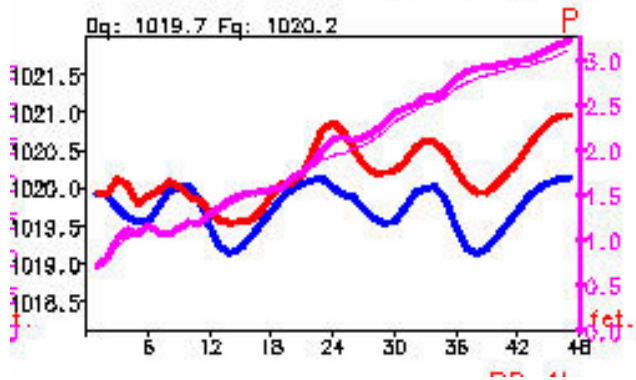
Forecasted and **observed**
values of surface level pressure over
the region of Germany during
DJF 2005/2006
(RMSE and STDV)
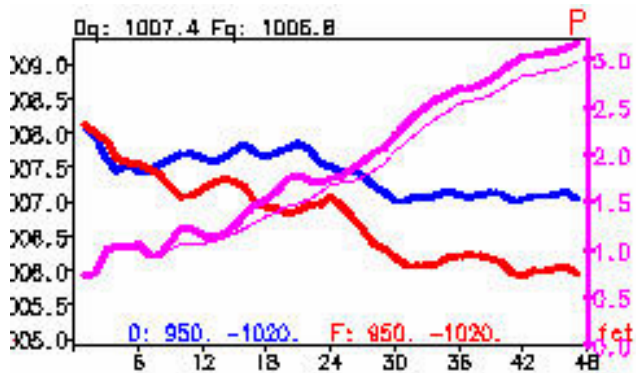
Forecasted and **observed**
values of surface level pressure over
the region of Germany during
DJF 2005/2006
observed and forecasted values **lower** than 1020 hPa
(RMSE and STDV)

Forecasted and **observed**
values of surface level pressure over
the region of Germany during
DJF 2005/2006
observed and forecasted values **higher** than 1020 hPa
(RMSE and STDV)

Example for comparison of two model versions

RMSE
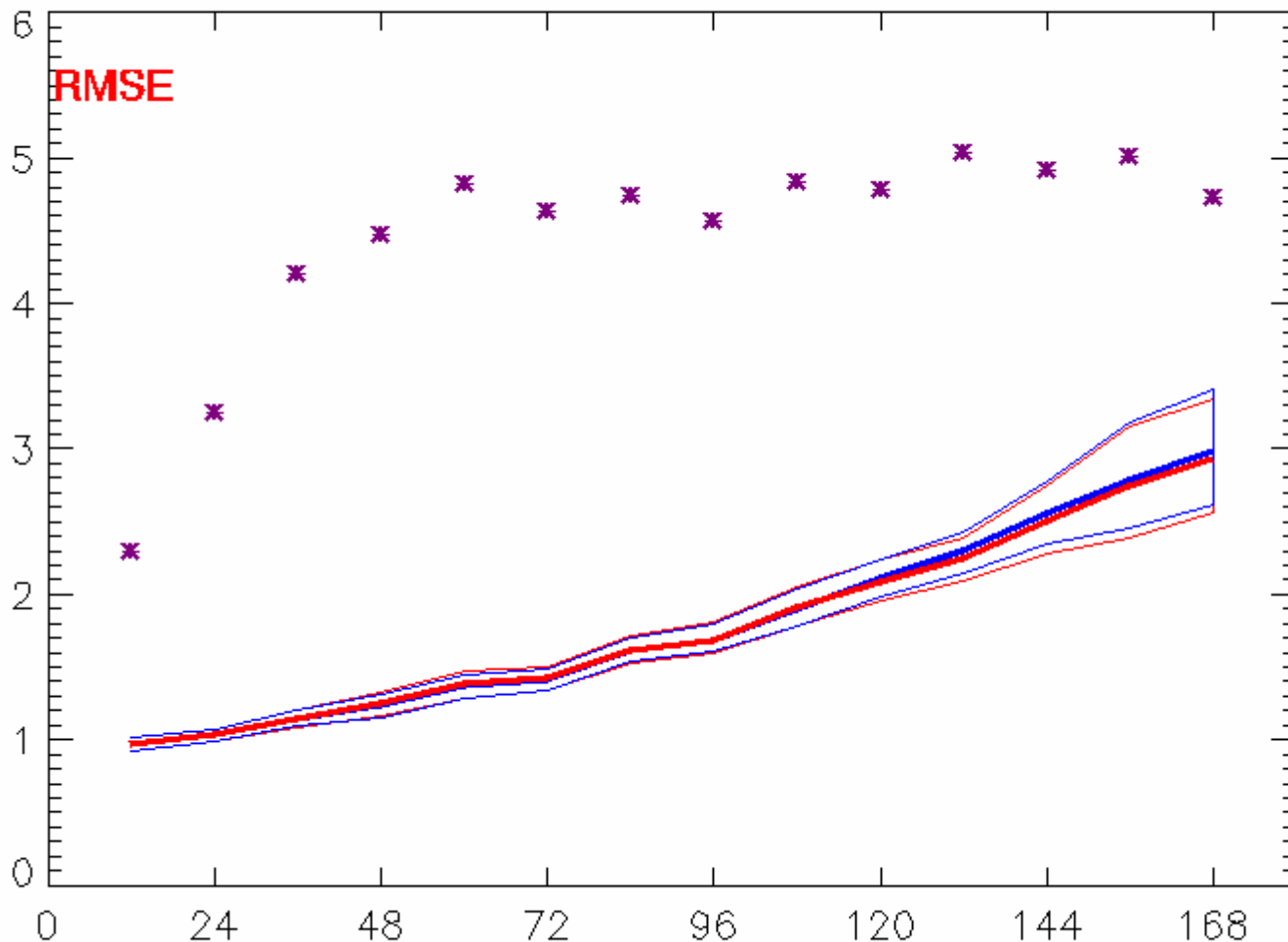
Verification of forecasts from 12.11.2006 12UTC - 13.12.2006 12UTC GME, GME_p, Persistence
Parameter: PRESSURE, region: IN_AU_NZ , Frames: Bootstrap confidence interval 5 − 95 %

Interests of meteorologically educated users (e.g., forecaster)

- Guidance for interpreting the model results

- Understanding systematic errors for forecast of different elements allows the forecaster to more correctly specify the final forecasts if model forecasts are used as a guidance

Time series of bias for Tmin over Germany
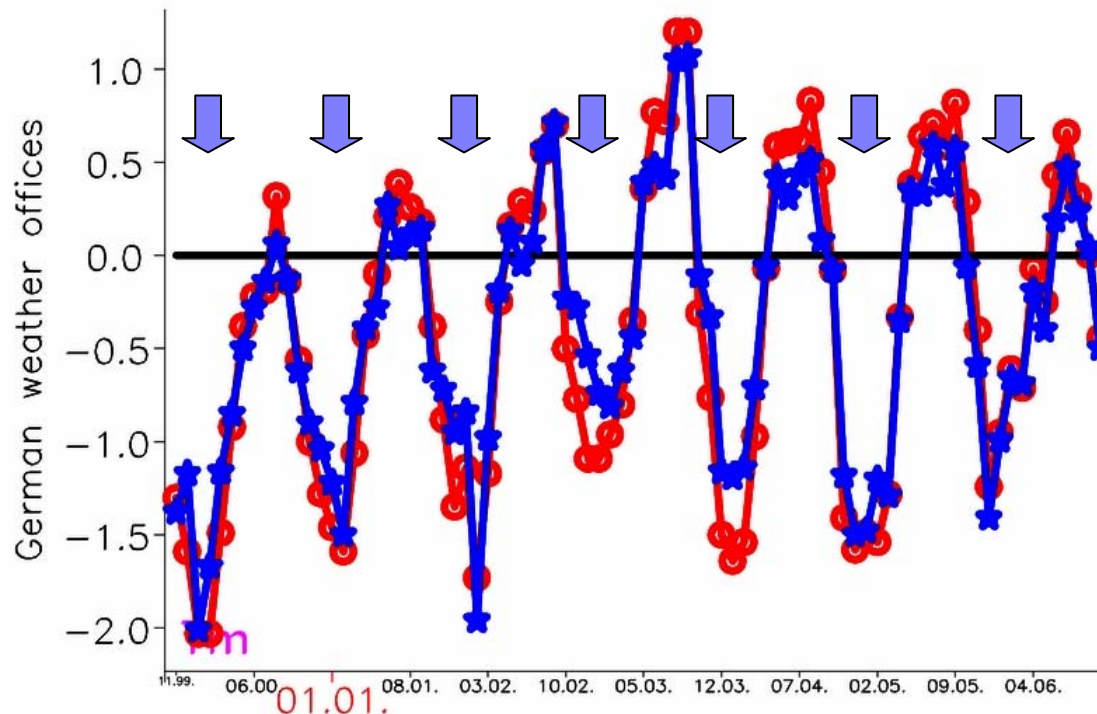
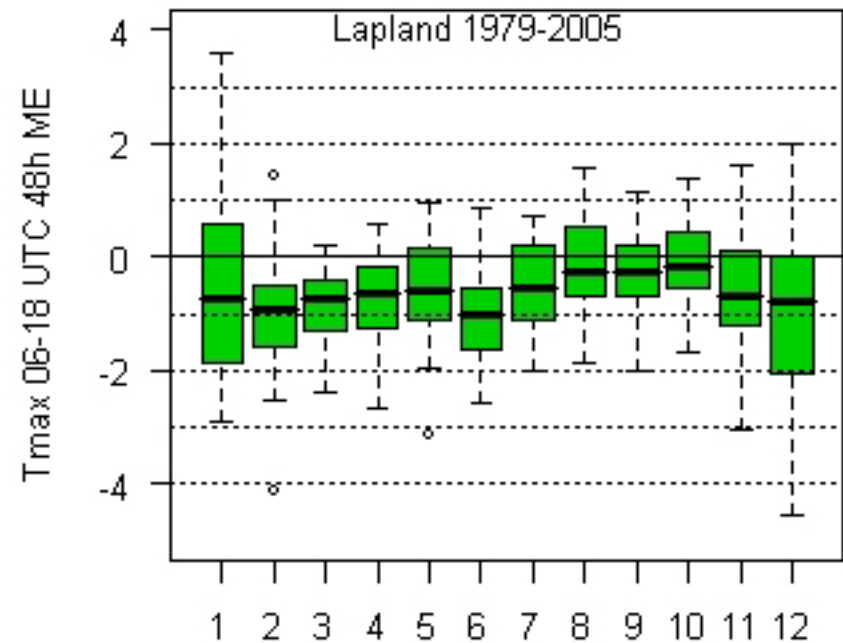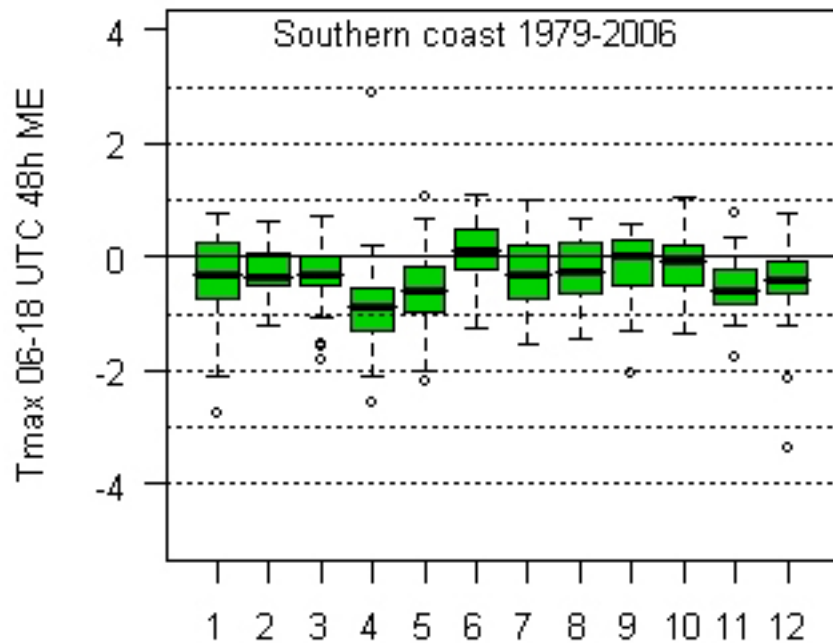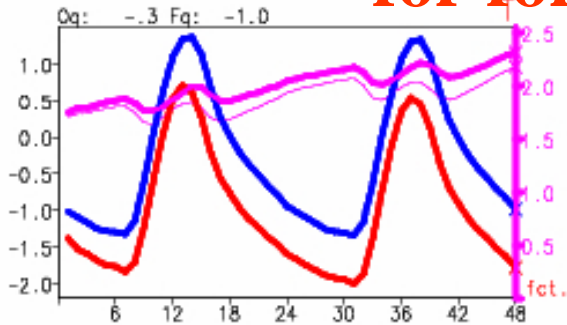Results of verification of forecasts for local weather elements at surface stations frequency bias for cloud covers (−: 0−2/8, − −: 7−8/8), gusts and precipitation T−6 till T, mean error for other elements

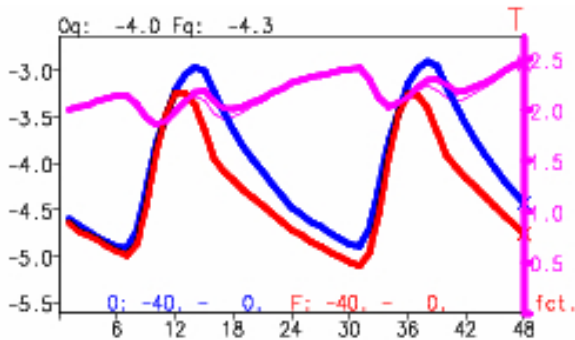# Monthly distribution of Bias for Tmax over Finland
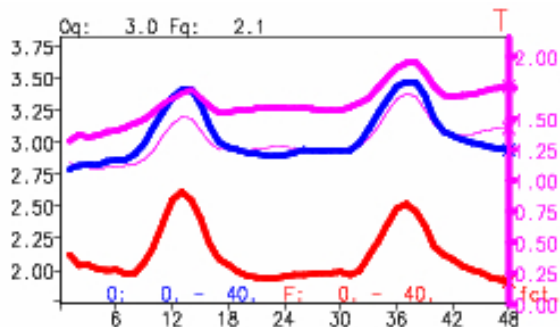
Meteorologically educated users

Example for conditional verification to be used for forecasters (and modellers)

Forecasted and **observed** values of temperature 2m over the region of Germany during DJF 2005/2006 (RMSE and STDV)

Forecasted and **observed** values of temperature 2m over the region of Germany during DJF 2005/2006 observed and forecasted values **lower** than 0° C (RMSE and STDV)
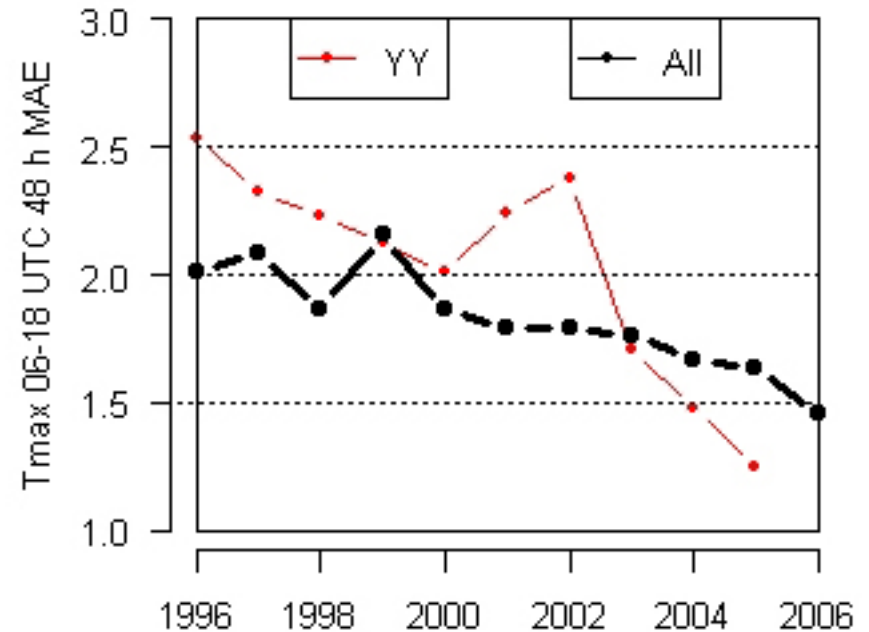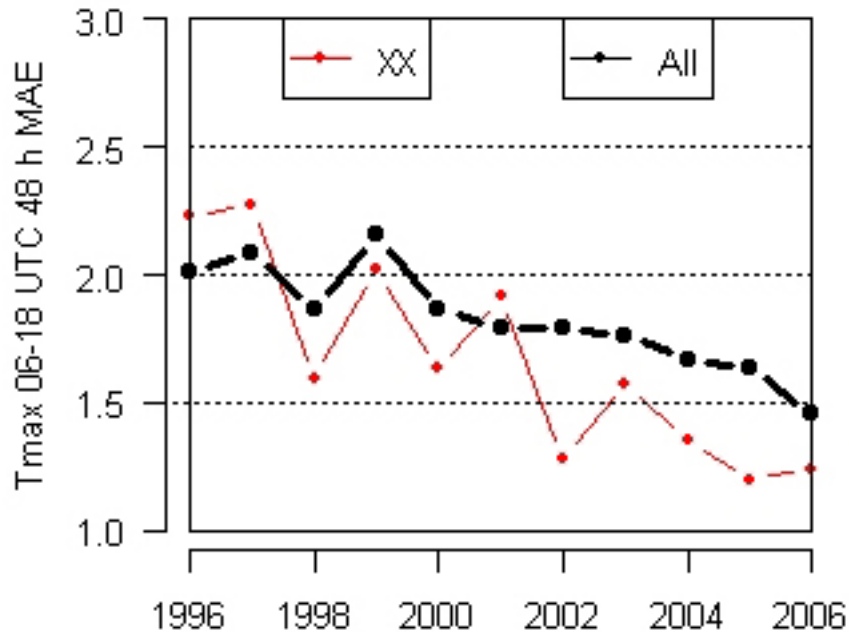

Forecasted and **observed** values of temperature 2m over the region of Germany during DJF 2005/2006 observed and forecasted values **higher** than than 0° C (RMSE and STDV)

Comparison of individual forecasters - Feedback (case Finland)
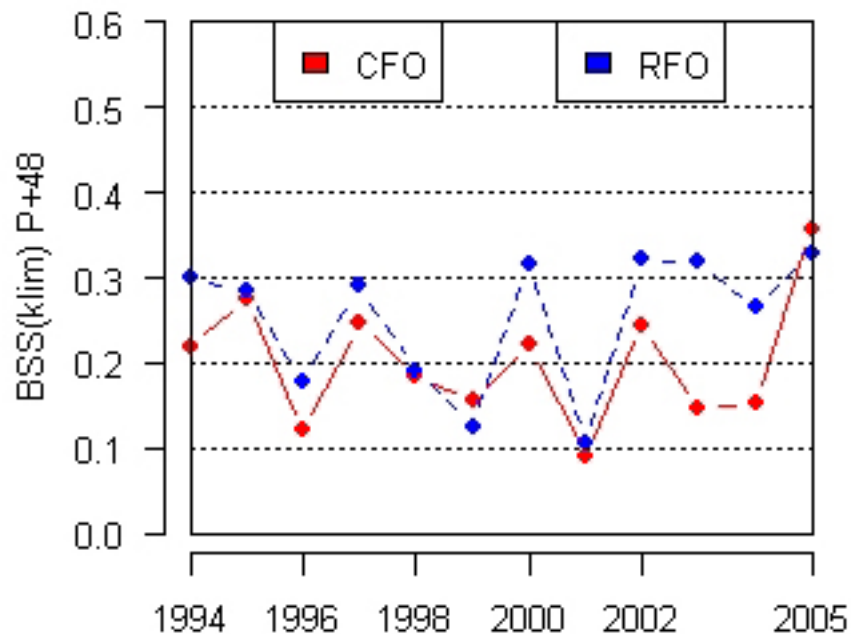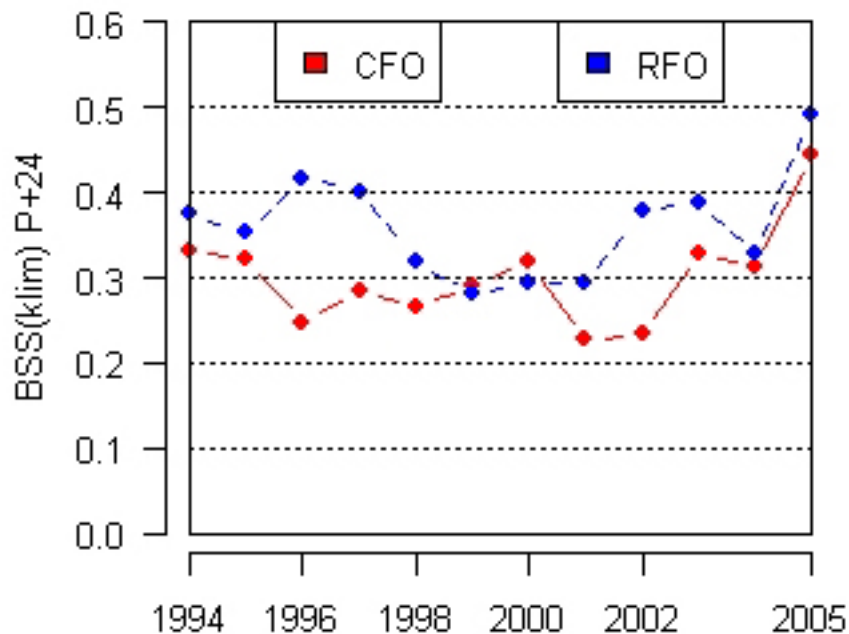
Meteorologically educated users

**Maximum Temperature
Mean Absolute Error; MAE**

Comparison of two forecast producers: centralized and local (case Finland)

Meteorologically educated users

Probability of Precipitation
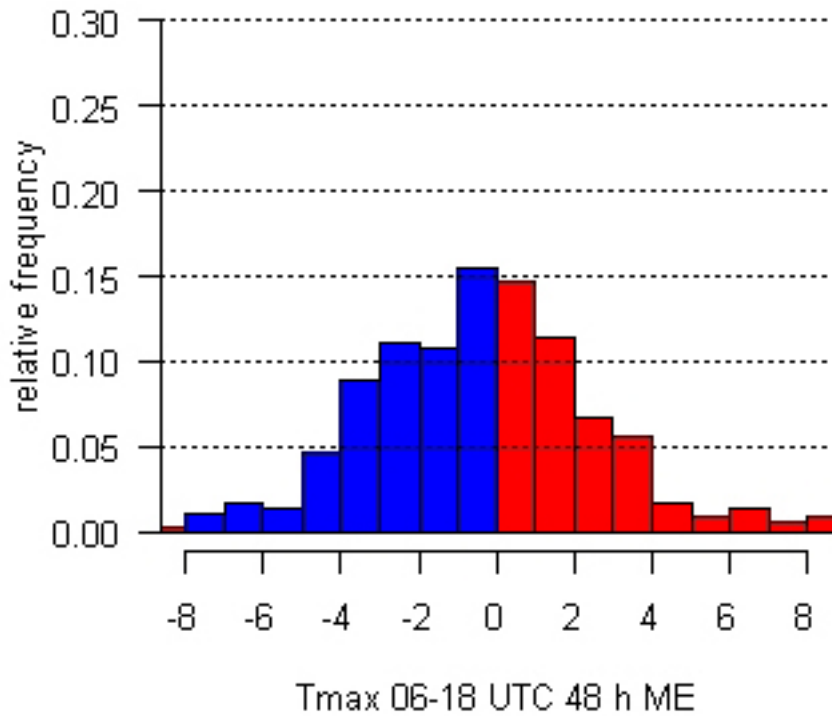## Brier Skill Score; BSS

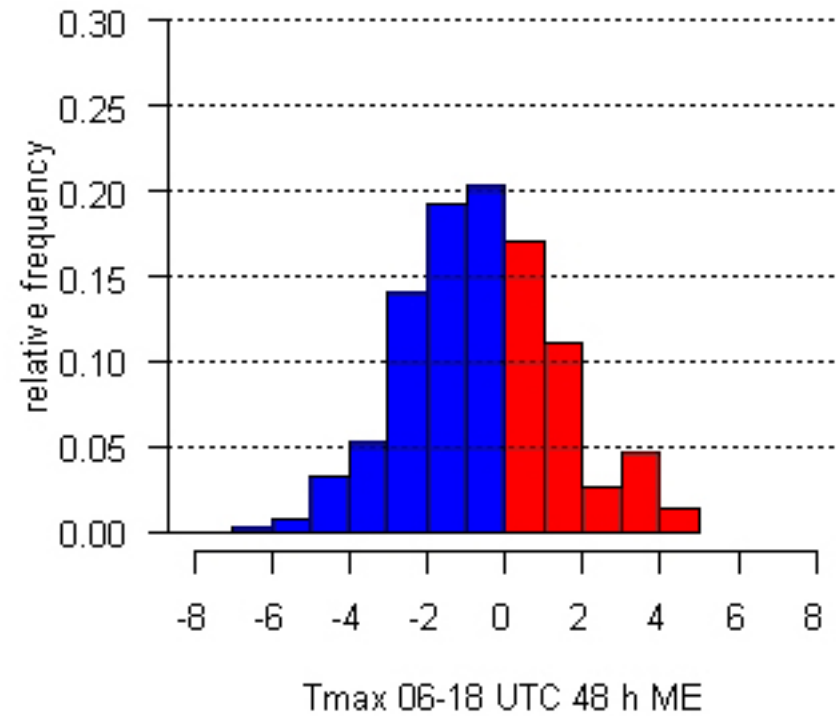# Interests of non-meteorologically educated users

- How much should I trust the forecast?
- If they say the temperature will be 25 degrees, does that mean 20-30? 23-27?
- Input to decision-making systems

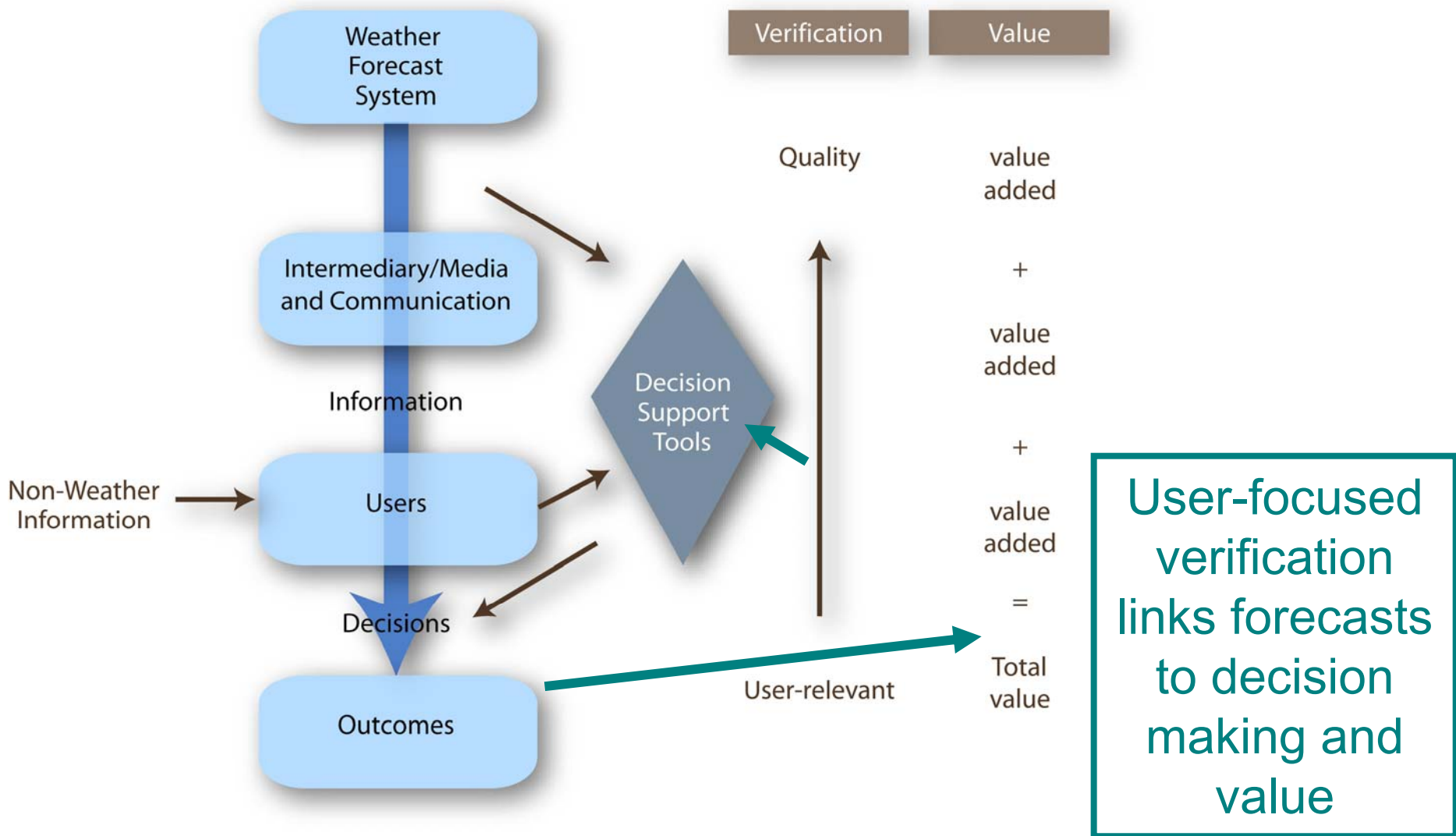# Interests of meteorologically not educated users

Helsinki 1981

Helsinki 2006

Tmax 06-18 UTC 48 h ME

Interests of meteorologically not educated users
A model (from North American SERA workshop)

Requirements to a verification system

Calculate such results that any user can learn things that she/he needs!