



# State of VERSUS at DWD, long term trends, systematic model errors ...

Ulrich Damrath





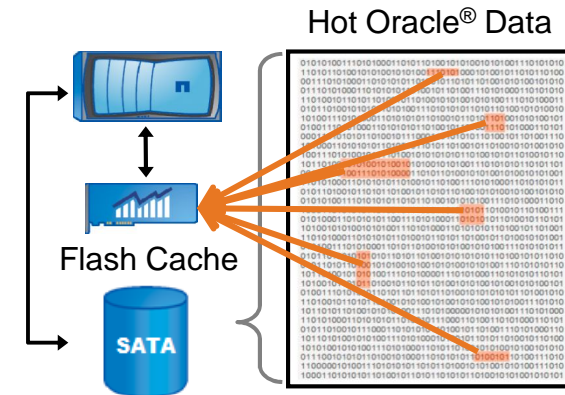
- Current state of VERSUS
  - ➔ Modified server status
    - ➔ NetApp FAS 3070 replaced by NetApp 3270
    - ➔ old: 2 x 4 GBit/s
    - ➔ new: 4 x 3 GBit/s
    - ➔ **Important: flash cash 1Tb** (100 k€)
    - ➔ Speed up: ~ 100%
      - ➔ Conditional verification CDE for one month: 20 seconds
      - ➔ Conditional verification CEU for one month: 1200 - 5500 seconds (depends on flash cash state)
    - ➔ mySql caches play now a minor role!
  - ➔ Some problems
  - ➔ Some important results
  - ➔ Intranet web page
- Long term trends
  - ➔ COSI
  - ➔ Precipitation
    - ➔ Trend using SYNOP reports
    - ➔ Trend using high density precipitation measurement network
- Fuzzy-Verification of precipitation forecasts
- Verification of vertical structures
- FABEC



# Higher Performing Oracle Databases

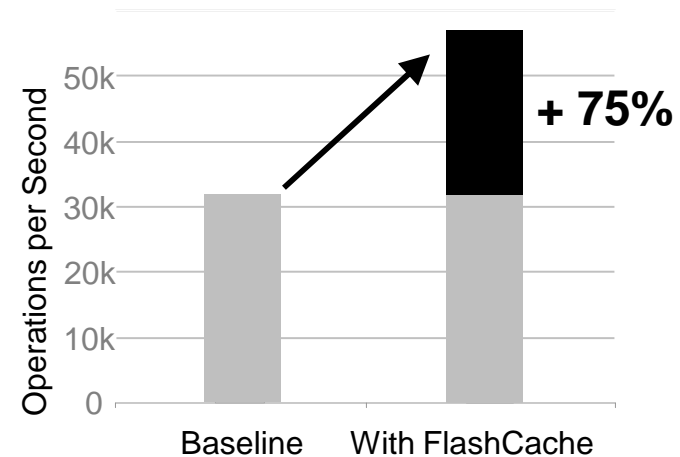
## Benefits for applications

- Frequent data in fast cache
- Increases I/O throughput by 75%
- Average response time improved by 30%



## Benefits for infrastructure

- Enable SATA as primary disk technology
- Reduce storage footprint
- Save 55% of expected budget
- Self-managing cache



## Some problems

- Consistency of results

  - ➔ Number of cases in the standard verification

- Functionality

  - ➔ Horizontal distribution of errors of wind components (posted to the forum)

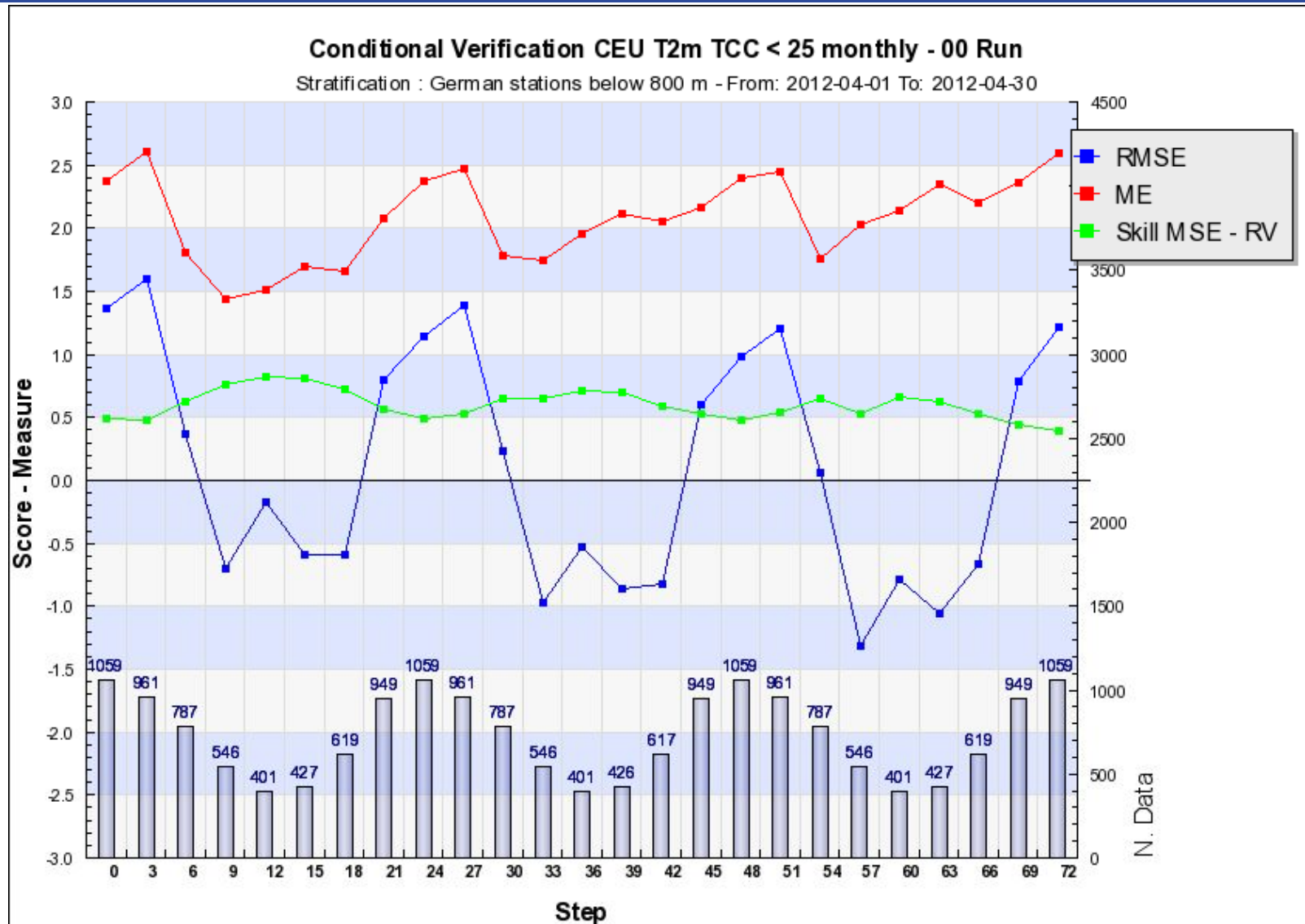
  - ➔ Right score on the right place (posted to the forum)



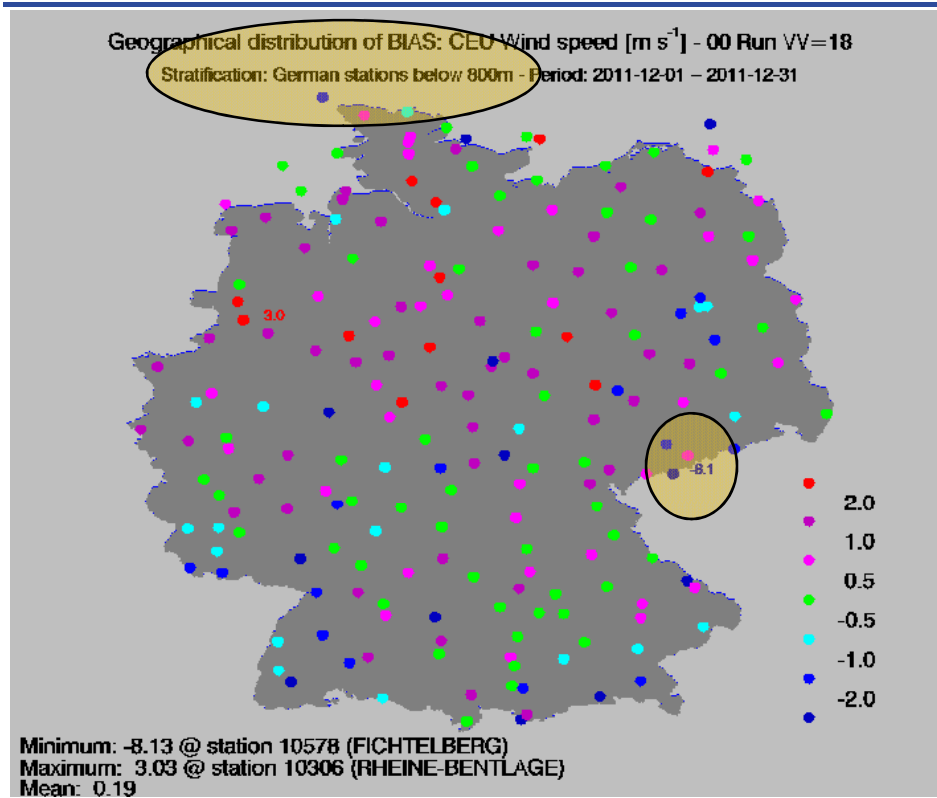
Month	Counts	Counts
201112 T2M CEU geographical distribution:	289858 Maximum: 31	time series: 266708 Relationship: .92013
201201 T2M CEU geographical distribution:	312364 <b>Maximum: 32</b>	time series: 287638 Relationship: .92084
201202 T2M CEU geographical distribution:	290780 <b>Maximum: 30</b>	time series: 267988 Relationship: .92161
201203 T2M CEU geographical distribution:	307308 <b>Maximum: 32</b>	time series: 283184 Relationship: .92149
201204 T2M CEU geographical distribution:	303450 <b>Maximum: 31</b>	time series: 279572 Relationship: .92131
201205 T2M CEU geographical distribution:	313472 <b>Maximum: 32</b>	time series: 288660 Relationship: .92084
201206 T2M CEU geographical distribution:	302856 <b>Maximum: 31</b>	time series: 278806 Relationship: .92058
201207 T2M CEU geographical distribution:	293398 <b>Maximum: 30</b>	time series: 270268 Relationship: .92116
201112 T2M CDE geographical distribution:	47531 Maximum: 31	time series: 43735 Relationship: .92013
201201 T2M CDE geographical distribution:	50012 <b>Maximum: 32</b>	time series: 46043 Relationship: .92063
201202 T2M CDE geographical distribution:	47083 <b>Maximum: 30</b>	time series: 43385 Relationship: .92145
201203 T2M CDE geographical distribution:	50414 <b>Maximum: 32</b>	time series: 46463 Relationship: .92162
201204 T2M CDE geographical distribution:	48577 <b>Maximum: 31</b>	time series: 44755 Relationship: .92132
201205 T2M CDE geographical distribution:	50180 <b>Maximum: 32</b>	time series: 46210 Relationship: .92088
201206 T2M CDE geographical distribution:	46941 Maximum: 30	time series: 43221 Relationship: .92075
201207 T2M CDE geographical distribution:	46758 <b>Maximum: 30</b>	time series: 43074 Relationship: .92121



# ??? And no chance to change it!!!



# 800 m: yes or no???



**Fichtelberg**

Elevation 1,214.6 m (3,985 ft)

Location

Location in Saxony

Location Saxony, Germany  
Range Ore Mountains  
Coordinates 50°25'43"N 12°57'17"E

Criteria: CEU horizontal distribution of Wind 10m errors 3h-steps  
Index: ME

Frequency: Monthly - From: 2011-12-01 To: 2011-12-31

Step Index Value Number Value Station

From: 2011-12-01 To: 2011-12-31

0	-7.03003	20	FICHTELBERG-10578
3	-7.17631	20	FICHTELBERG-10578
6	-7.17186	22	FICHTELBERG-10578

.....

Source: <http://en.wikipedia.org/wiki/Fichtelberg>



# VERSUS results with related aspects

Deutscher Wetterdienst  
*Wetter und Klima aus einer Hand*

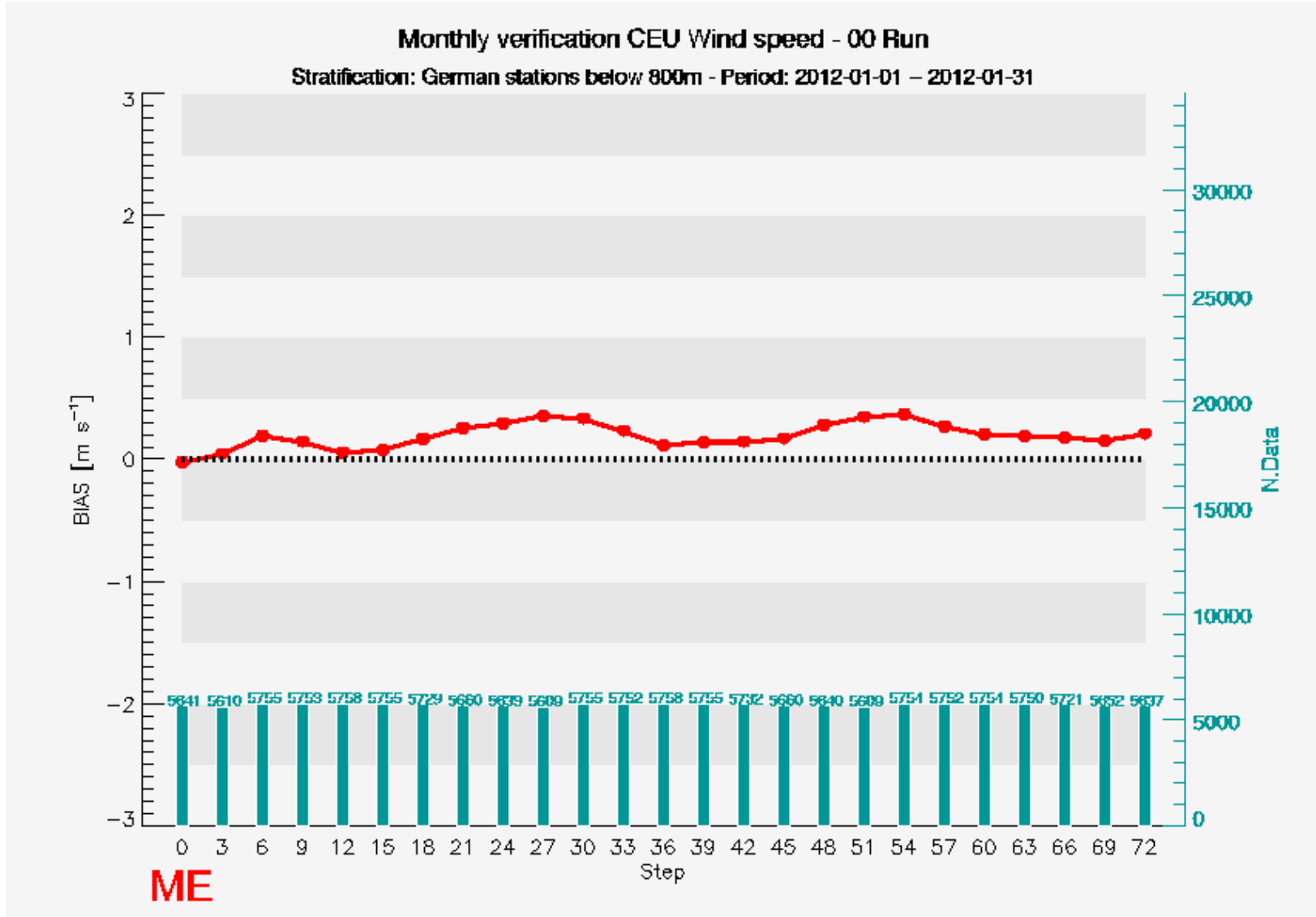


- Wind
  - Seasonal behaviour of errors
  - Forecast quality depending on elevation of station
- Temperature
  - The COSMO-DE problem during summer and its influence on other parameters
- Conditional verification
  - TCC < 25%
  - TCC > 75%

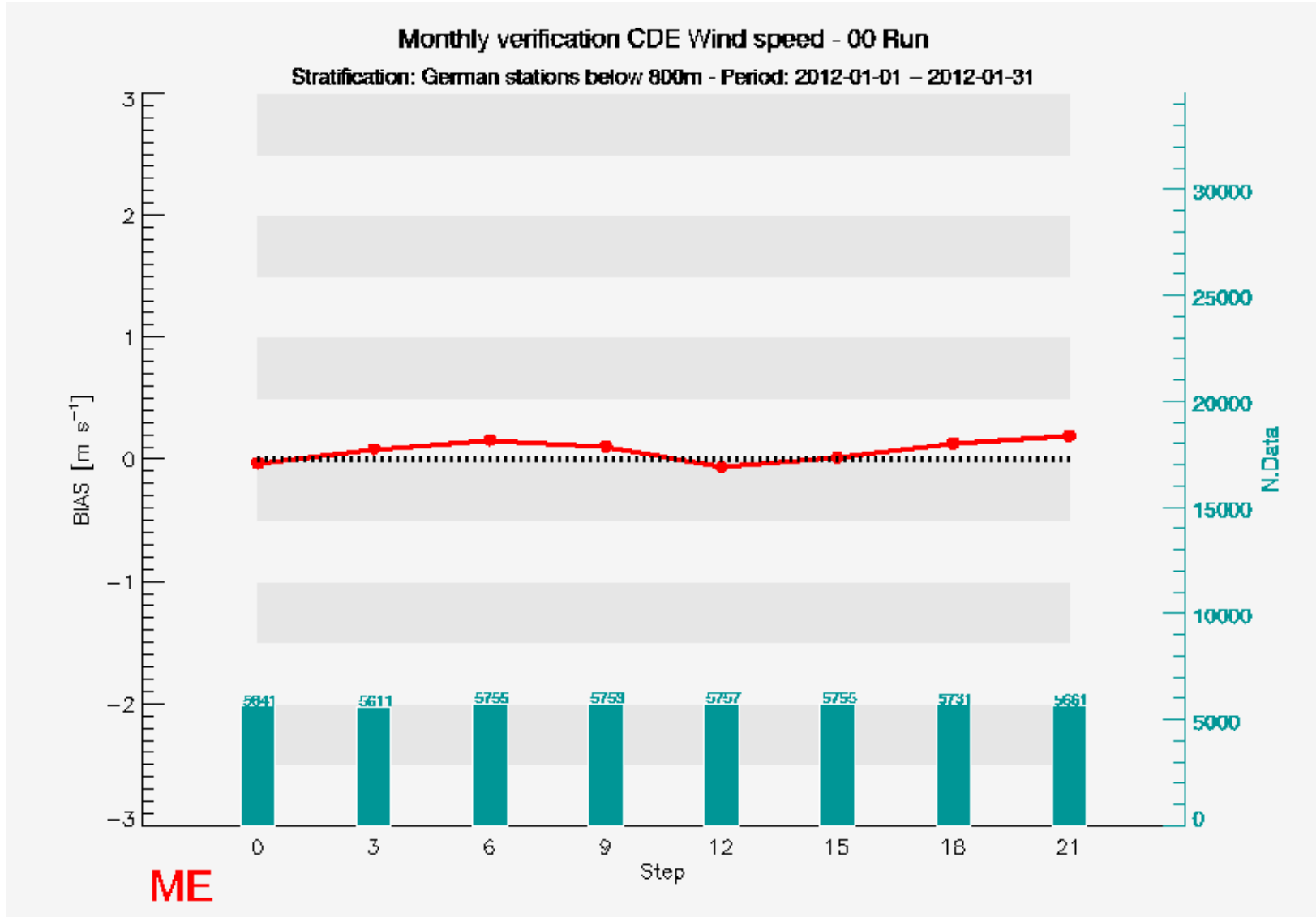




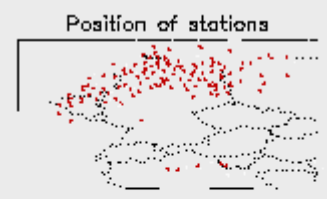
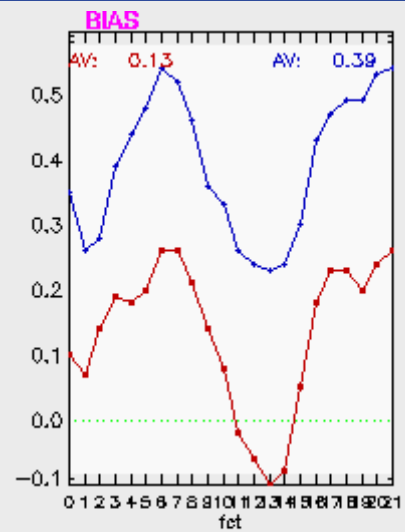
# CEU: Windspeed 10m, January 2012



# CDE: Windspeed 10m, January 2012

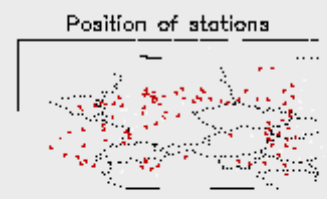
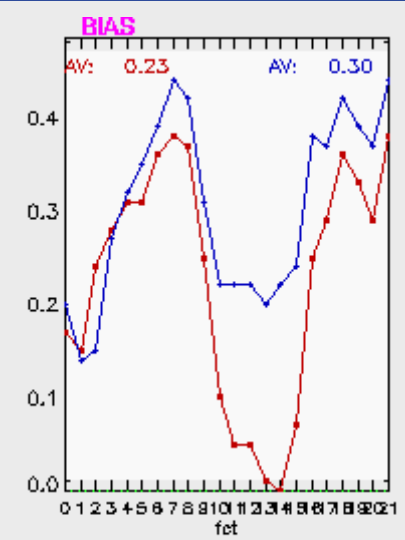


# CEU + CDE: Windspeed 10m, January 2012



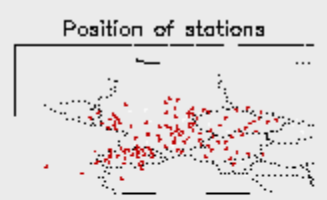
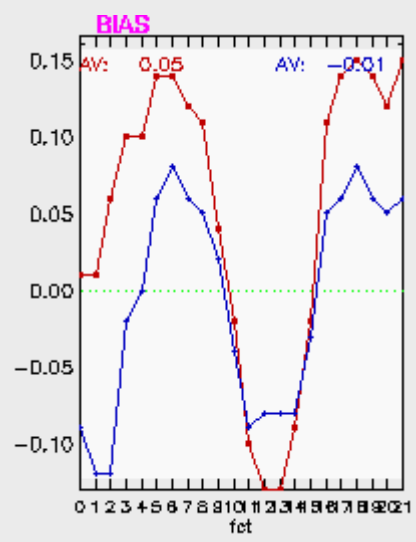
Number of stations: 170

Stations below 100 m



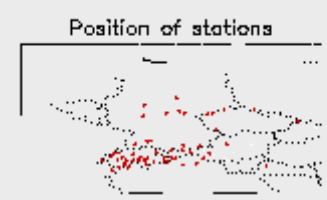
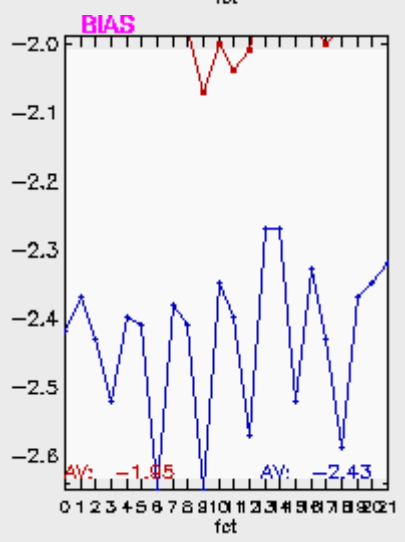
Number of stations: 127

Stations 100 – 300 m



Number of stations: 144

Stations 300 – 800 m



Number of stations: 68

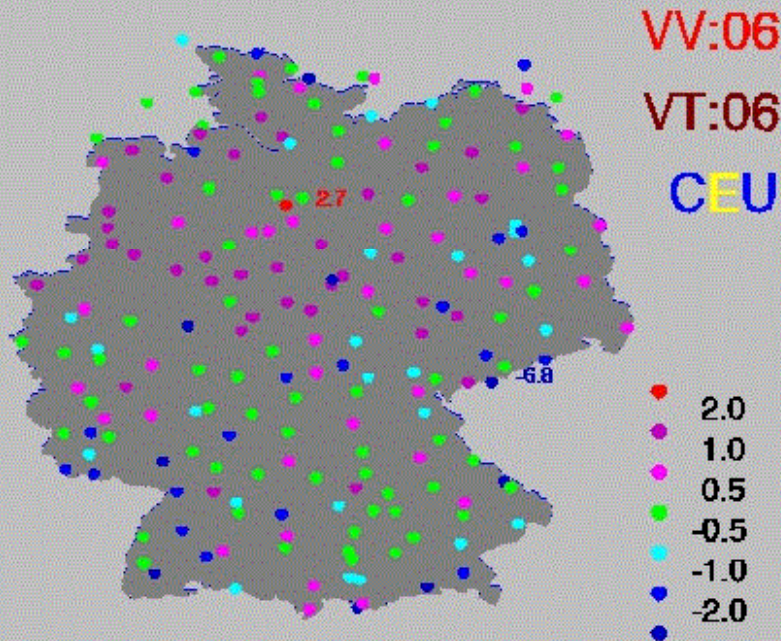
Stations above 800 m



# CEU + CDE: Windspeed 10m, 06 UTC, January 2012

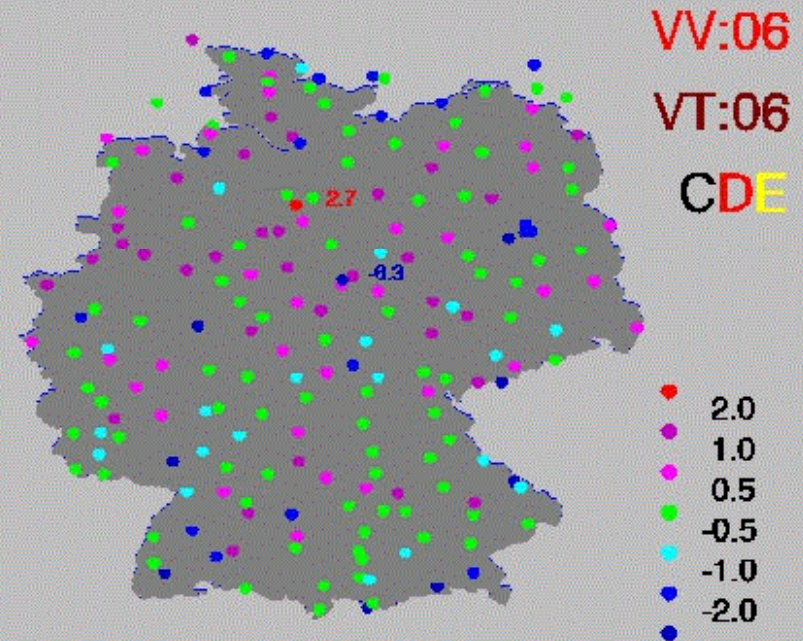


Geographical distribution of BIAS: CEU Wind speed [ $\text{m s}^{-1}$ ] - 00 Run  
Stratification: German stations below 800m - Period: 2012-01-01 - 2012-01-31



Minimum: -6.76 @ station 10578 (FICHELBERG)  
Maximum: 2.73 @ station 10238 (BERGEN)  
Mean: -0.01

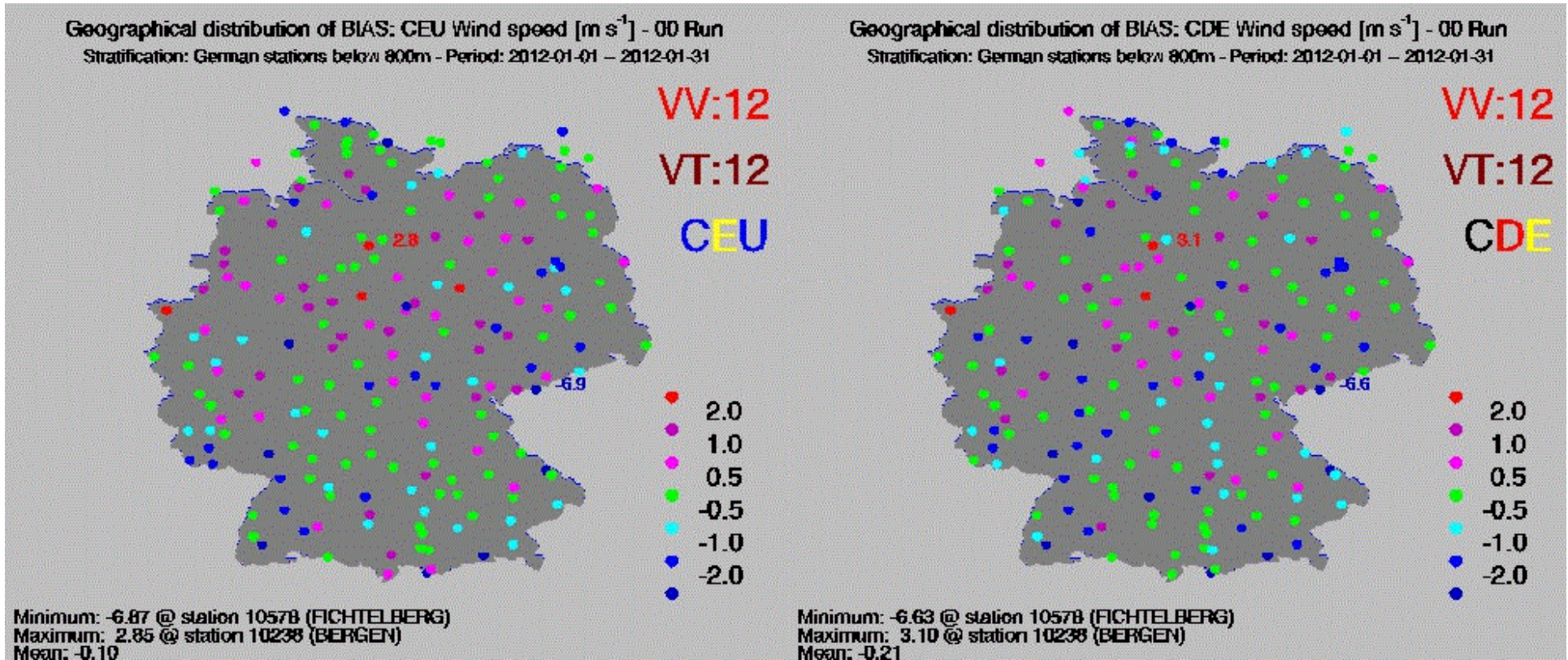
Geographical distribution of BIAS: CDE Wind speed [ $\text{m s}^{-1}$ ] - 00 Run  
Stratification: German stations below 800m - Period: 2012-01-01 - 2012-01-31



Minimum: -6.30 @ station 10453 (BROCKEN)  
Maximum: 2.73 @ station 10238 (BERGEN)  
Mean: -0.02

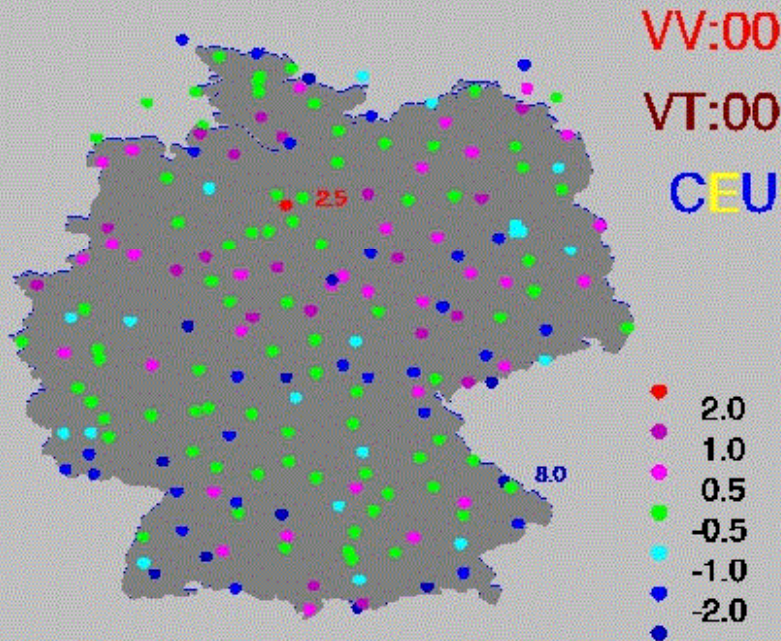


# CEU + CDE: Windspeed 10m, 15 UTC, January 2012



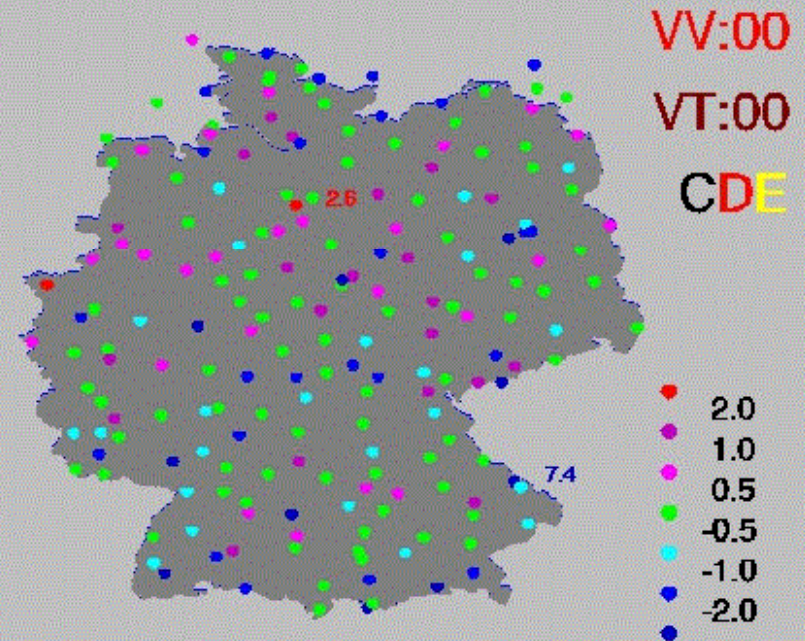
# CEU + CDE: Windspeed 10m, January 2012

Geographical distribution of BIAS: CEU Wind speed [ $\text{m s}^{-1}$ ] - 00 Run  
Stratification: German stations below 800m - Period: 2012-01-01 - 2012-01-31

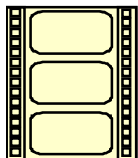


Minimum: -8.01 @ station 10791 (GROSSER ARBER)  
Maximum: 2.51 @ station 10238 (BERGEN)  
Mean: -0.17

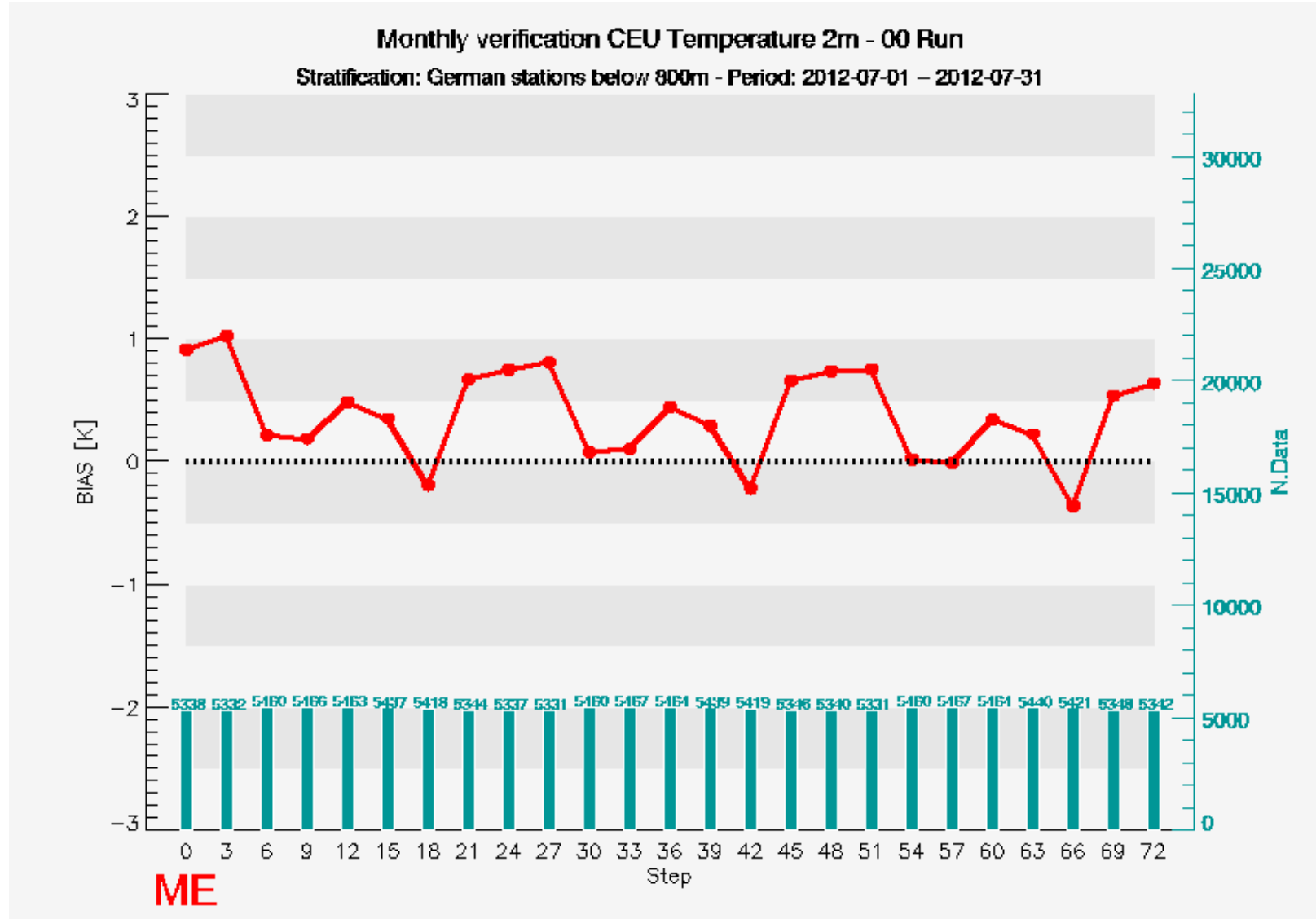
Geographical distribution of BIAS: CDE Wind speed [ $\text{m s}^{-1}$ ] - 00 Run  
Stratification: German stations below 800m - Period: 2012-01-01 - 2012-01-31



Minimum: -7.39 @ station 10791 (GROSSER ARBER)  
Maximum: 2.61 @ station 10238 (BERGEN)  
Mean: -0.16



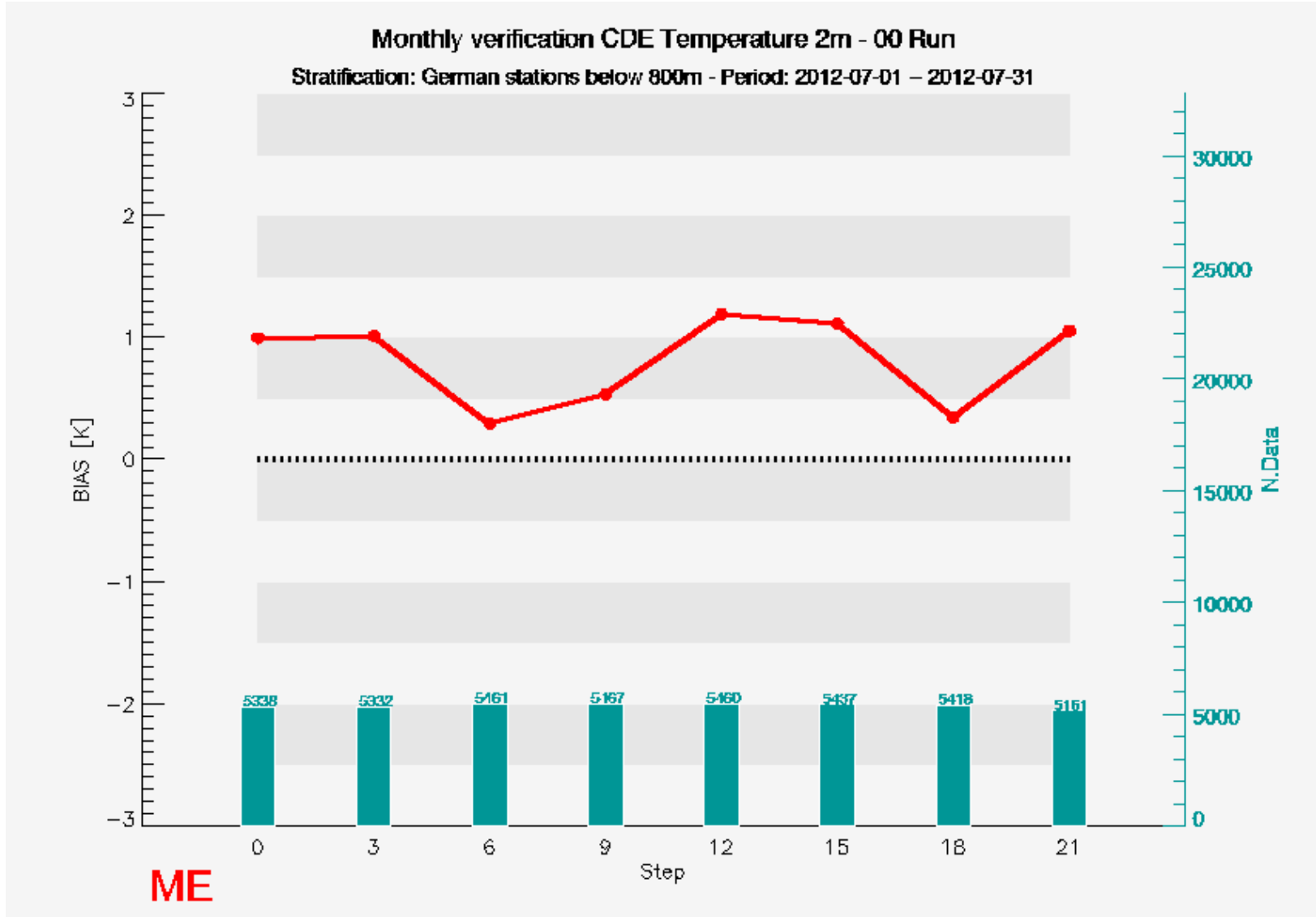
# CEU: Temperature 2m, July 2012



ME

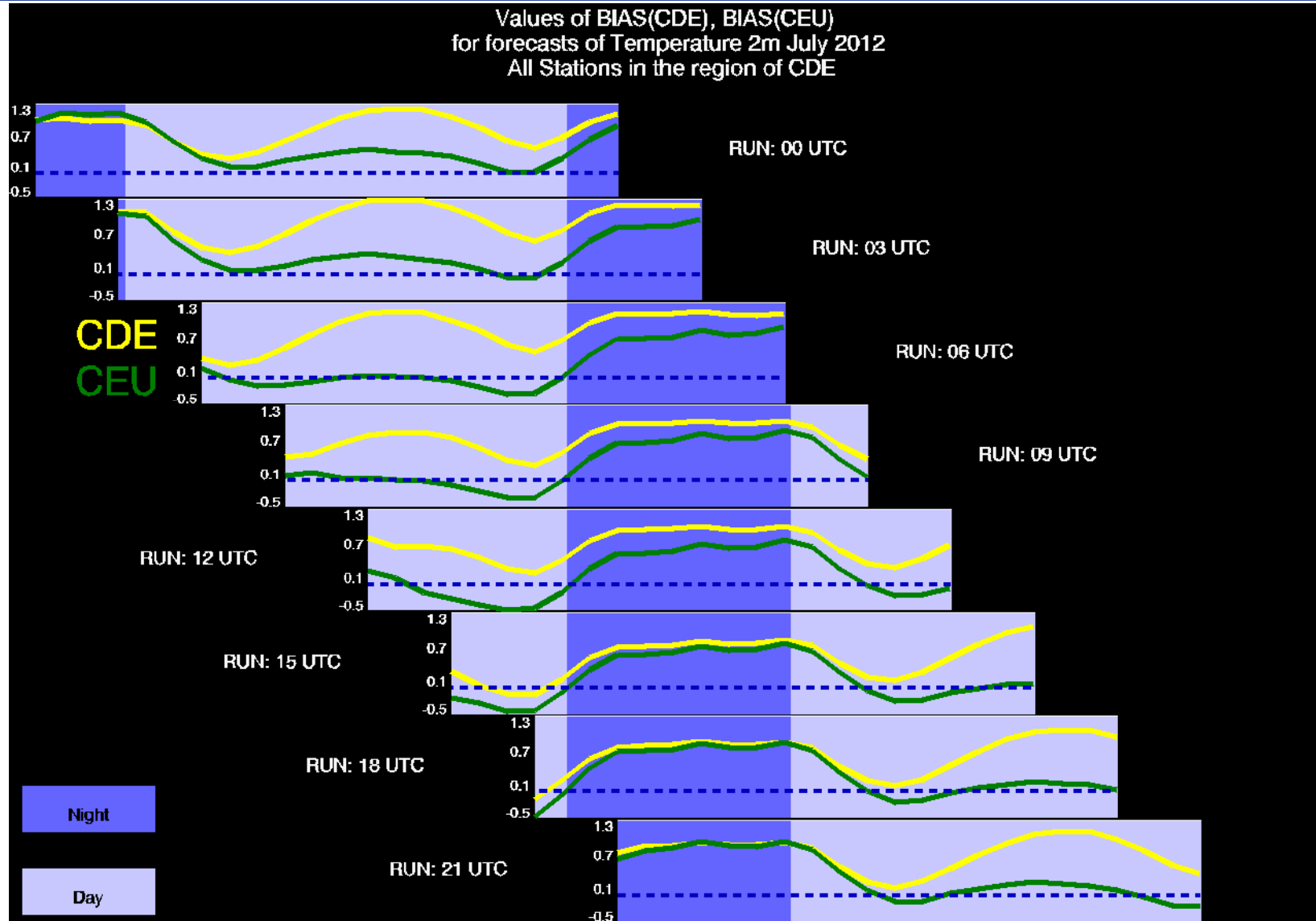


# CDE: Temperature 2m, July 2012

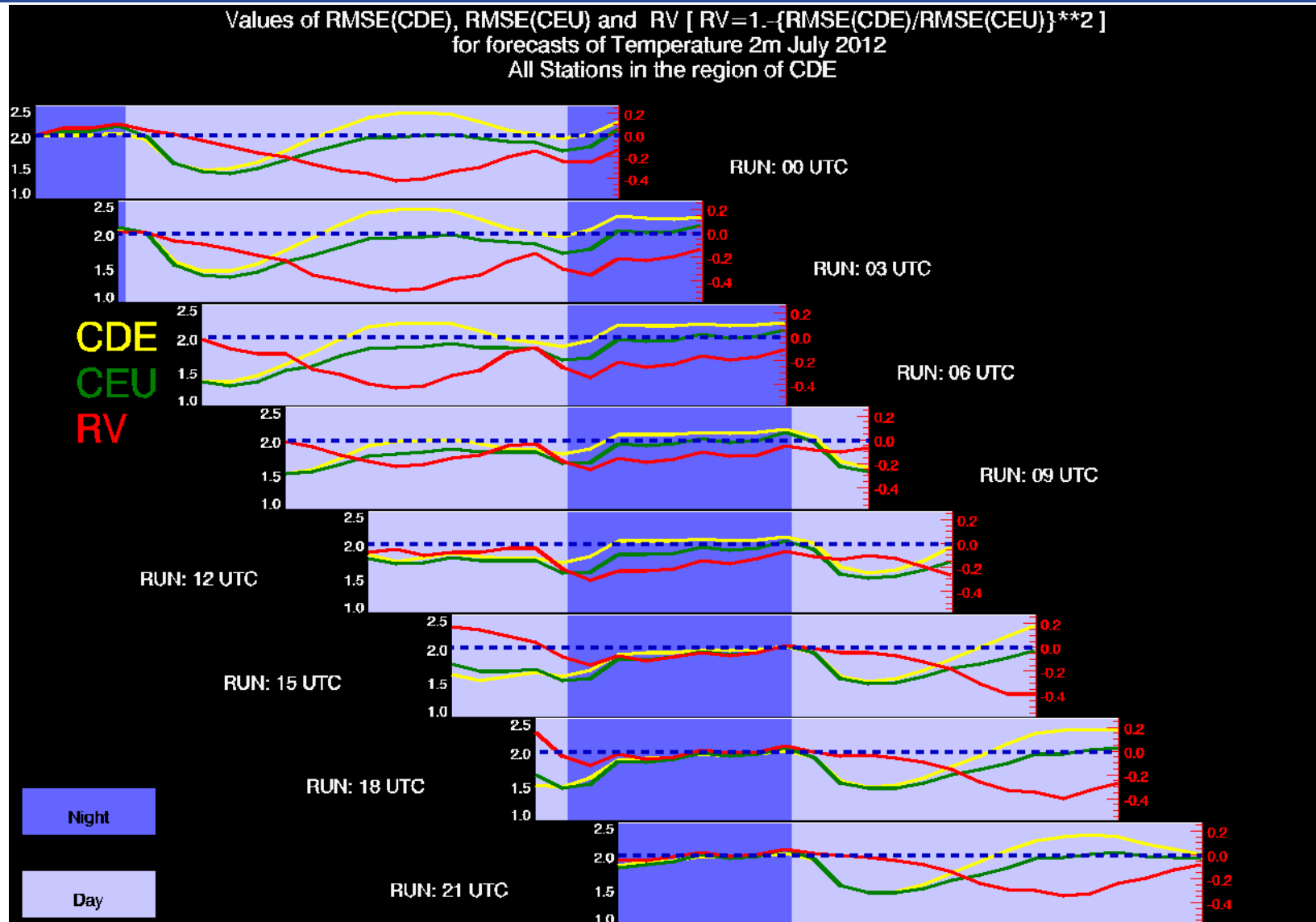




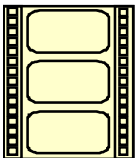
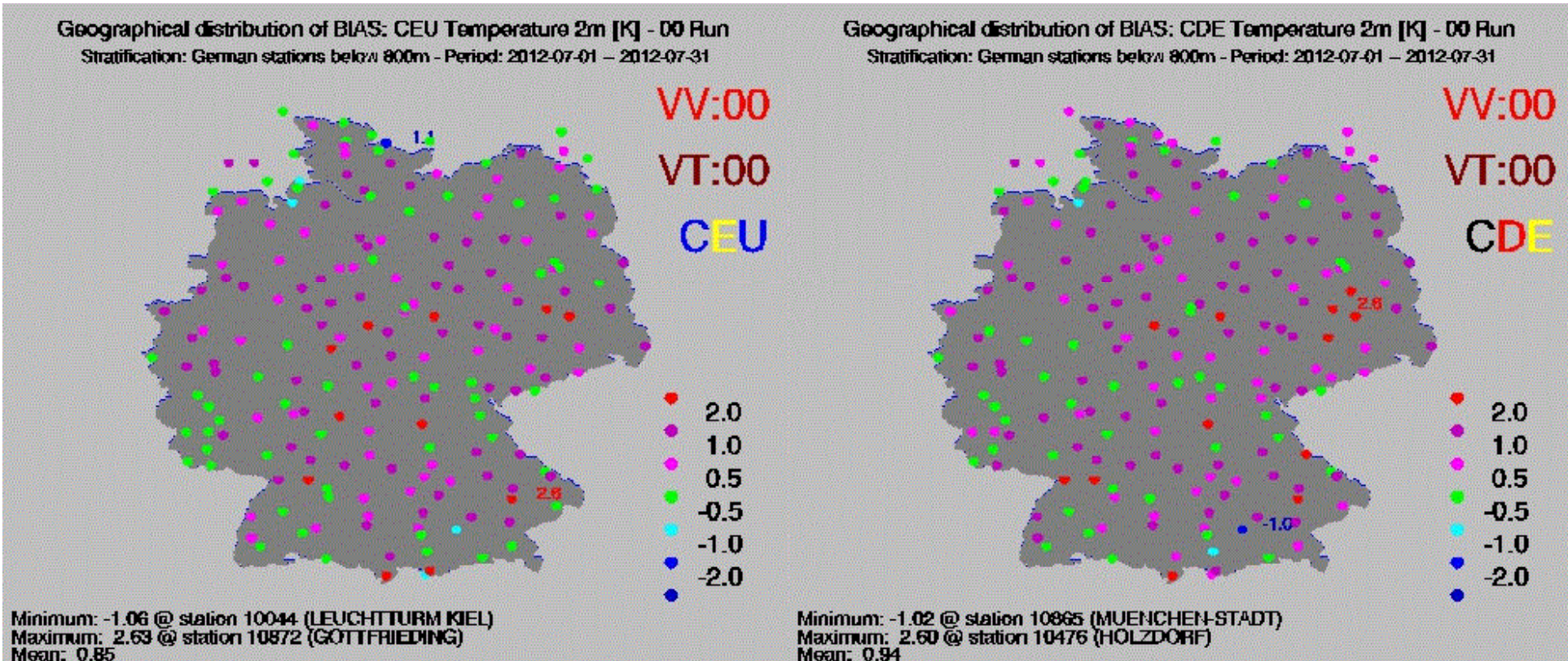
# CEU + CDE: Temperature 2m, July 2012, Bias



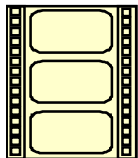
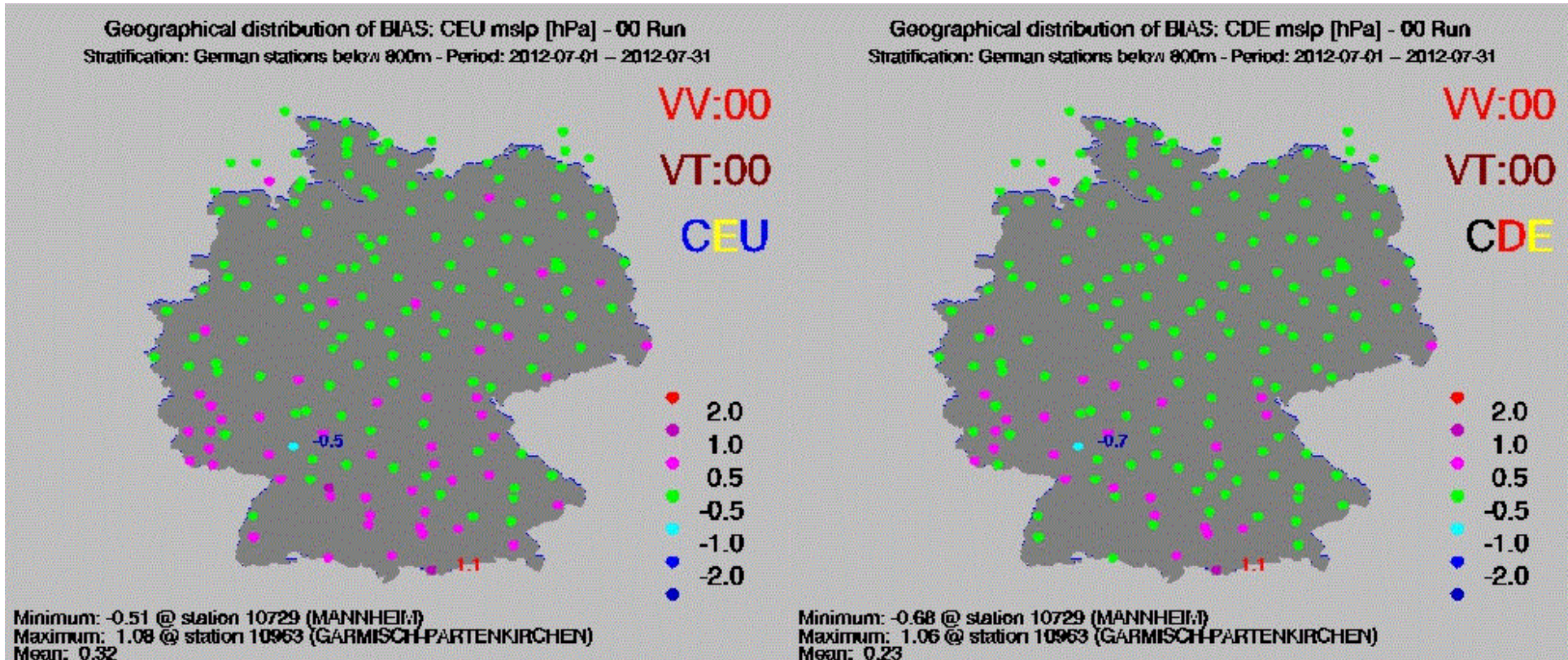
# CEU + CDE: Temperature 2m, July 2012, RMSE



# CEU + CDE: Temperature 2m, July 2012

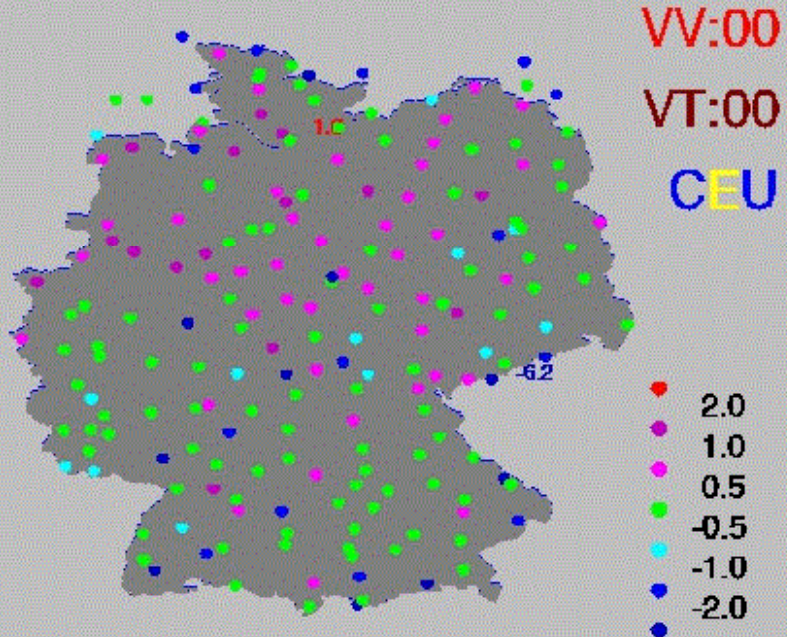


# CEU + CDE: Pressure reduced to NHN, July 2012



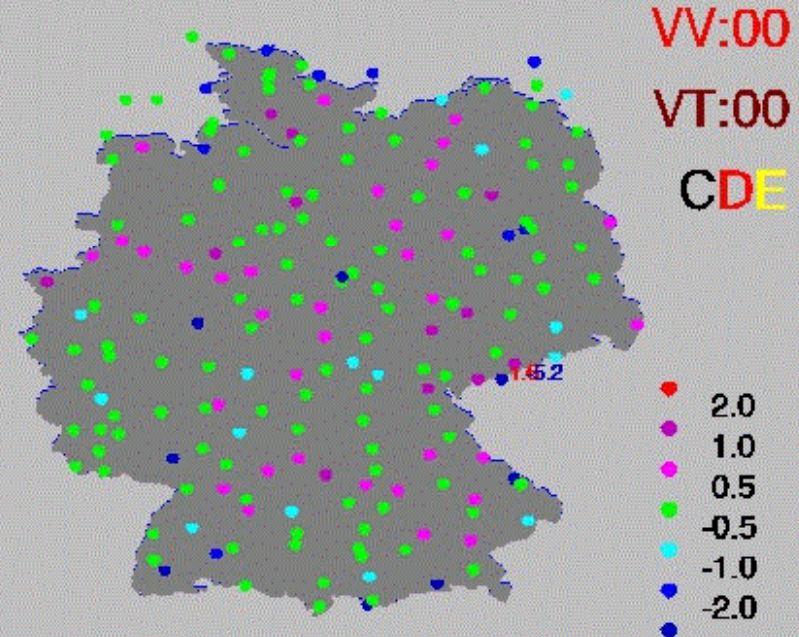
# CEU + CDE: Wind 10m, July 2012

Geographical distribution of BIAS: CEU Wind speed [ $\text{m s}^{-1}$ ] - 00 Run  
Stratification: German stations below 800m - Period: 2012-07-01 - 2012-07-31



Minimum: -6.22 @ station 1057B (FICHELBERG)  
Maximum: 1.60 @ station 10146 (QUICKBORN)  
Mean: -0.10

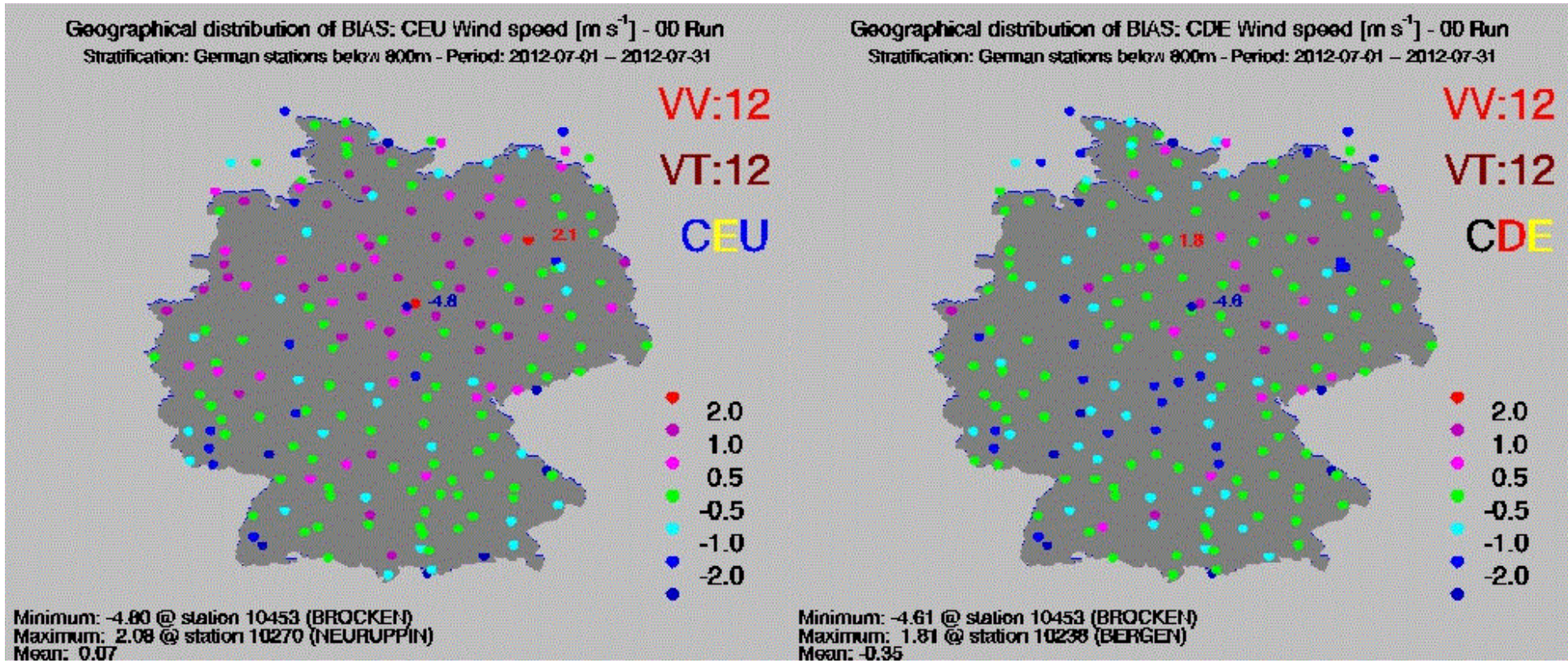
Geographical distribution of BIAS: CDE Wind speed [ $\text{m s}^{-1}$ ] - 00 Run  
Stratification: German stations below 800m - Period: 2012-07-01 - 2012-07-31



Minimum: -5.16 @ station 1057B (FICHELBERG)  
Maximum: 1.62 @ station 10574 (CARLSFELD)  
Mean: -0.03

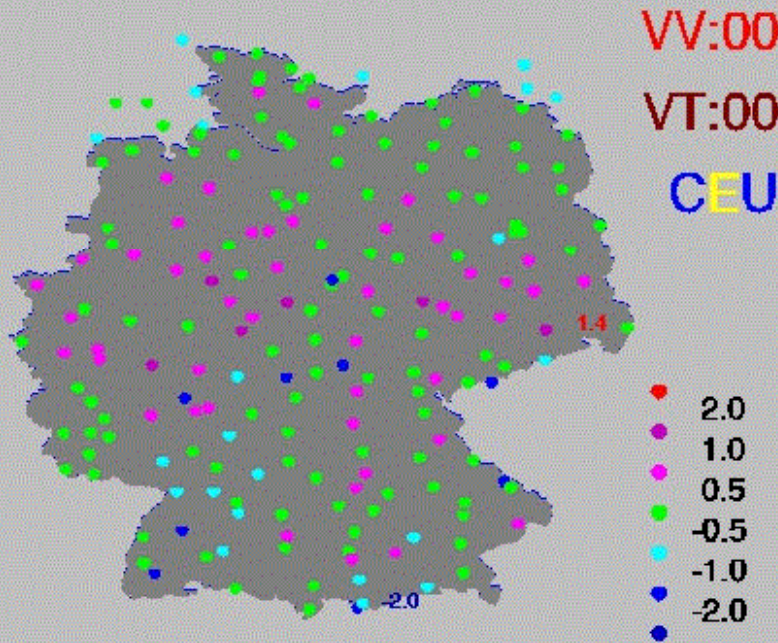


# CEU + CDE: Wind 10m, July 2012



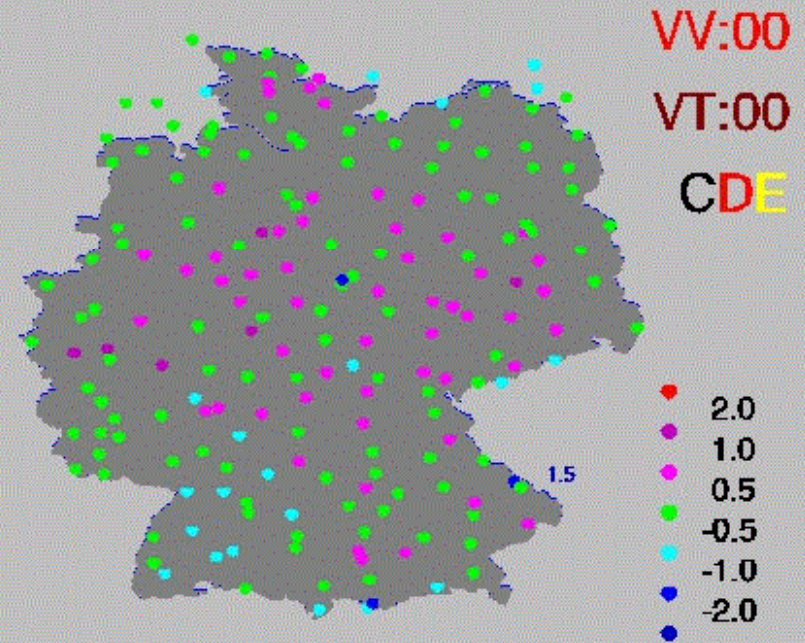
# CEU + CDE: Dew point temperature 2m, July 2012

Geographical distribution of BIAS: CEU Dew point temperature 2m [K] - 00 Run  
Stratification: German stations below 800m - Period: 2012-07-01 - 2012-07-31

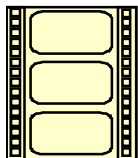


Minimum: -2.00 @ station 10961 (ZUGSPITZE)  
Maximum: 1.44 @ station 10488 (DRESDEN-KLOTZSCHE)  
Mean: 0.13

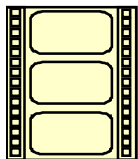
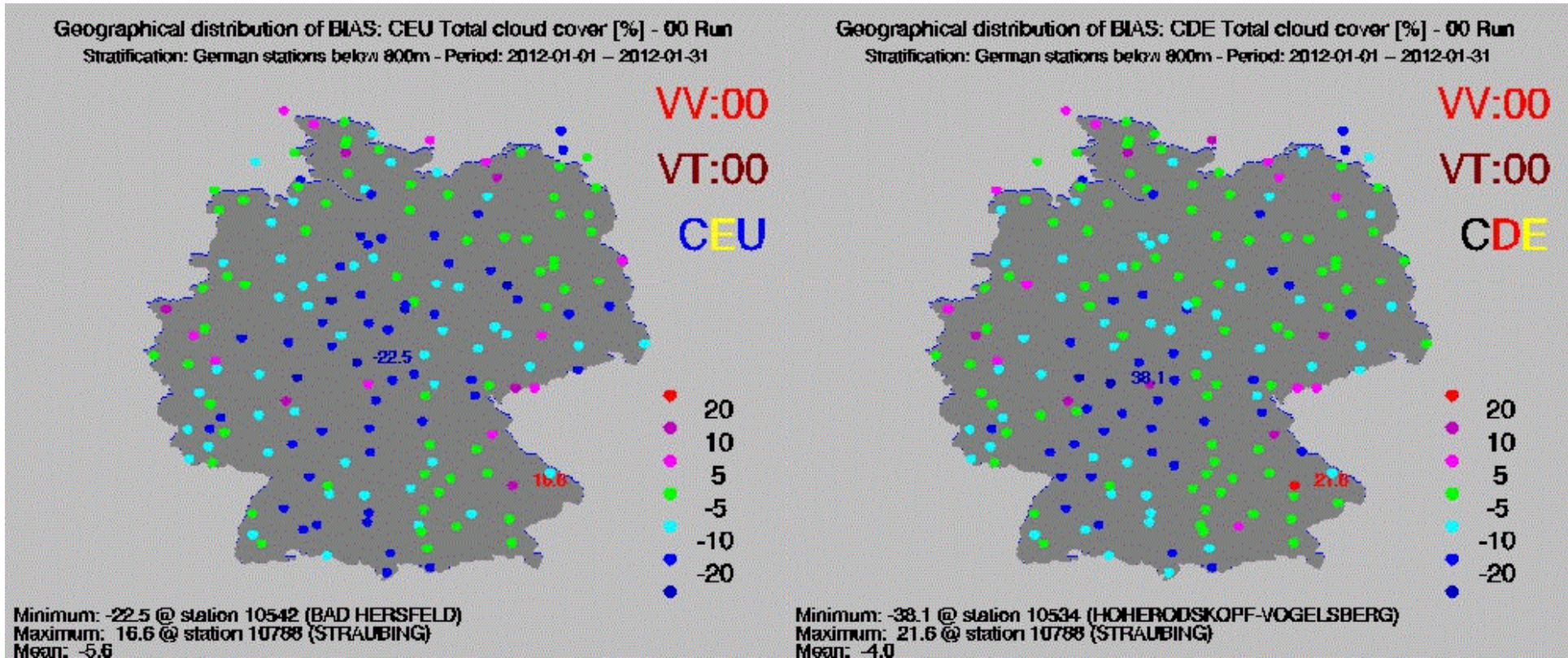
Geographical distribution of BIAS: CDE Dew point temperature 2m [K] - 00 Run  
Stratification: German stations below 800m - Period: 2012-07-01 - 2012-07-31



Minimum: -1.49 @ station 10791 (GROSSER ARBER)  
Maximum: 1.50 @ station 10505 (BONN-HANGELAR)  
Mean: 0.17

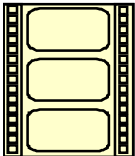
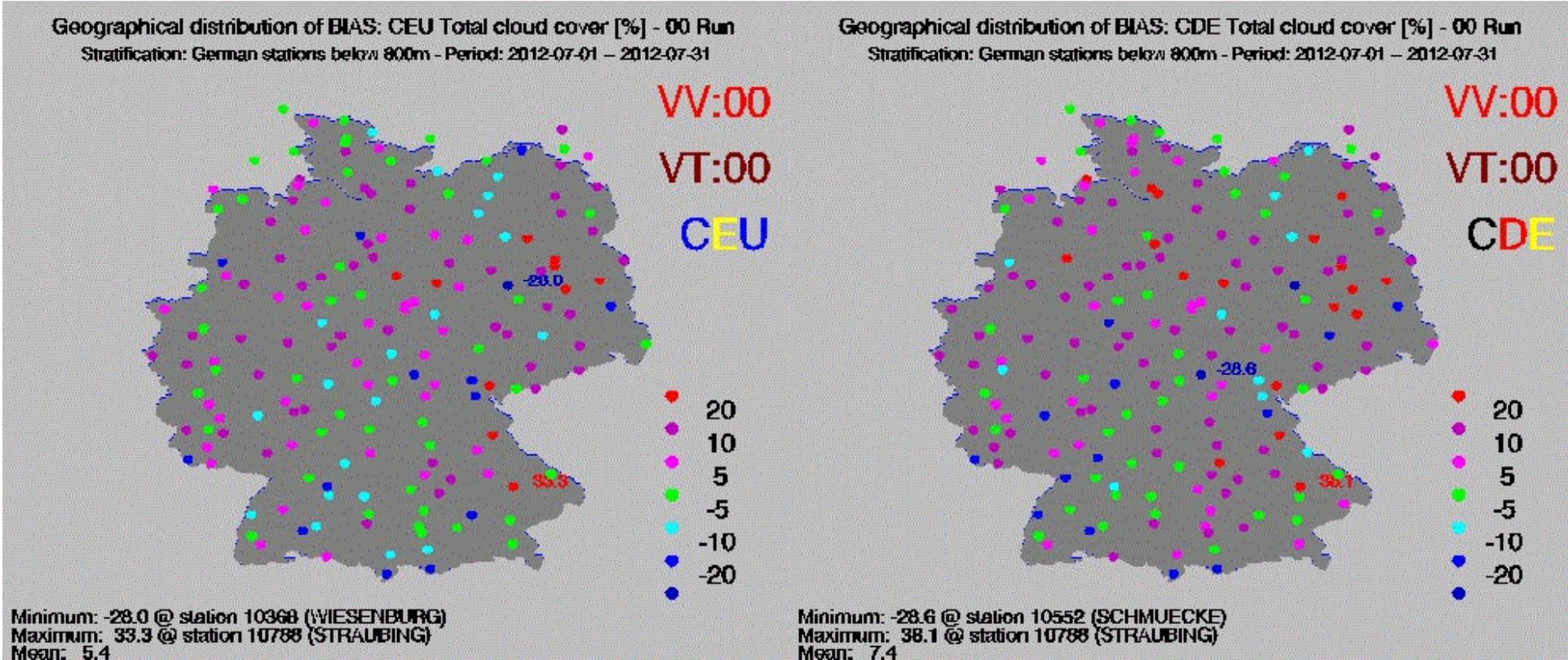


# CEU + CDE: TCC, January 2012

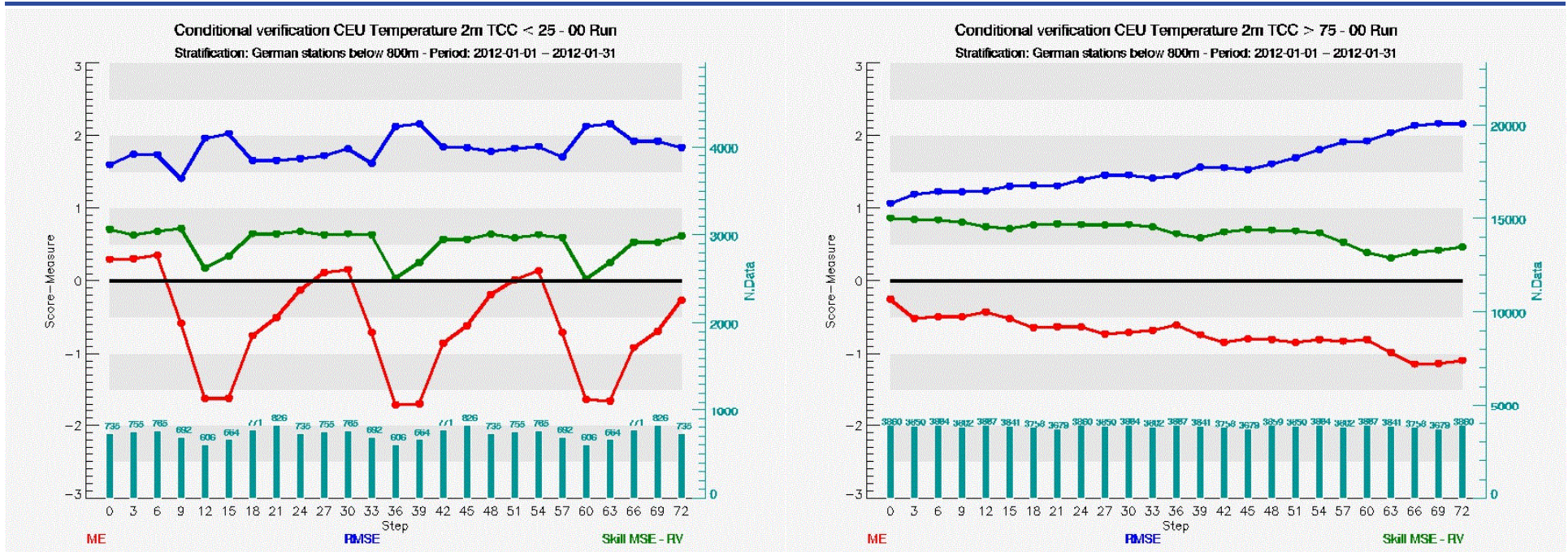




# CEU + CDE: TTC, July 2012



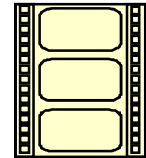
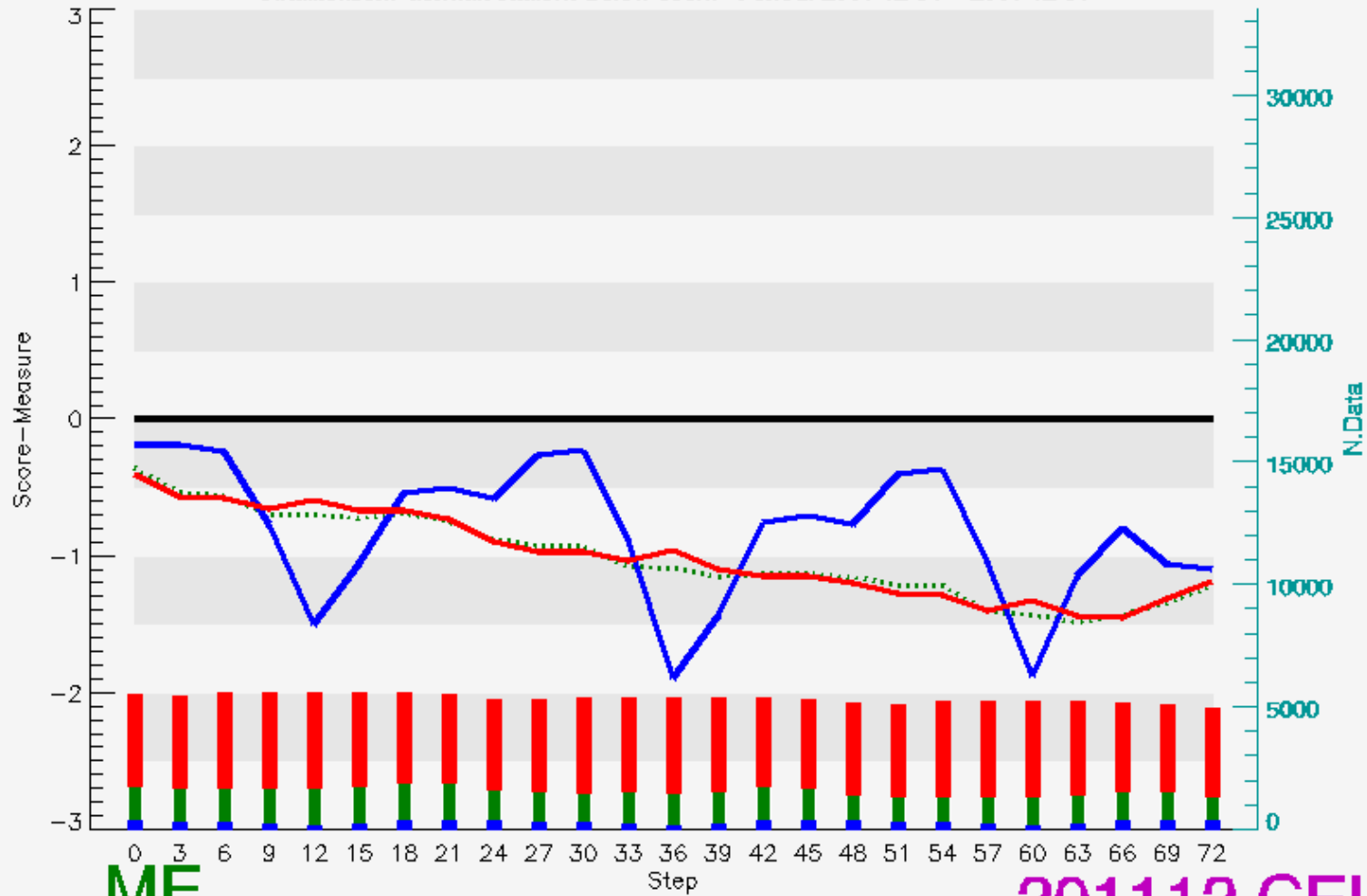
# CEU: Temperature 2m, January 2012, BIAS depending on TCC



# CEU: Temperature 2m, BIAS depending on TTC



Monthly verification CEU Temperature 2m - 00 Run all cases cases with TTC < 25% cases with TTC > 75%  
Stratification: German stations below 800m - Period: 2011-12-04 - 2011-12-31

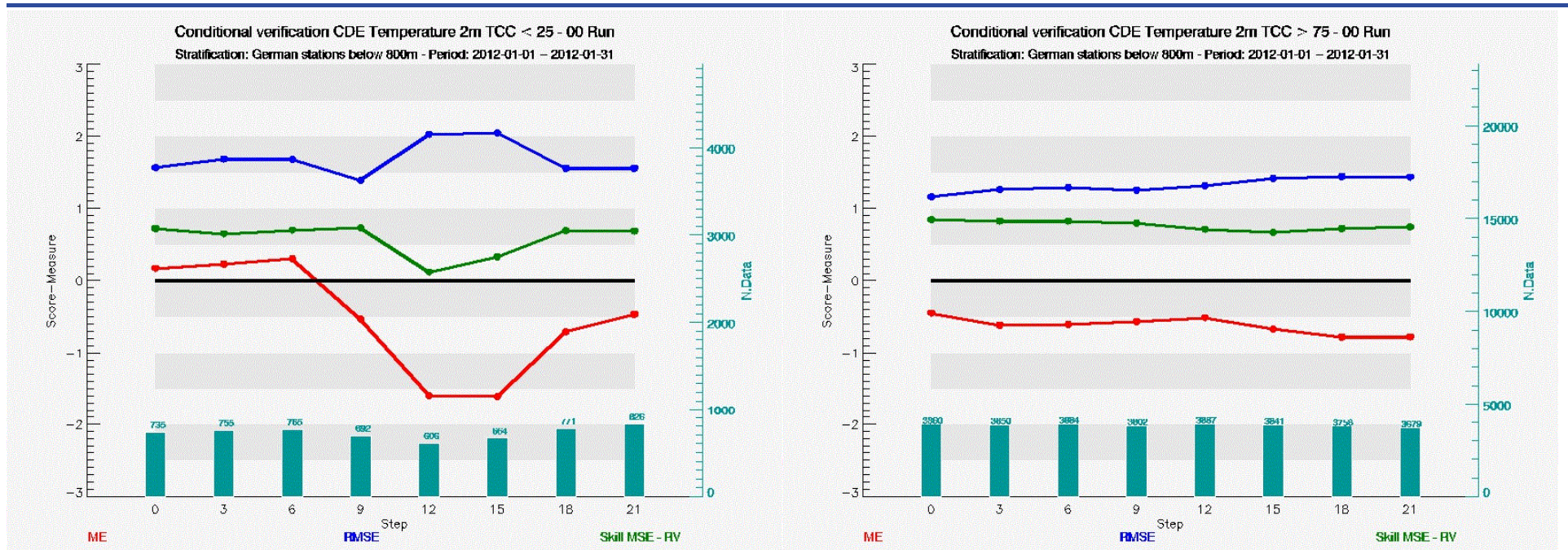


ME

201112 CEU

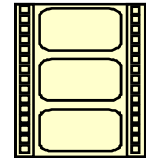
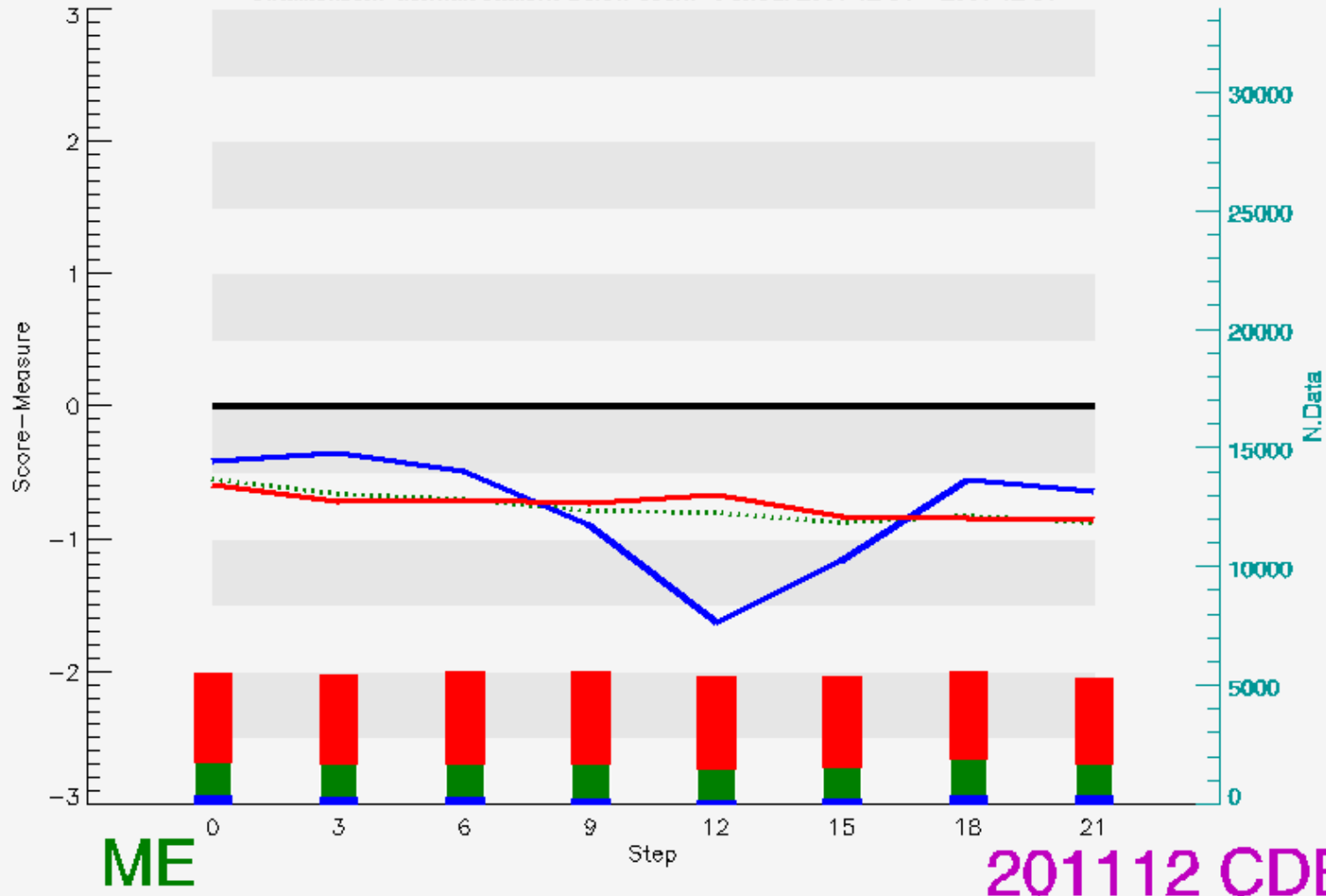


# CDE: Temperature 2m, January 2012, BIAS depending on TCC

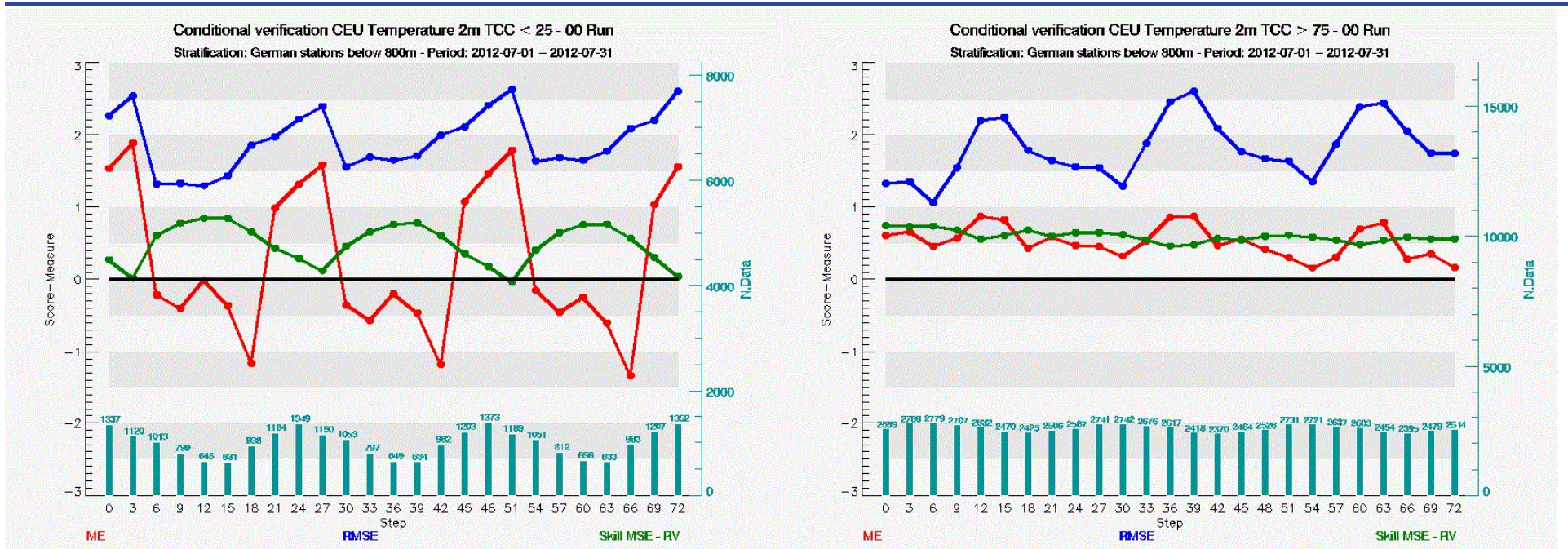


# CDE: Temperature 2m, BIAS depending on TTC

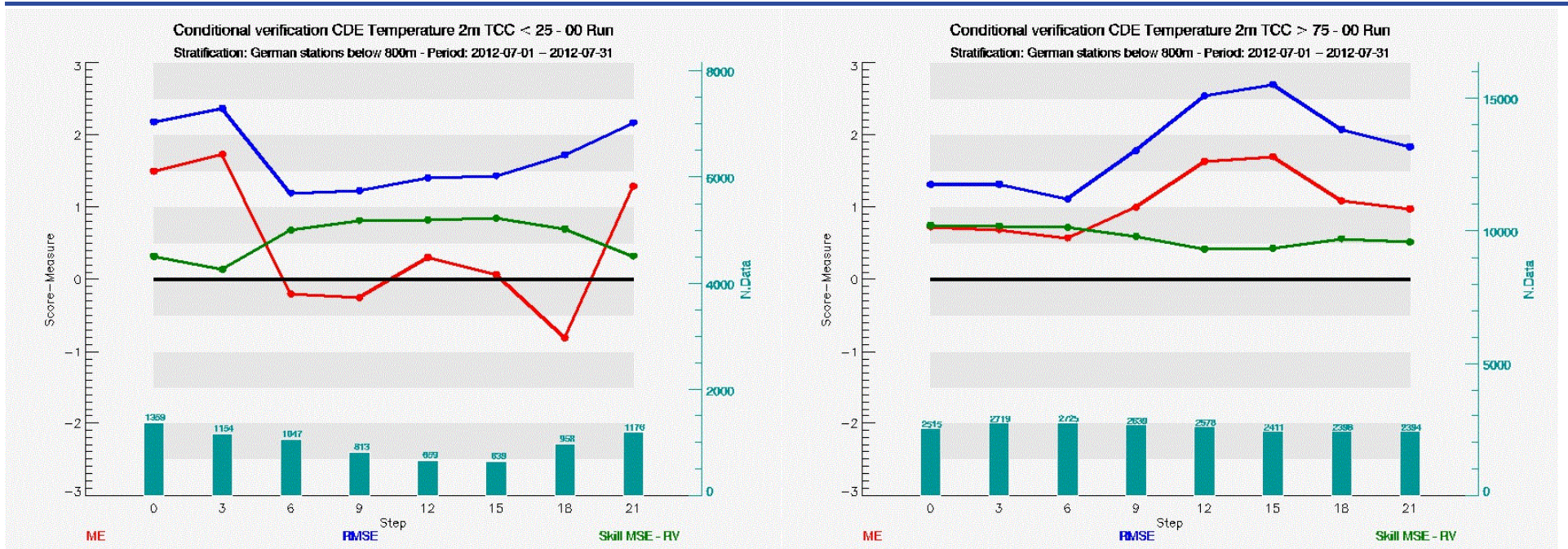
Monthly verification CDE Temperature 2m - 00 Run **all cases** **cases with TTC < 25%** **cases with TTC > 75%**  
 Stratification: German stations below 800m - Period: 2011-12-04 - 2011-12-31



# CEU: Temperature 2m, July 2012, BIAS depending on TCC



# CEU: Temperature 2m, July 2012, BIAS depending on TCC





## Results got from the verification system VERSUS in the framework of



Please note that due to problems in different levels the data are partly not complete.

Data are available without gaps starting with March 2012.

The table headers contain the abbreviations MO and TS.

The choice of MO allows a animation of graphics with the horizontal distribution of the errors, with TS a time series of the sum of errors for each time step is shown.

### Deutsche Version dieser Seite

[CEU Horizontal distribution of BIASes for months](#)

[CEU Standard verification of continuous elements for seasons](#)

[CEU Standard verification of categorical elements for seasons](#)

[CEU Conditional verification of temperature forecast 2m for seasons](#)

[CEU Conditional verification of temperature forecast 2m for months](#)

[CDE Horizontal distribution of BIASes for months](#)

[CDE Standard verification of continuous elements for seasons](#)

[CDE Standard verification of categorical elements for seasons](#)

[CDE Conditional verification of temperature forecast 2m for seasons](#)

[CDE Conditional verification of temperature forecast 2m for months](#)







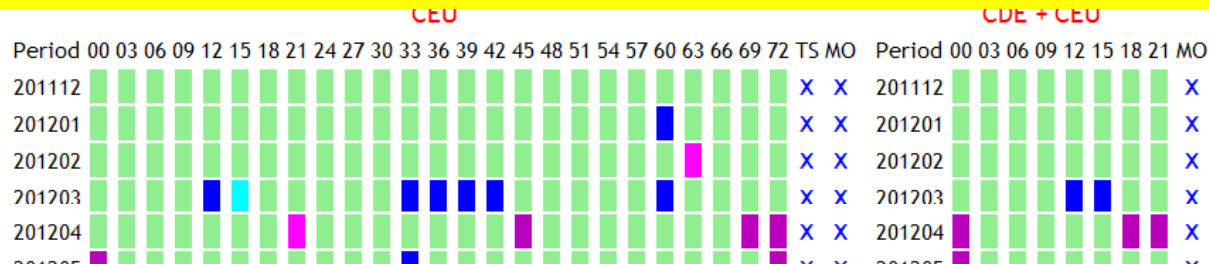
## Solution:

- Presentation of X's vor with a background that contains a crude information on the content of the graphics,
  - ➔ Here: Most frequent value of blue, red, green ... points
- Steps:
  - ➔ Get the most frequent color and store it in an ascii-file.
  - ➔ Creation of html-file:
    - ➔ Read the relevant value from the ascii-file
    - ➔ Set a class of a link (like: `<a class=VERSUS_CLASS_3 ..`
  - ➔ Definition of class VERSUS\_CLASS\_3 in a css-file as
    - ➔ `a.VERSUS_CLASS_3:link {color:purple;text-decoration:none;border-color:lightgreen;border-width:1;background-color:lightgreen;border-style:solid}`
    - ➔ `a.VERSUS_CLASS_3:visited {color:purple;text-decoration:none; font-style:italic; border-color:lightgreen;border-width:1;background-color:lightgreen}`
- Result: next slide with an overview about interesting cases with a color that marks an alarm or a situation with no alarm

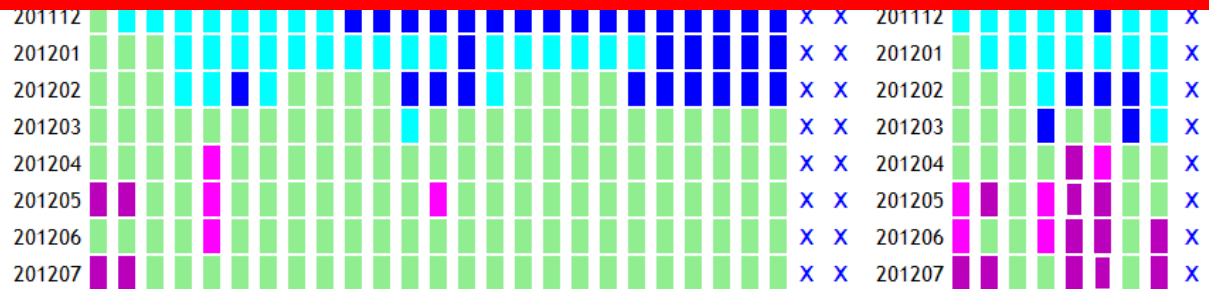




Graphics per month: 178  
Clicks to produce the basic information: 114  
Clicks (graphic) <sup>-1</sup>: 0.64



Regardless of some minor problems:  
**VERSUS is really excellent!**

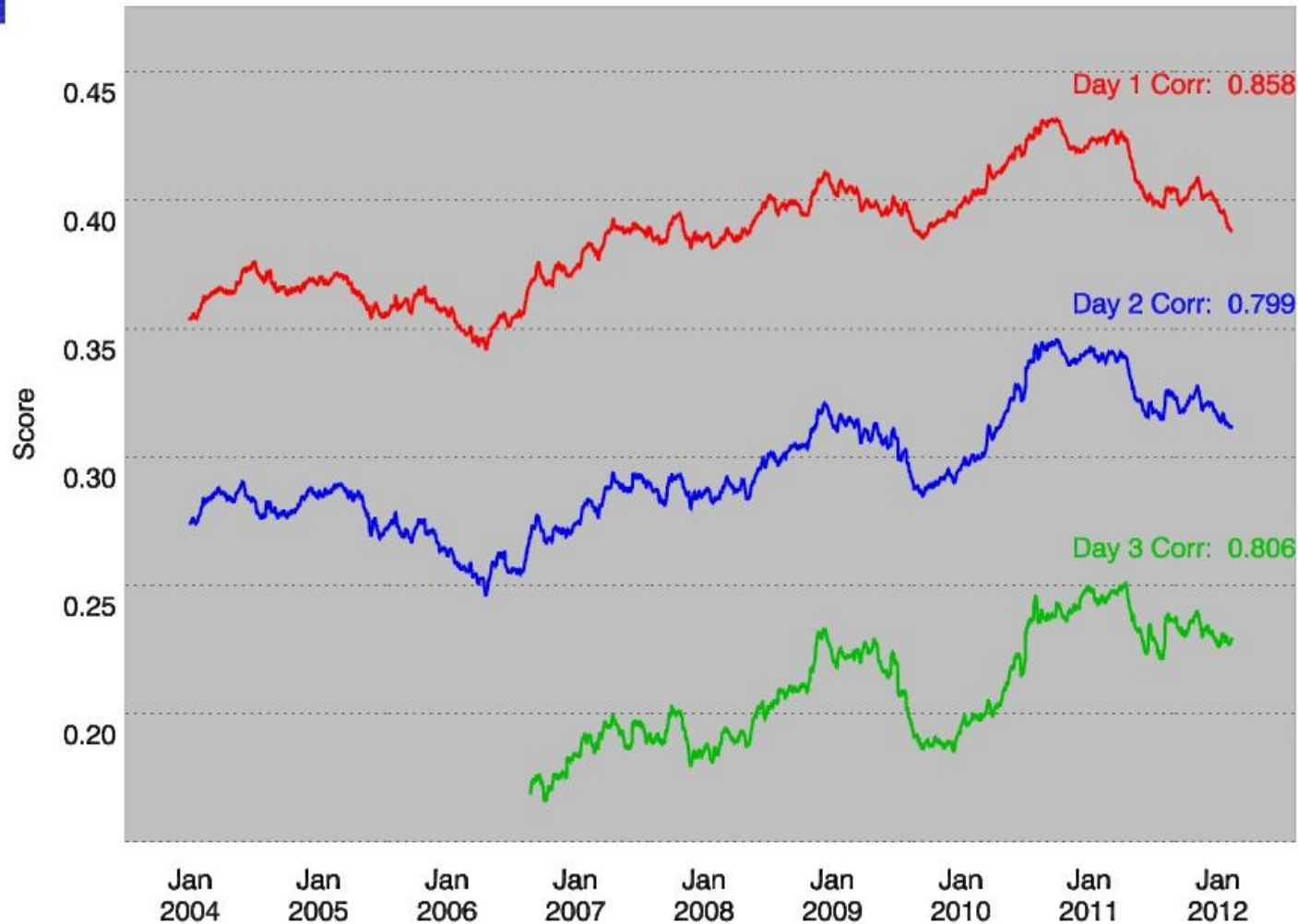


# COSI – long term trends: Overview

Deutscher Wetterdienst  
Wetter und Klima aus einer Hand



Universal Score Period 01.07.2003 till 25.08.2012  
averaging interval 365 days: All forecast days



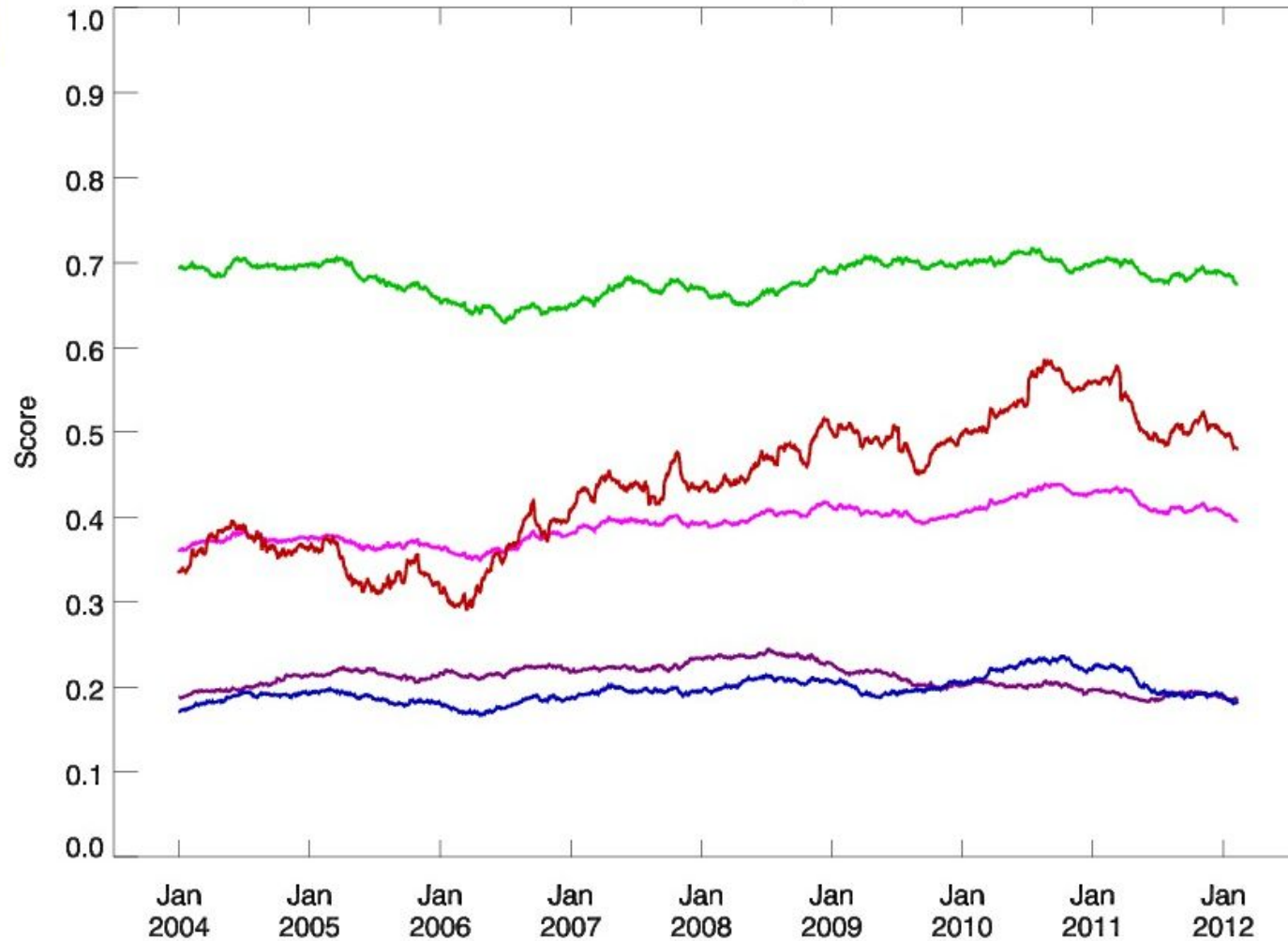
31.08.2012 12:02:12 MESZ



# COSI – long term trends: Day 1



All Scores Day 1



Universal Score Cloud cover Vector wind Temperature Precipitation

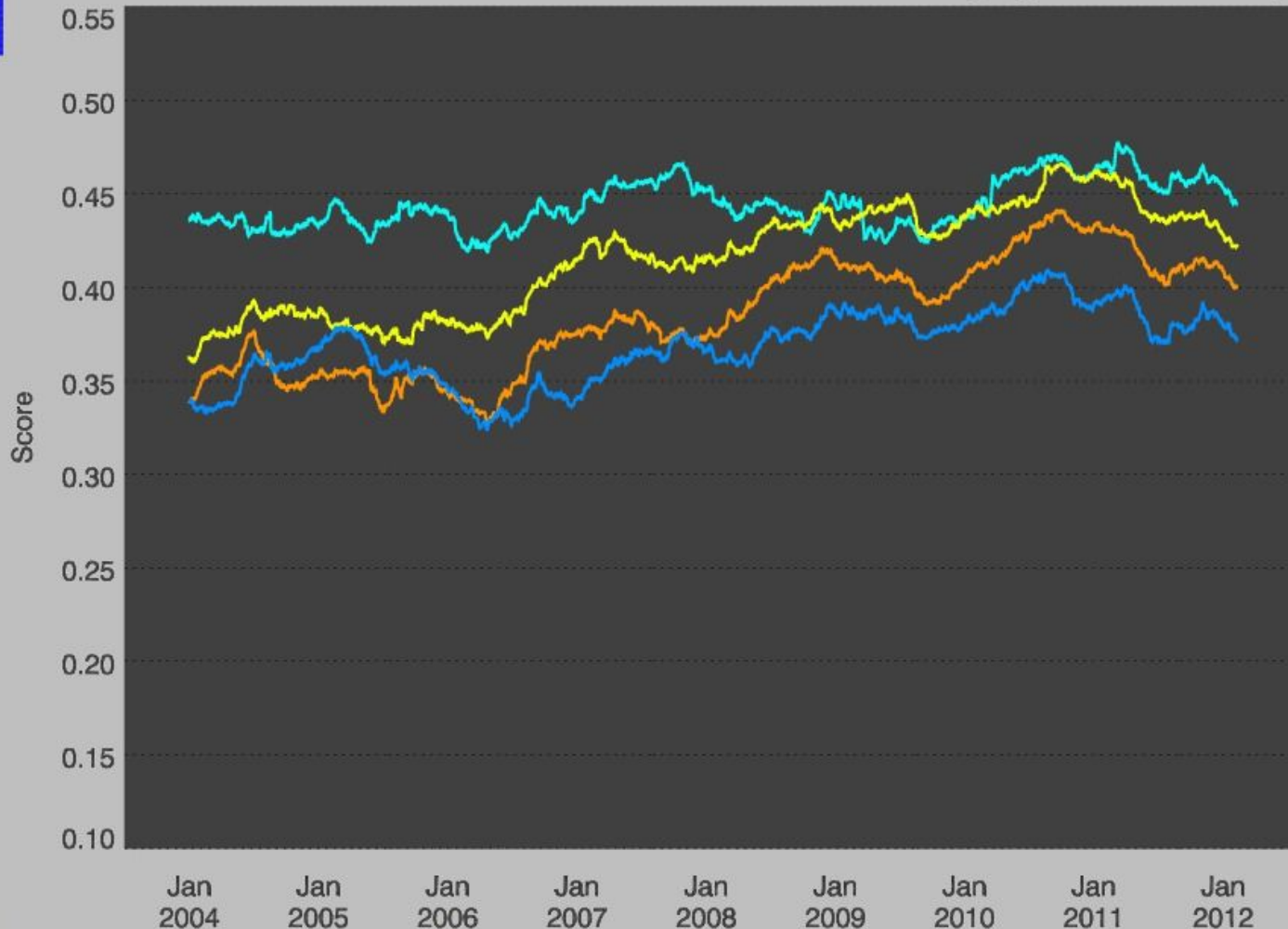
31.08.2012 12:02:06 MESZ



# COSI – long term trends: Day 1



Universal Score Period 01.07.2003 till 25.08.2012 averaging interval 365 days



VV: 06 (M: 0.449 C: 0.359) VV: 12 (M: 0.433 C: 0.736) VV: 18 (M: 0.402 C: 0.790) VV: 24 (M: 0.377 C: 0.756)

31.08.2012 12:02:17 MESZ

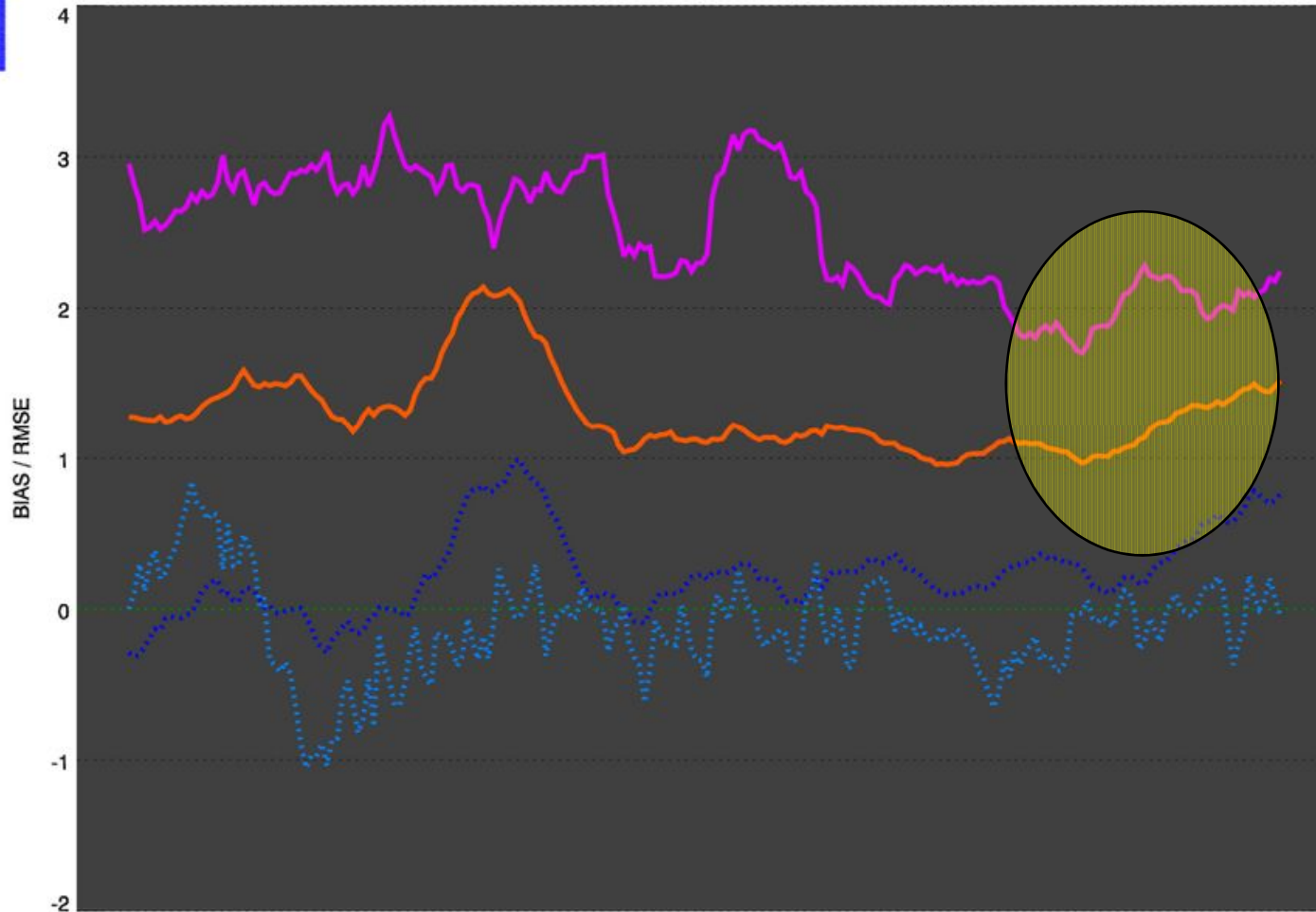


# COSI – long term trends: Day 1

## Temperature at the end of the night



BIAS and RMSE Period 01.01.2012 till 28.08.2012 averaging interval 30 days



13.01.2012 25.01.2012 06.02.2012 18.02.2012 01.03.2012 13.03.2012 25.03.2012 06.04.2012 18.04.2012 30.04.2012 12.05.2012 24.05.2012 05.06.2012 17.06.2012 29.06.2012 11.07.2012 23.07.2012 04.08.2012 16.08.2012 28.08.2012  
 Temperature VV: 06 RMSE BIAS RMSE (Pers.) BIAS (Pers.)

03.09.2012 12:59:15 MESZ

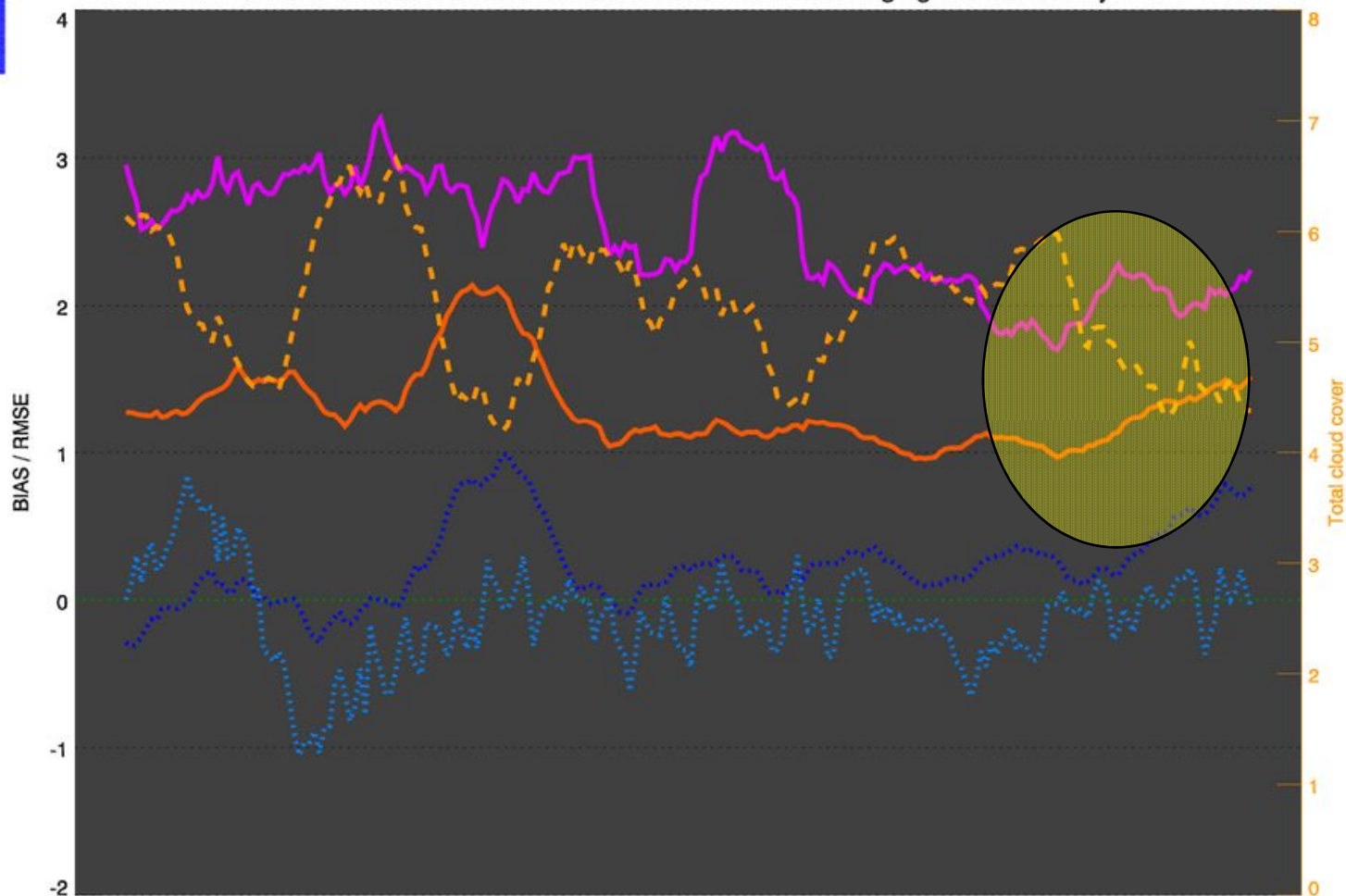


# COSI – long term trends: Day 1

## Temperature at the end of the night together with TCC (???)



BIAS and RMSE Period 01.01.2012 till 28.08.2012 averaging interval 30 days



13.01.2012 25.01.2012 06.02.2012 18.02.2012 01.03.2012 13.03.2012 25.03.2012 06.04.2012 18.04.2012 30.04.2012 12.05.2012 24.05.2012 05.06.2012 17.06.2012 29.06.2012 11.07.2012 23.07.2012 04.08.2012 16.08.2012 28.08.2012

Temperature VV: 06 RMSE BIAS RMSE (Pers.) BIAS (Pers.)

03.09.2012 12:59:19 MESZ

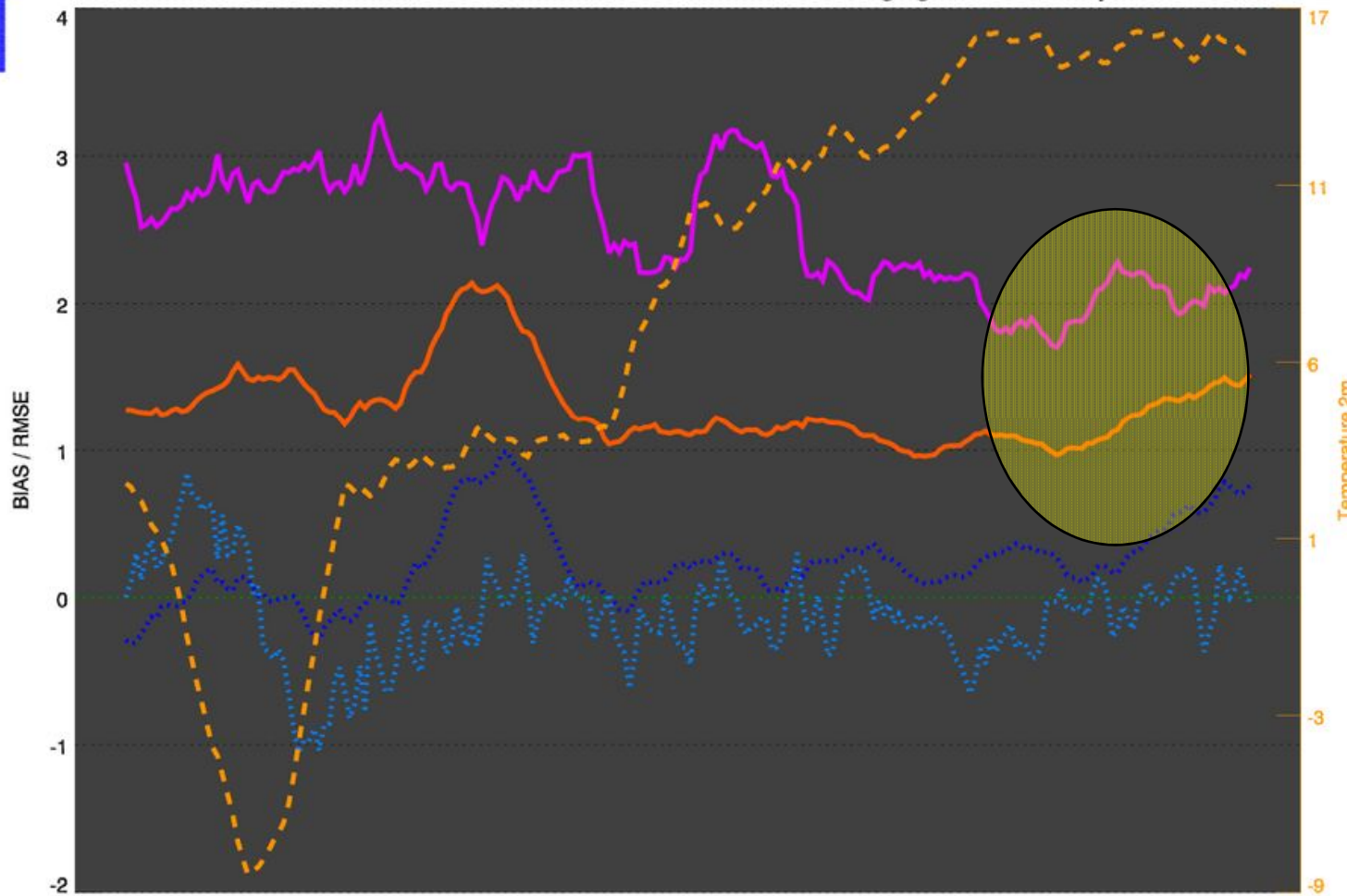


# COSI – long term trends: Day 1

## Temperature at the end of the night together with T2m (???)



BIAS and RMSE Period 01.01.2012 till 28.08.2012 averaging interval 30 days



13.01.2012 25.01.2012 06.02.2012 18.02.2012 01.03.2012 13.03.2012 25.03.2012 06.04.2012 18.04.2012 30.04.2012 12.05.2012 24.05.2012 05.06.2012 17.06.2012 29.06.2012 11.07.2012 23.07.2012 04.08.2012 16.08.2012 28.08.2012

Temperature VV: 06 RMSE BIAS RMSE (Pers.) BIAS (Pers.)

03.09.2012 12:59:27 MESZ



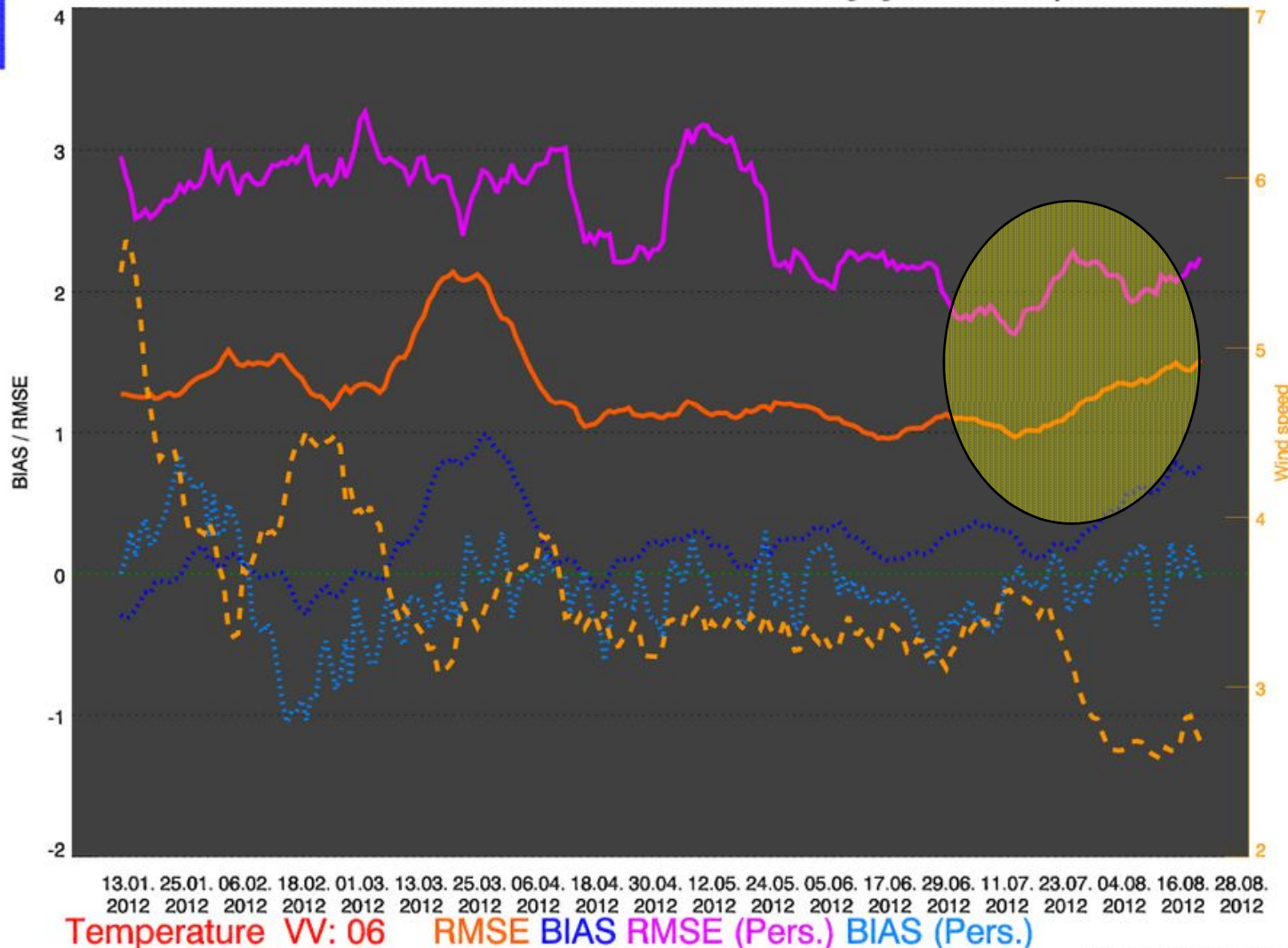


# COSI – long term trends: Day 1

## Temperature at the end of the night together with **WS (!!!)**



BIAS and RMSE Period 01.01.2012 till 28.08.2012 averaging interval 30 days



03.09.2012 12:59:23 MESZ

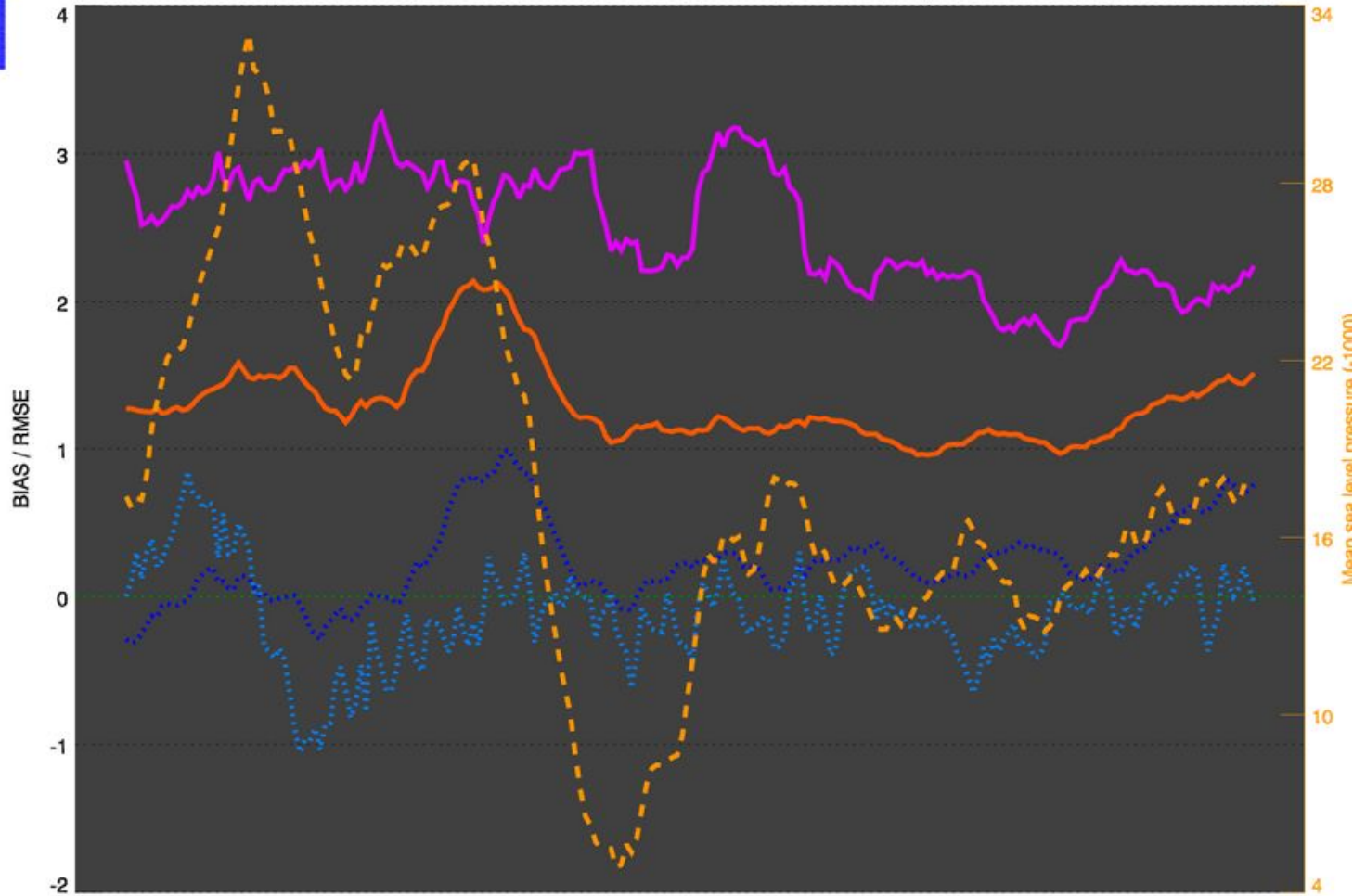


# COSI – long term trends: Day 1

## Temperature at the end of the night together with mslp (!!!)



BIAS and RMSE Period 01.01.2012 till 28.08.2012 averaging interval 30 days



13.01. 25.01. 06.02. 18.02. 01.03. 13.03. 25.03. 06.04. 18.04. 30.04. 12.05. 24.05. 05.06. 17.06. 29.06. 11.07. 23.07. 04.08. 16.08. 28.08.  
2012 2012 2012 2012 2012 2012 2012 2012 2012 2012 2012 2012 2012 2012 2012 2012 2012 2012 2012 2012

Temperature VV: 06 RMSE BIAS RMSE (Pers.) BIAS (Pers.)

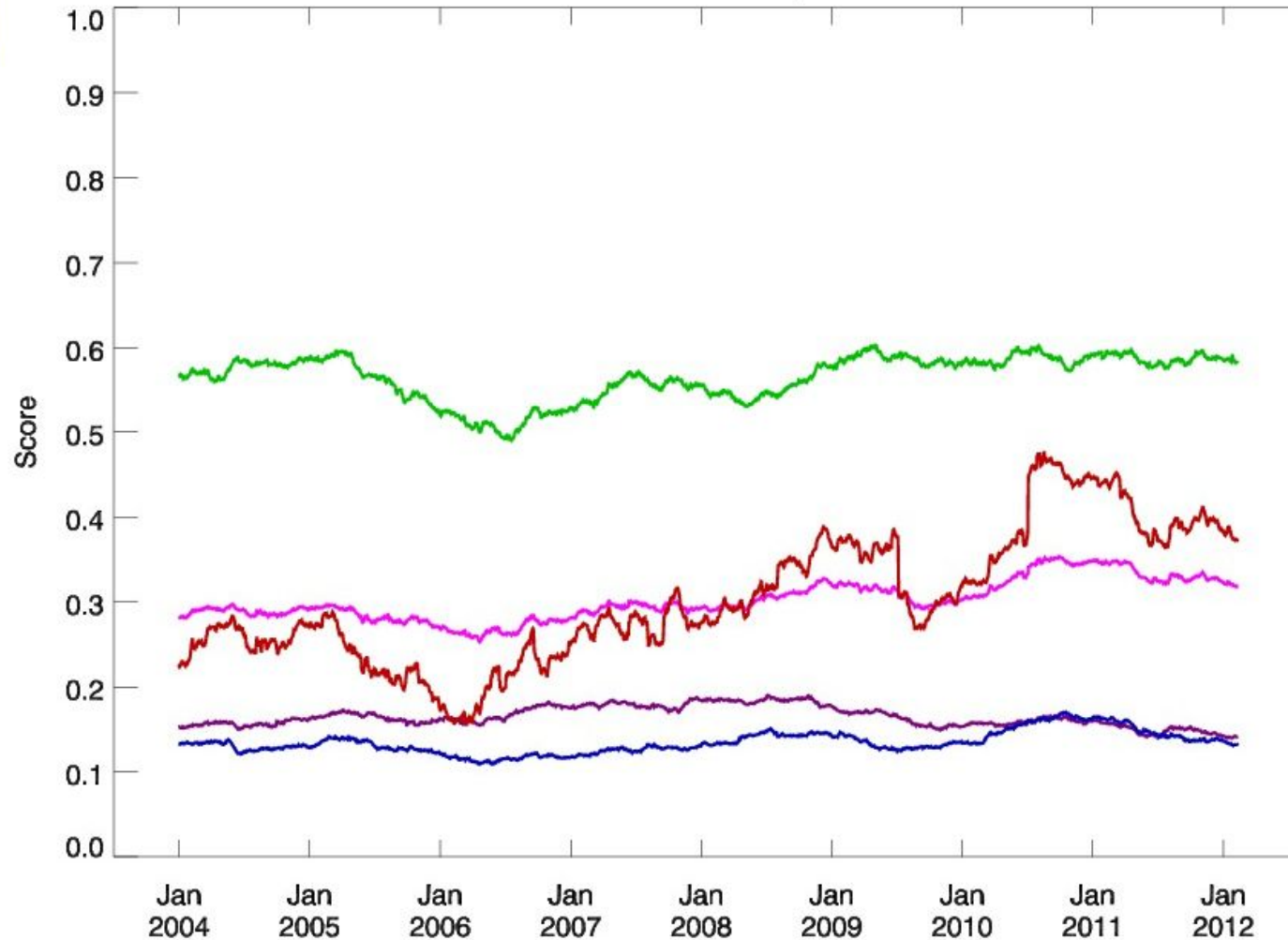
03.09.2012 12:59:31 MESZ



# COSI – long term trends: Day 2



All Scores Day 2

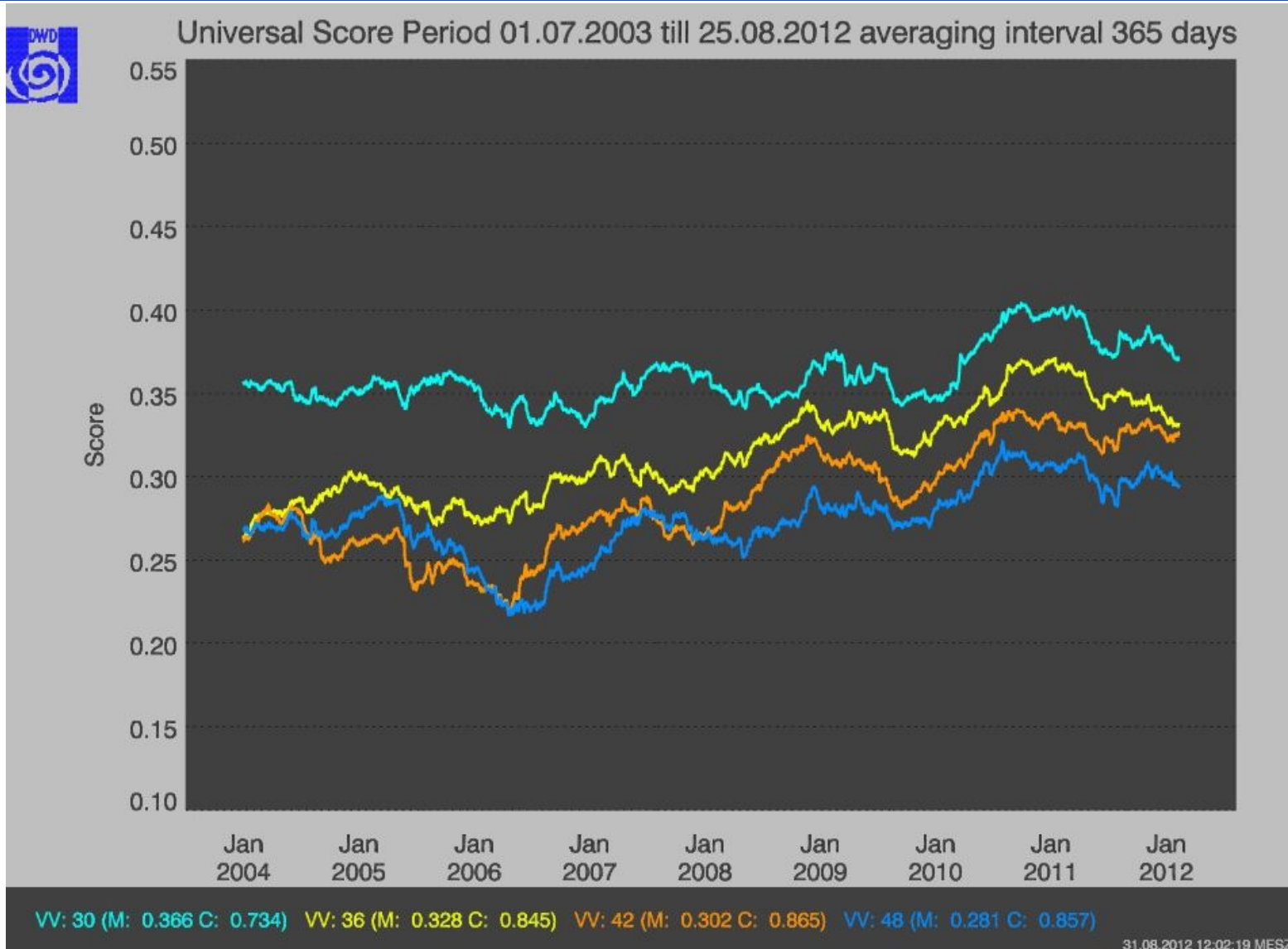


Universal Score Cloud cover Vector wind Temperature Precipitation

31.08.2012 12:02:08 MESZ



# COSI – long term trends: Day 2



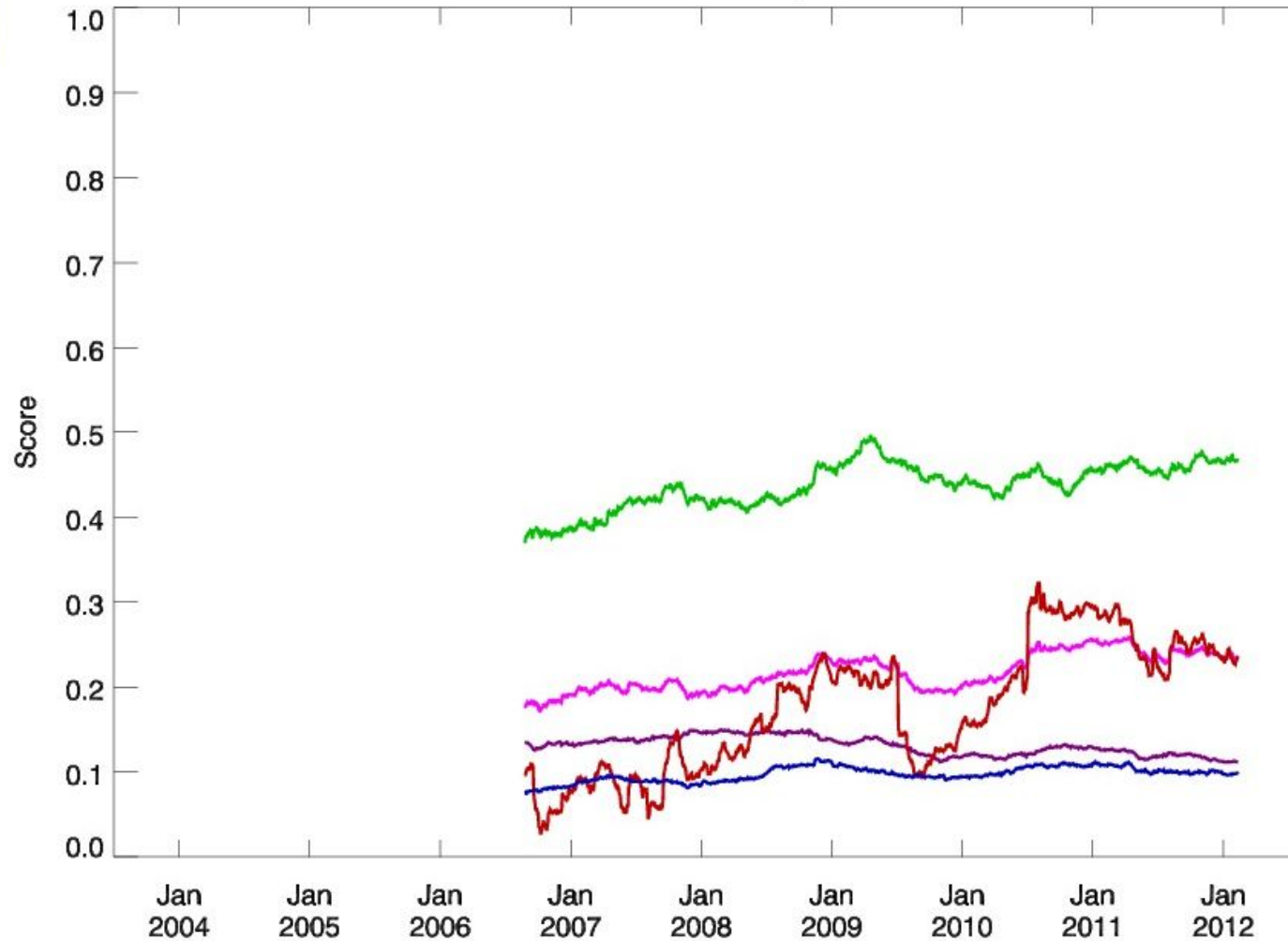
31.08.2012 12:02:19 MESZ



# COSI – long term trends: Day 3



All Scores Day 3

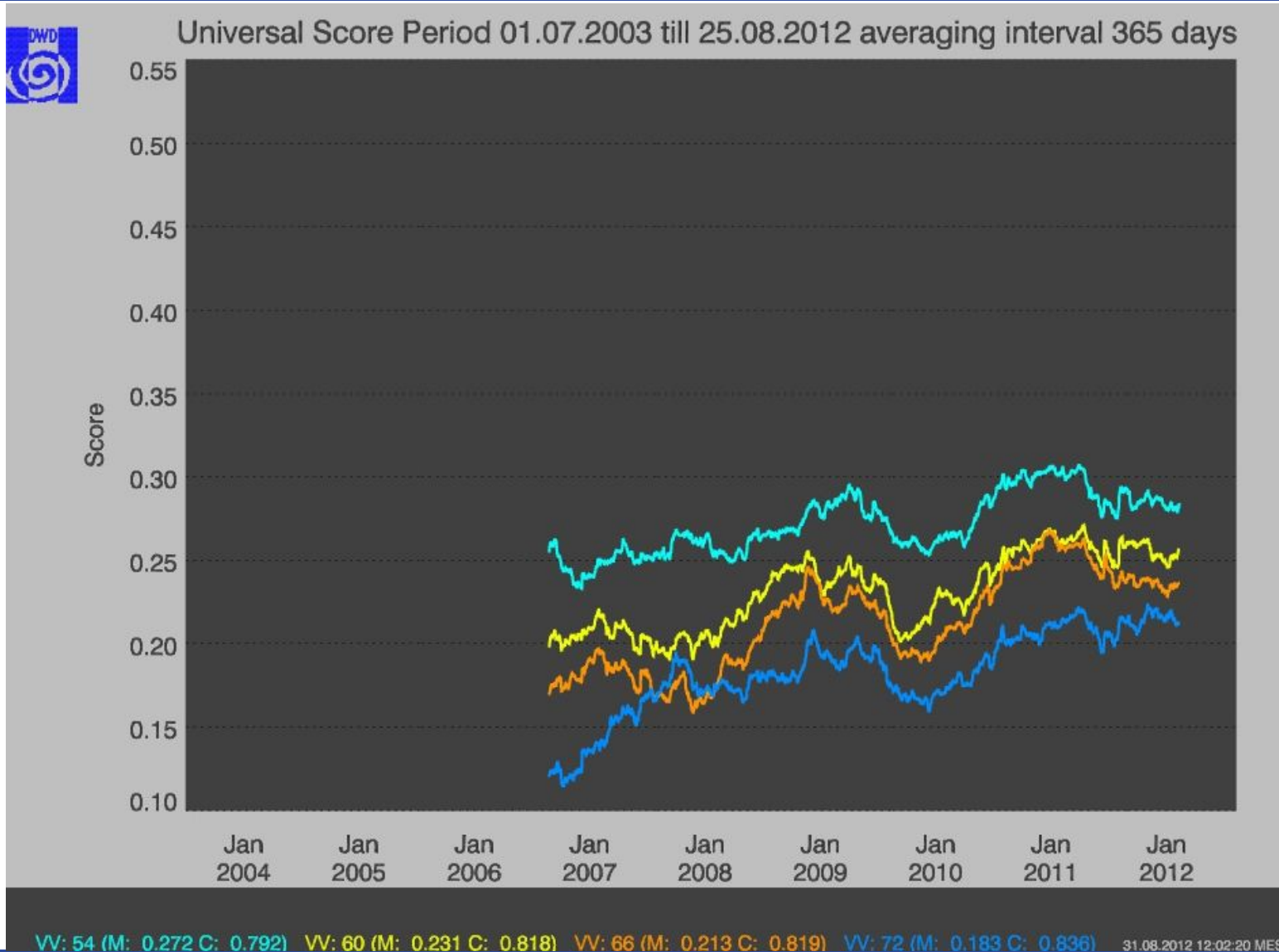


Universal Score Cloud cover Vector wind Temperature Precipitation

31.08.2012 12:02:10 MESZ

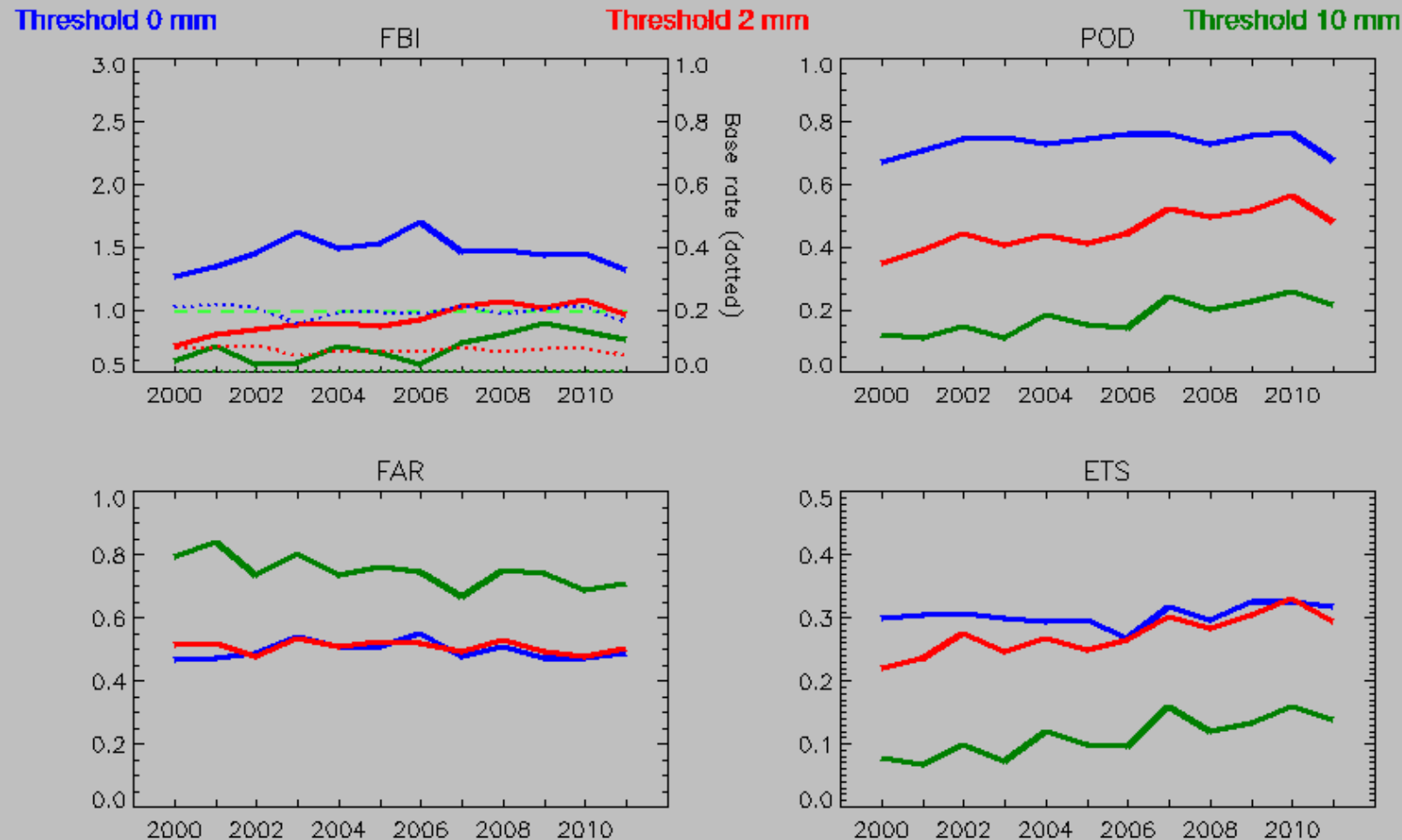


# COSI – long term trends: Day 3



# Long term trend of QPF quality (SYNOP observation network): Major change in the model: 29.06.2011: Introduction of Bott-Advection

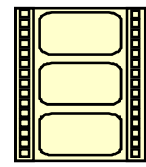
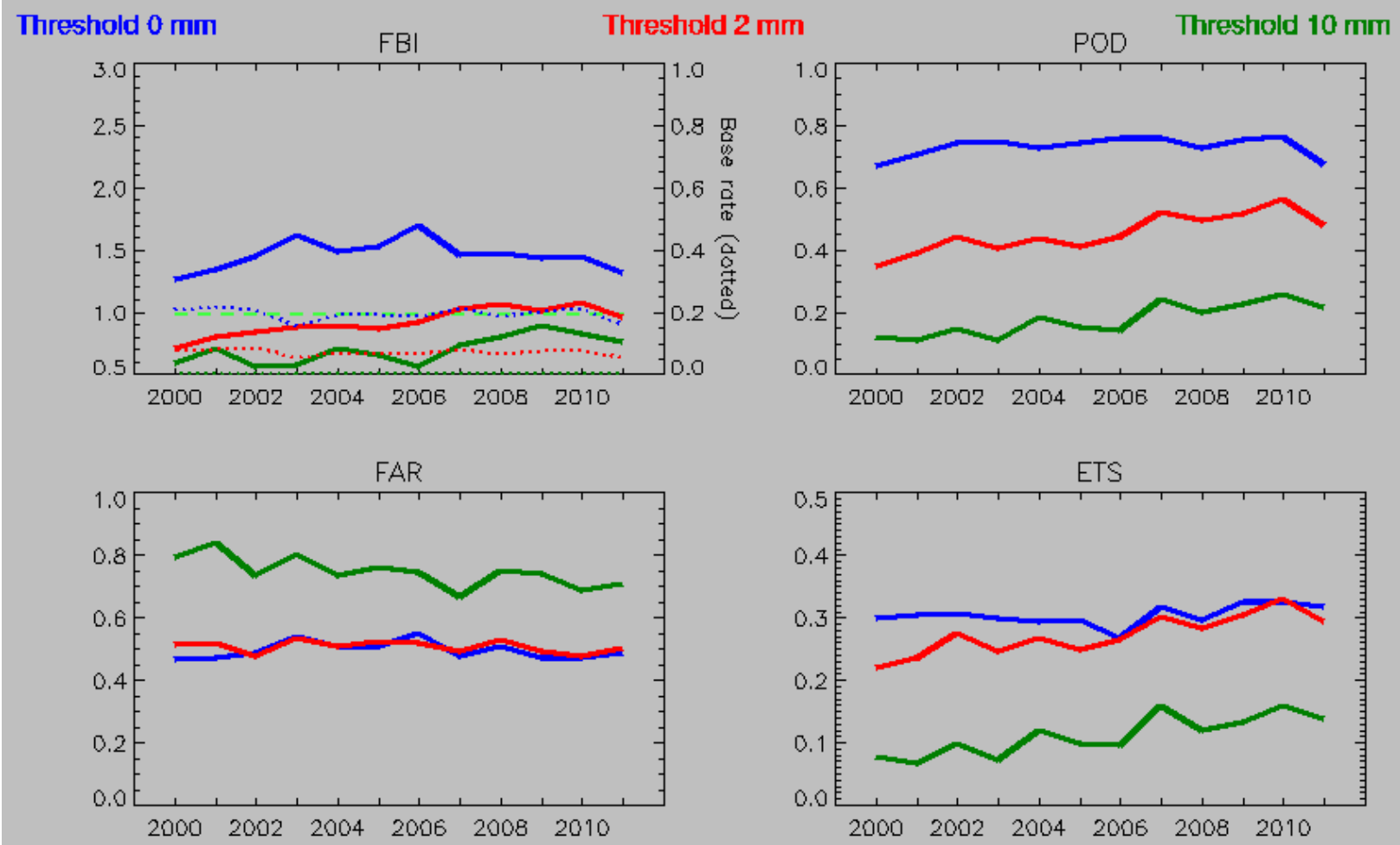
Deutscher Wetterdienst  
Wetter und Klima aus einer Hand



Results of precipitation verification (6h-cumulation time) for season:  
COSMO-EU: Years: 2000 - 2011 Run: 12 UTC VT: 00 VV: 012



# Long term trend of QPF quality (SYNOP observation network): Valid time 00 UTC since 2000



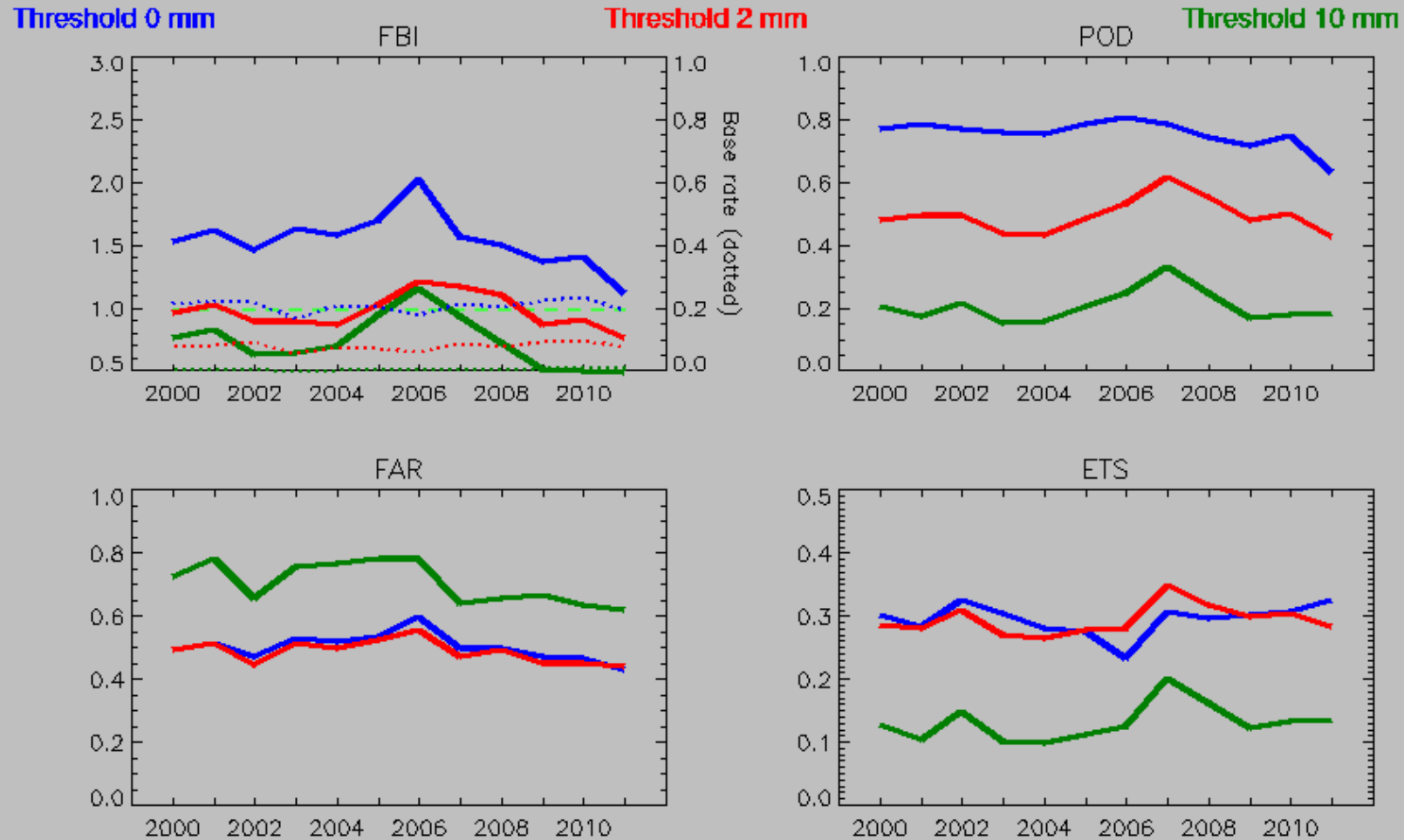
**Results of precipitation verification (6h-cumulation time) for season:**  
**COSMO-EU: Years: 2000 - 2011 Run: 12 UTC VT: 00 VV: 012**



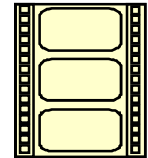


# Long term trend of QPF quality (SYNOP observation network): Valid time 06 UTC since 2000

Deutscher Wetterdienst  
Wetter und Klima aus einer Hand

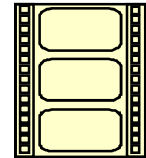
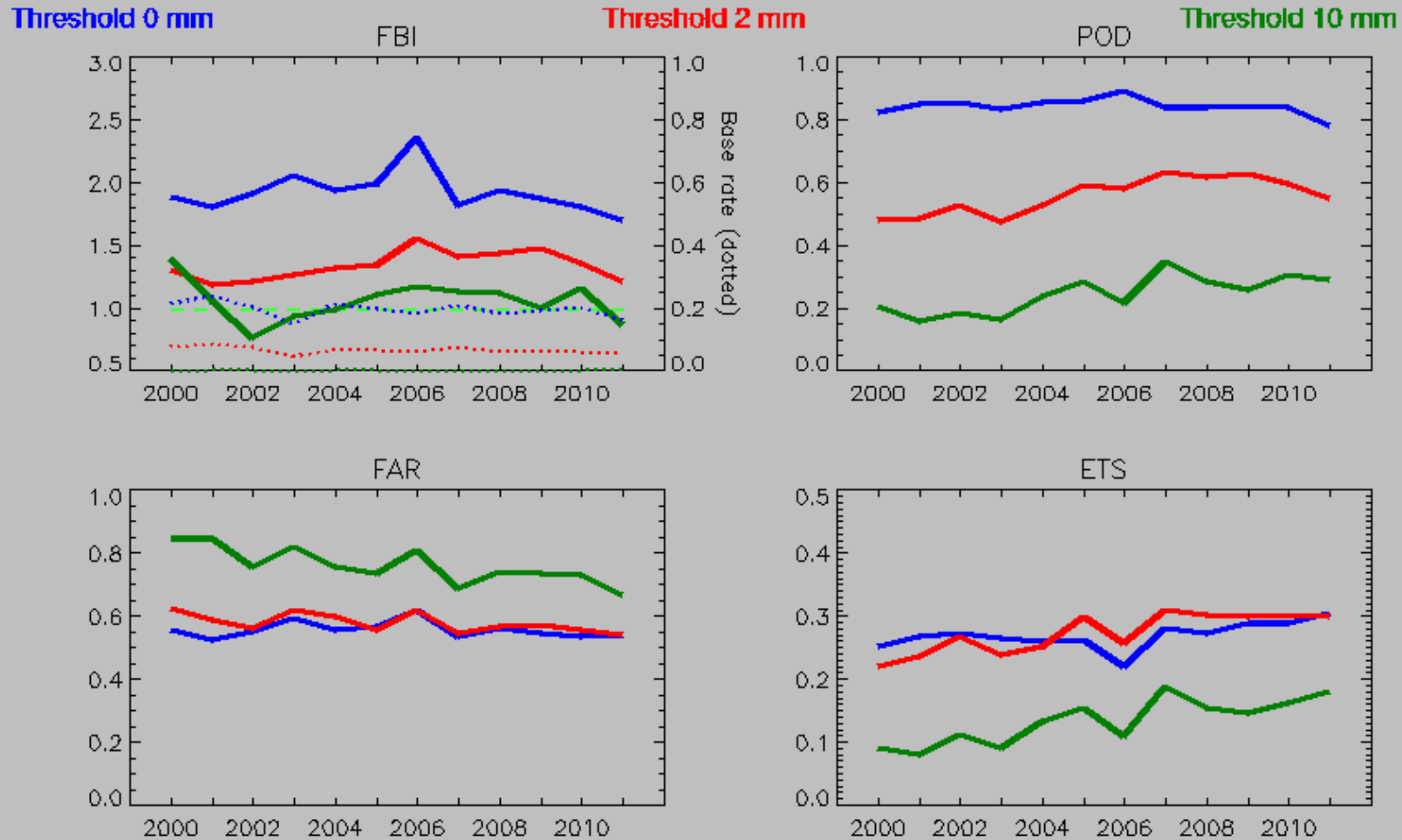


Results of precipitation verification (6h-cumulation time) for season:  
COSMO-EU: Years: 2000 - 2011 Run: 00 UTC VT: 06 VV: 006



# Long term trend of QPF quality (SYNOP observation network): Valid time 12 UTC since 2000

Deutscher Wetterdienst  
Wetter und Klima aus einer Hand

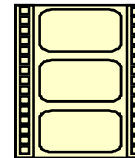
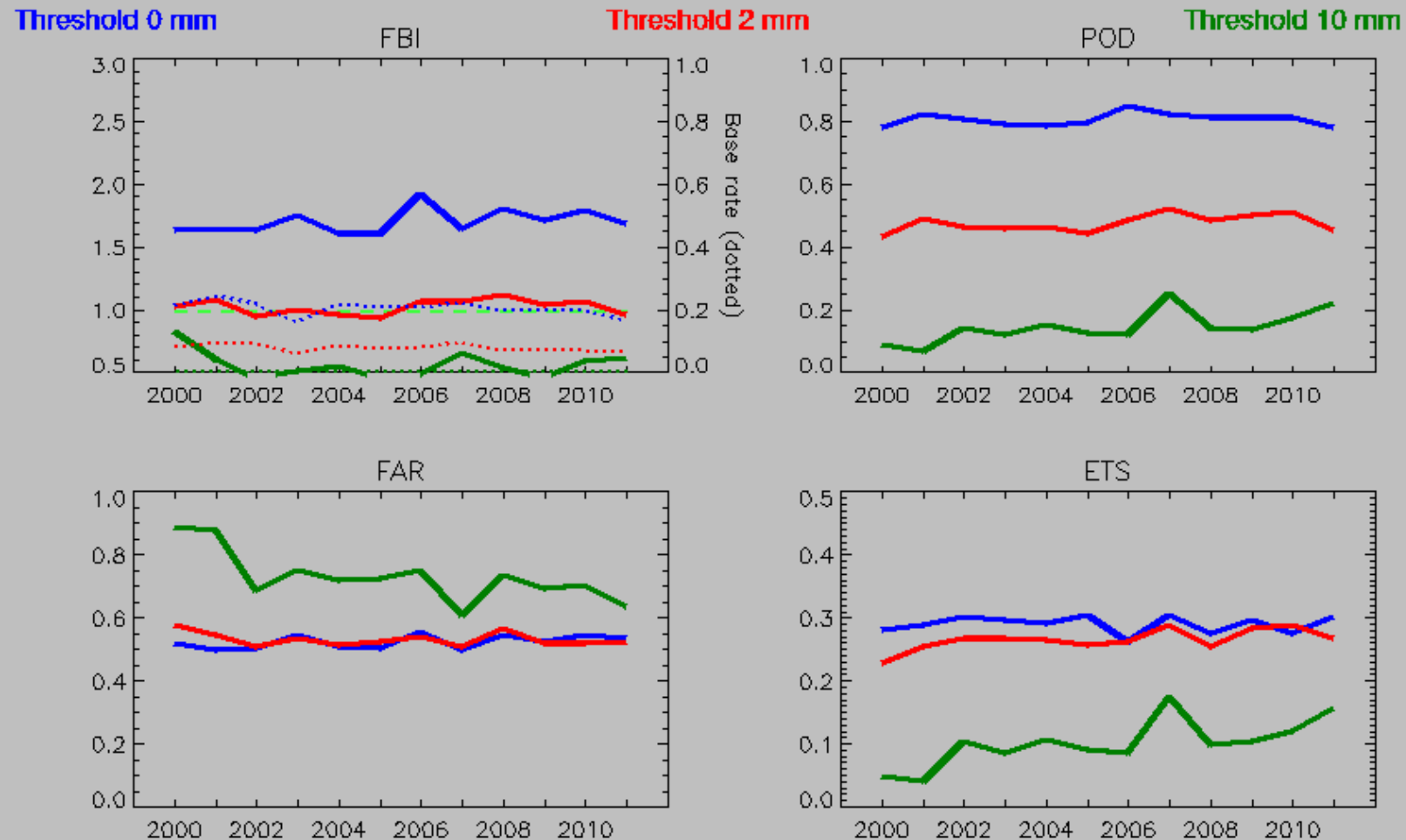


Results of precipitation verification (6h-cumulation time) for season:  
COSMO-EU: Years: 2000 - 2011 Run: 00 UTC VT: 12 VV: 012



# Long term trend of QPF quality (SYNOP observation network): Valid time **18 UTC** since 2000

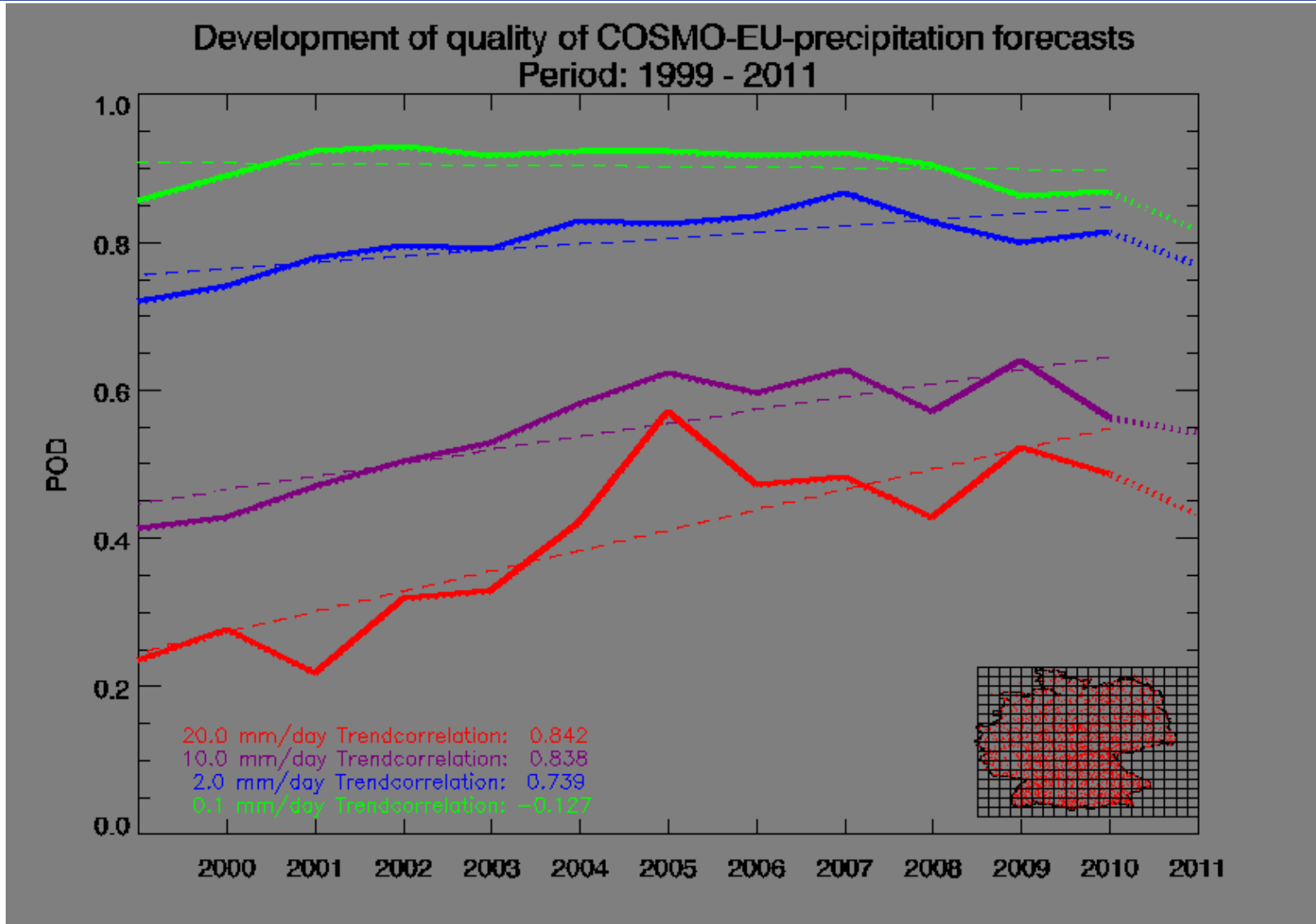
Deutscher Wetterdienst  
Wetter und Klima aus einer Hand



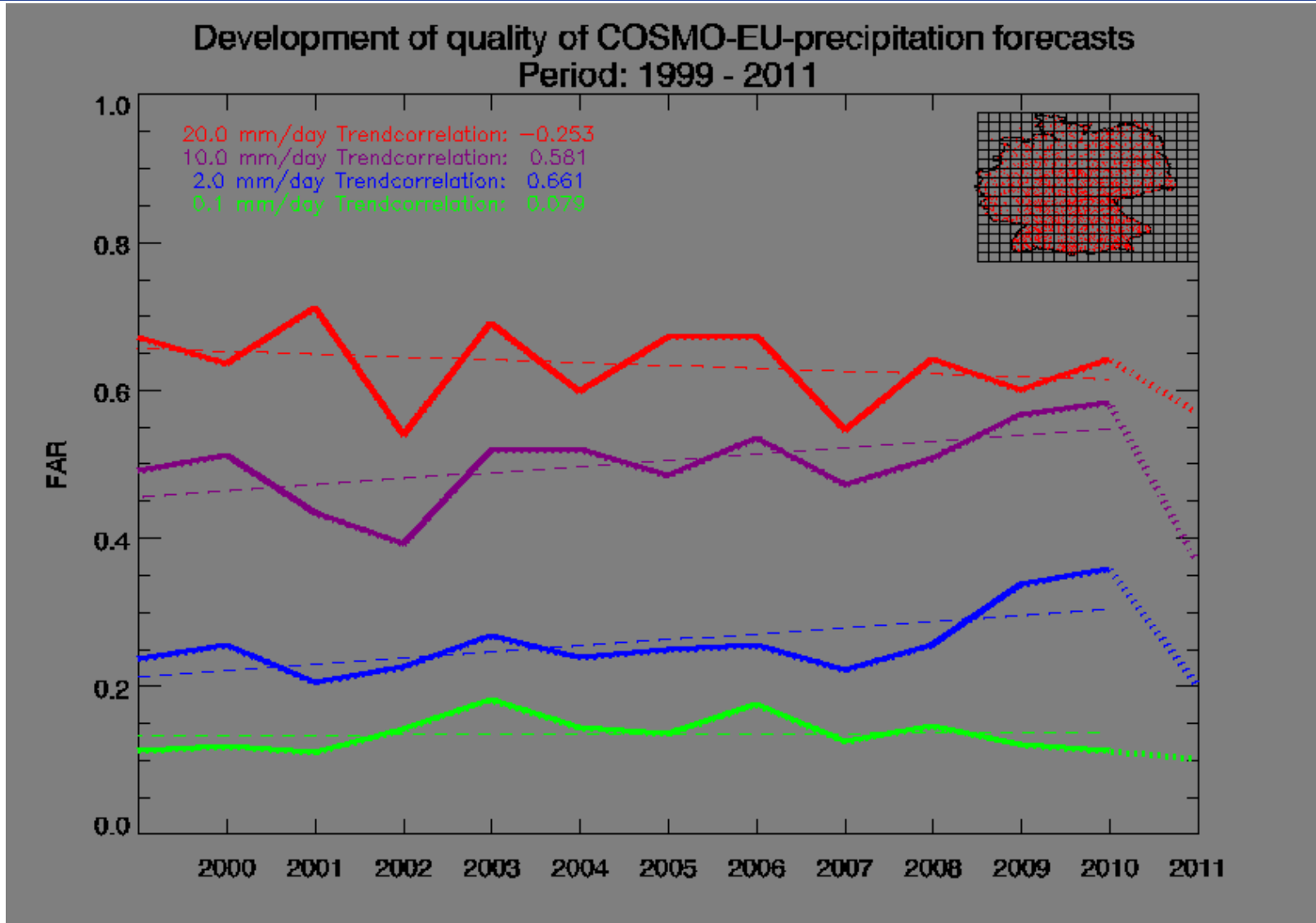
Results of precipitation verification (6h-cumulation time) for season:  
COSMO-EU: Years: 2000 - 2011 Run: **12 UTC** VT: 18 VV: **006**



# Long term trend of QPF quality (high density observation network): Probability of detection

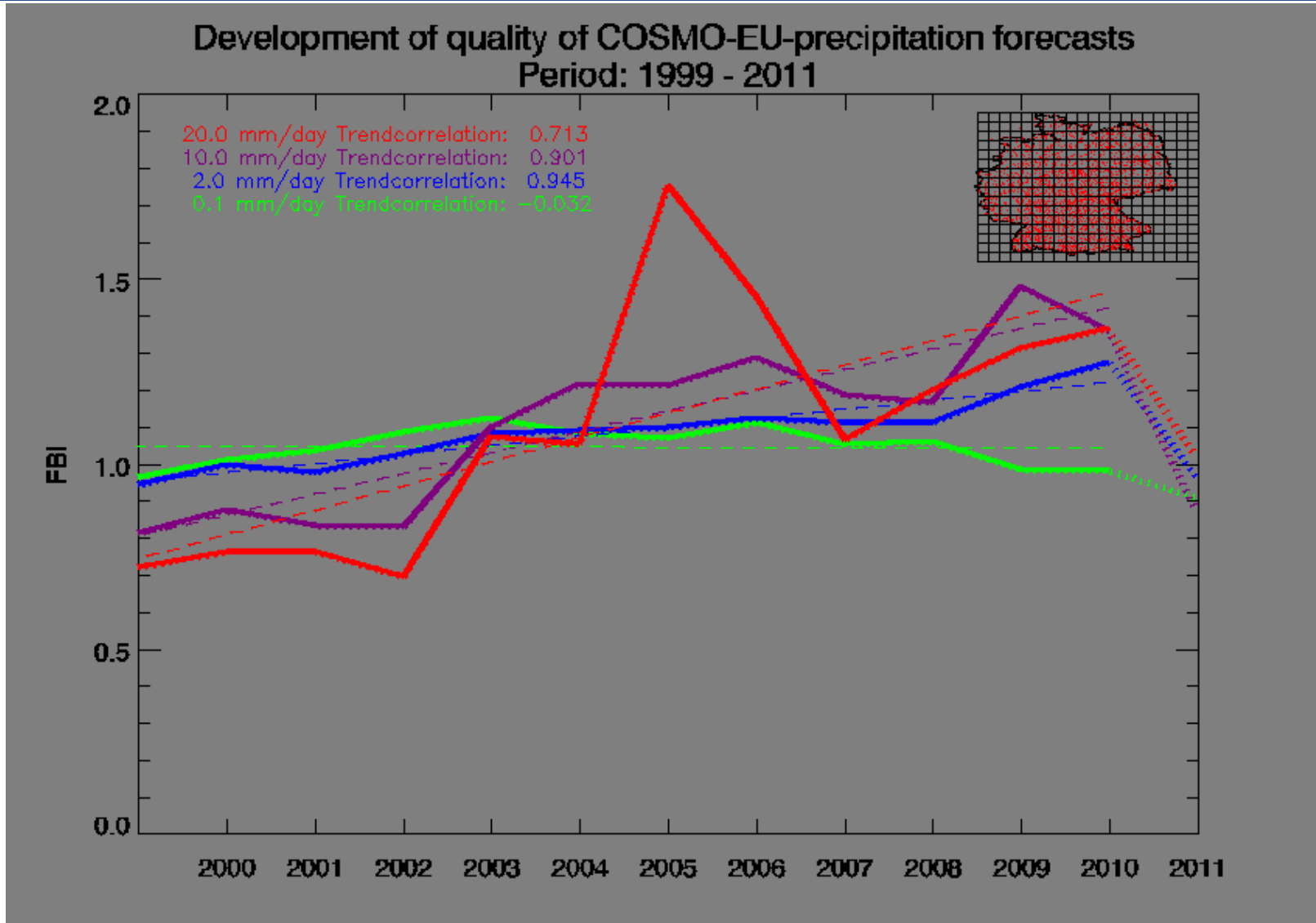


# Long term trend of QPF quality (high density observation network): False alarm ratio



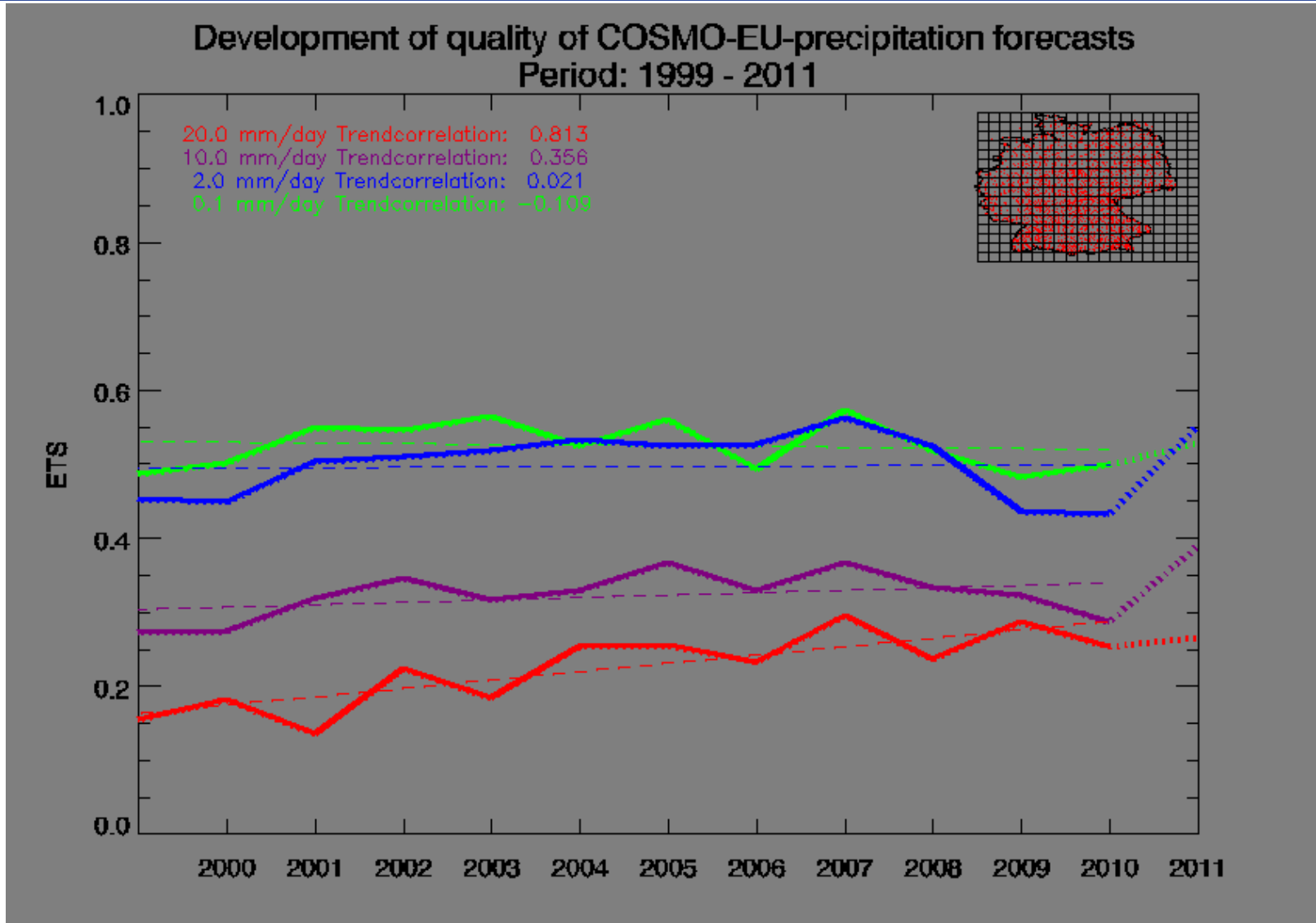
# Long term trend of QPF quality (high density observation network): Frequency bias

Deutscher Wetterdienst  
Wetter und Klima aus einer Hand



# Long term trend of QPF quality (high density observation network): Equitable threat score

Deutscher Wetterdienst  
Wetter und Klima aus einer Hand



Long term trend of QPF quality (SYNOP observation network):  
 Valid time **00** UTC, Spring, since 2000, Major change in the model:  
 29.06.2011: Introduction of Bott-Advection

Deutscher Wetterdienst  
 Wetter und Klima aus einer Hand

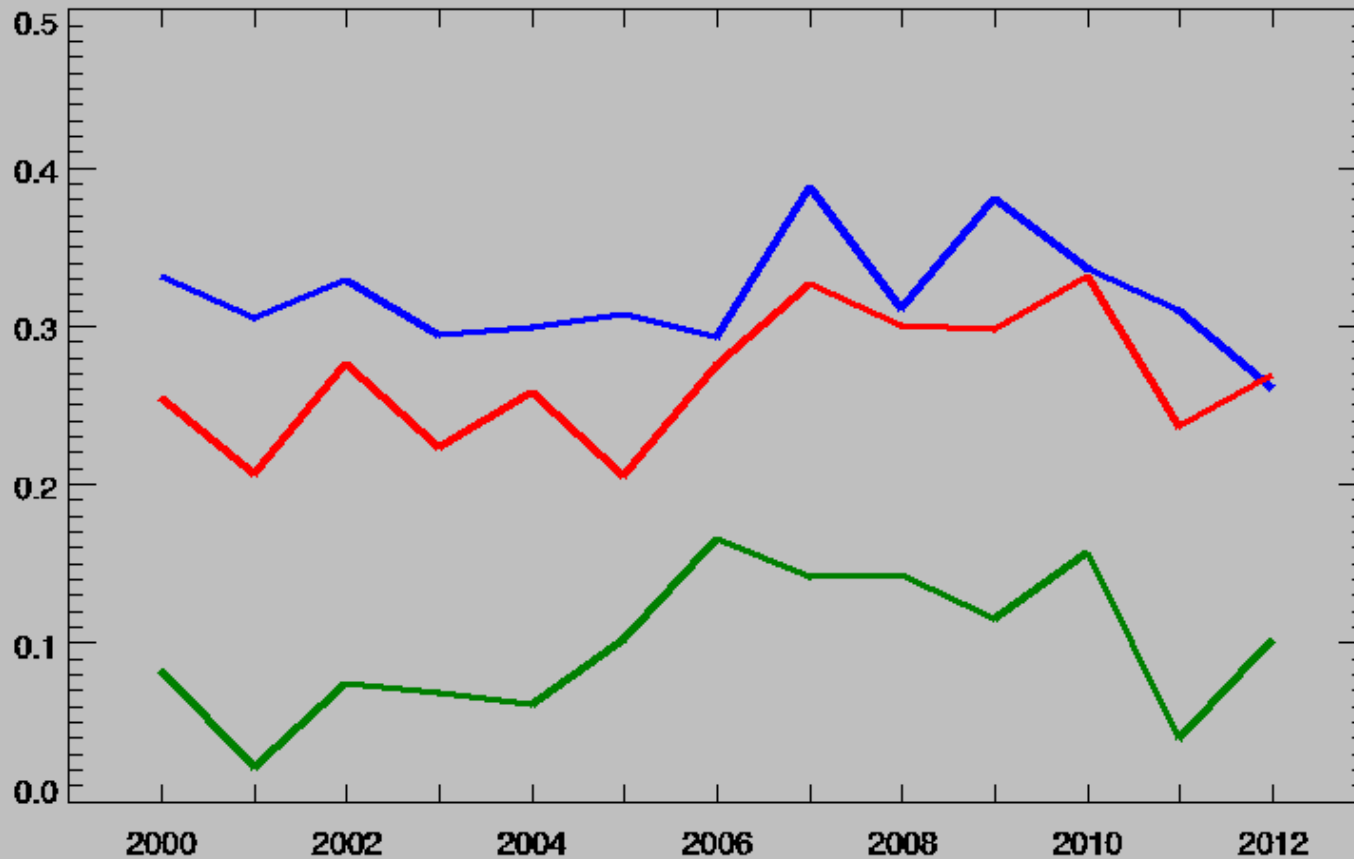


Threshold 0 mm

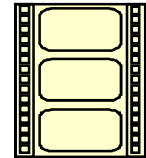
Threshold 2 mm

Threshold 10 mm

ETS



Results of precipitation verification (6h-cumulation time) for season: MAM  
 COSMO-EU: Years: 2000 - 2012 Run: **12** UTC VT: 00 VV: **012**





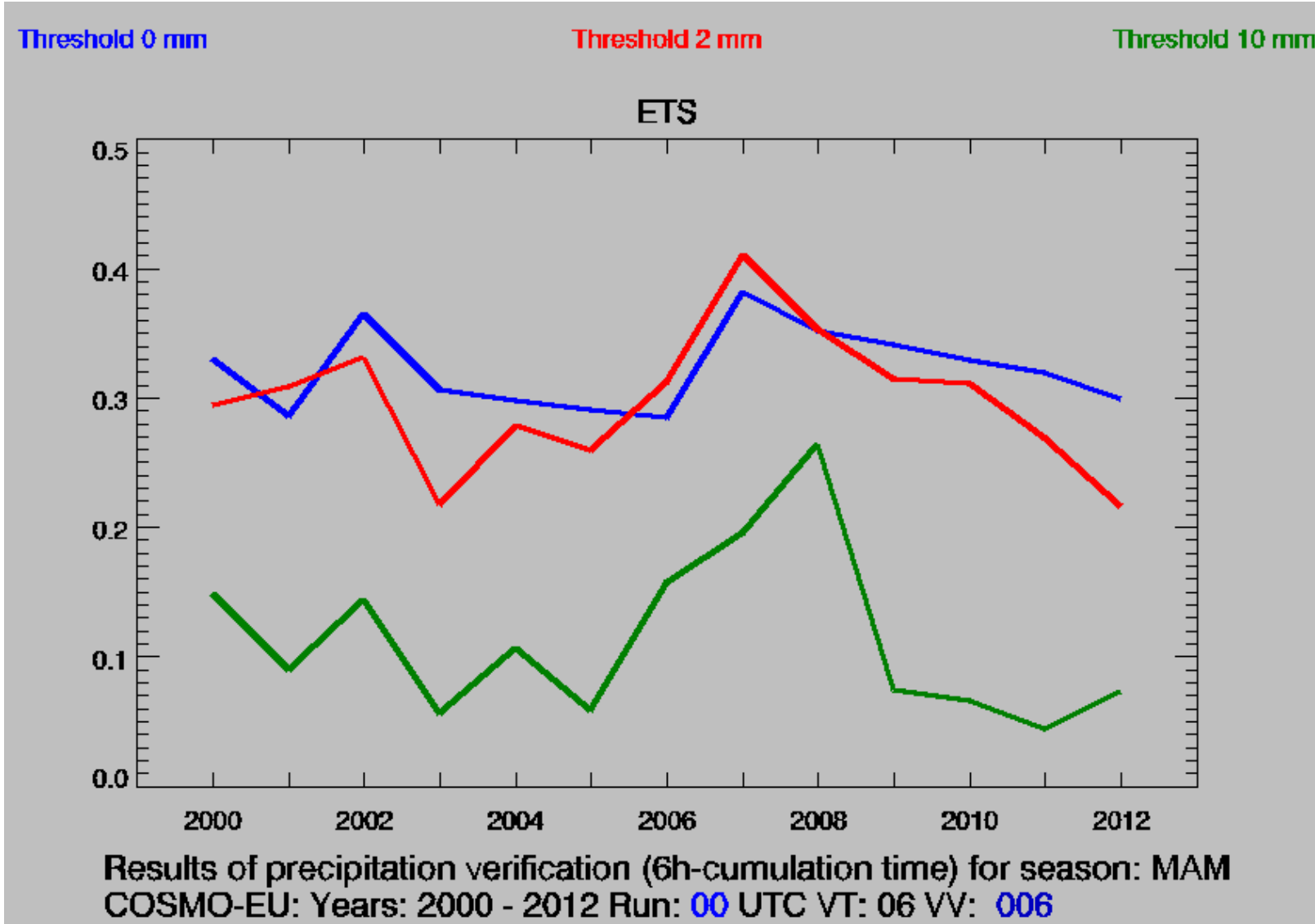
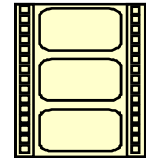
Long term trend of QPF quality (SYNOP observation network):  
 Valid time **06** UTC, Spring, since 2000, Major change in the model:  
 29.06.2011: Introduction of Bott-Advection



Threshold 0 mm

Threshold 2 mm

Threshold 10 mm



Long term trend of QPF quality (SYNOP observation network):  
 Valid time **12 UTC**, Spring, since 2000, Major change in the model:  
 29.06.2011: Introduction of Bott-Advection

Deutscher Wetterdienst  
 Wetter und Klima aus einer Hand

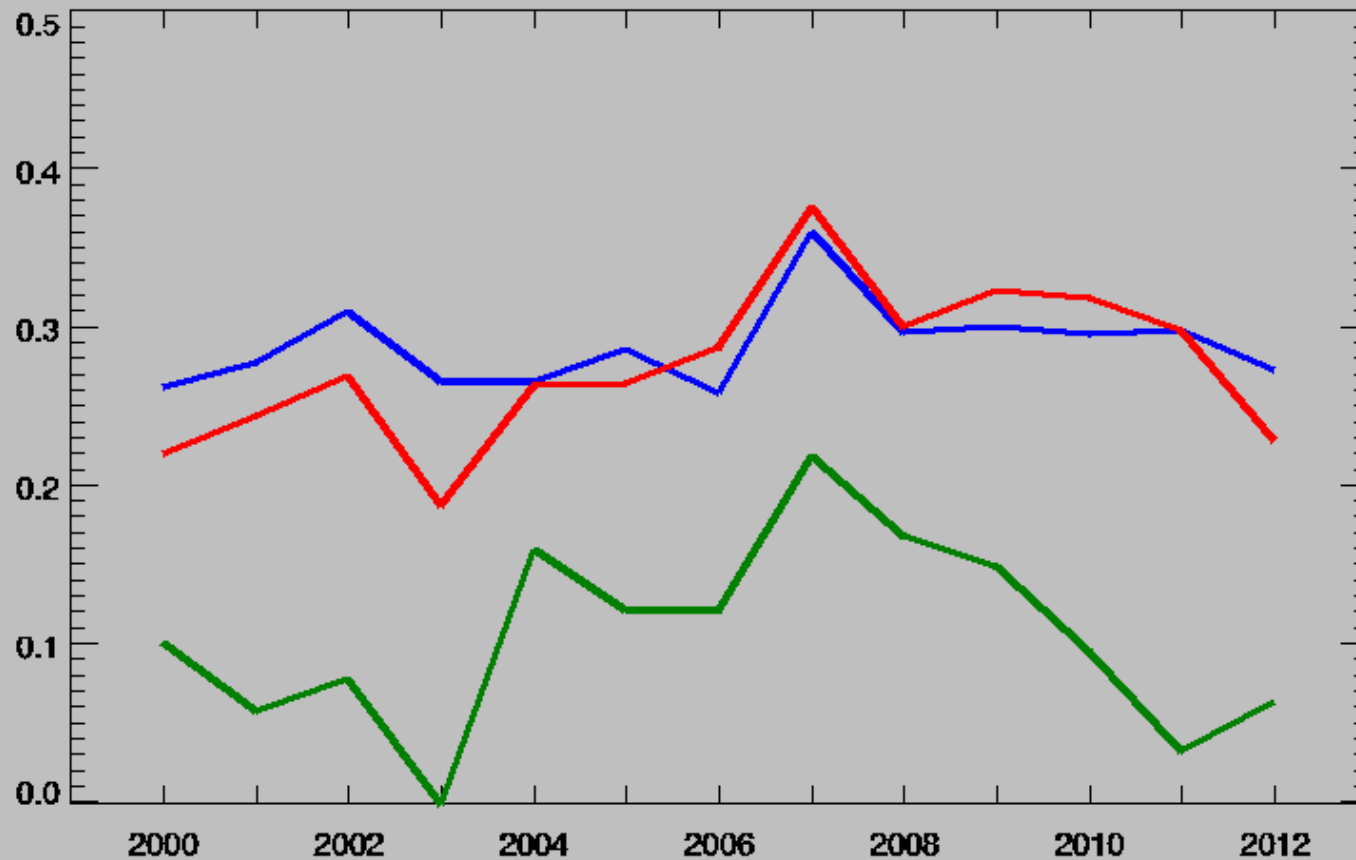


Threshold 0 mm

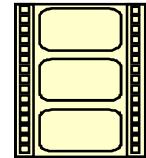
Threshold 2 mm

Threshold 10 mm

ETS



Results of precipitation verification (6h-cumulation time) for season: MAM  
 COSMO-EU: Years: 2000 - 2012 Run: 00 UTC VT: 12 VV: 012



Long term trend of QPF quality (SYNOP observation network):  
 Valid time **18 UTC**, Spring, since 2000, Major change in the model:  
 29.06.2011: Introduction of Bott-Advection

Deutscher Wetterdienst  
 Wetter und Klima aus einer Hand

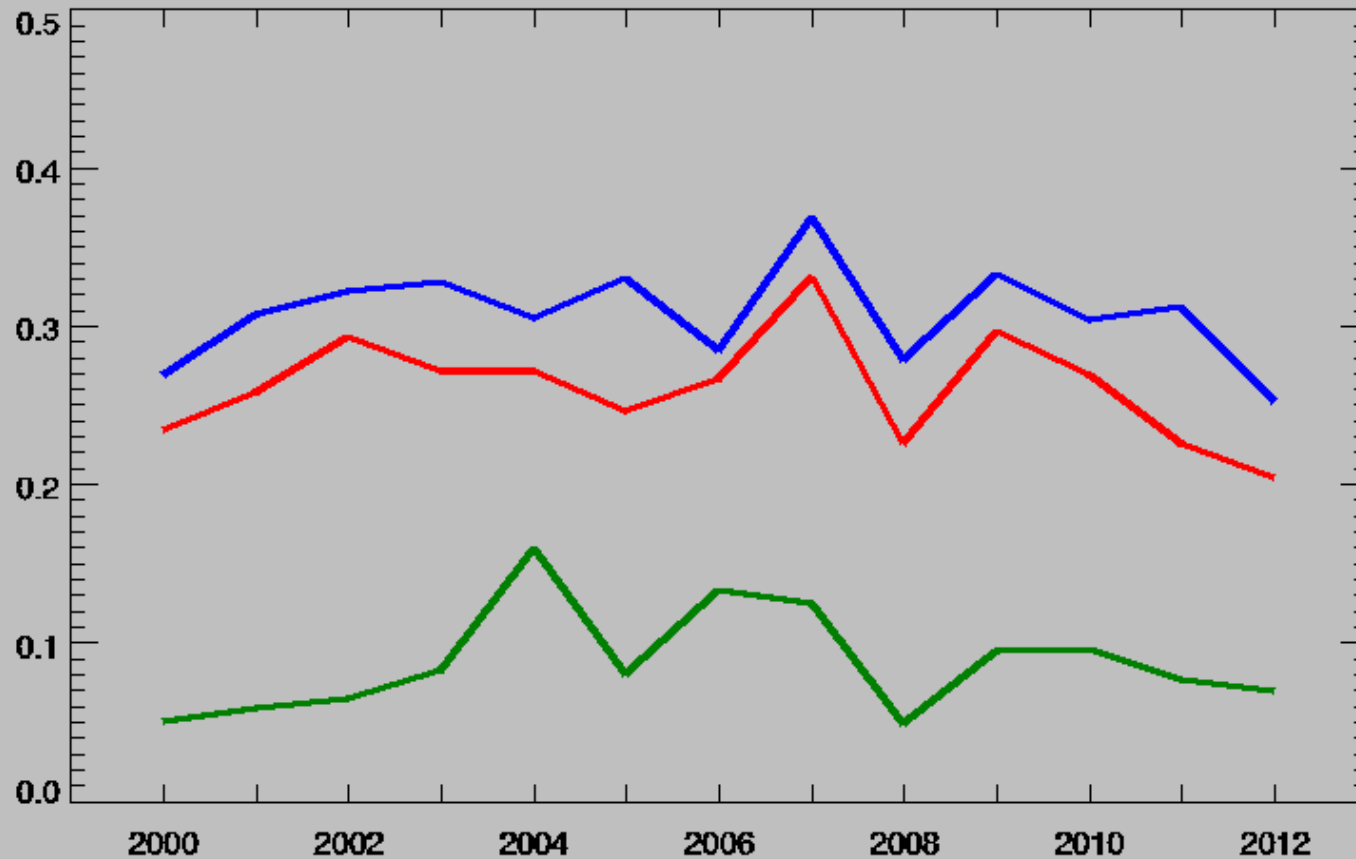


Threshold 0 mm

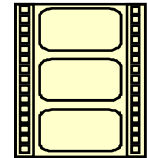
Threshold 2 mm

Threshold 10 mm

ETS

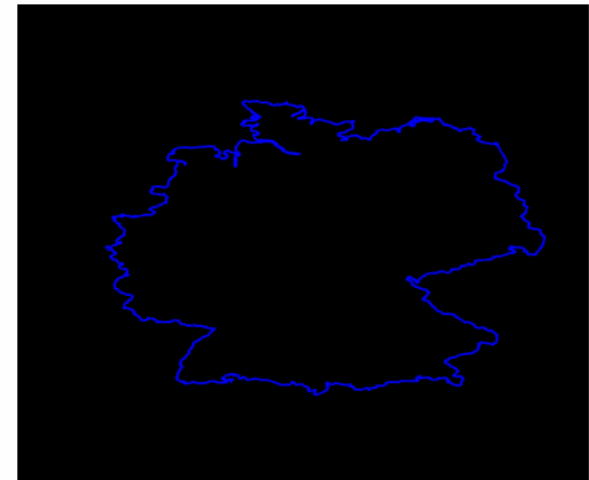
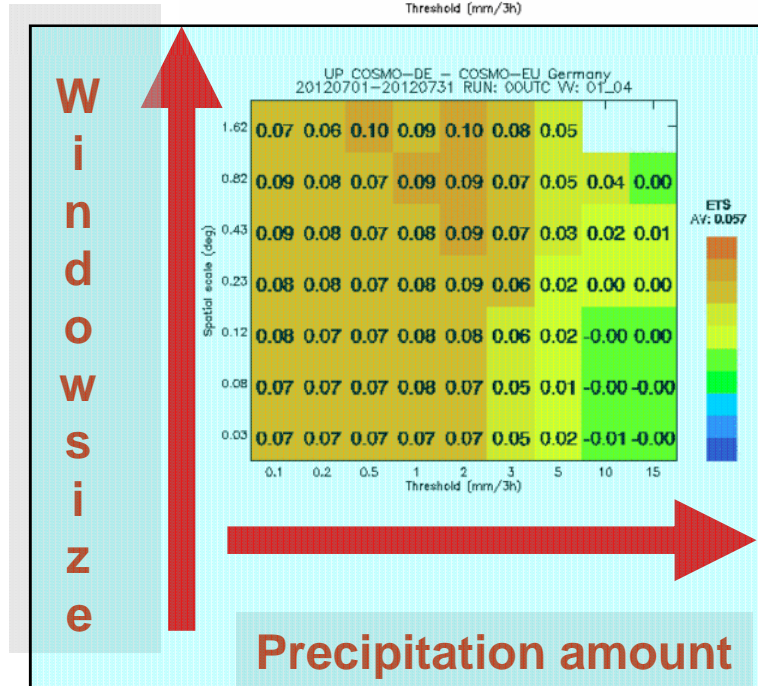
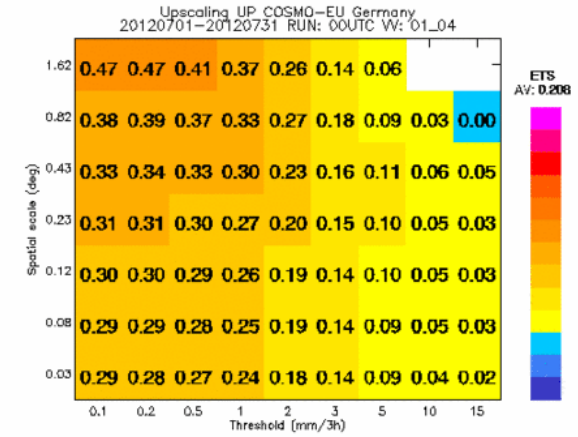
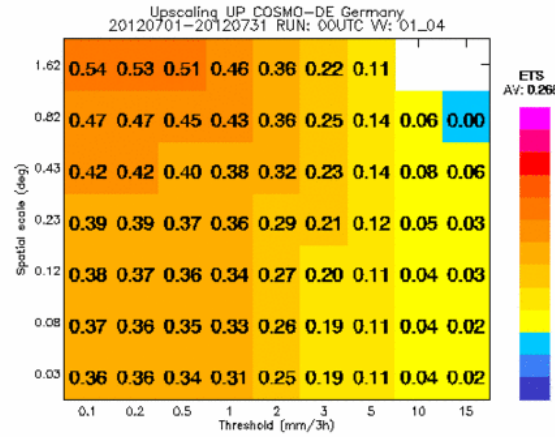


Results of precipitation verification (6h-cumulation time) for season: MAM  
 COSMO-EU: Years: 2000 - 2012 Run: **12** UTC VT: 18 VV: **006**



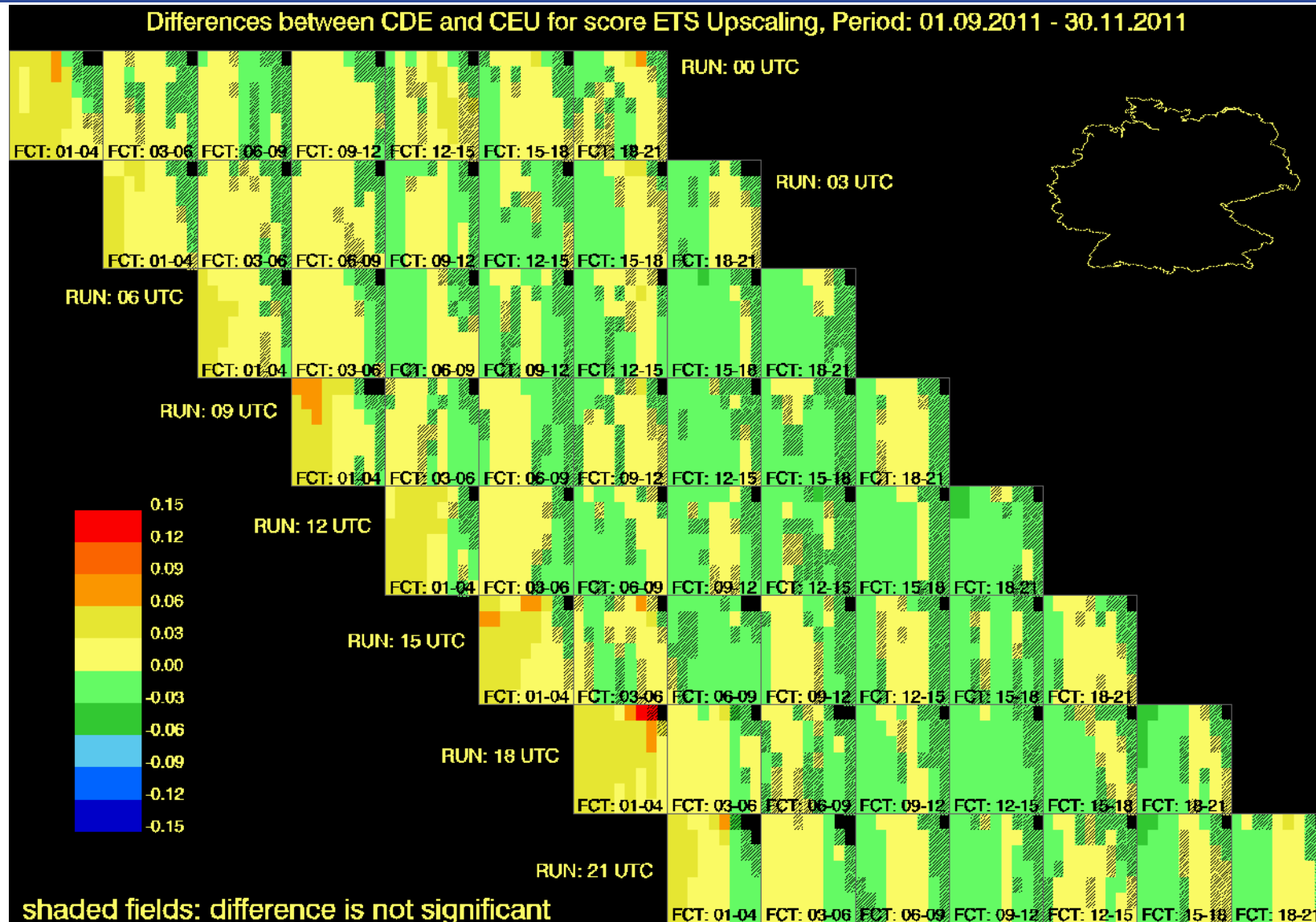
# Presentation of Fuzzy-verification results

- Look at windows with different horizontal size
- Calculate scores that are representative for these windows



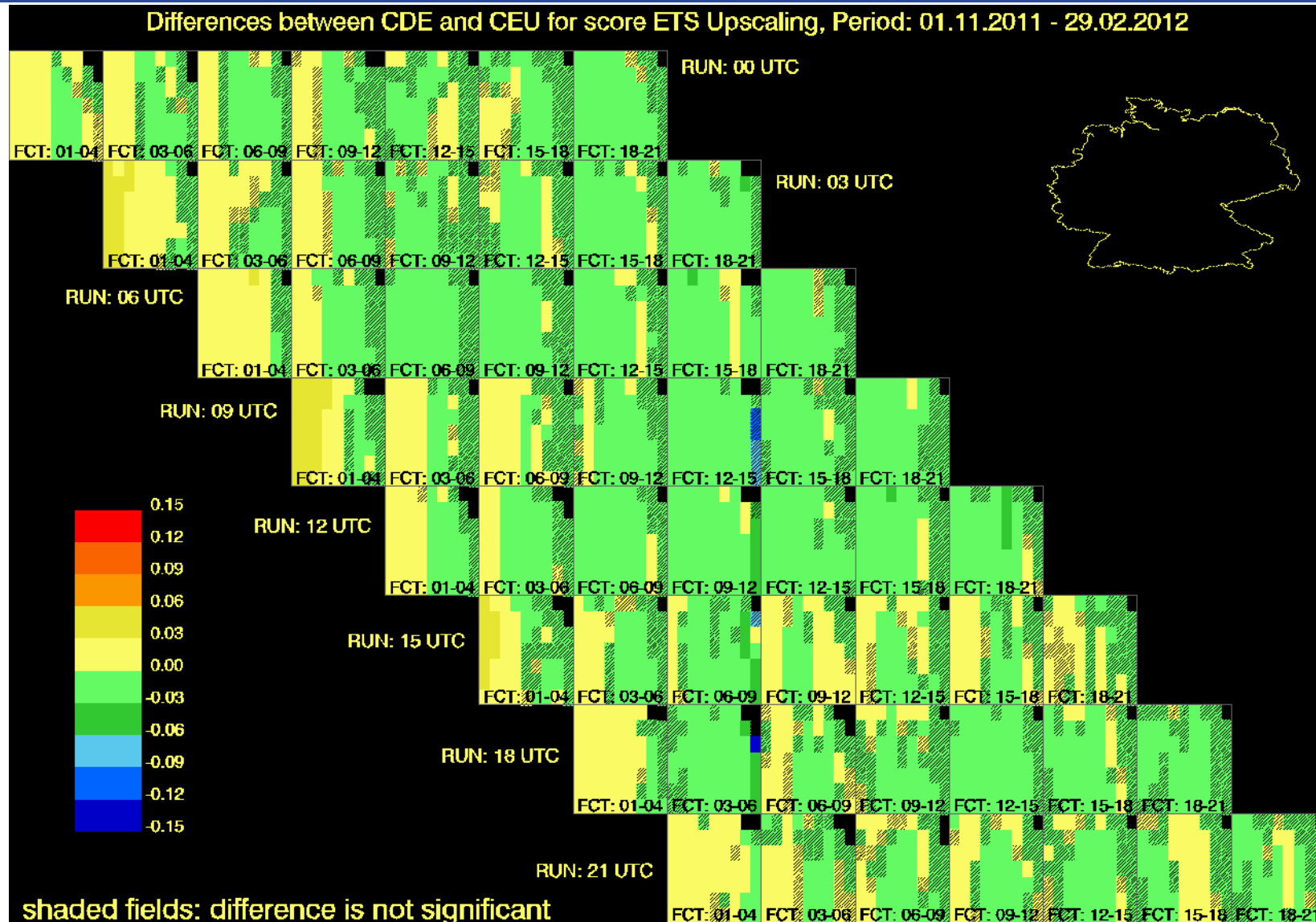
# CEU + CDE: Fuzzy-Precipitation verification, Autumn 2011

Deutscher Wetterdienst  
Wetter und Klima aus einer Hand

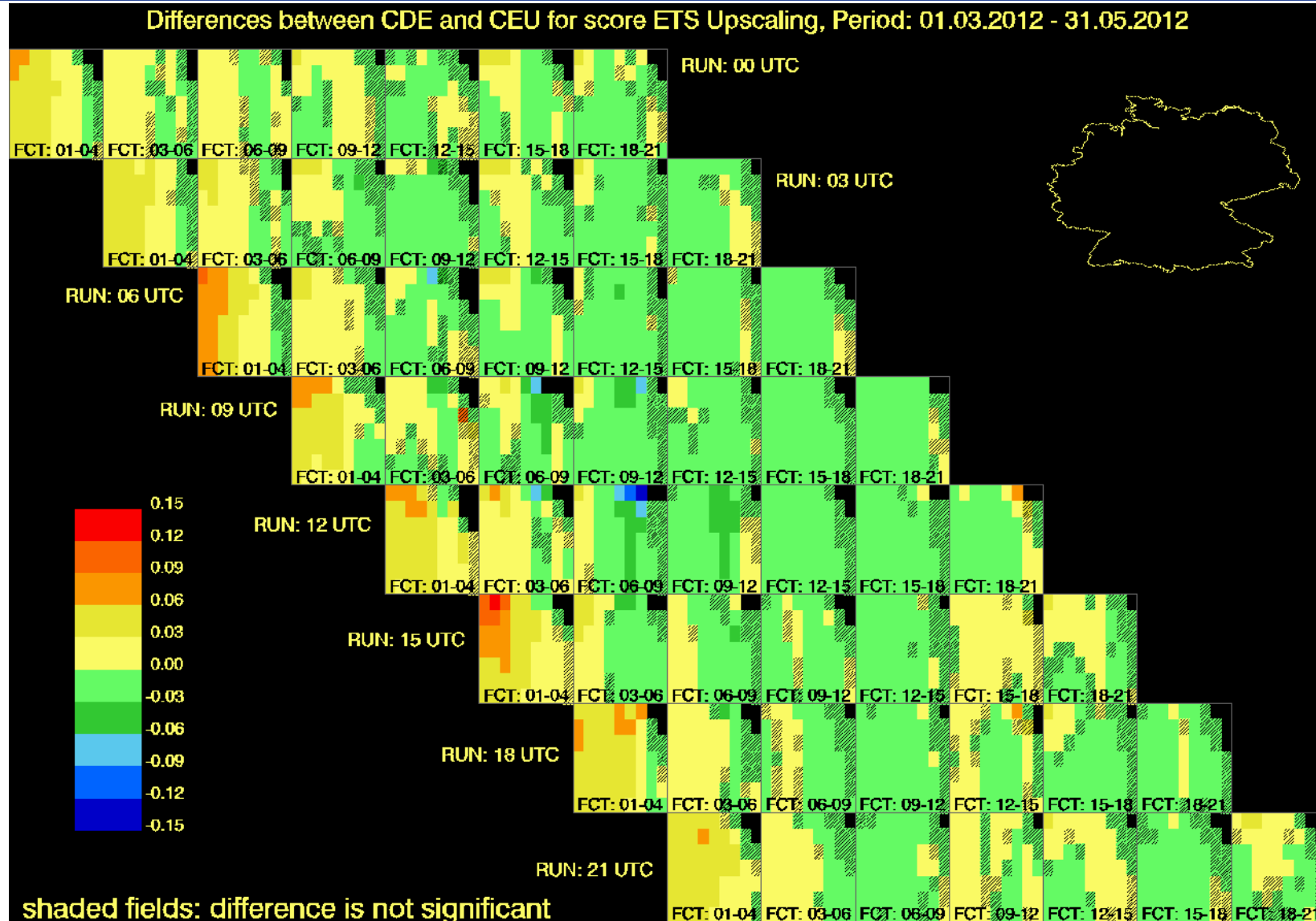


# CEU + CDE: Fuzzy-Precipitation verification, Winter 2011/2012

Deutscher Wetterdienst  
Wetter und Klima aus einer Hand

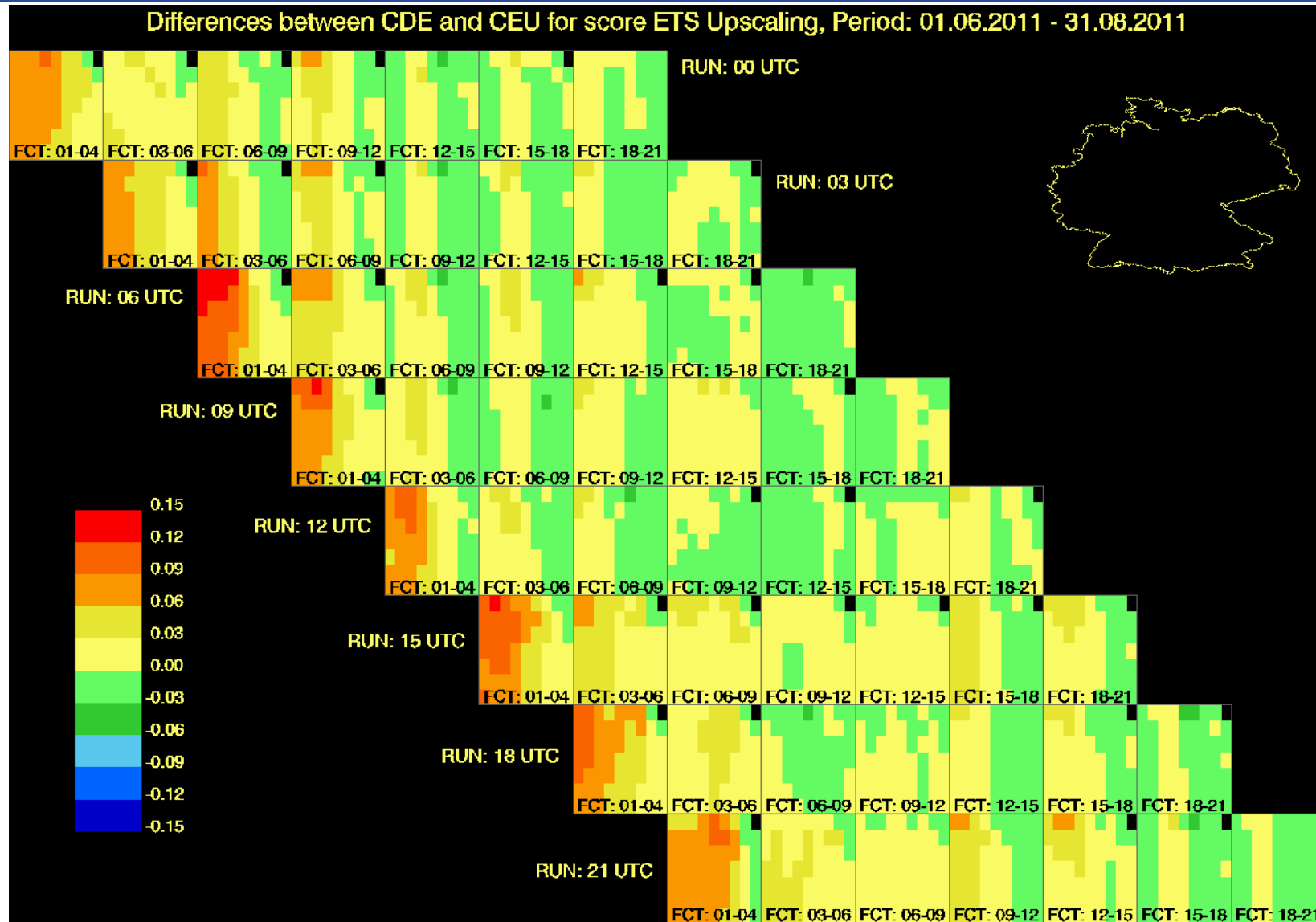


# CEU + CDE: Fuzzy-Precipitation verification, Spring 2012



# CEU + CDE: Fuzzy-Precipitation verification, Summer 2011

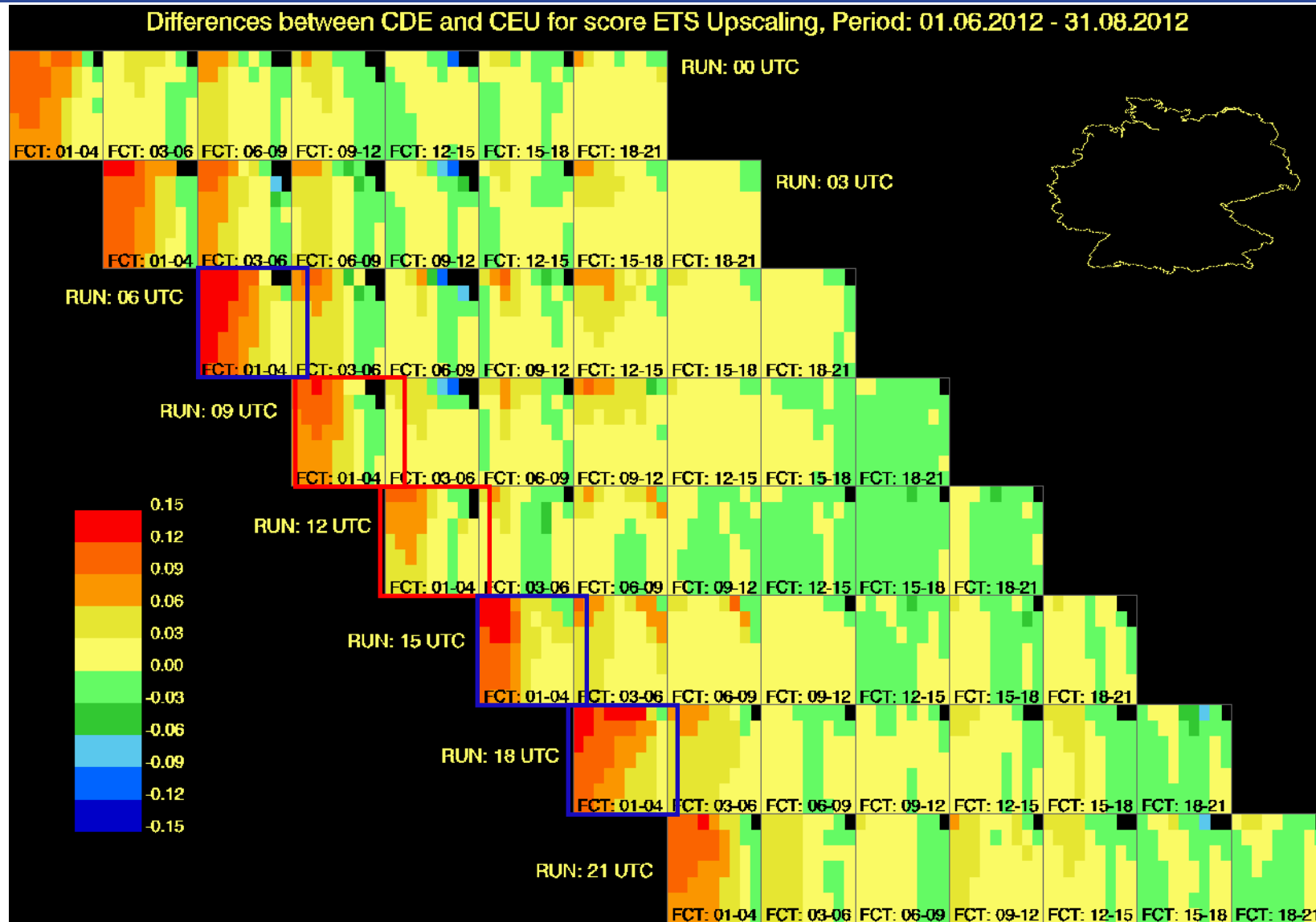
Deutscher Wetterdienst  
Wetter und Klima aus einer Hand





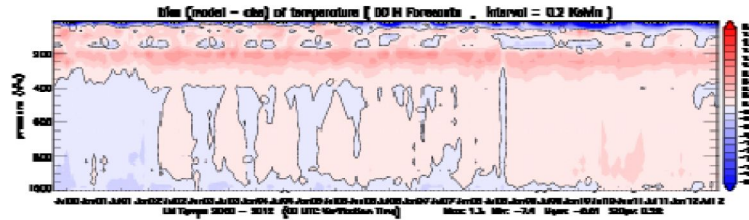
# CEU + CDE: Fuzzy-Precipitation verification, Summer 2012

Deutscher Wetterdienst  
Wetter und Klima aus einer Hand

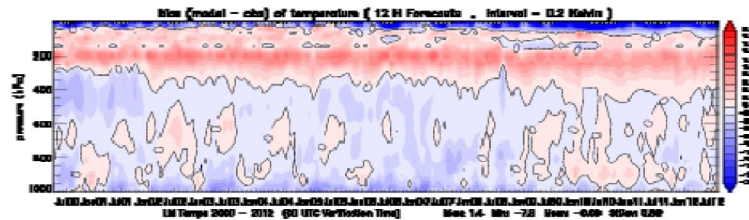


# CEU: Verification of vertical profiles

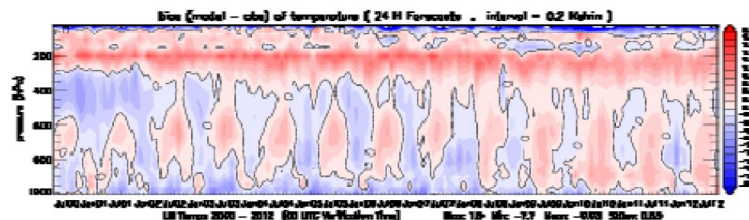
## BIAS Temperature last two years



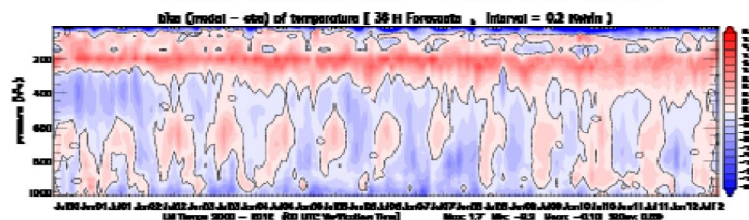
VV=00



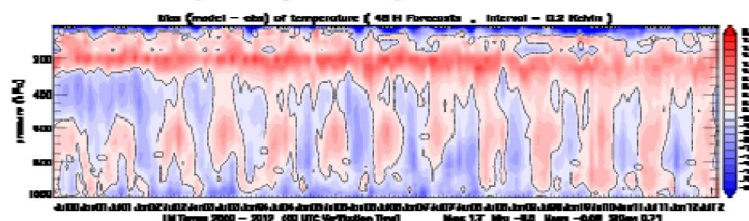
VV=12



VV=24



VV=36

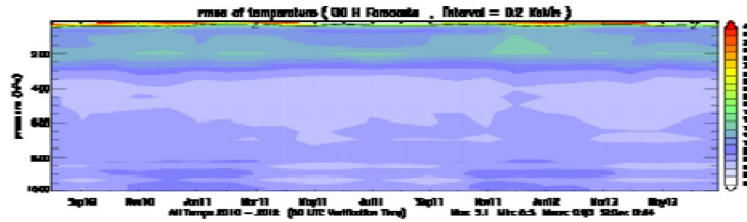


VV=48

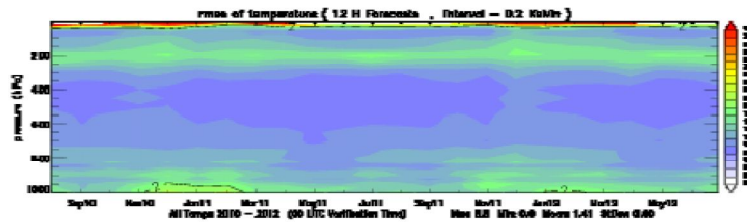


# CEU: Verification of vertical profiles

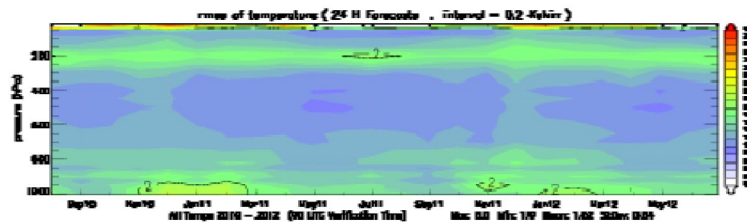
## RMSE Temperature last two years



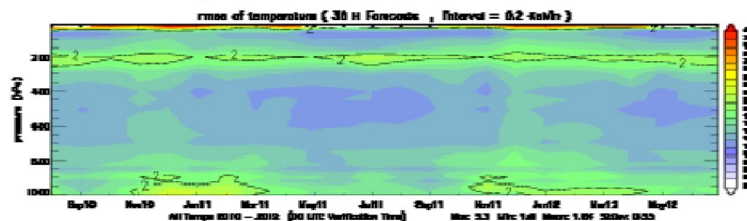
VV=00



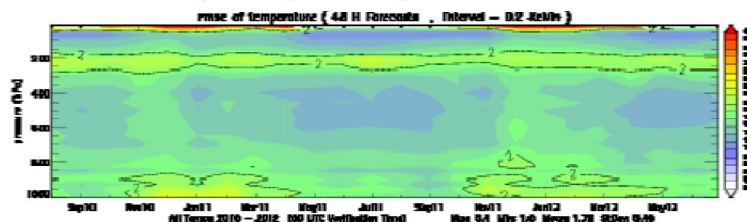
VV=12



VV=24



VV=36

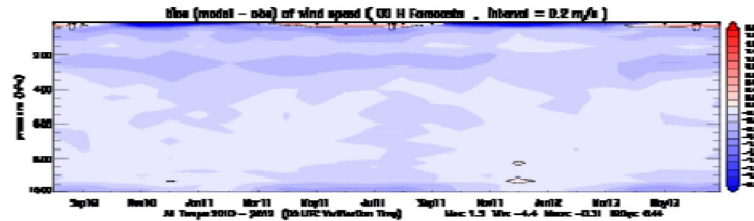


VV=48

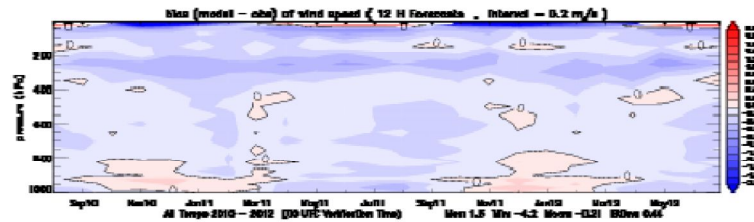


# CEU: Verification of vertical profiles

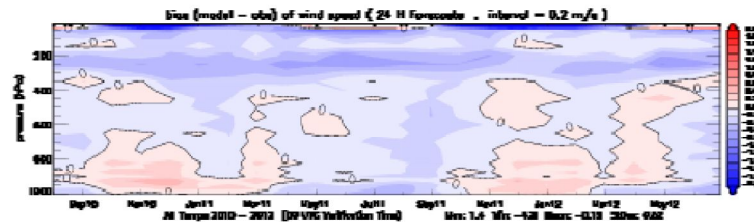
## BIAS Windspeed last two years



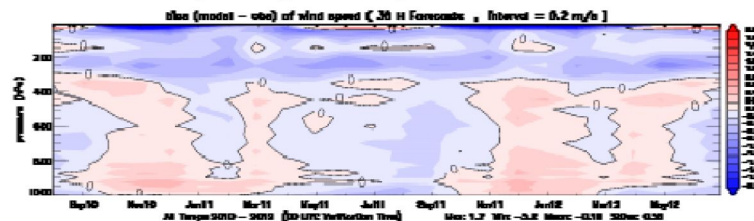
VV=00



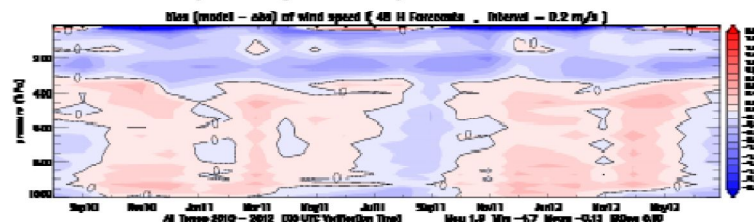
VV=12



VV=24



VV=36

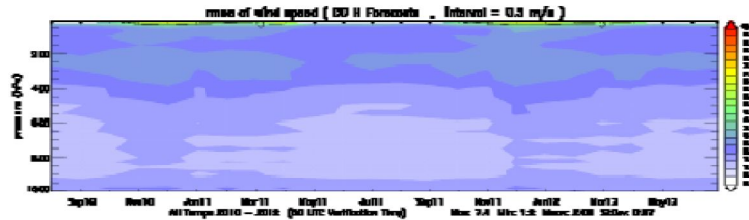


VV=48

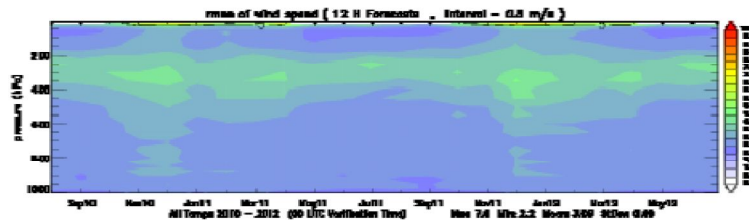


# CEU: Verification of vertical profiles

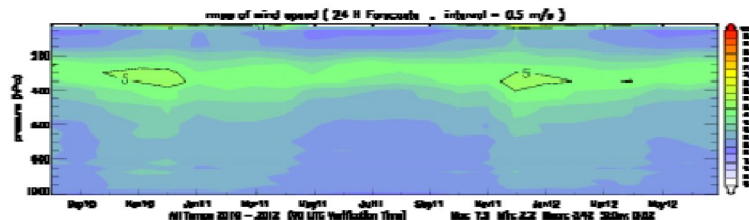
## RMSE Windspeed last two years



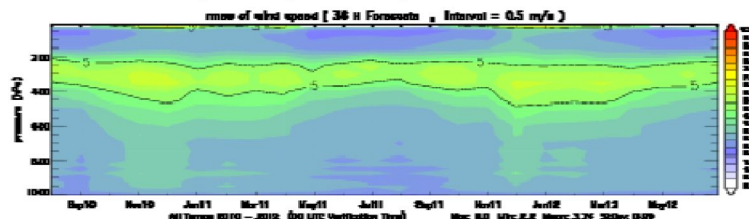
VV=00



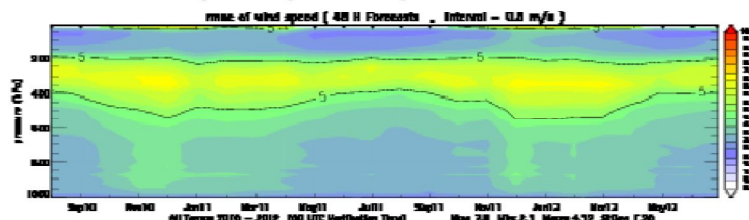
VV=12



VV=24



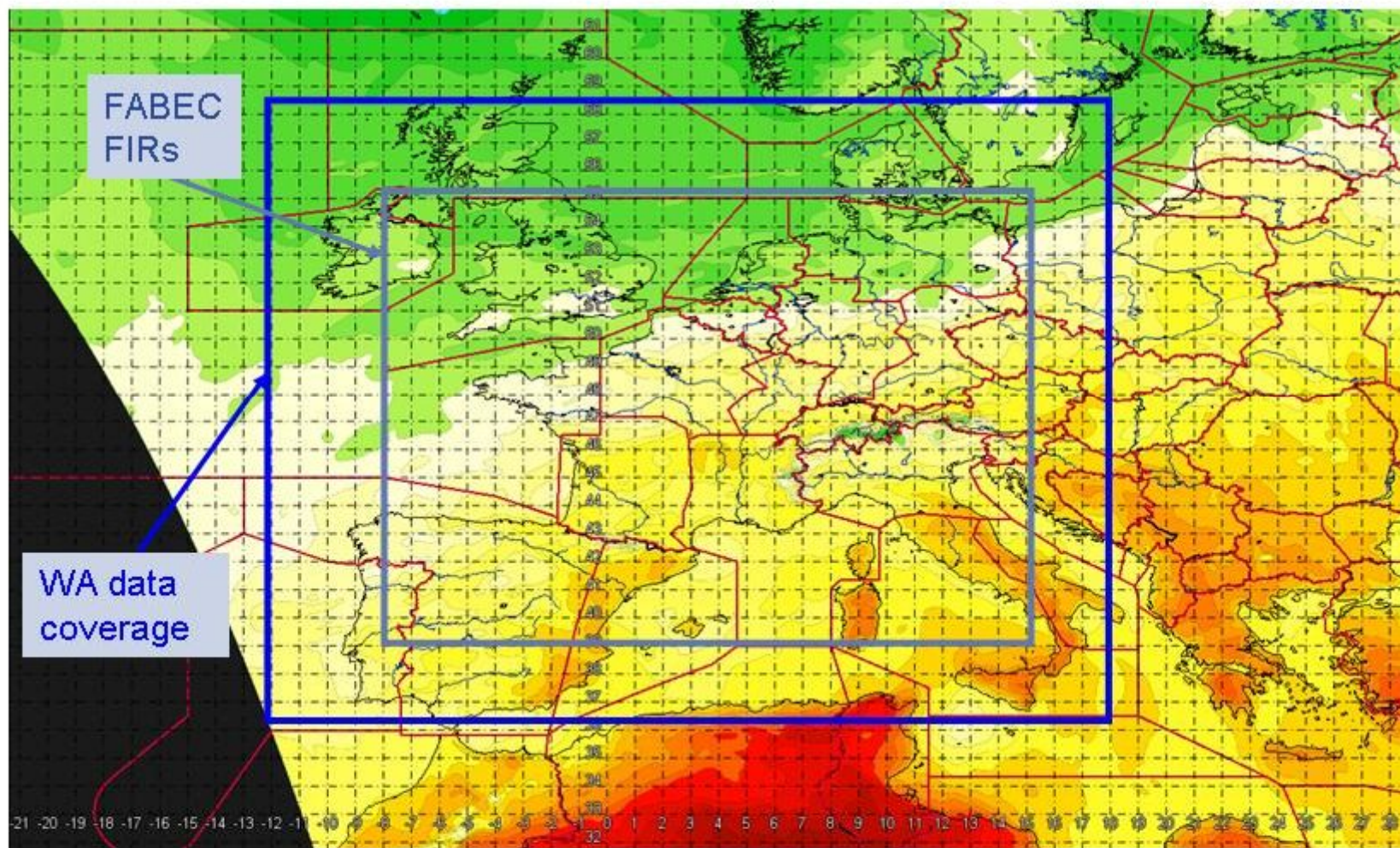
VV=36



VV=48

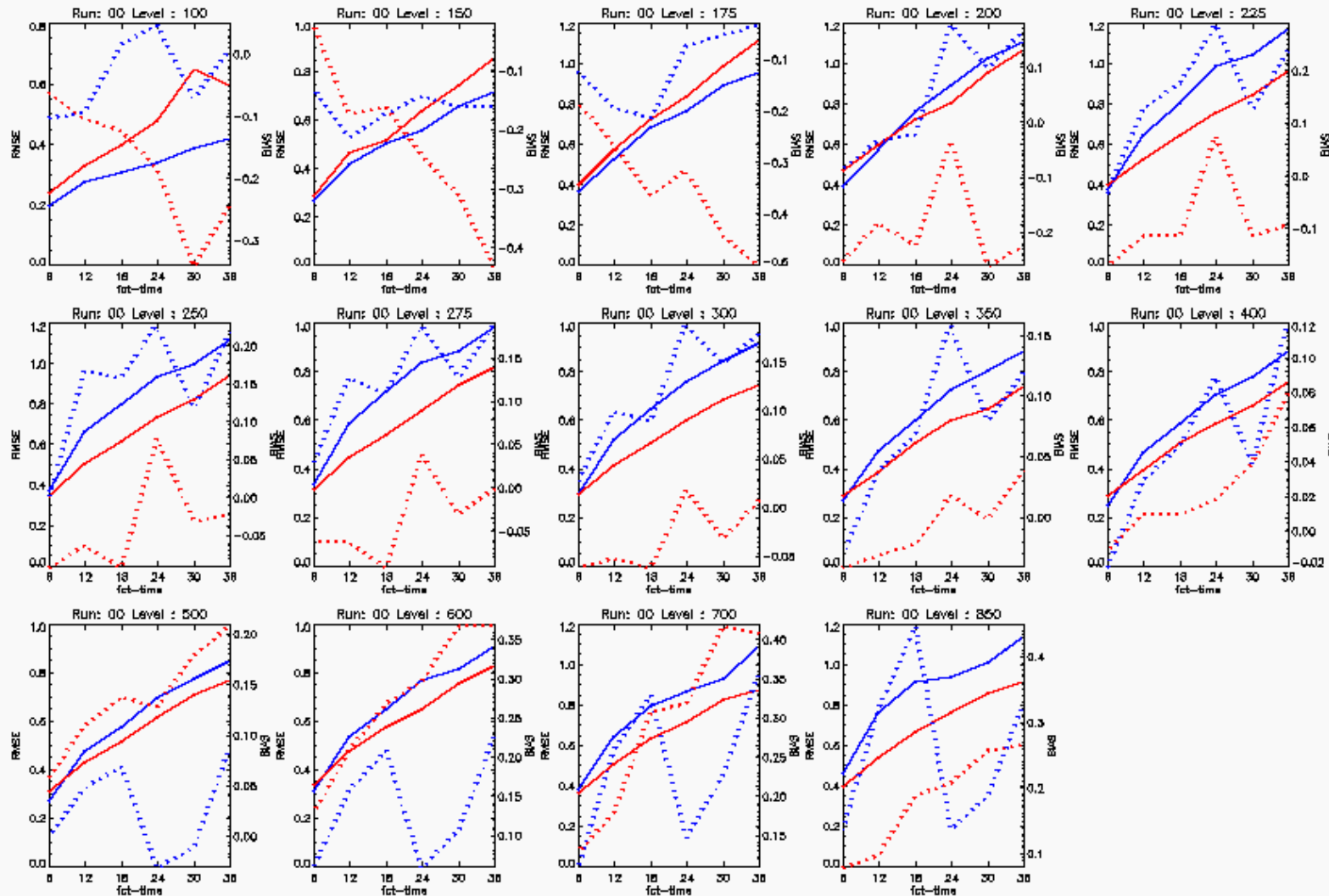


# WA data coverage



FABEC WA





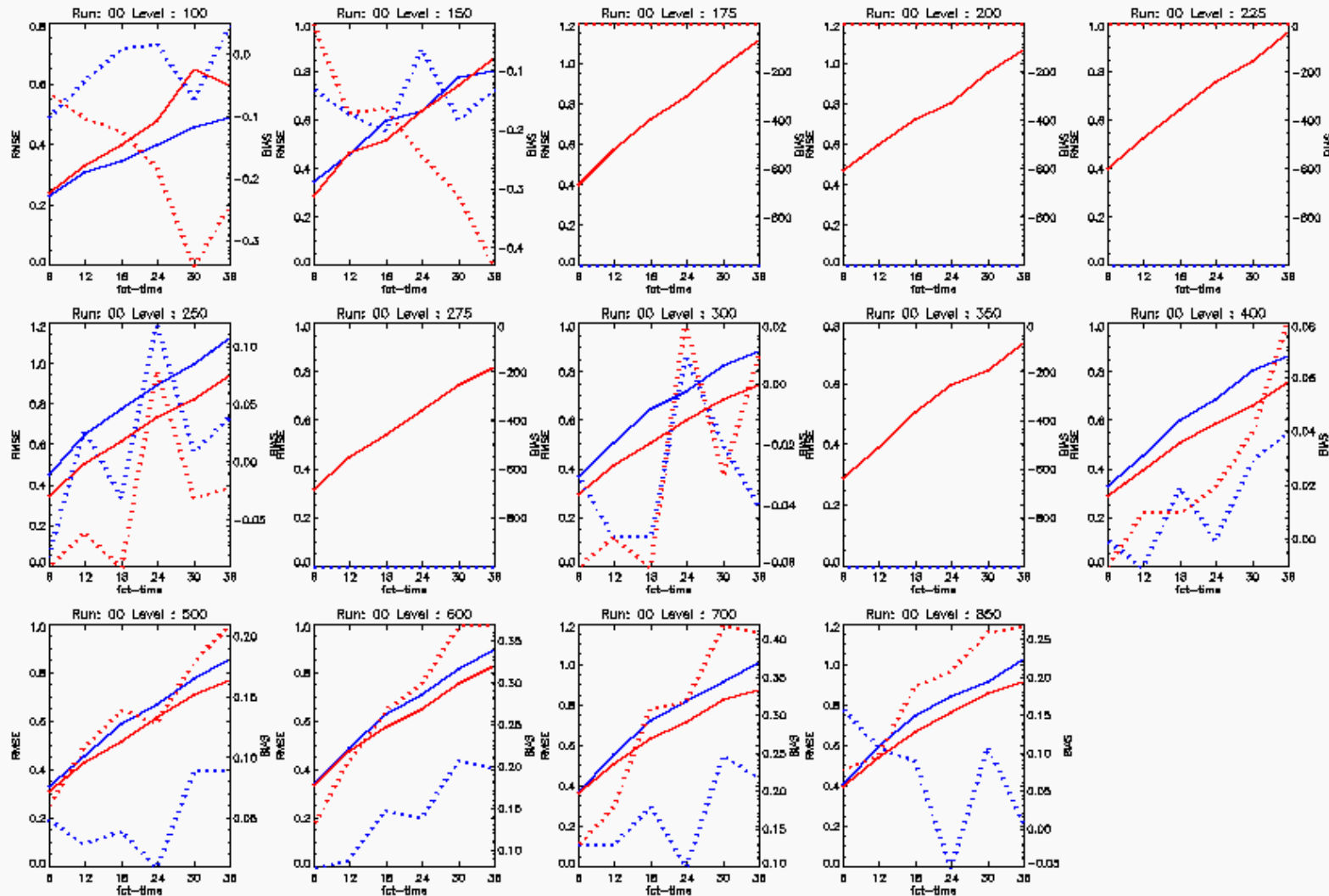
Comparison of FABEC verification results, Element: T, Period: 20120501 - 20120531, left scale RMSE, right scale BIAS  
**ARPEGE** **COSMO-EU**



# Temperature 00-UTC-Run, pressure levels, May 2012, ARPEGE and GME



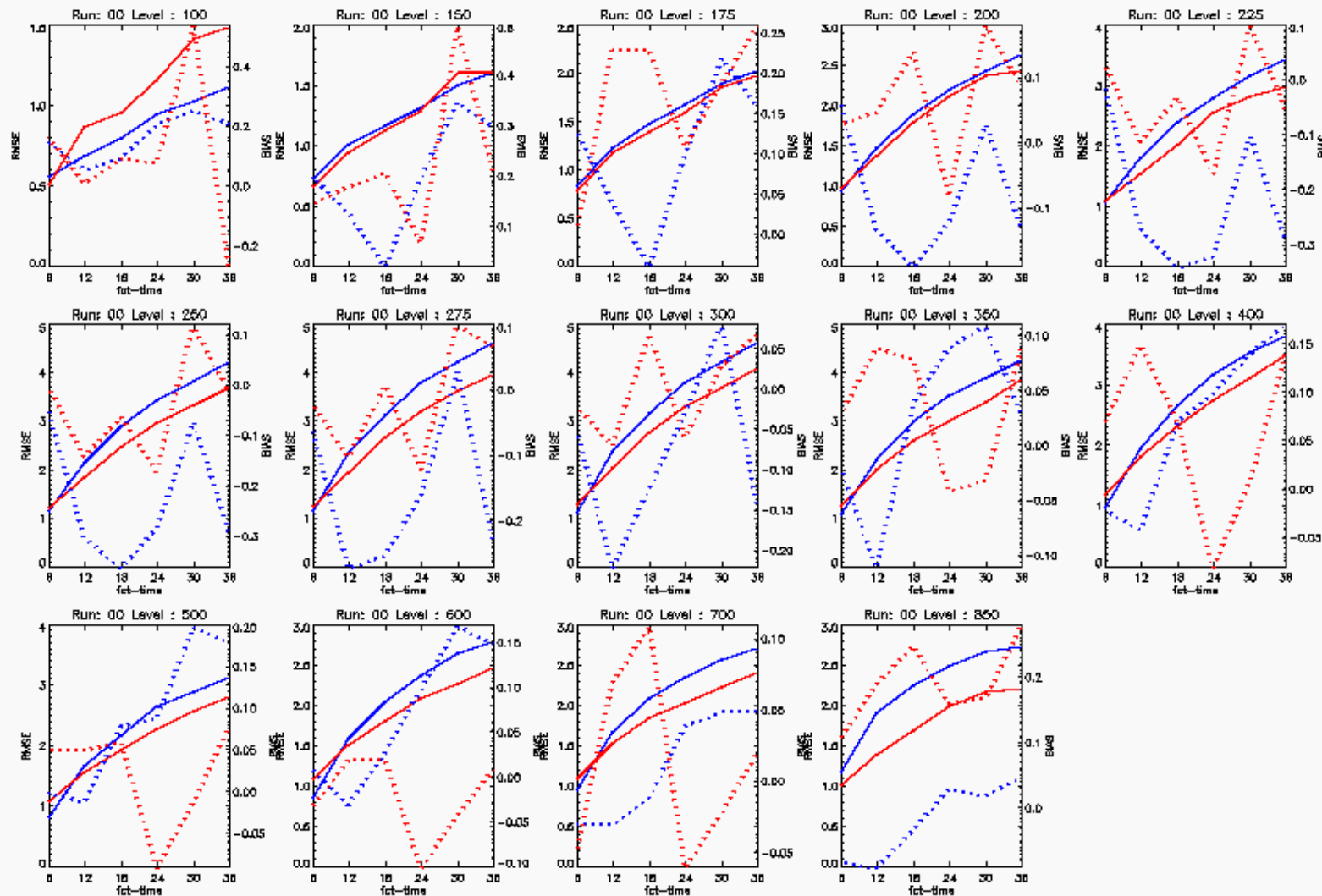
Deutscher Wetterdienst  
Wetter und Klima aus einer Hand



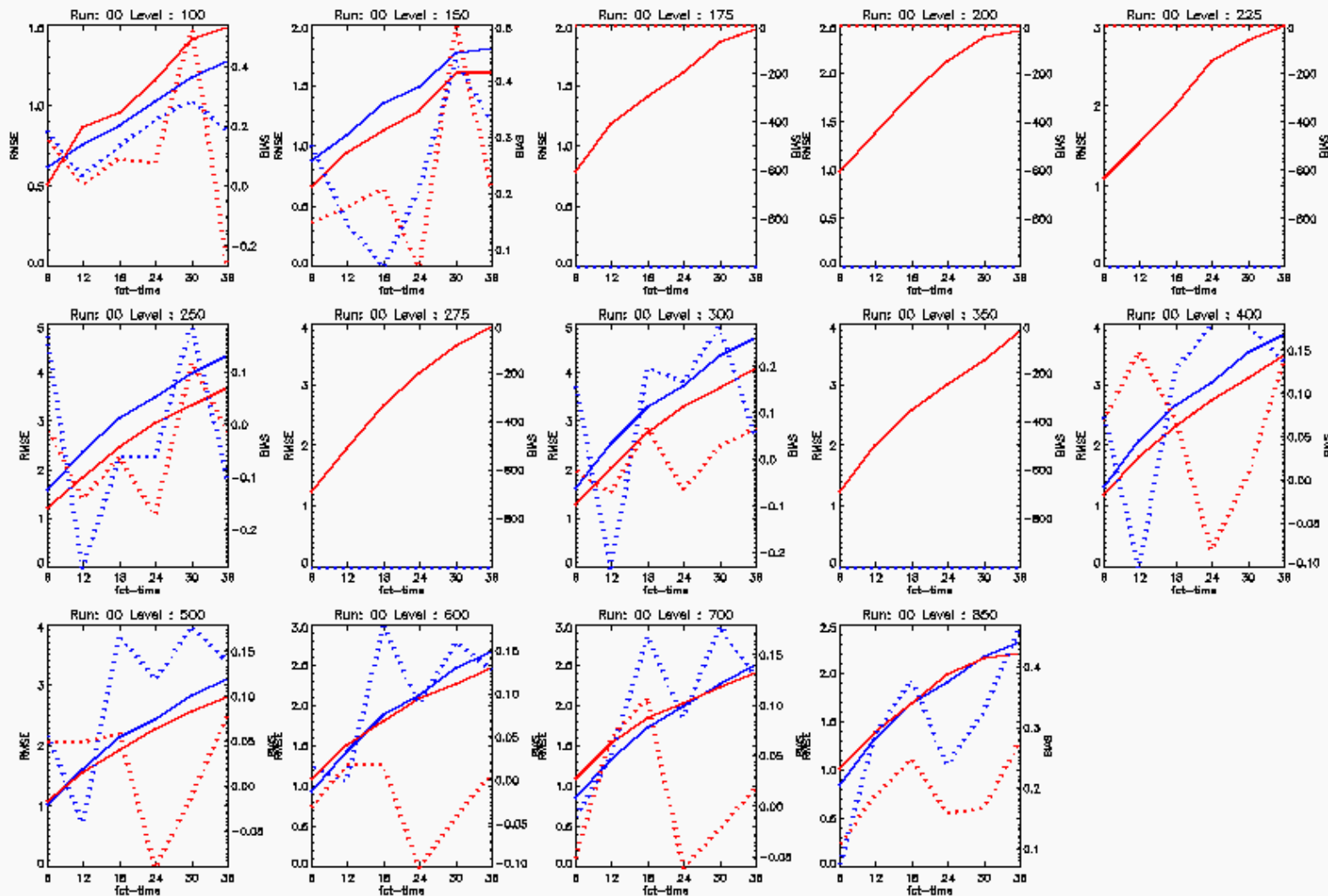
Comparison of FABEC verification results, Element: T, Period: 20120501 - 20120531, left scale RMSE, right scale BIAS  
ARPEGE GME







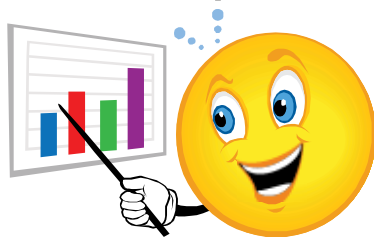
Comparison of FABEC verification results, Element: FF, Period: 20120501 - 20120531, left scale RMSE, right scale BIAS  
**ARPEGE COSMO-EU**



Comparison of FABEC verification results, Element: FF, Period: 20120501 - 20120531, left scale RMSE, right scale BIAS  
**ARPEGE GME**



- All things look fine and can be well interpreted.  
(at least to a certain degree)



- A tragedy (perhaps a bit provocative)

→ In general models with finer horizontal and vertical resolution should be used for operational purposes instead of models with coarser resolution.

→ The experiences with CDE and CEU for T2m during summer months and with CEU and GME for verification against analysis in the lower troposphere seem to violate this principle!

