BC-EPS
Generating boundary values for the
COSMO-DE-EPS

Helmut Frank

Helmut.Frank@dwd.de

including modified slides from S. Theis, T. Hanisch, D. Majewski

Deutscher Wetterdienst
Wetter und Klima aus einer Hand
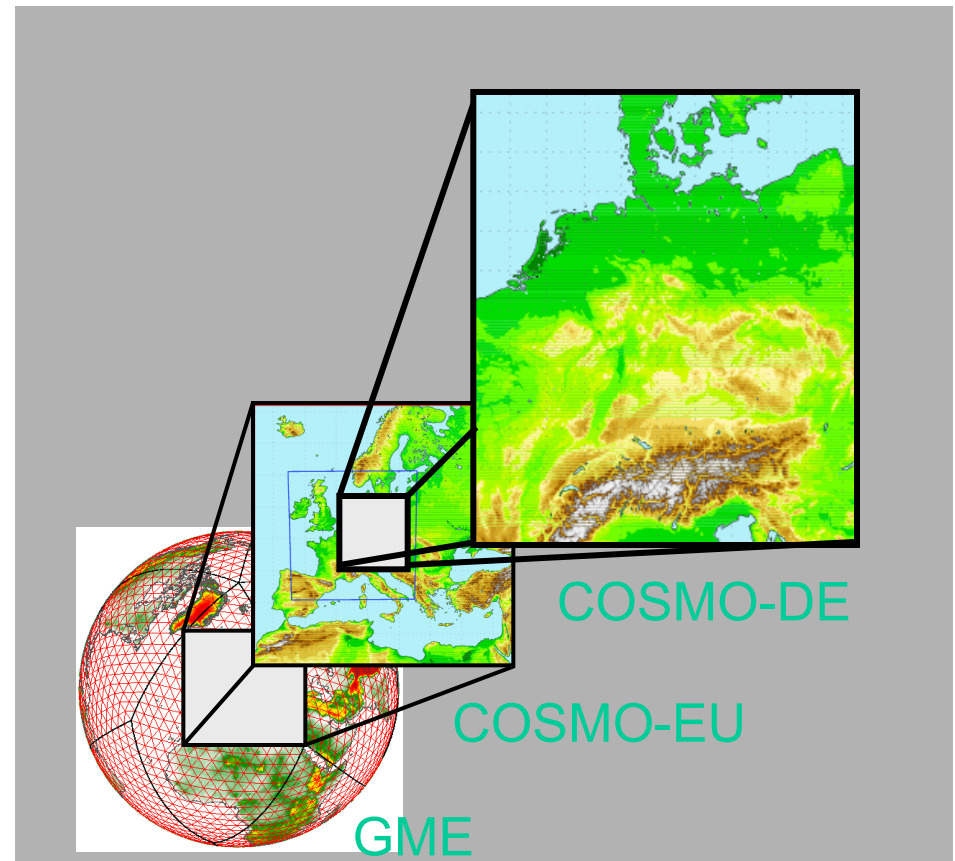
What is COSMO-DE?

NWP model of DWD

operational since 2007

grid size: 2.8 km

    convection-permitting

lead time: 0-21 hours

    8 starts per day

    (00, 03, 06,... UTC)

COSMO-DE

COSMO-EU

GME

Deutscher Wetterdienst
Wetter und Klima aus einer Hand

The COSMO-DE Ensemble Prediction System

pre-operational phase:

started in **December 2010**

(planed operational end 2012)

setup:

20 members (later 40 members)
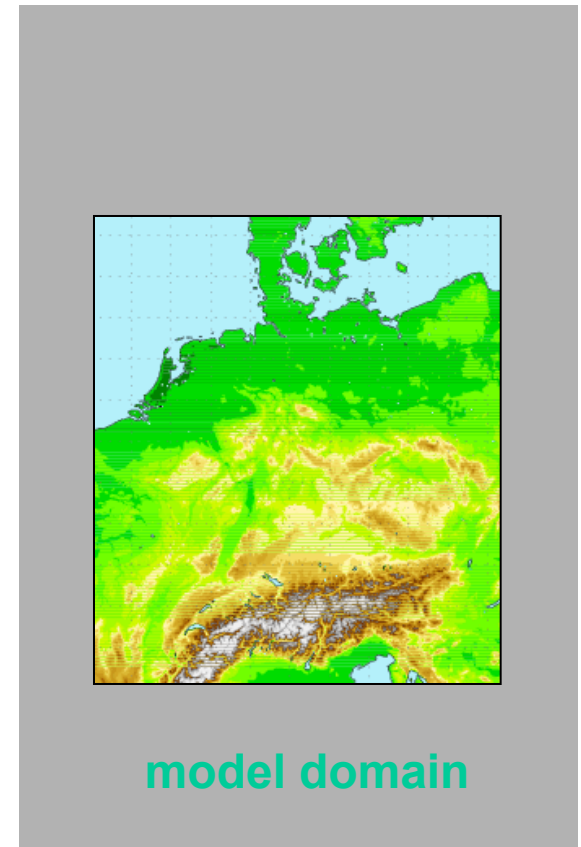
grid size: 2.8 km

convection-permitting

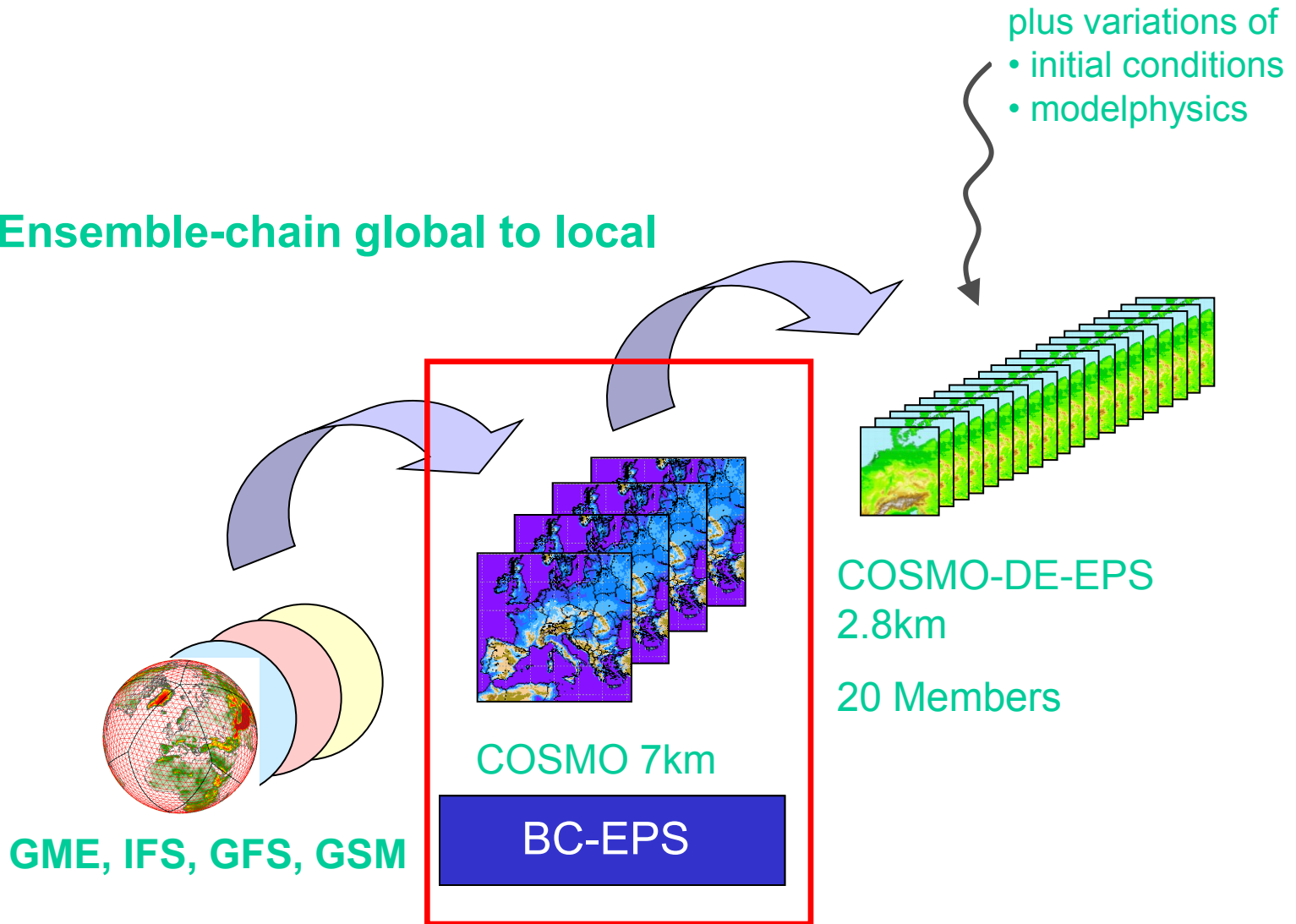lead time: 0-21 hours,

8 starts per day (00, 03, 06,... UTC)

variations in

lateral boundaries, initial conditions, physics

model domain

COSMO-DE-EPS

plus variations of
• initial conditions
• modelphysics

Ensemble-chain global to local

COSMO-DE-EPS
2.8km

20 Members

COSMO 7km

BC-EPS

GME, IFS, GFS, GSM

- Introduction: What is BC-EPS?

- How does BC-EPS work?

  – BC-EPS domain

  – Global model data

  – Data transfer

- How is BC-EPS used?

  – Operational set up

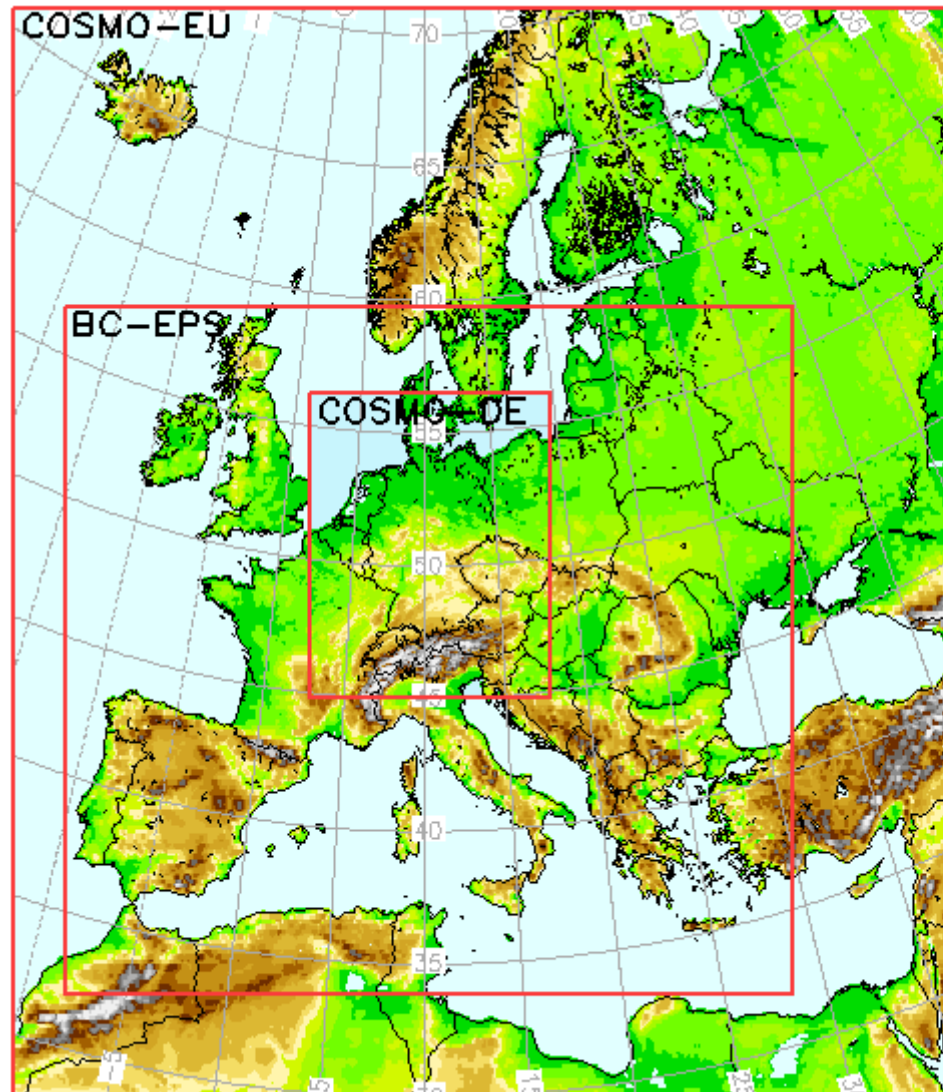- Example

- Summary
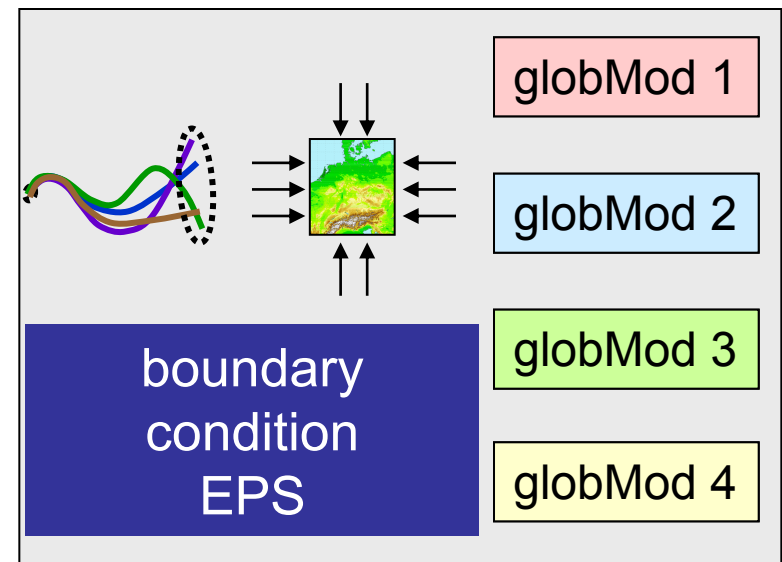
COSMO domains

COSMO-EU:
Mesh size: 7 km
665 × 657 × 40 Grid points

BC-EPS:
Mesh size: 7 km
511 × 415 × 40 Grid points
Same as COSMO-LEPS
and SREPS domains

COSMO-DE:
Mesh size: 2.8 km
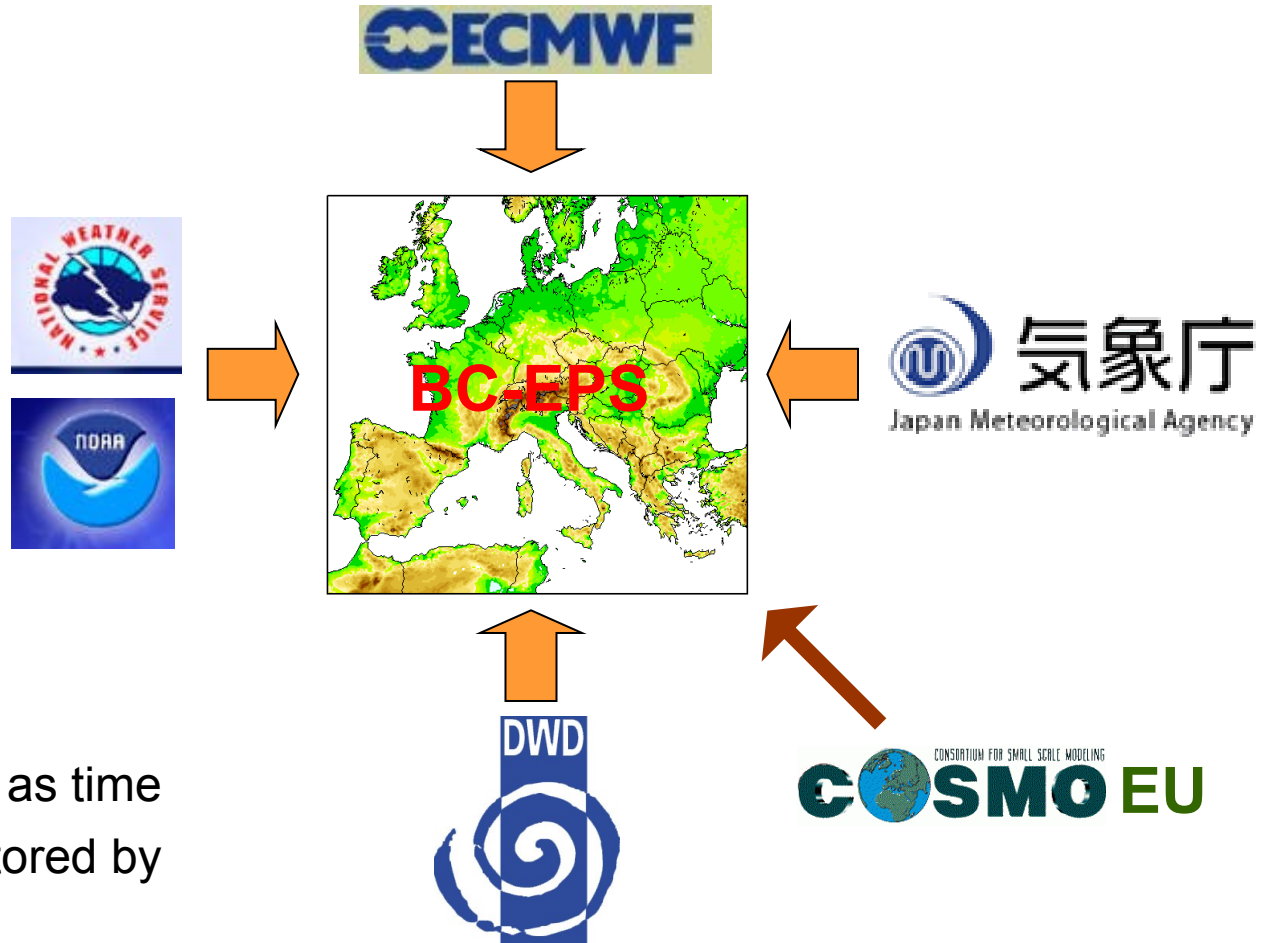421 × 461 × 50 Grid points

Input data

Global model data:

- **IFS** from ECMWF

- **GME** from DWD

- **GFS** from NCEP

- **GSM** from JMA

- Soil and surface (snow) data from **COSMO-EU** of DWD

BC-EPS is run at ECMWF as time critical work option 2 monitored by ECMWF staff

Global model data used by BC-EPS

Global model	Variables	Resolution	Levels	Grid points per level
IFS (ECMWF) (00, 12 UTC)	U, V, T, QV, QC, QI, PS	0.125^o	73 (of 91)	480 x 230 = 110400
GME (DWD)	U, V, T, QV, QC, QI, PS	30 km	60	13829
GFS (NCEP)	U, V, T, QV, QC, PS	0.5^o	26 p-levels	211 x 121 = 25531
GSM (JMA)	U, V, T, QV, QC, PS	0.25^o	50	421 x 241 = 101461

Data transfer to ECMWF

Deutscher Wetterdienst
Wetter und Klima aus einer Hand

Model	program	Size per run (MB) for 39 h (48h)	Time of jobs to transfer to data ECMWF [s]	Data at ECMWF (Ini. + hh:mm)
IFS (ECMWF)	local dissemination (Mars)	1403 (1704)	~ 13 (~3600 from Mars)	+ 06:00
GME (DWD)	ecaccess	222 (270)	~ 280	+ 02:55
GFS (NCEP)	wget	79 (96)	~ 300	+ 03:50
GSM (JMA)	wget	165 jpeg (200)	~ 950	+ 04:15
COSMO-EU (DWD)	ecaccess	14	~ 40	+ 02:50

Generation of BC-EPS data

get global and soil data

→

Interpolate initial and boundary data every **3 hours** with int2lm

→

Run COSMO; boundary data for COSMO-DE-EPS **every hour**

08:50

/bceps/06/ifs/get_ifs → /bceps/06/ifs/global2lmi → /bceps/06/ifs/cosmo_lmi

/bceps/06/gme/get_soil

/bceps/06/gme/global2lmi → /bceps/06/gme/cosmo_lmi

/bceps/06/gme/get_gme

/bceps/06/gfs/get_gfs

/bceps/06/gfs/global2lmi → /bceps/06/gfs/cosmo_lmi

/bceps/06/gsm/get_gsm

/bceps/06/gsm/global2lmi → /bceps/06/gsm/cosmo_lmi

Generating boundary data from one global model takes 30-47 min:

- Fetching data: <1-15 min

- Interpolation with int2lm: 30-90 sec

- Running COSMO: 20 min

The suites uses 10360 BU per day:

- Fetching global data: < 1 BU

- Interpolation global model to COSMO grid using 64 CPUs: ~ 11 BU

- Running COSMO for BC-EPS using 192 CPUs: ~ 635 BU

Data transfer to DWD

Data transfer with ecaccess with special association

- 39 hours per run (later 48h)

- 81 files; 7.7 GB per run, or 124 GB per day

- Transfer takes approx. 22 - 31 Minutes for one run

- Average transfer rate 2.26 Mbytes/s, up to 13.5 Mbytes/s, for big files

Data arrival at DWD: Storage minus initial time (27h fct)
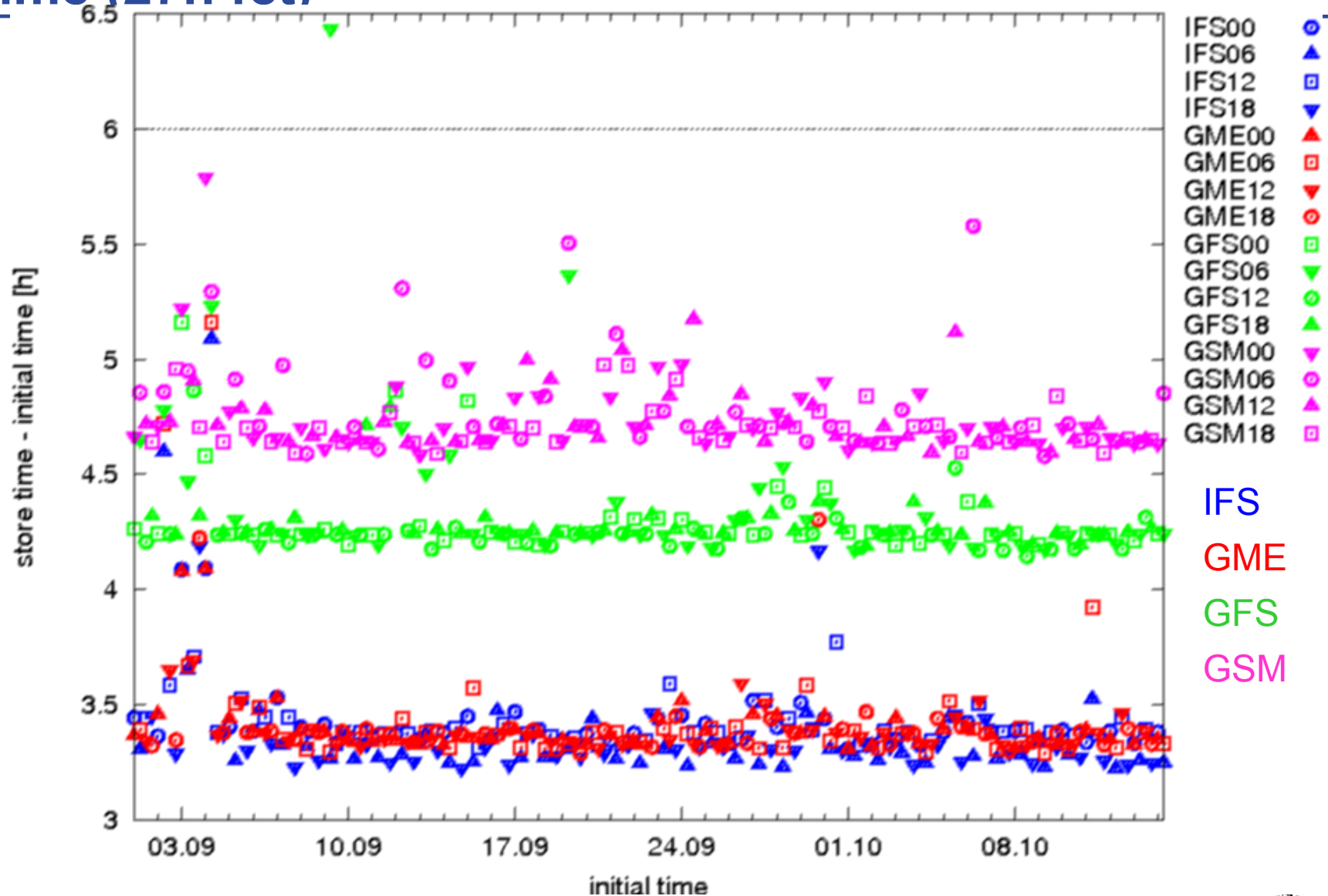
Global model forecasts collected at ECMWF

GSM
GFS
IFS
GME
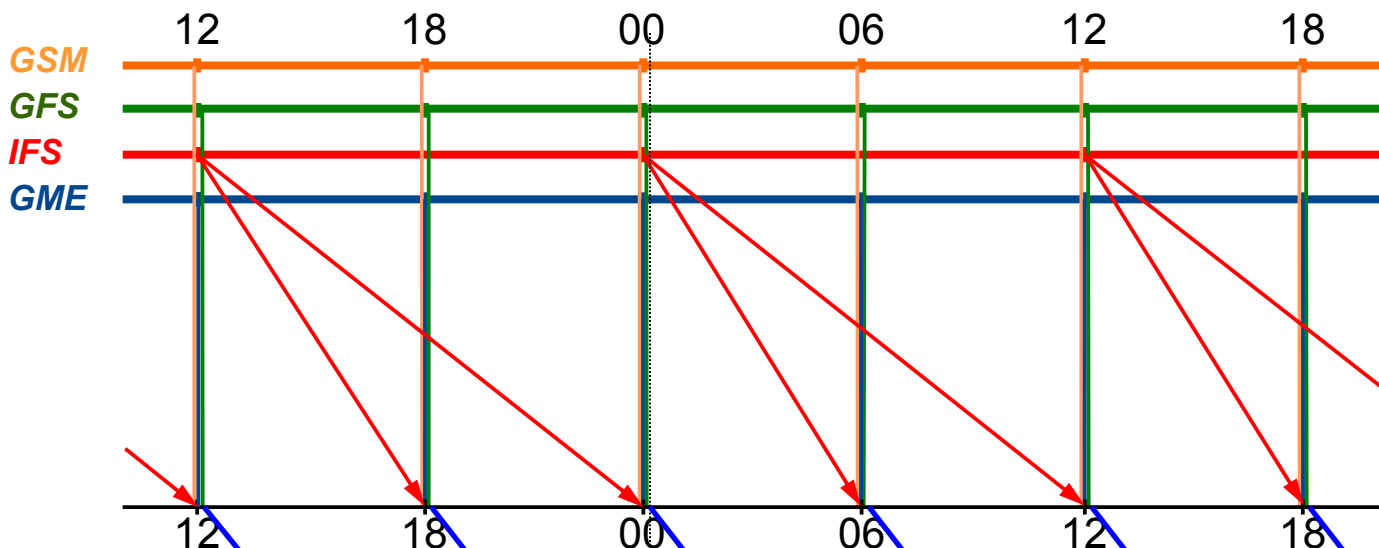
Start BC-EPS at ECMWF:
+2:50 to +4:00

arrival BC-EPS at DWD:
+3:30 to +5:00
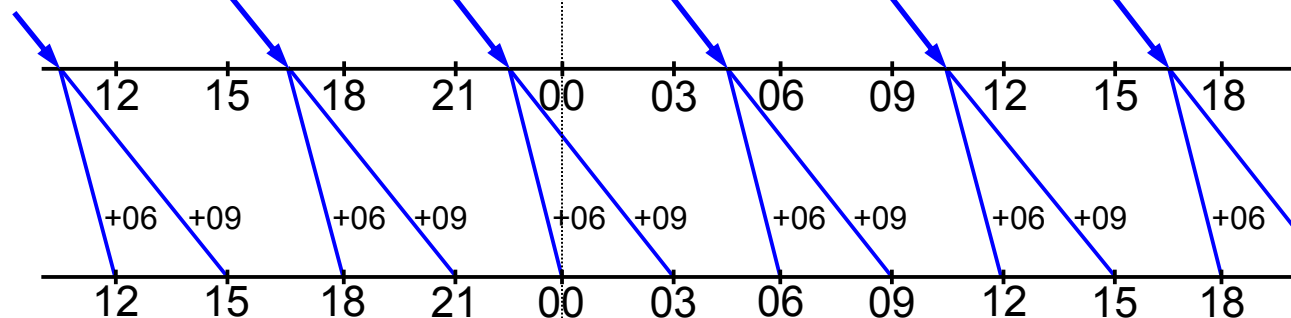
start COSMO-DE-EPS:
+0:55

Thu 2011101306 (Thu 13 +06): pmsl [hPa] at z1
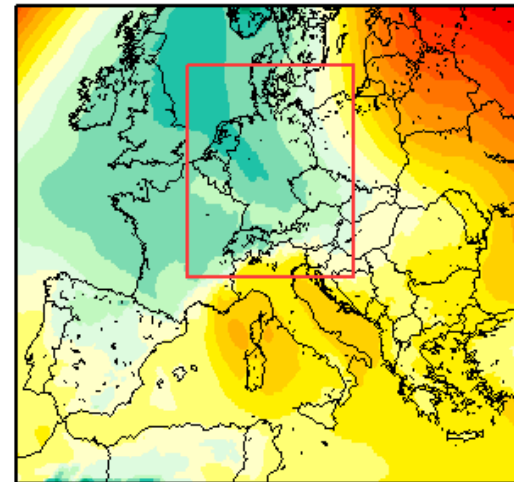

IFS2BCEPS
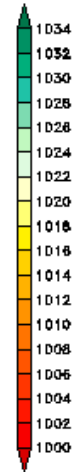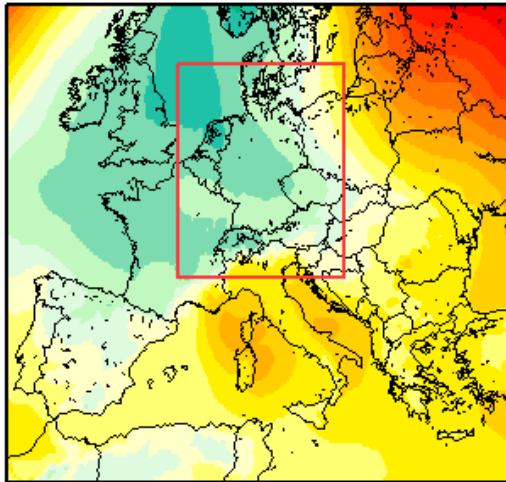
MIN=998.9   AVE=1019.8   MAX=1031.9   VAR=32.4

GME2BCEPS
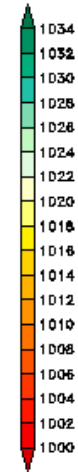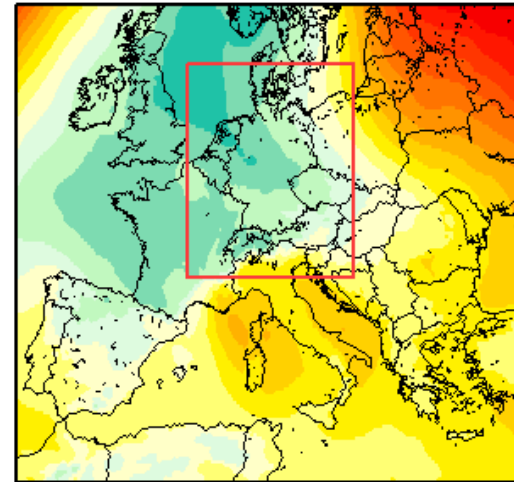
MIN=999.22   AVE=1019.8   MAX=1029.35   VAR=32.5

GFS2BCEPS
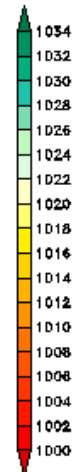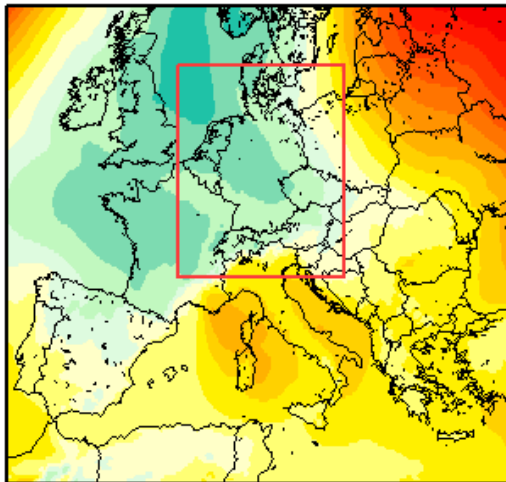
MIN=999.7   AVE=1019.6   MAX=1029.18   VAR=32.28

GSM2BCEPS
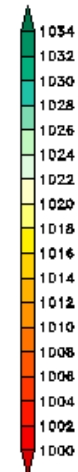
MIN=1000.030   AVE=1020.08   MAX=1042.12   VAR=33.031

Example:

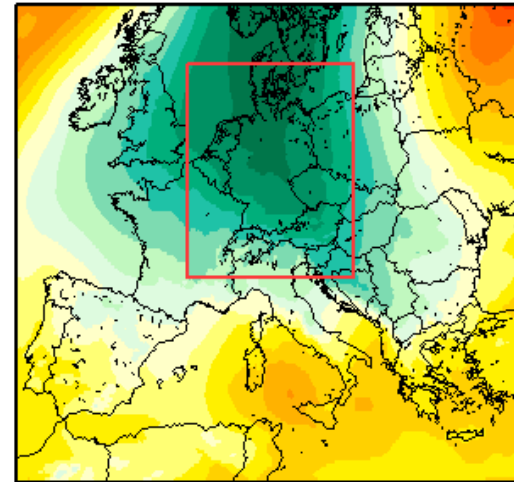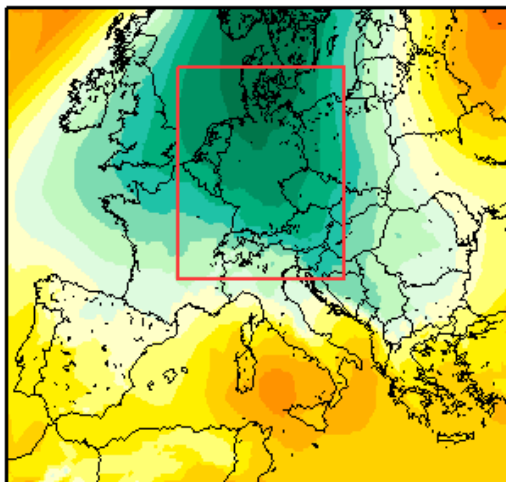Fri 2011101403 (Thu 13 +27): pmsl [hPa] at z1
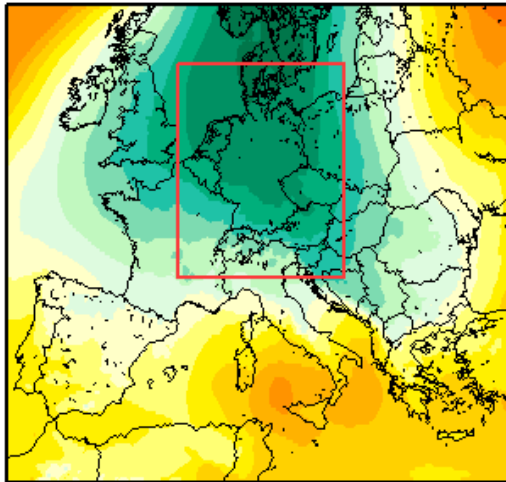
Helmut Frank
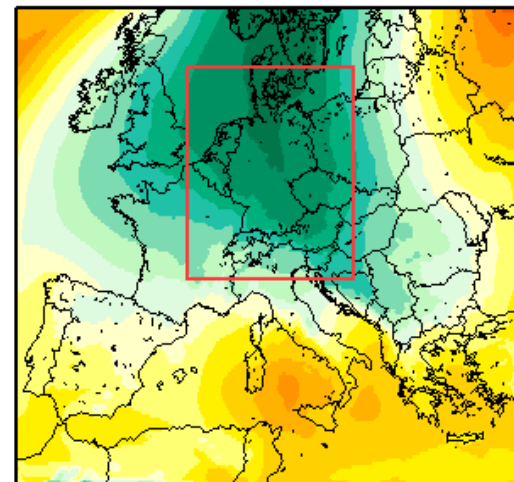
Example:

Thu 2011101306 (Thu 13 +06): RELHUM [%] at 700 hPa
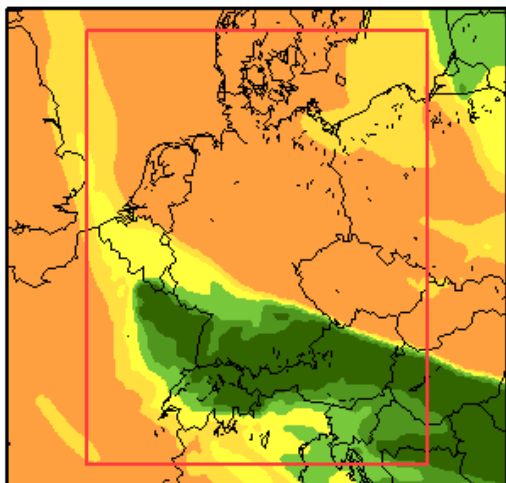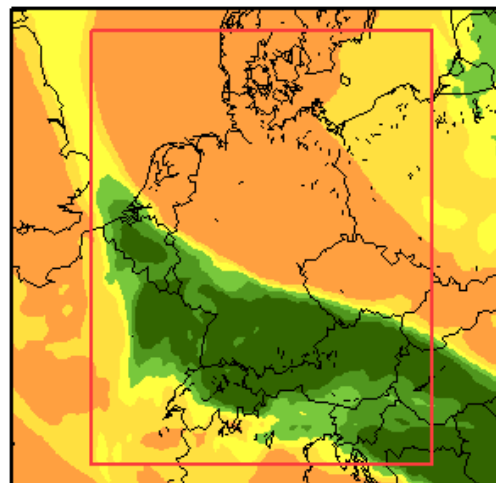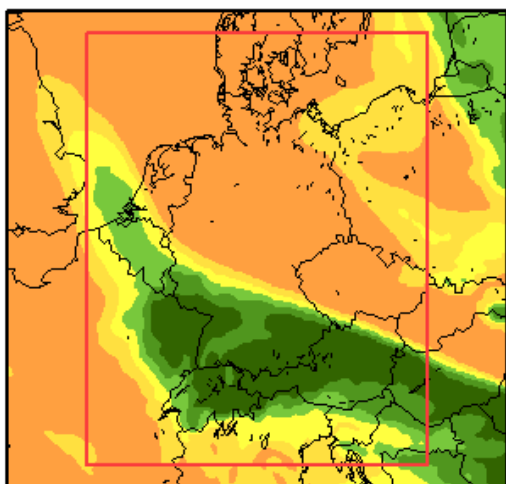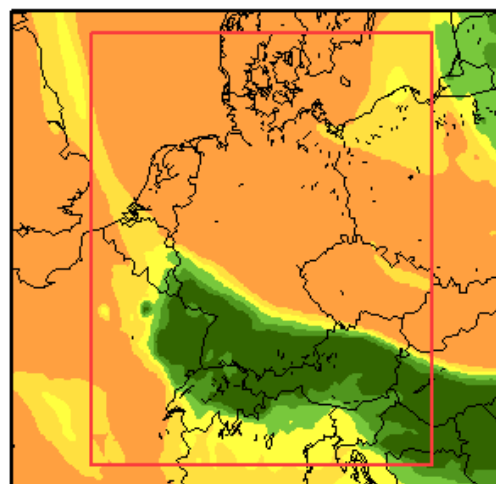
- COSMO is run using initial and boundar data from the 4 global model IFS, GME, GFS, and GSM.

- The data from the 4 BC-EPS runs is used as boundary data and for perturbation of initial conditions of COSMO-DE-EPS.

- The BC-EPS suite is run as member state time-critical application (option 2) monitored by ECMWF staff at ECMWF

- Data is available at DWD approximately 5 hours after initial time

- Data transfer to DWD is mostly reliable. However, there were rare interruptions for several hours of unknown cause! This needs further monitoring.

- COSMO-DE-EPS is in pre-operational production at DWD

Acknowledgments:

- **Susanne.Theis@dwd.de** (project head COSMO-DE-EPS), Christoph Gebhardt, Michael Buchhold

- Ulrich Schättler, Thomas Hanisch, Kai-Thorsten Wirth (int2lm, operational set-up, data transfer)

- ECMWF user support, Carsten Maaß

- Chiara Marsigli, ARPA-SIMC, Bologna

- Yvonne Schmidt-Reiter (improving slides)