Future Plans of DWD: GME and LME

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COSMO General Meeting 2004

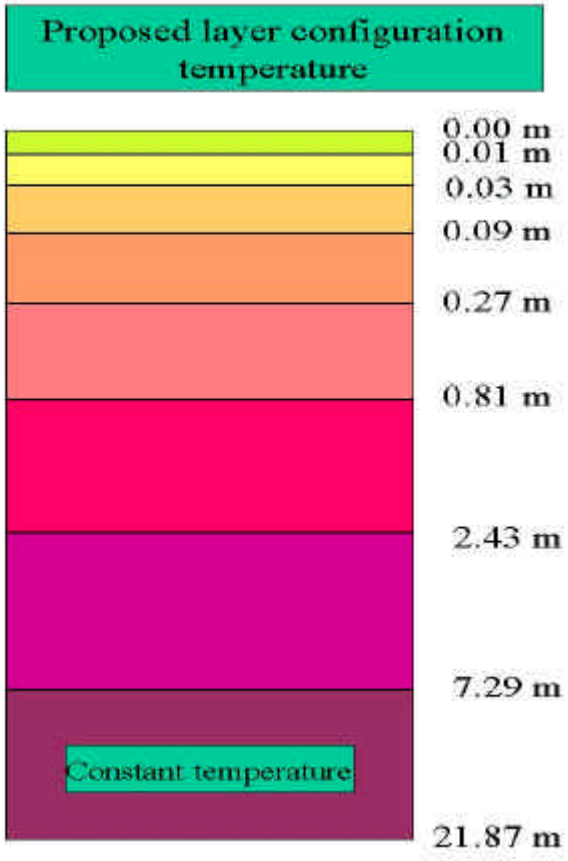
Global model GME

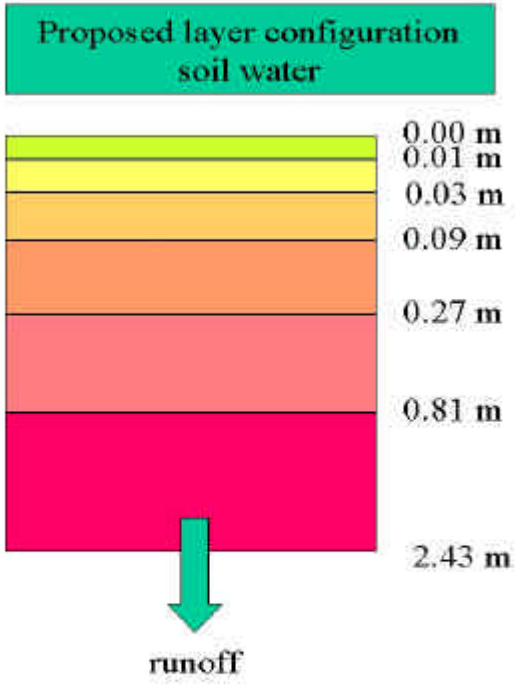
- Operational NWP model at DWD
- Icosahedral-hexagonal grid
- Operators of second order accuracy
- 60 (40) km mesh size, 164000 (369000) gridpoints/layer
- 31 (40) layers (hybrid, sigma/pressure)
- Prognostic variables: p_s, u, v, T, q_v, q_c, q_i, o_3
- Programming: Fortran90, MPI for message passing
- Intermittent data assimilation (OI, 3-hourly)
- From 00 and 12 UTC: Forecasts up to 174 hours
- From 18 UTC: Forecasts up to 48 hours

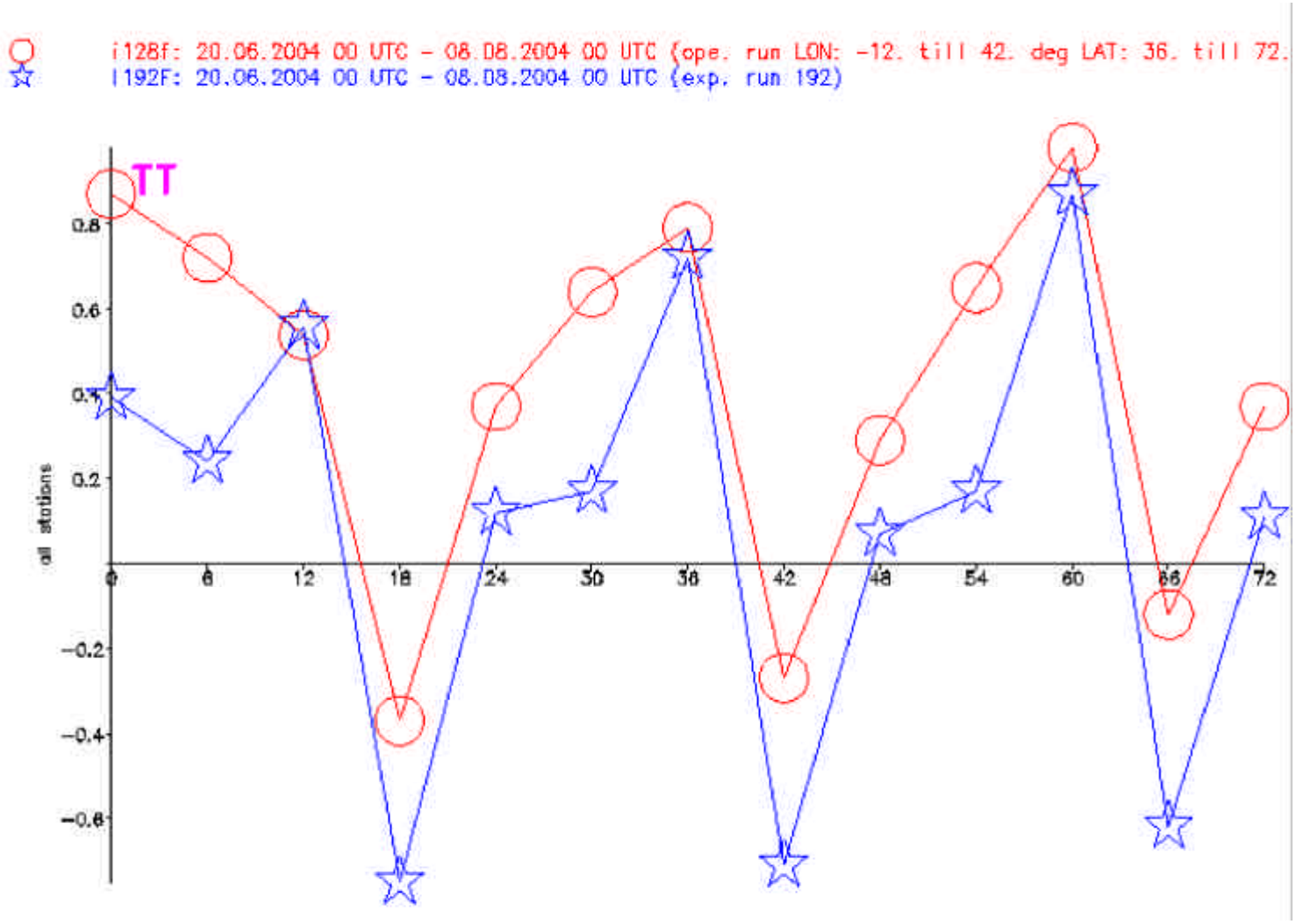
40-km GME, 40 layers, new soil model

- Grid spacing reduced from 60 km to 40 km
- Grid cell reduced from 3100 km^2 to 1384 km^2
- Number of layers increased from 31 to 40
- Size of lateral boundary files will increase by a factor of 3!
- Lowest model layer now 10 m above ground (before: 33 m)
- New multi-layer soil model with solution of heat conduction equation, inclusion of the effects of freezing/melting of soil water and improved snow model
- Planned operational introduction: 27 September 2004

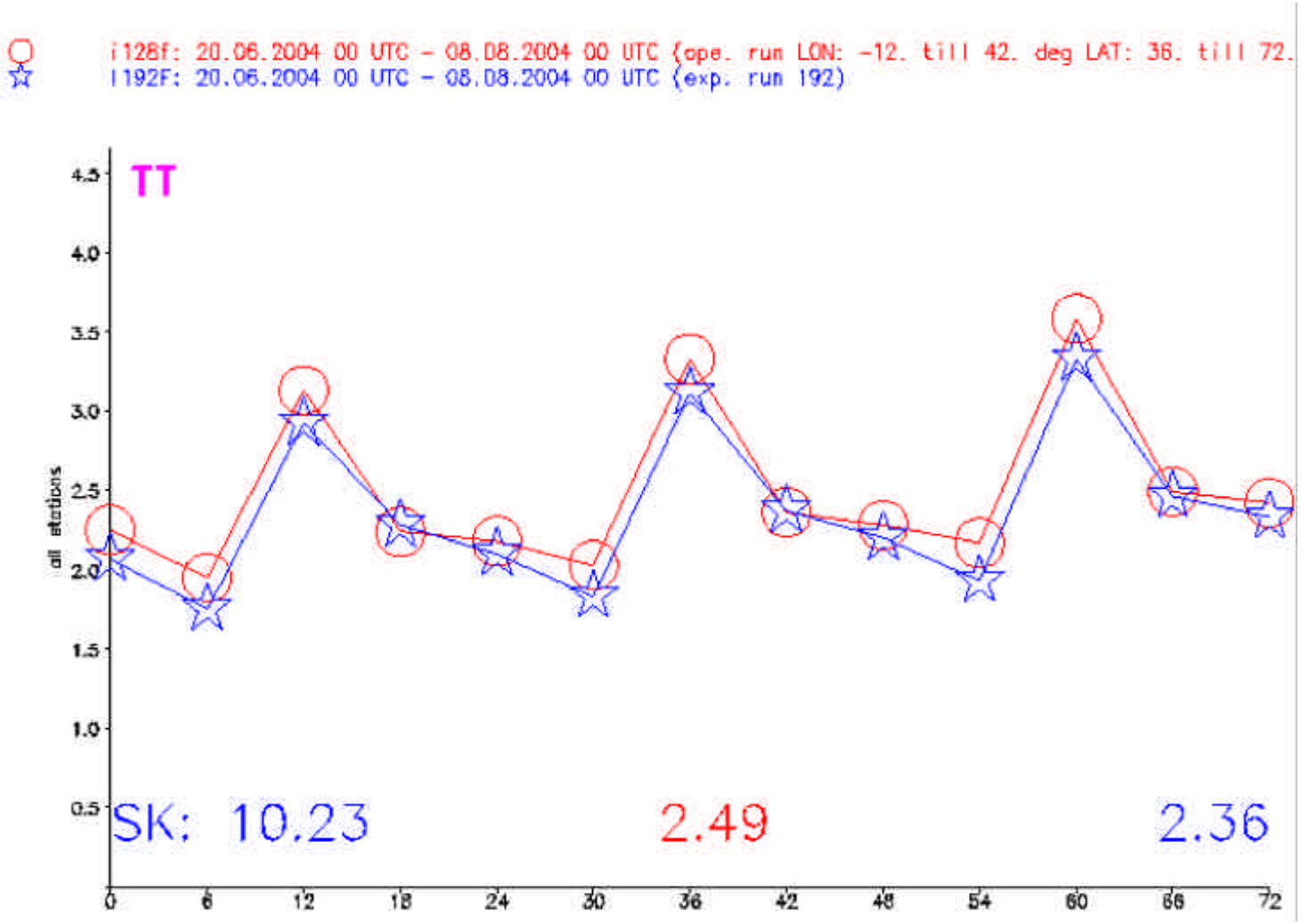
Configuration of the new multi-layer soil model



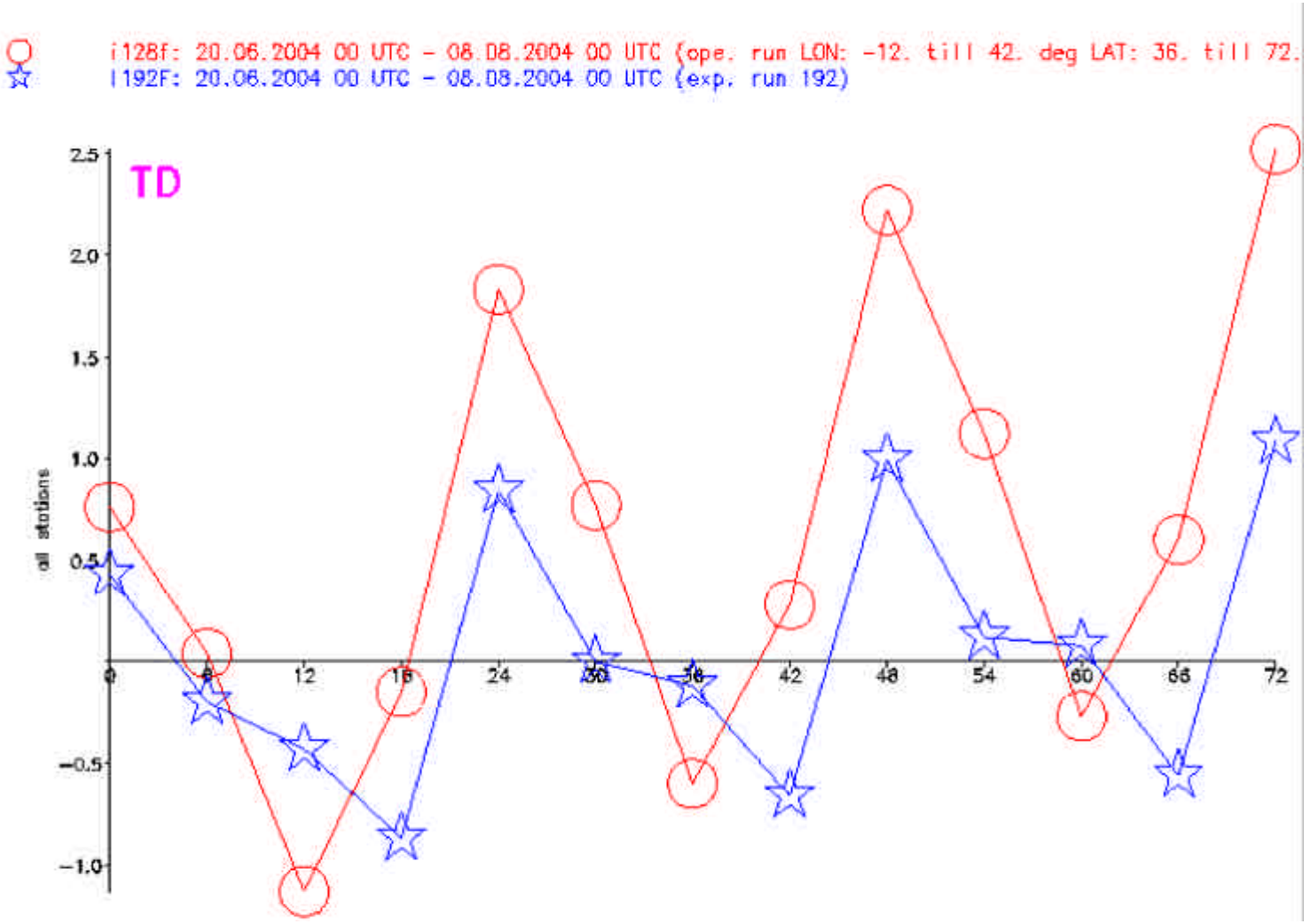




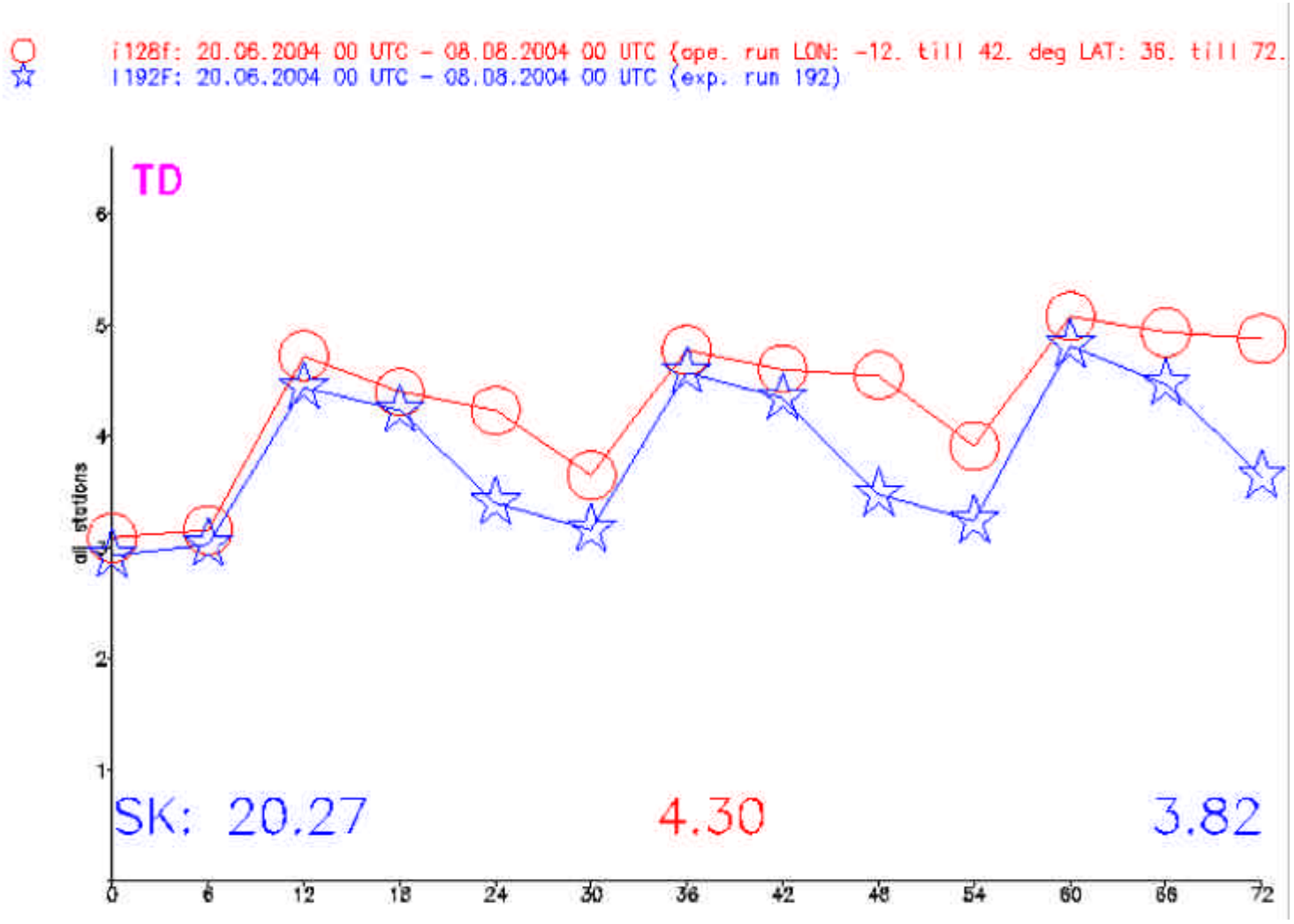
Mean error (K) of temperature at 2 m in Europe for GME 60 km/L31 and 40 km/L40



RMS error (K) of temperature at 2 m in Europe for GME 60 km/L31 and 40 km/L40



Mean error (K) of dew point at 2 m in Europe for GME 60 km/L31 and 40 km/L40



RMS error (K) of dew point at 2 m in Europe for GME 60 km/L31 and 40 km/L40

LME: LM Europe

The expansion of the LM domain has been requested by the following (internal) DWD customers:

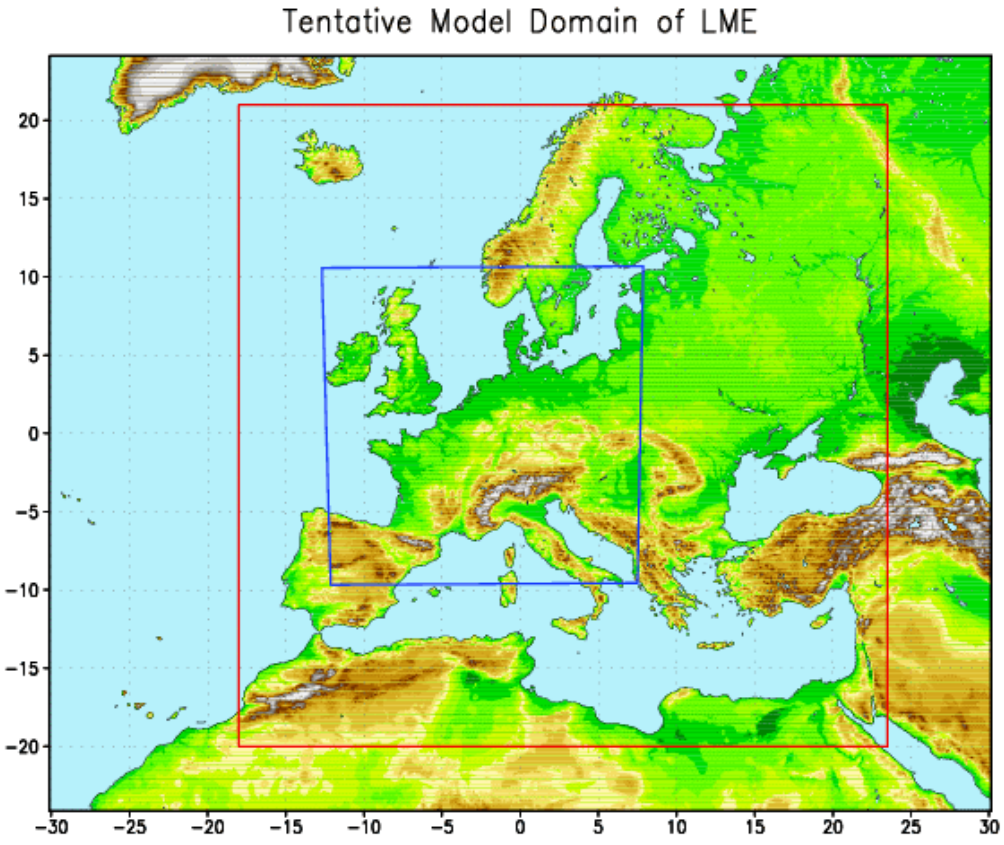
- **Air traffic consulting**
- **Ship traffic consulting**
- **Air pollution tracking**

Time schedule for LME

- **Implementation of LME at ECMWF using the shell scripts of the DWD operational forecasting system:**
  March 2004
- **Agreement on model domain between DWD departments:**
  May 2004
- **October 2004: Pre-operational in parallel suite with data assimilation at DWD including current model changes:**
  1. Prognostic precipitation
  2. New soil model
- **First quarter in 2005: Operational at DWD**

LME: LM Europe

- **Model Configuration**
  Grid spacing: 0.0625° (~ 7 km)
  665 x 657 grid points per layer
  40 vertical layers
  Timestep: 40 sec
  Daily runs at 00, 12, 18 UTC, +78h
- **Boundary Conditions**
  Interpolated GME forecasts with ds ~ 40 km and 40 layers (hourly)
  Hydrostatic pressure at lateral boundaries
- **Data Assimilation**
  Nudging analysis scheme
  Variational soil moisture analysis
  SST analysis at 00 UTC
  Snow depth analysis every 6 hrs



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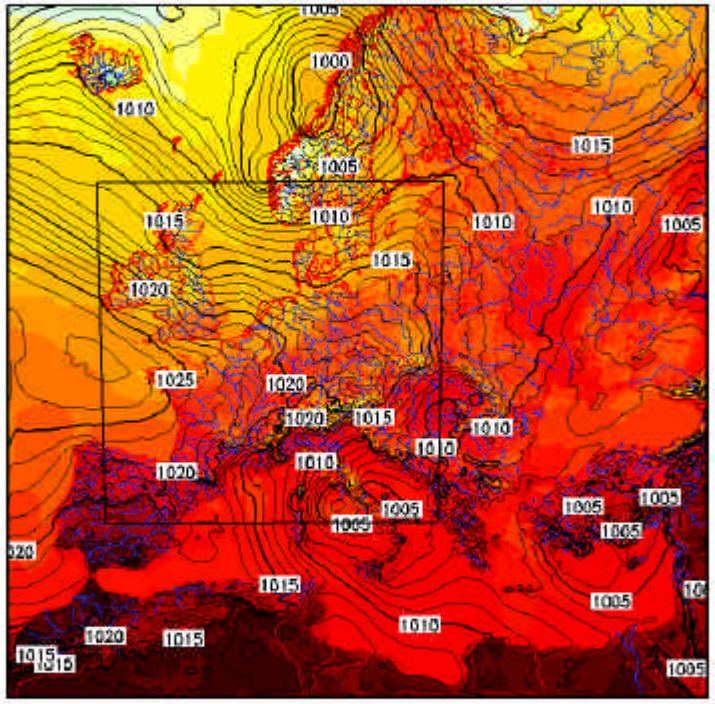
LME 7km/L40 (exp.: 4624)
initial: 24 JUL 2004 12 UTC
valid: 25 JUL 2004 12 UTC

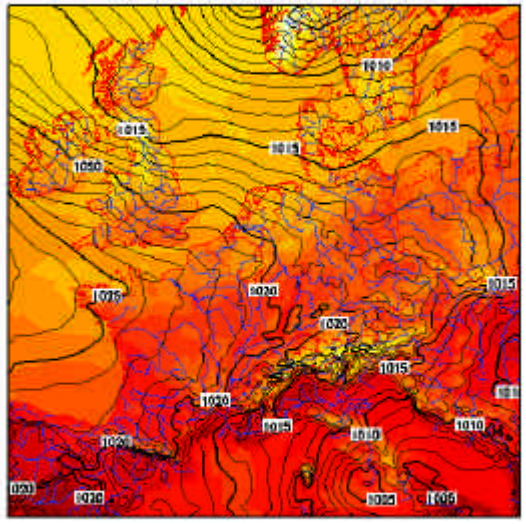
(1) 2m TEMPERATURE (2) PMSL



(1) Mean: 21.993 Min: −1.16 Max: 48.0412 Var: 60.2429
(2) Mean: 1014.18 Min: 986.701 Max: 1027.22

LM 7km/L40 (exp.: 4648)
initial: 24 JUL 2004 12 UTC
valid: 25 JUL 2004 12 UTC

(1) 2m TEMPERATURE (2) PMSL



(1) Mean: 19.5918 Min: 4.08339 Max: 37.6882 Var: 28.1831
(2) Mean: 1016.25 Min: 1003.05 Max: 1027.31

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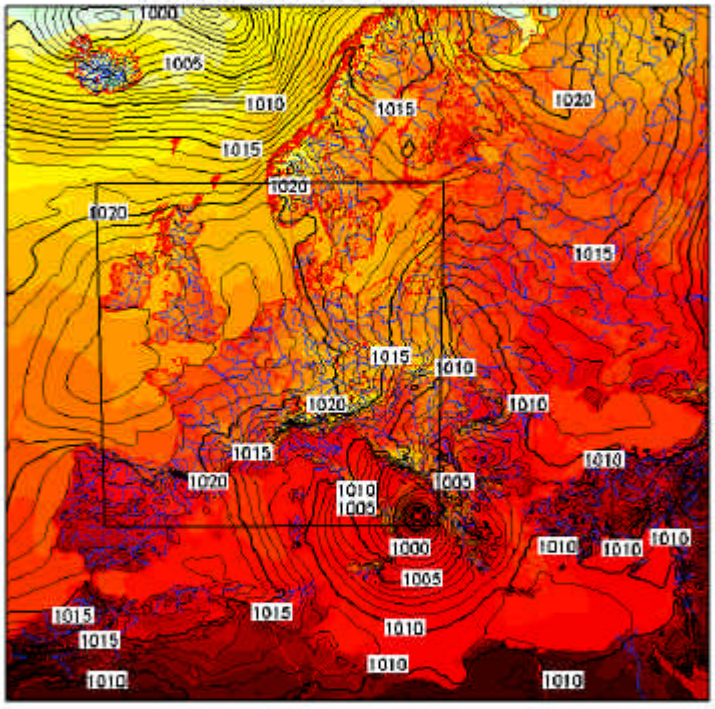
LME 7km/L40 (exp.: 4624)
initial: 24 JUL 2004 12 UTC
valid: 27 JUL 2004 12 UTC

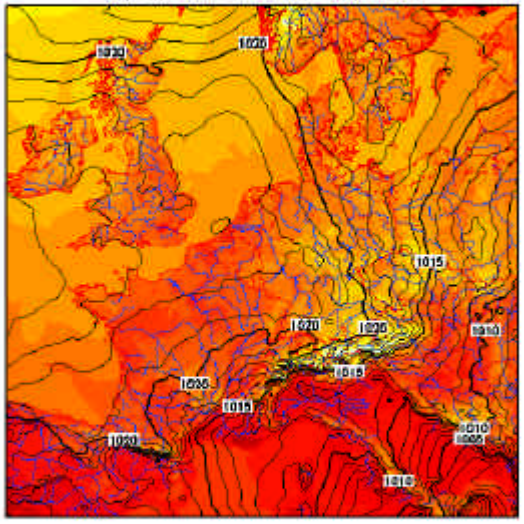
(1) 2m TEMPERATURE (2) PMSL



(1) Mean: 21.7263 Min: -3.8497 Max: 48.9403 Var: 56.1638
(2) Mean: 1015.9 Min: 987.023 Max: 1024.58

LM 7km/L40 (exp.: 4648)
initial: 24 JUL 2004 12 UTC
valid: 27 JUL 2004 12 UTC

(1) 2m TEMPERATURE (2) PMSL



(1) Mean: 19.0181 Min: 1.32488 Max: 34.2067 Var: 17.8074
(2) Mean: 1017.88 Min: 986.091 Max: 1024.52

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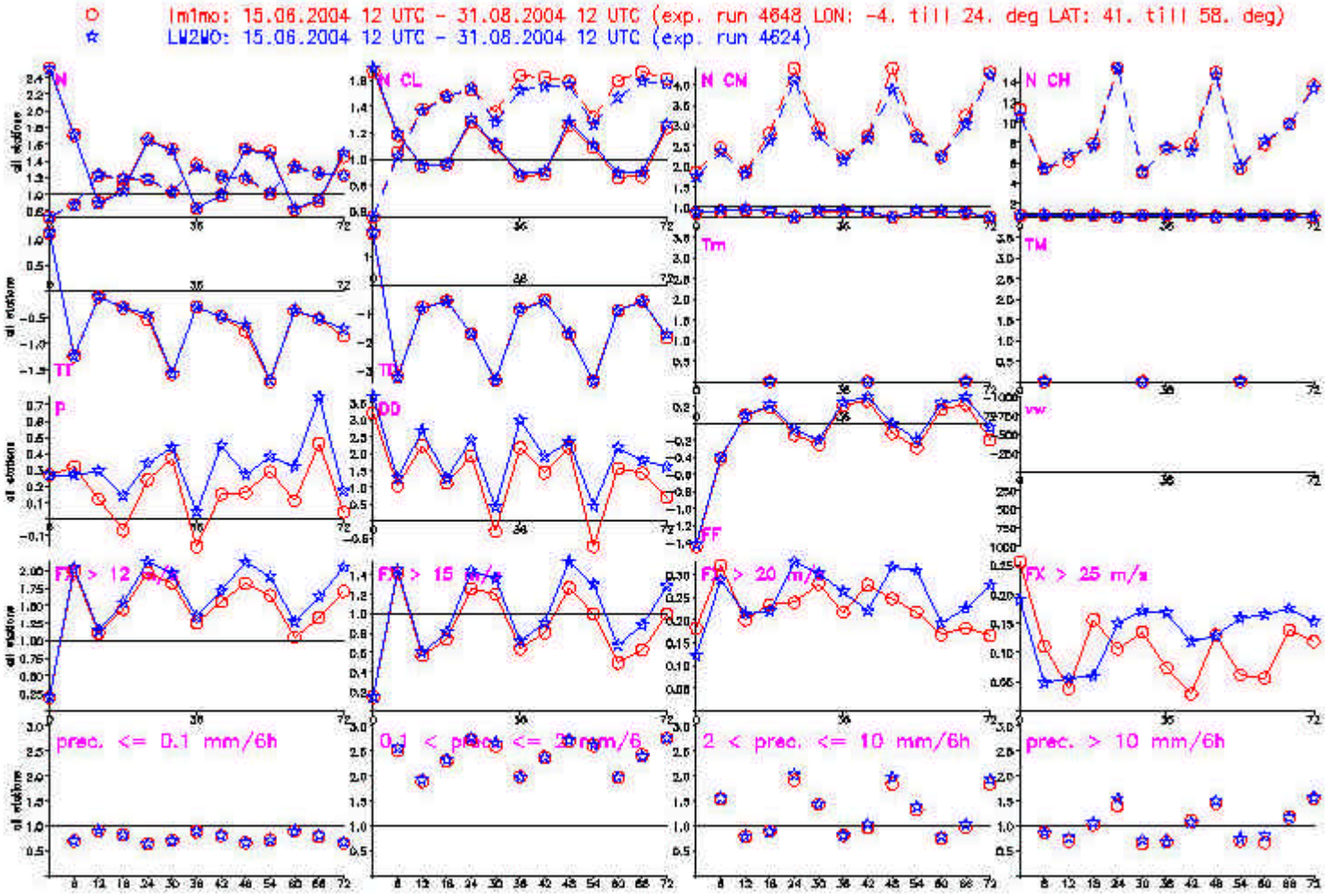

Results of verification of forecasts for local weather elements at surface weather stations

frequency bias for cloud covers (-: 0-2/8, – -: 7-8/8) and precipitation T-1 till T, mean error for other elements

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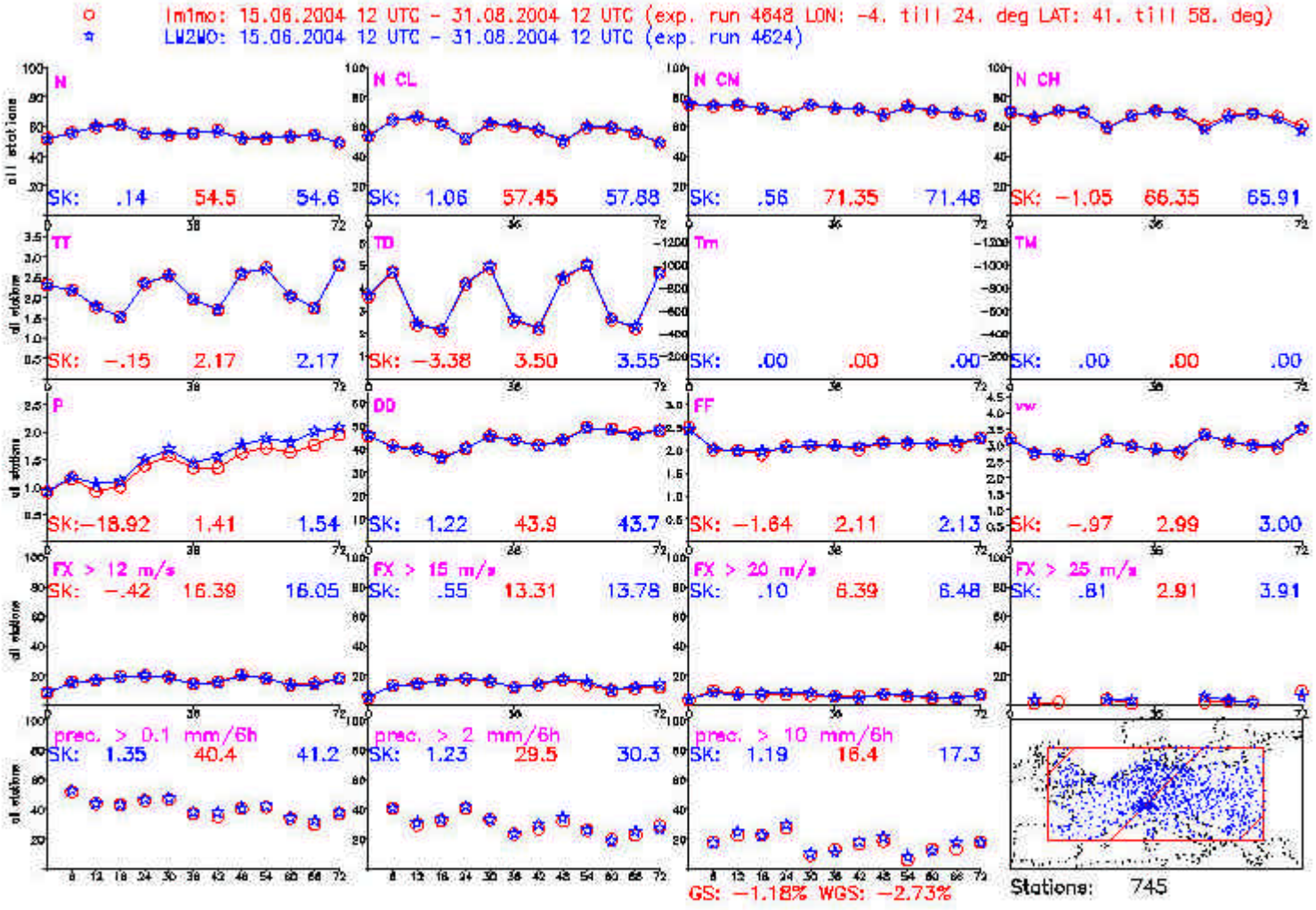

Results of verification of forecasts for local weather elements at surface weather stations

TSS for precipitation, ETS for gusts, percent correct for cloud cover, RMSE for other elements

Mean values over all forecast times as numbers

Conclusions

- LM and LME give generally very similar forecasts on the LM domain.
- But in some cases the LME solution deviates from the LM solution and the weather given by the driving model. LME is more able to develop its own weather regime in the interior of the model domain.
- Objective verification shows some advantages for LME precipitation and gusts, but some disadvantages for mean sea level pressure.