Revision of the COSMO External Parameters and Land-Surface Scheme

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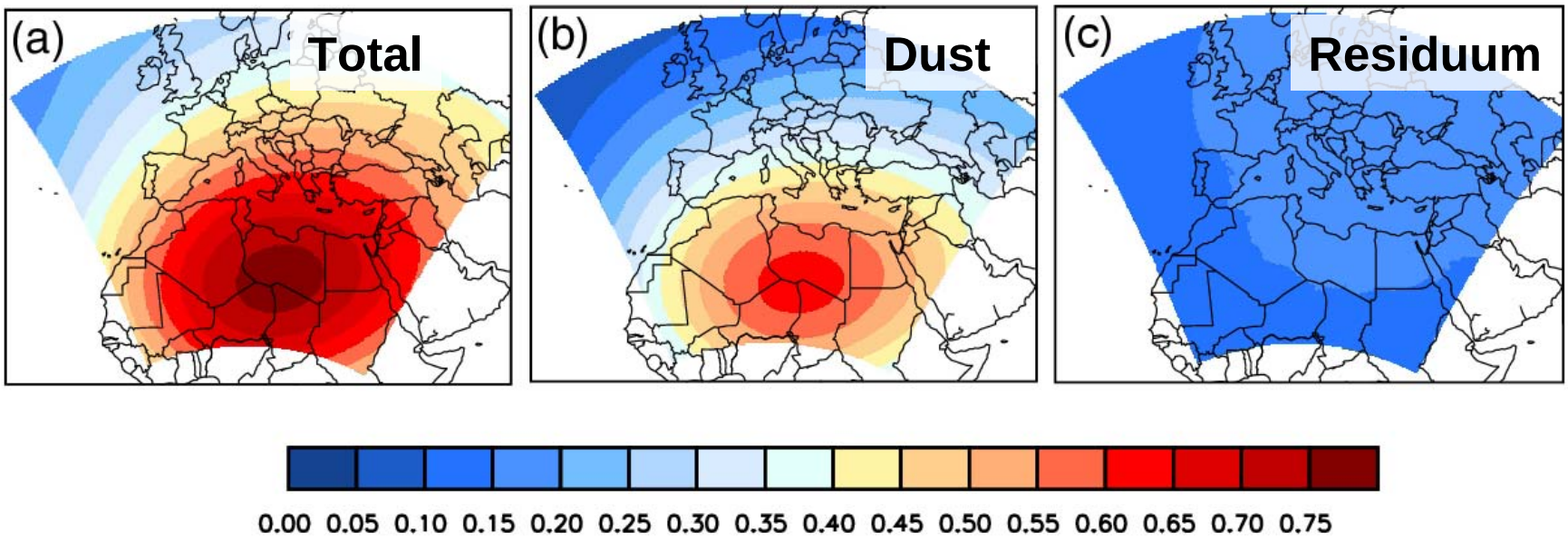
Outline

- Adaptions in external parameters of COSMO
- Experiment 7146: aerosol climatology, June 2009
- Experiment 7224: aerosol + TERRA adaptions, June 2009

Adaptions in external parameters of COSMO

- Aerosol climatology
- Emissivity
- Vegetation climatology (LAI, PLCOV),
- Minimum stomatal resistance
- Climatological soil temperature

Aerosol optical depth @ 550 nm

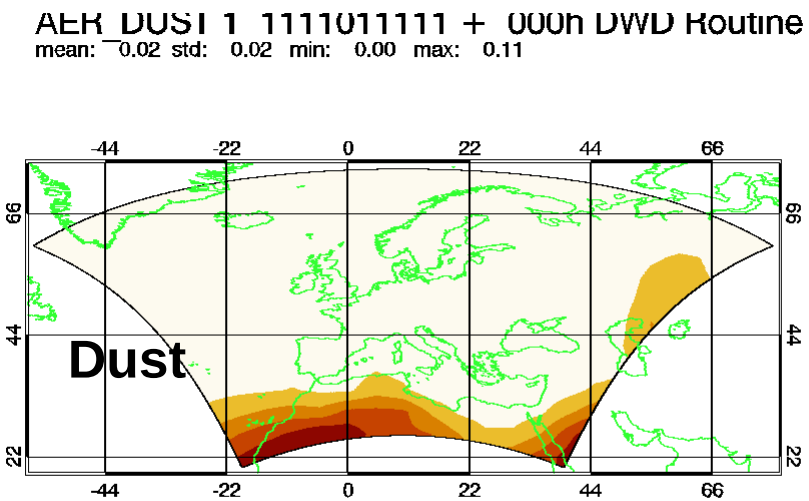


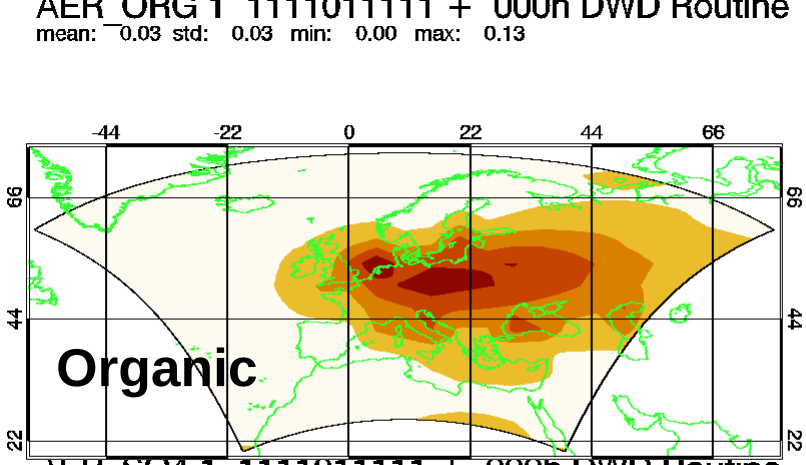
Total=Urban+Dust+Land+Maritim

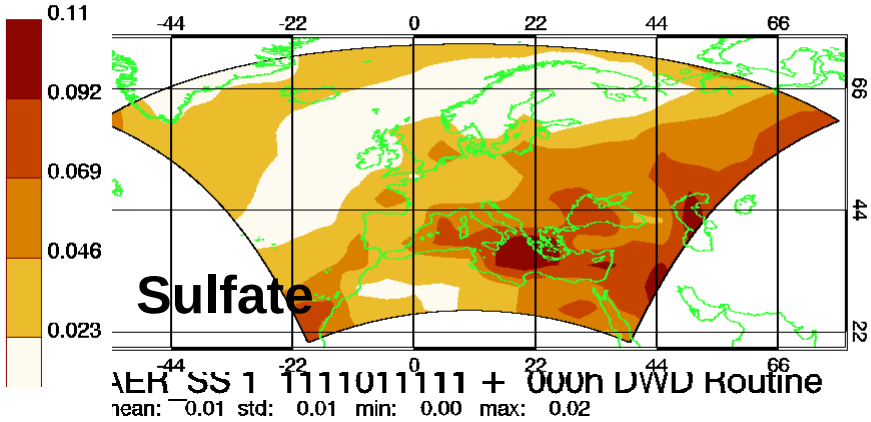
Helmert et al. (2007)

Aerosol climatology (Tegen et al., 1997) optical depth @ 550 nm

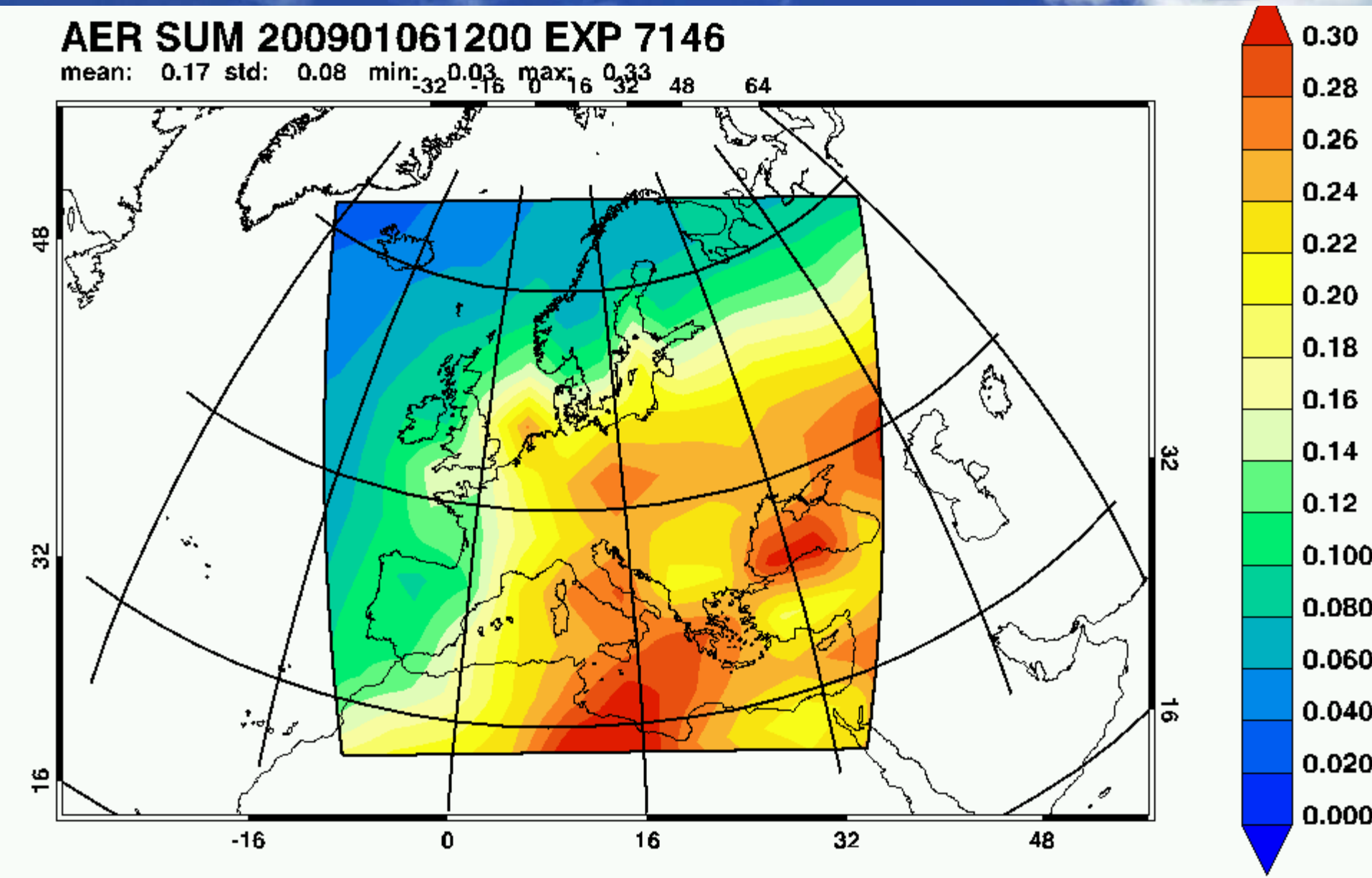
Lambert-Beer: $I = I_0 e^{-\tau z}$







Deutscher Wetterdienst



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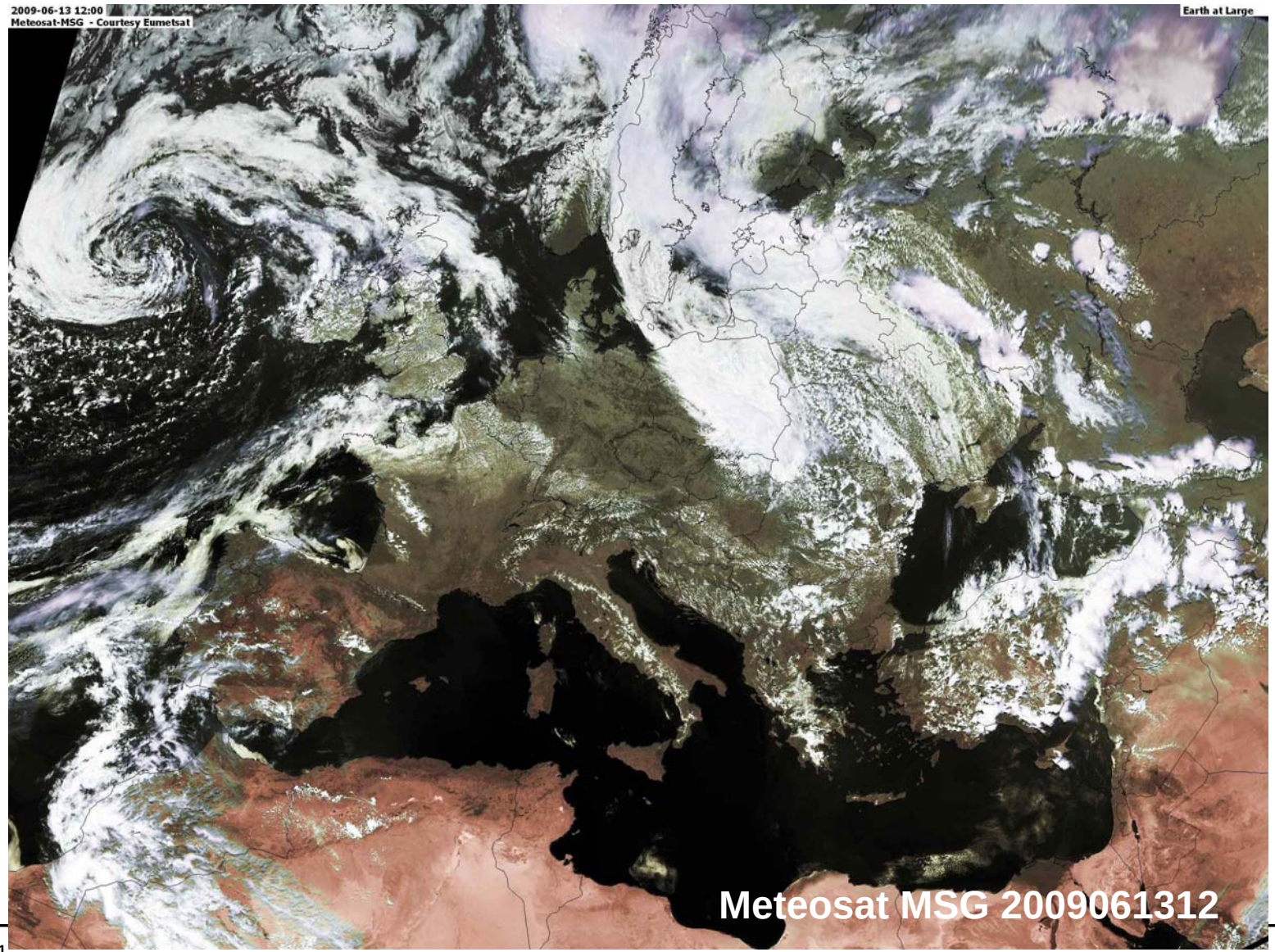

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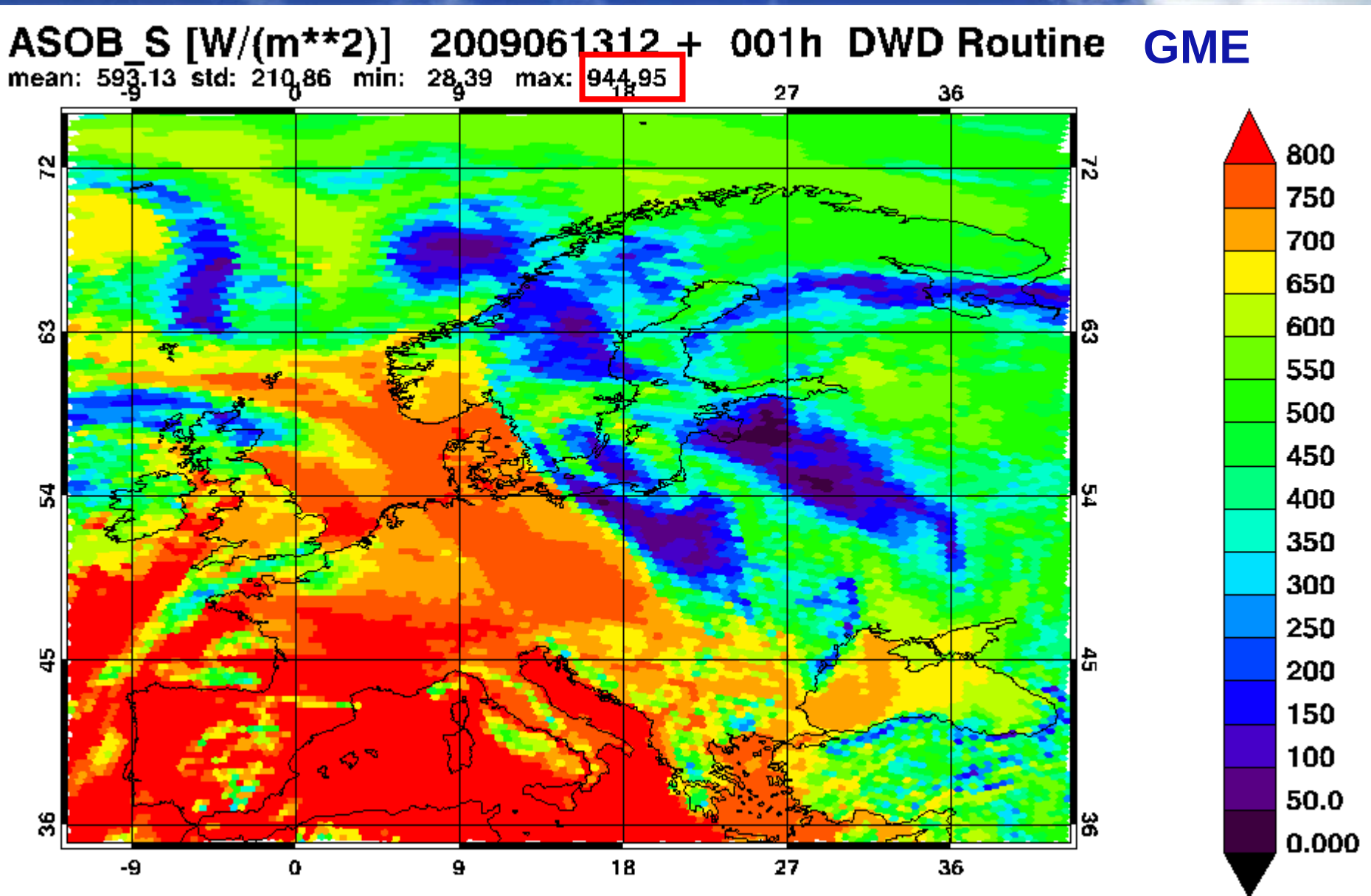

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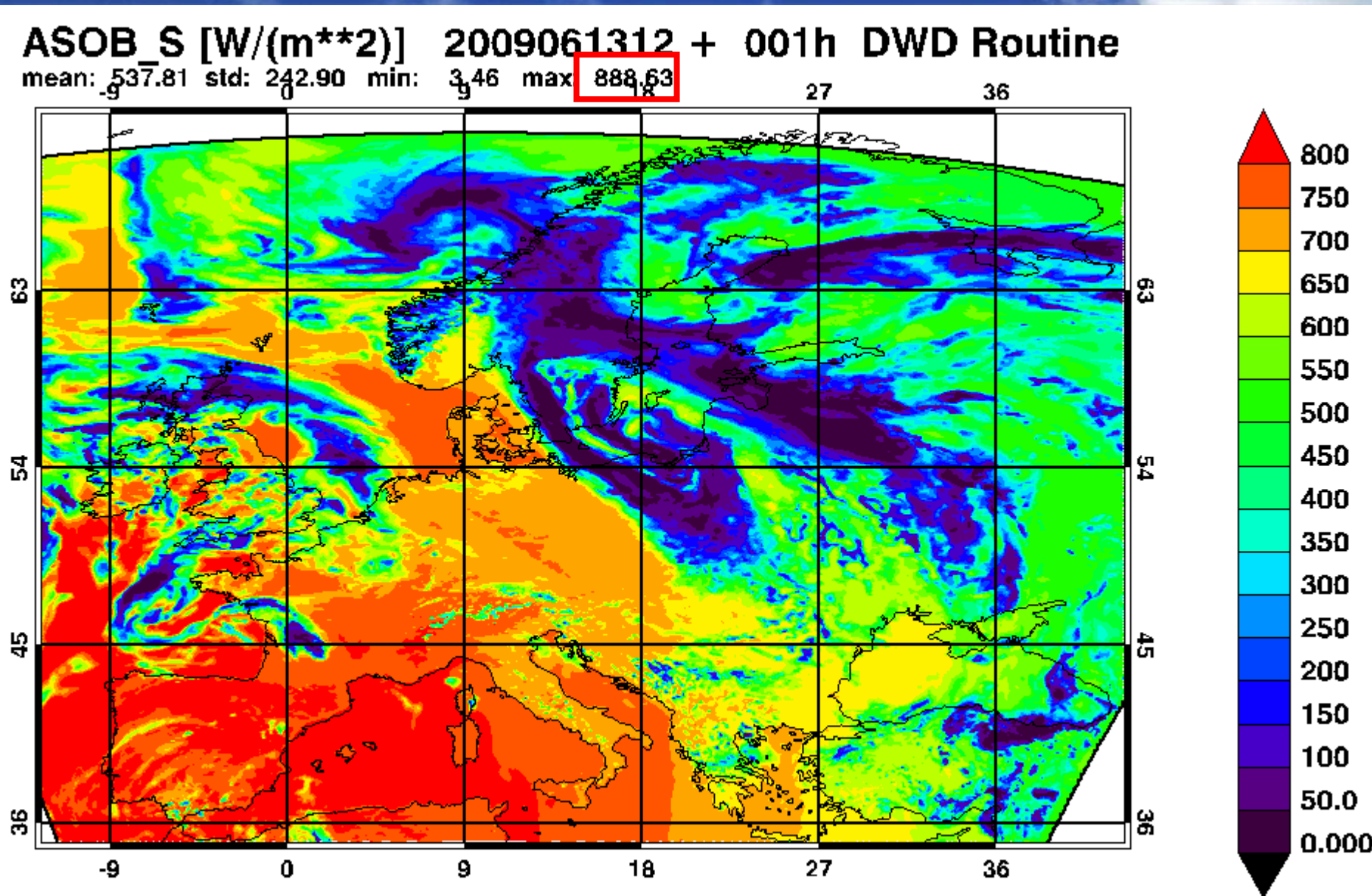

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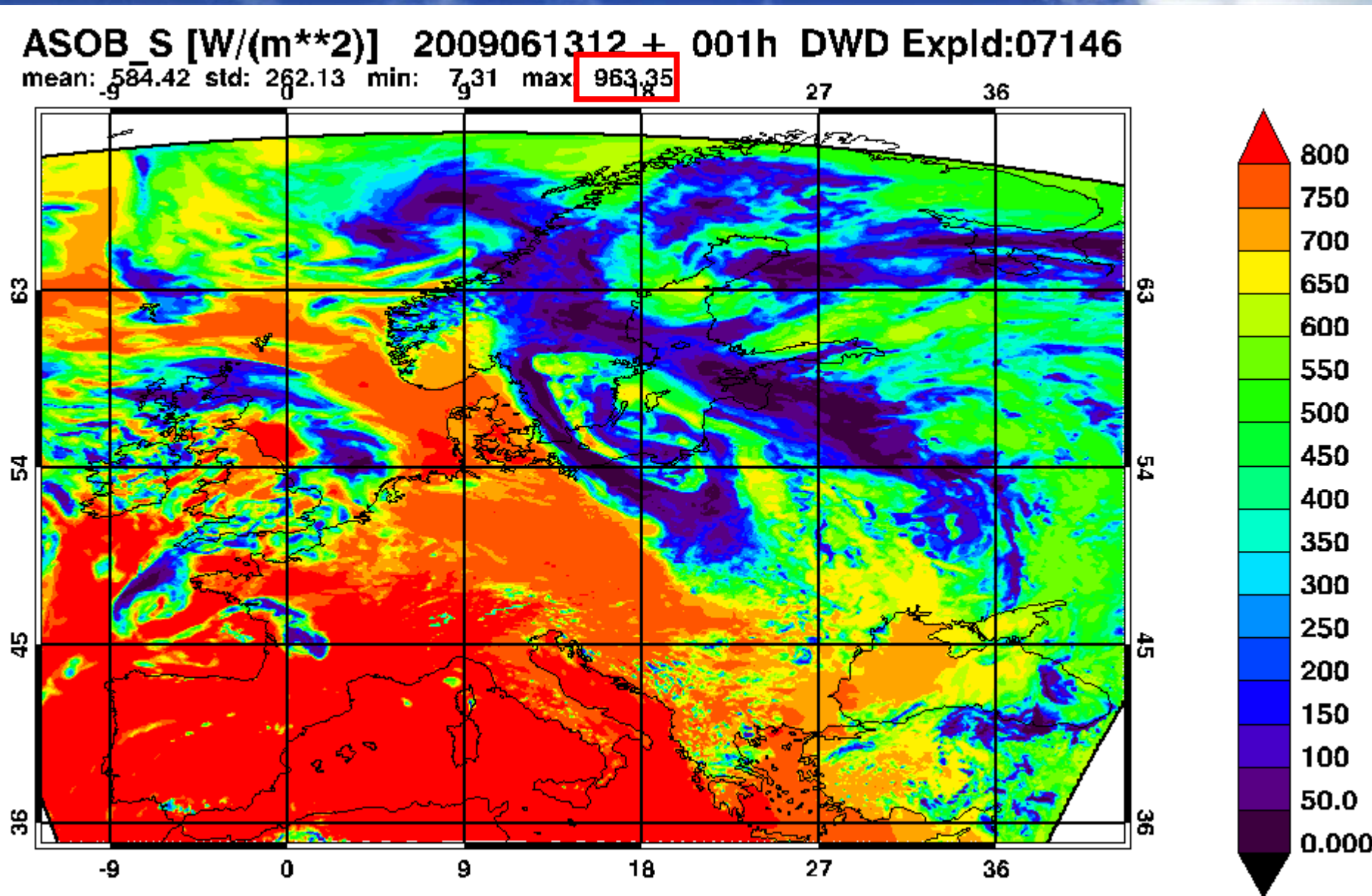

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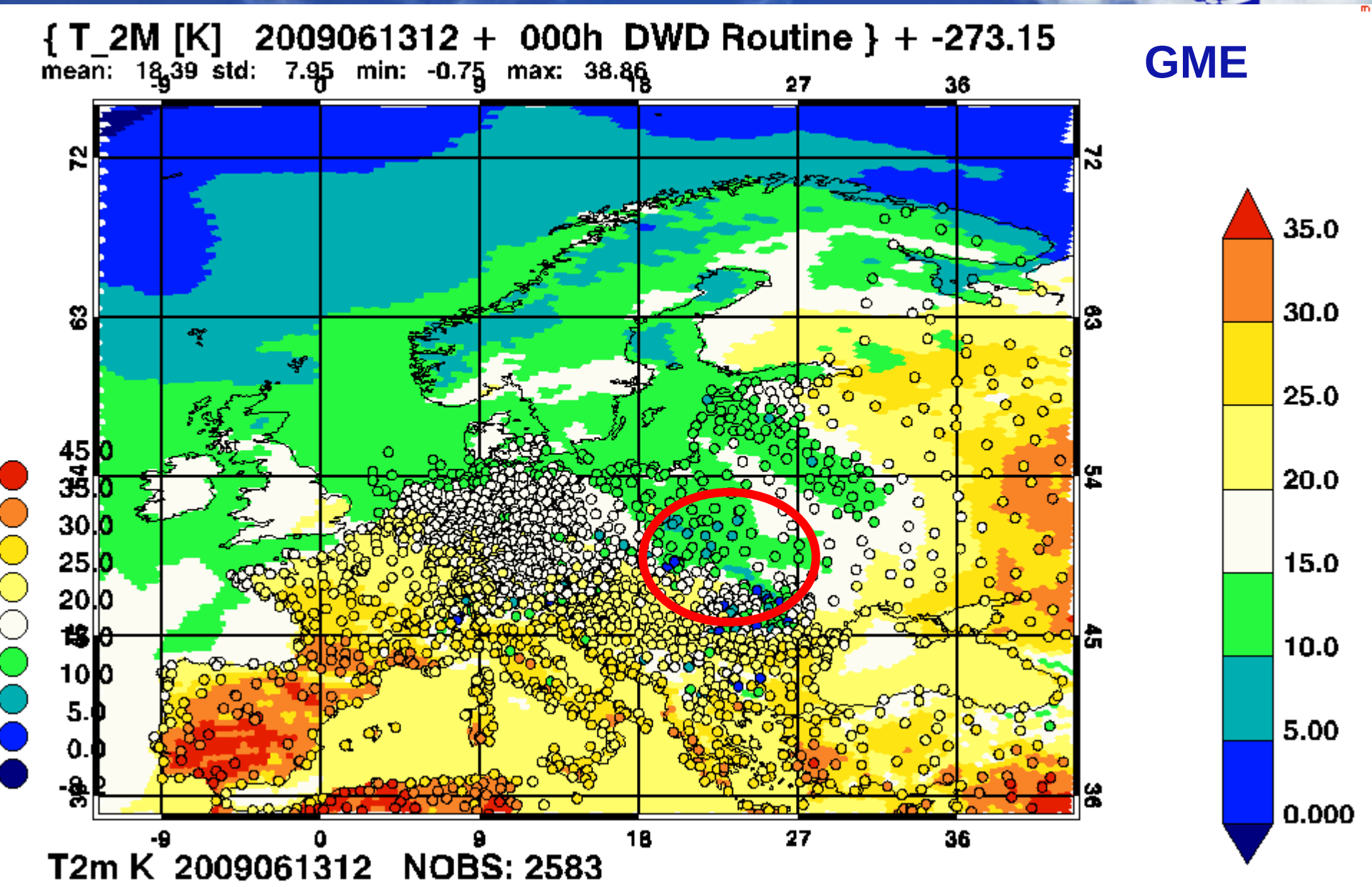

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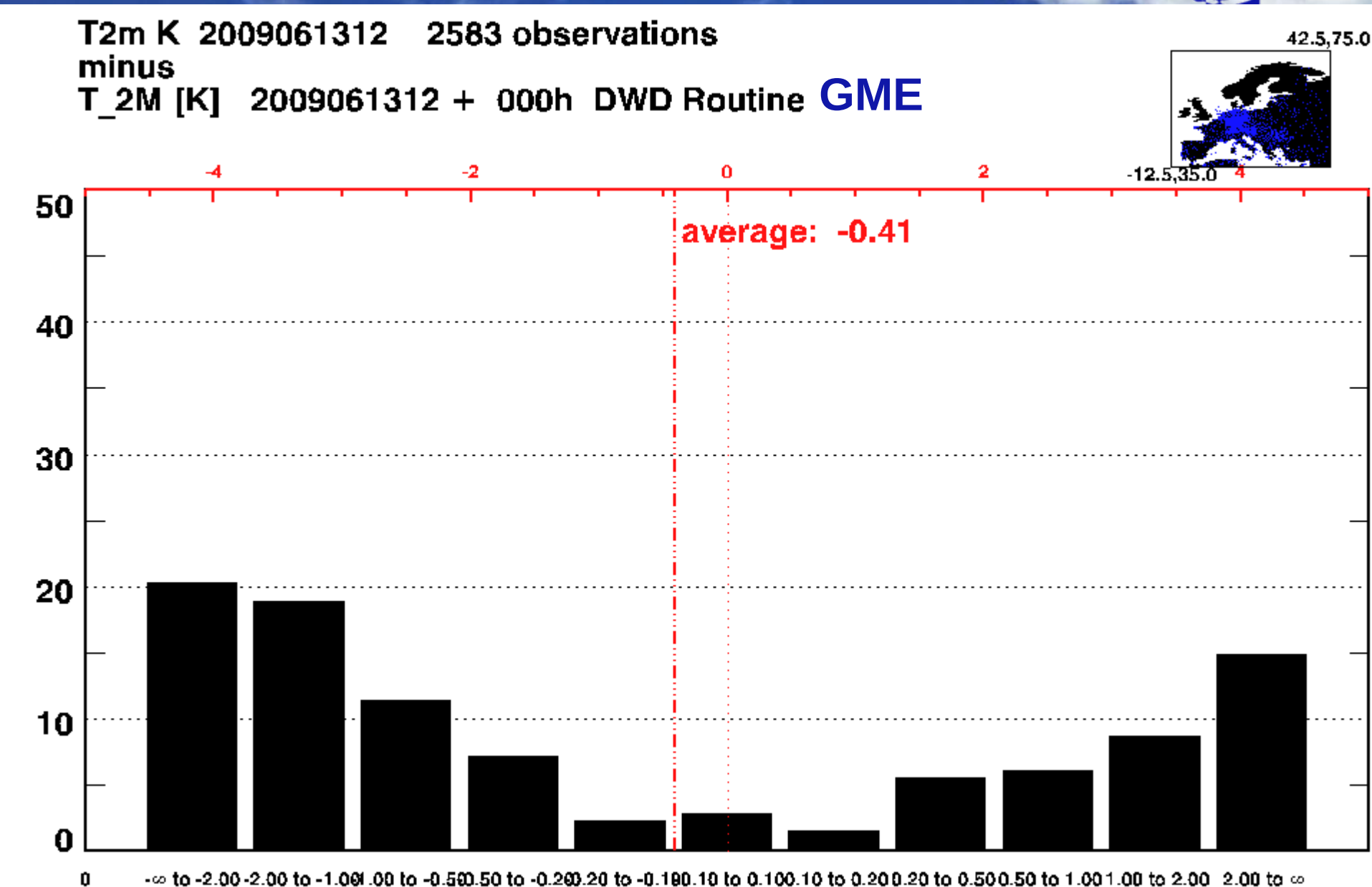

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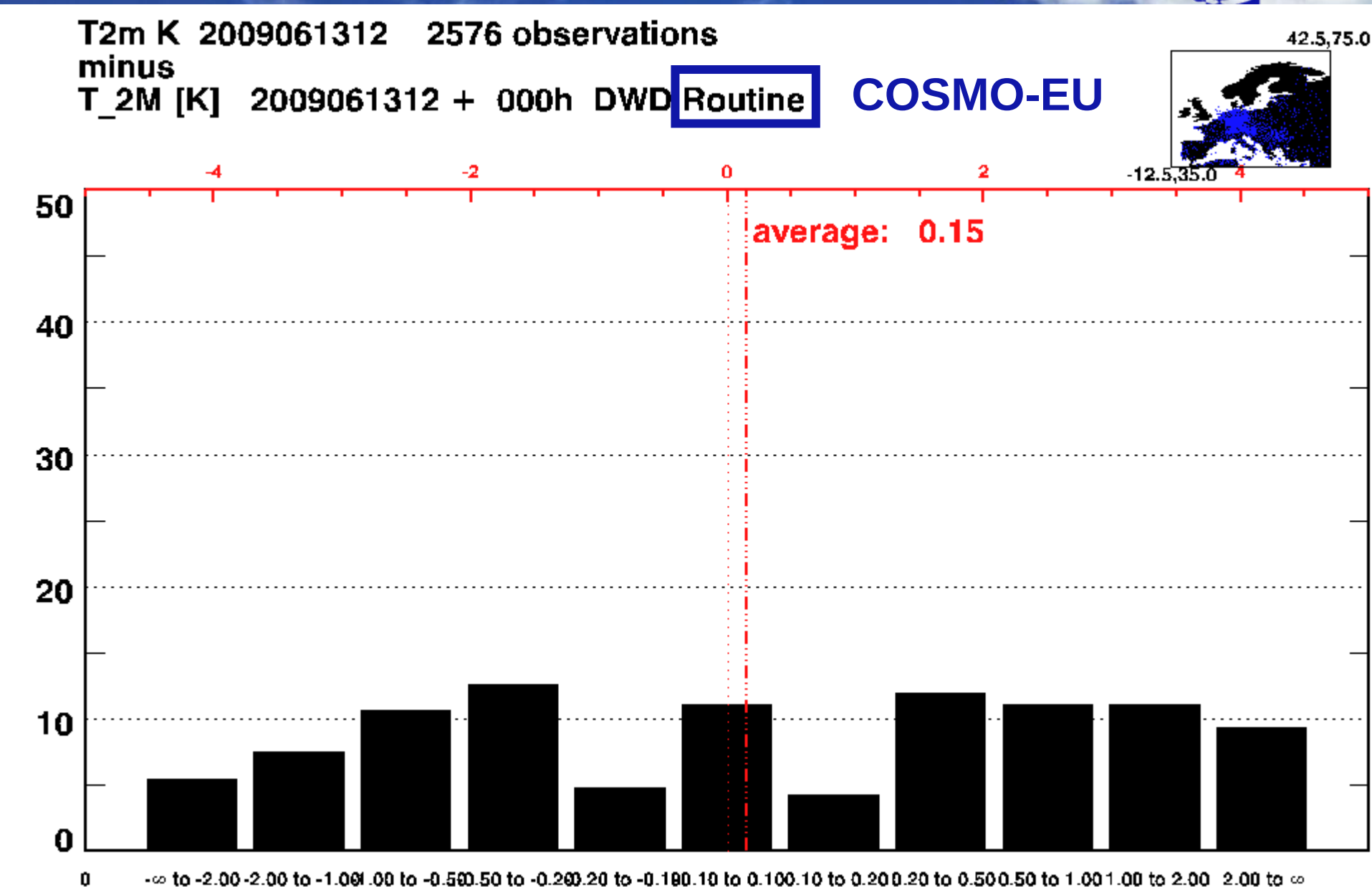

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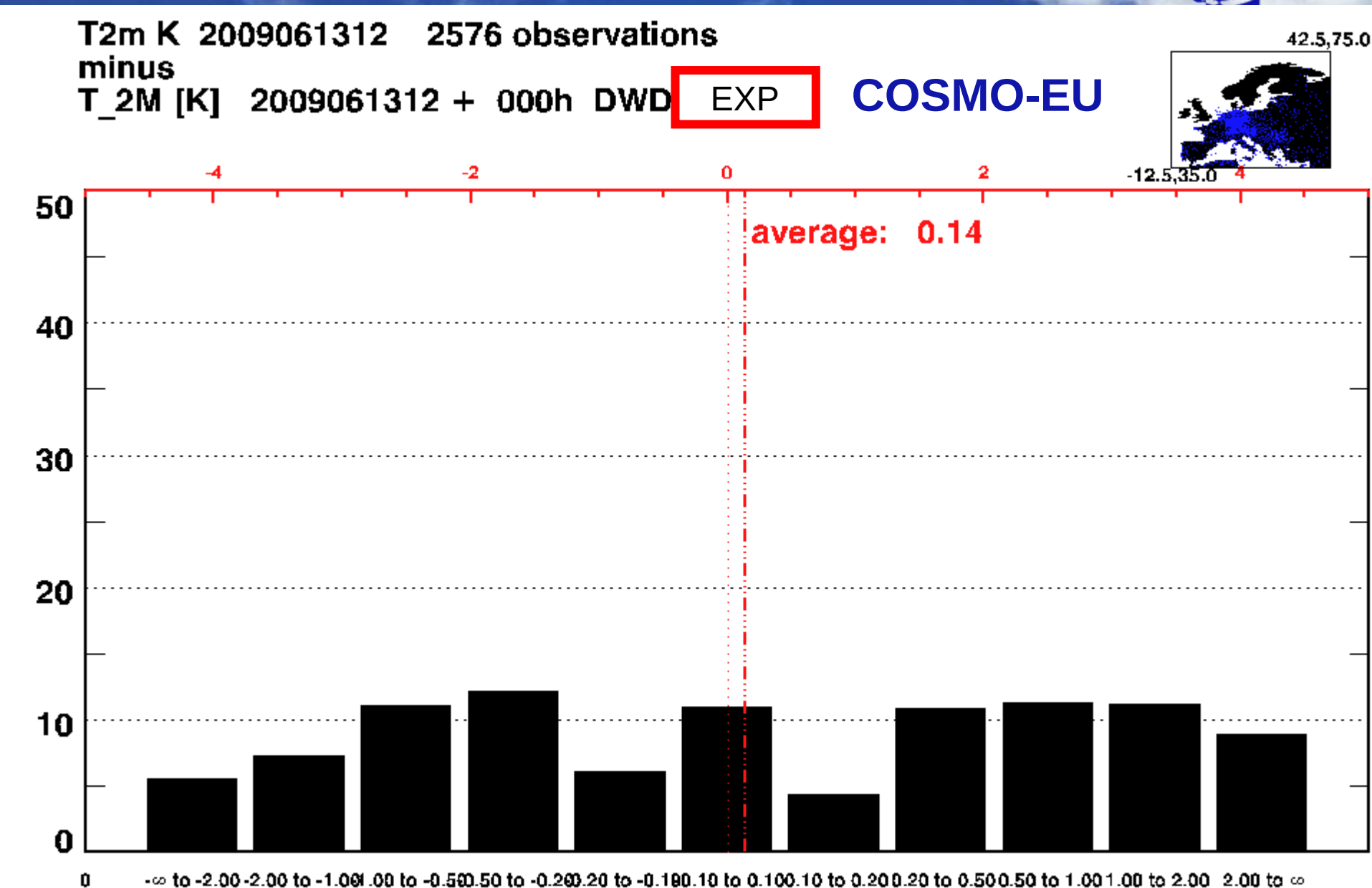
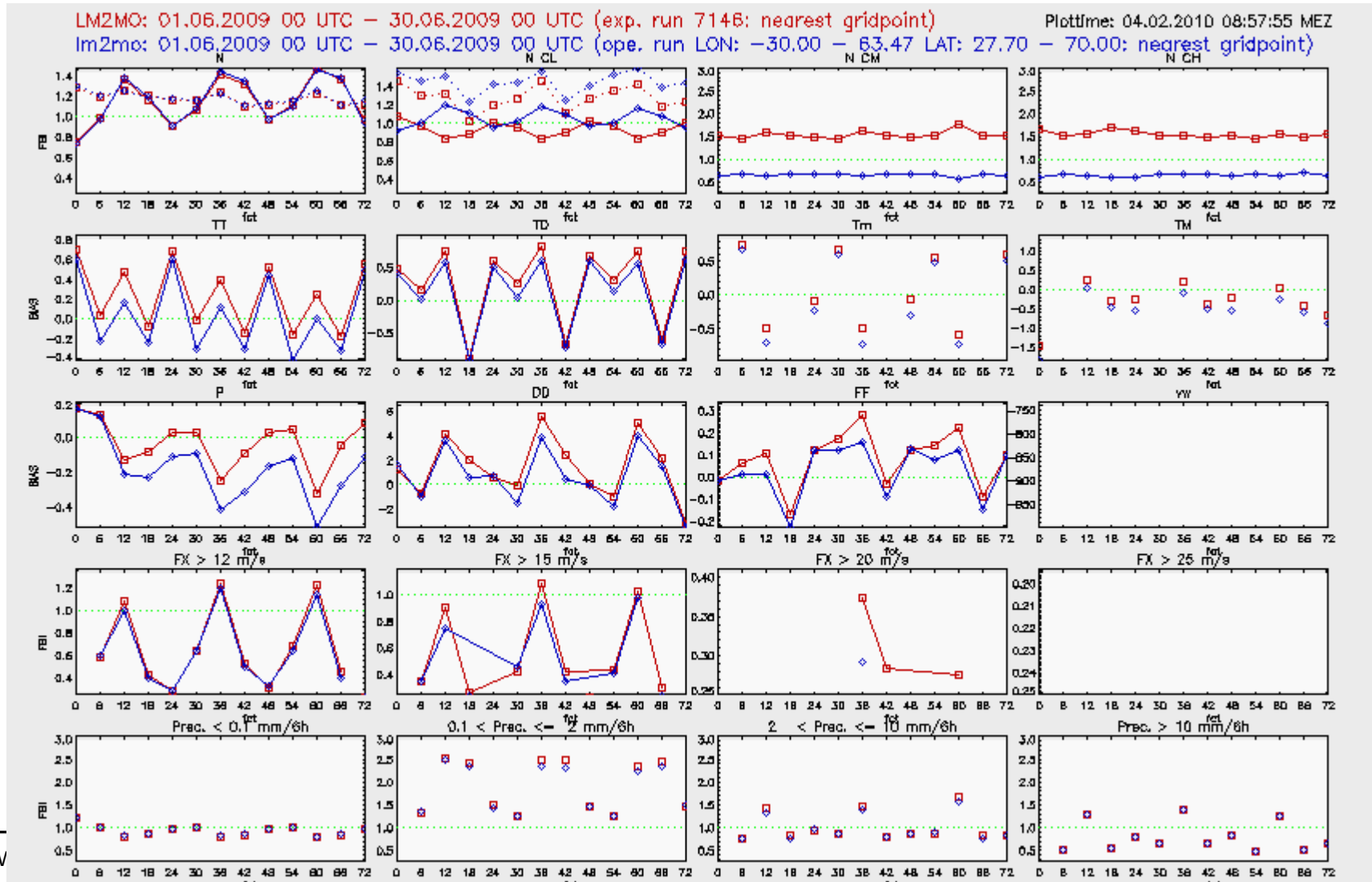
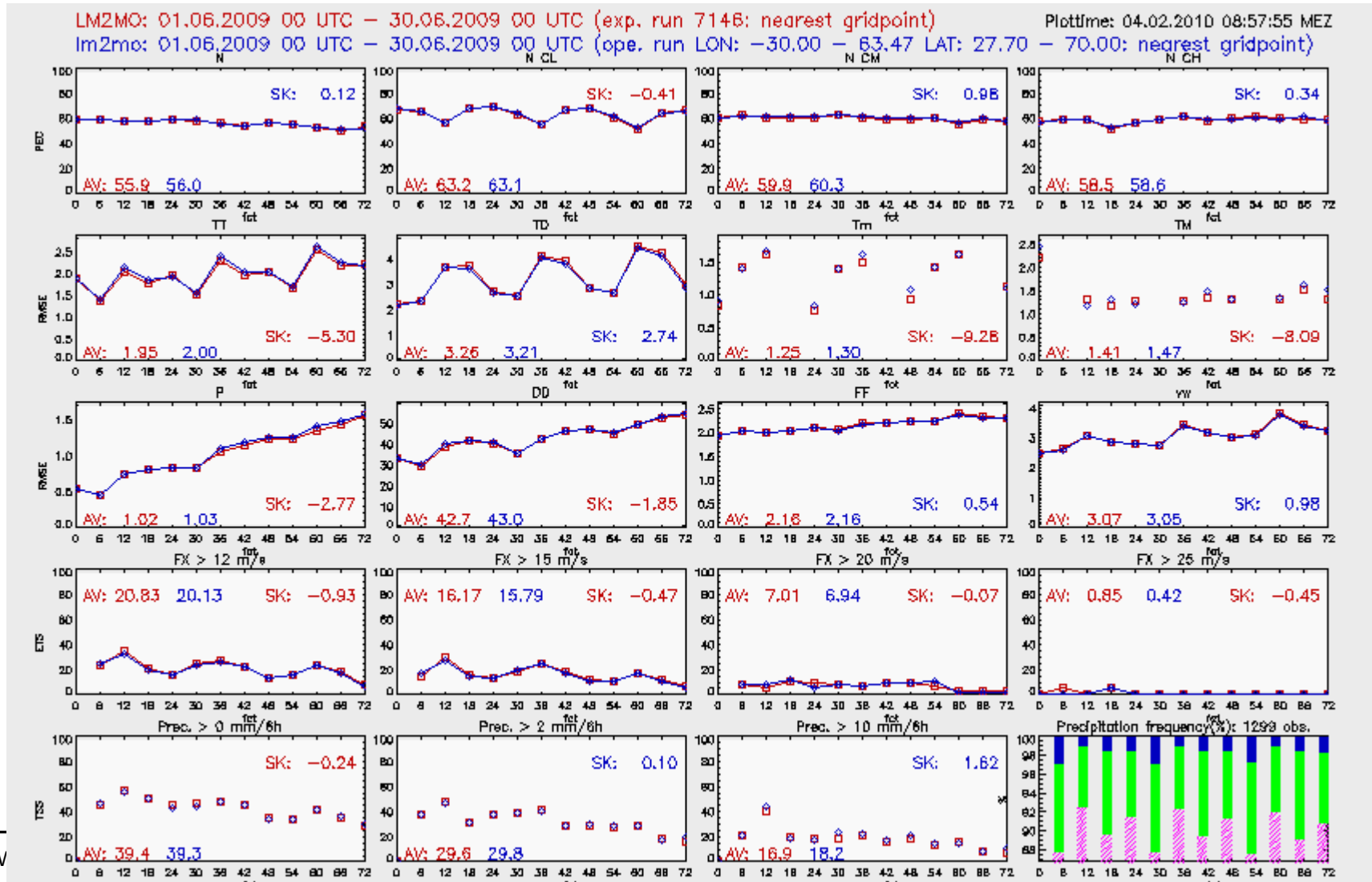


Verifikation COSMO-EU Start 00 UTC: LM2MO, alle Stationen



Verifikation COSMO-EU Start 00 UTC: LM2MO, alle Stationen



COSMO-EU Exp 7224

Tested adaptions in int2lm and TERRA

- Aerosol climatology, Emissivity, Vegetation climatology (LAI, PLCOV), Minimum stomatal resistance

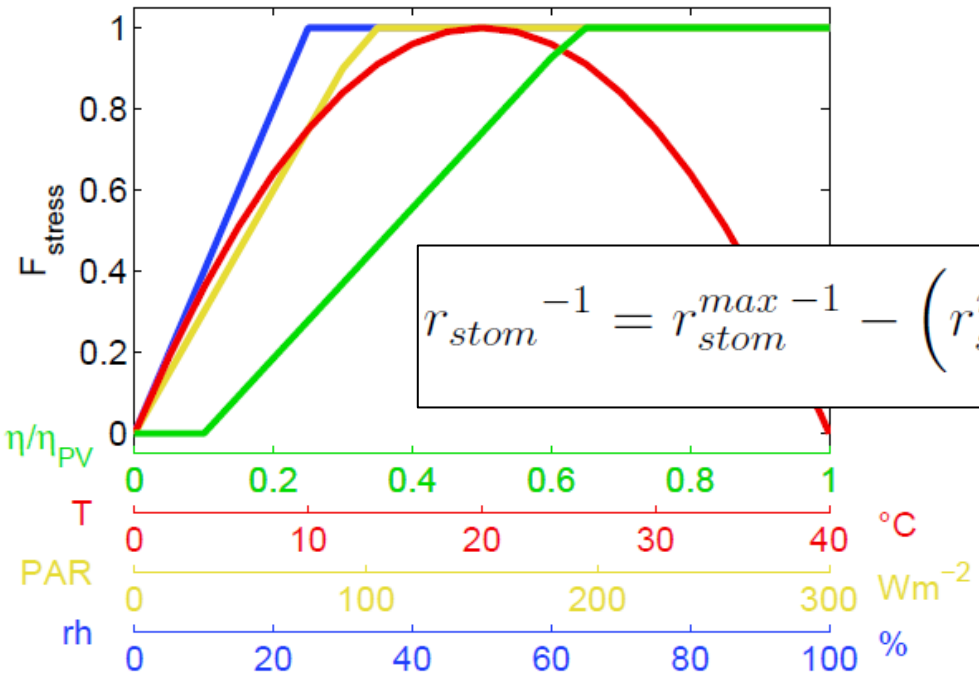
- Non-uniform root distribution
- Ground water with upward diffusion
- Soil moisture dependent heat conductivity

BATS Plant transpiration (Dickinson, 1984)

$$E_{trans}^{dick} = -\rho \left(q_{atm} - q^*(T_s)\right) \left(\frac{1}{r_{ca} + \frac{1}{f_{LAI}} \left(r_{lc} + r_{stom}\right)} \right)$$

r_{stom} stomatal resistance
r_{lc} res. btw. leaves and canopy air
r_{ca} res. btw. canopy air and atm. level

BATS Plant transpiration

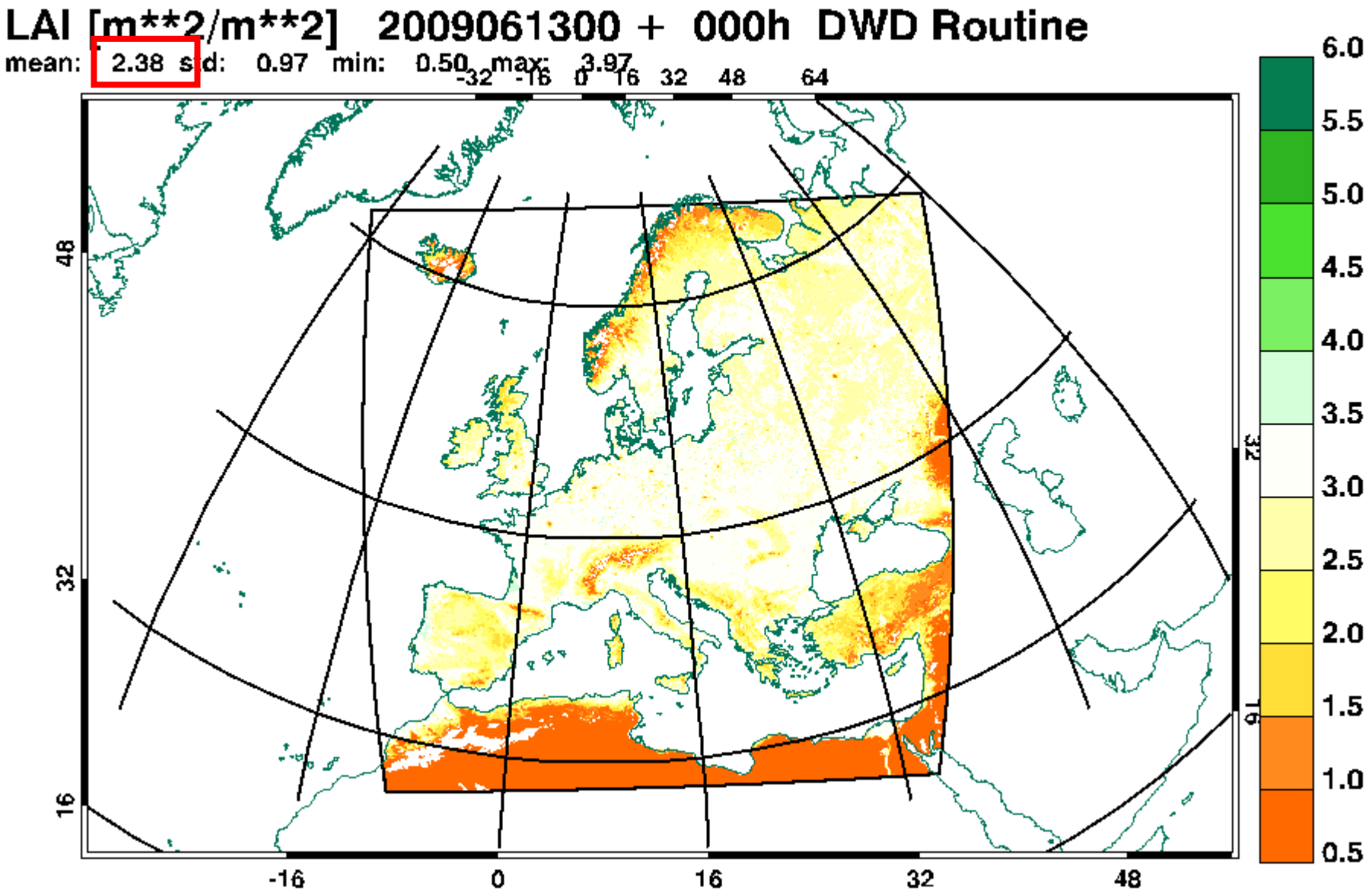


$$r_{stom}{}^{-1} = r_{stom}^{max\,-1} - \left(r_{stom}^{min\,-1} - r_{stom}^{max\,-1} \right) F_{rad} F_{\eta} F_{tem} F_{hum}$$

Parameterisation curves of the four stress factors limiting plant transpiration: soil moisture stress (green), temperature stress (red), insolation stress (yellow) and humidity stress (blue). Note, that low values indicate stress. (Curve of soil moisture stress is not exact; soil moisture threshold values are slightly soil type dependent.)

Figure taken from Ament, 2006

Deutscher Wetterdienst



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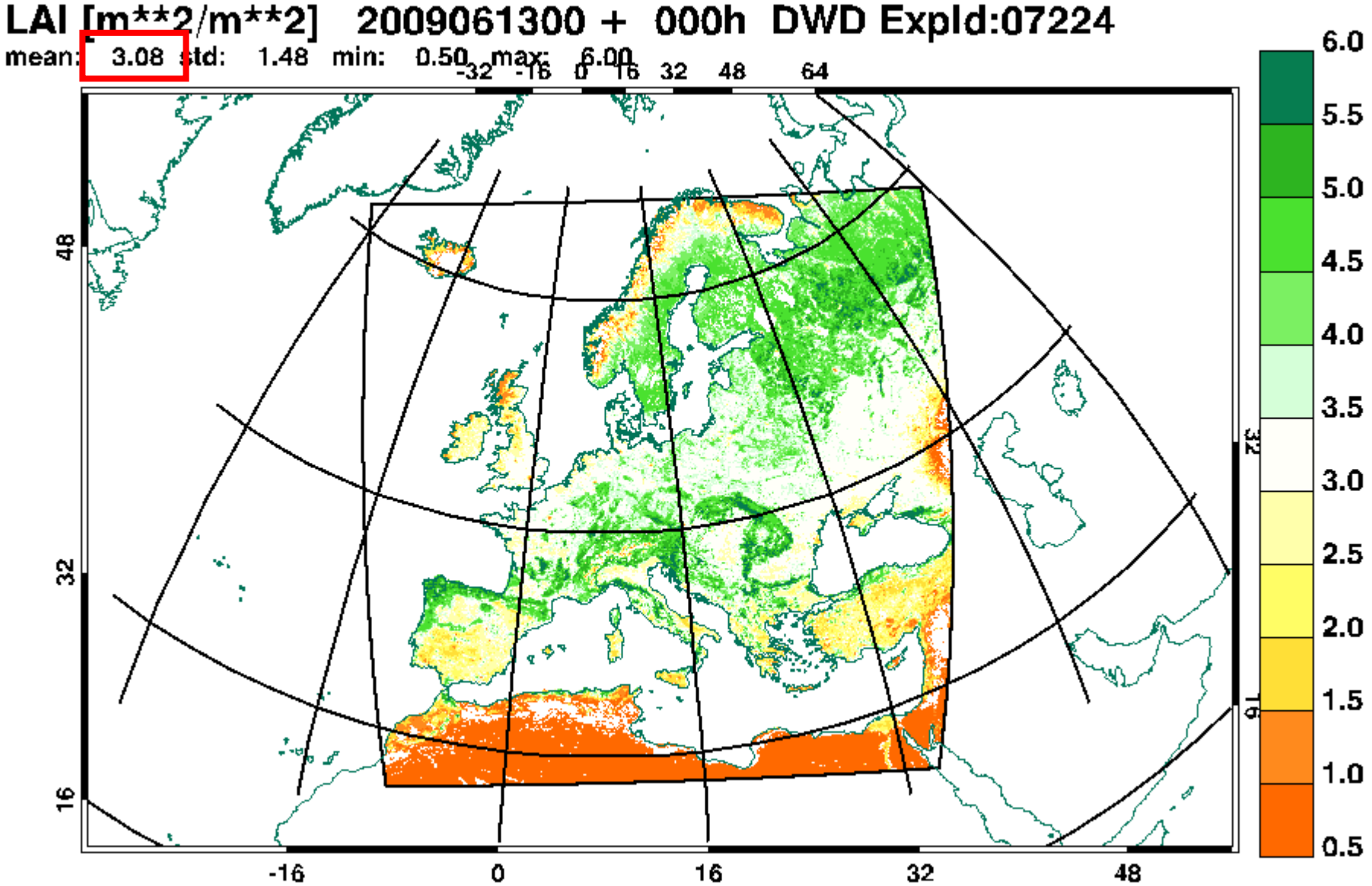

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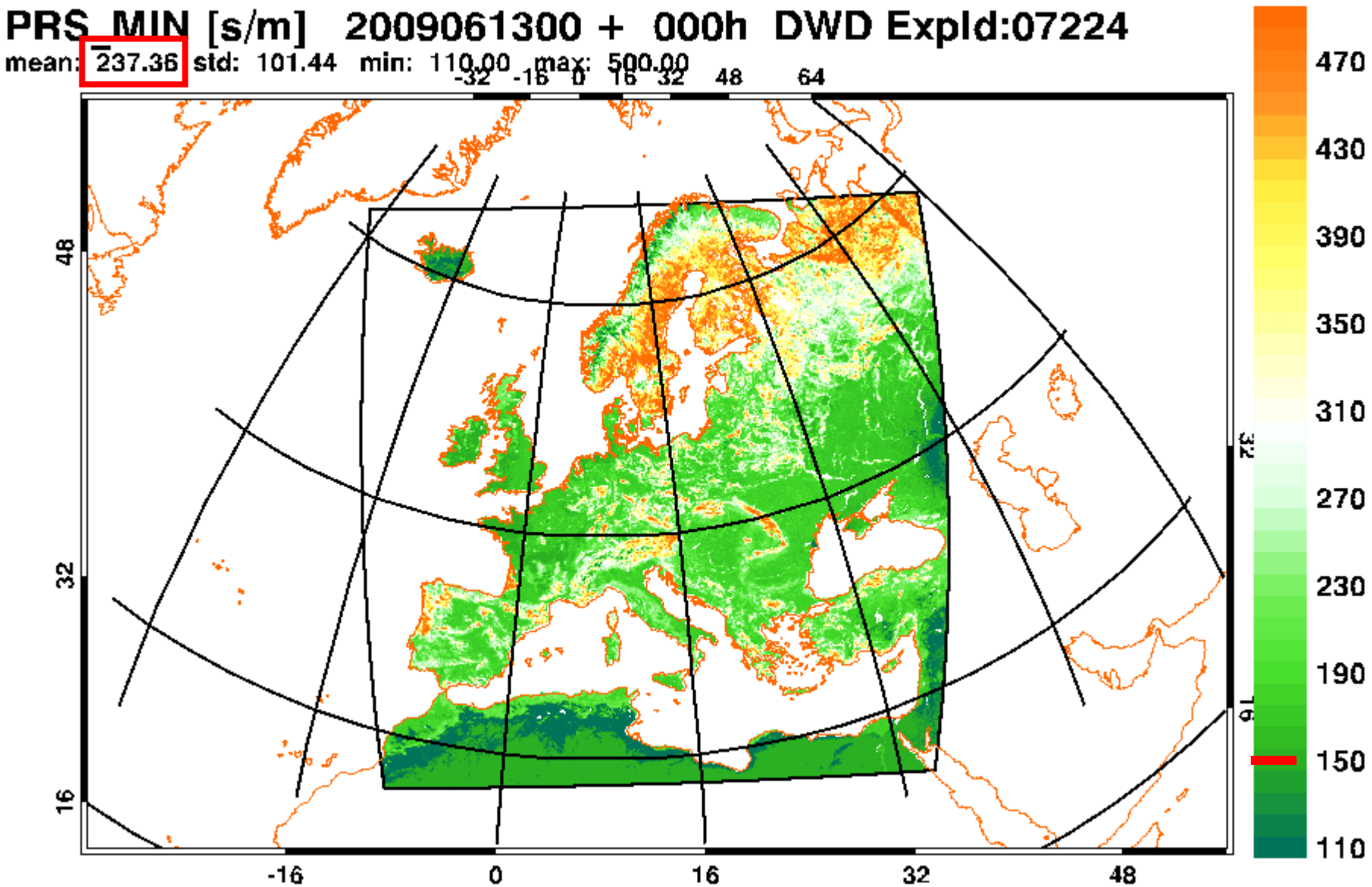

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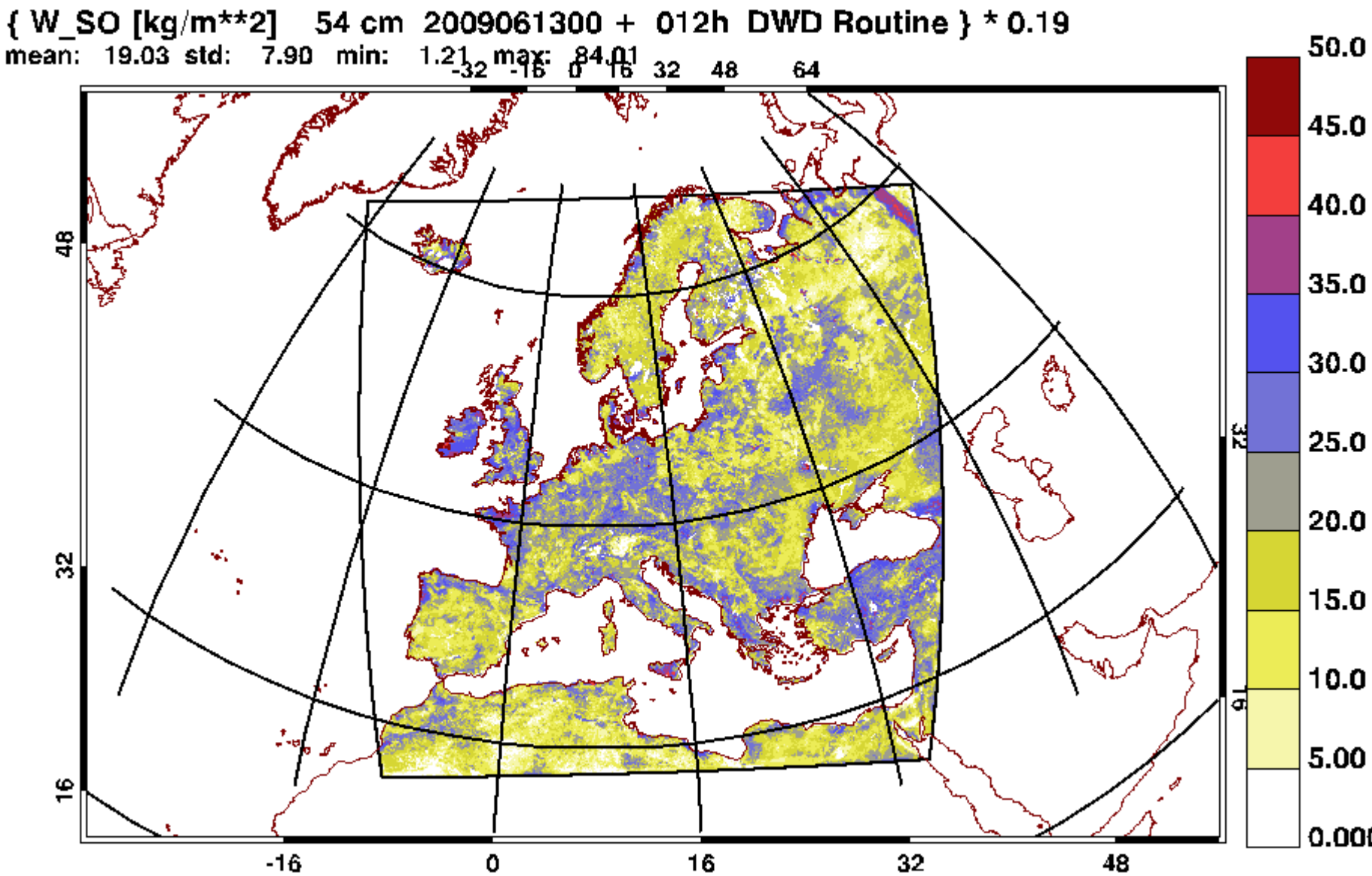

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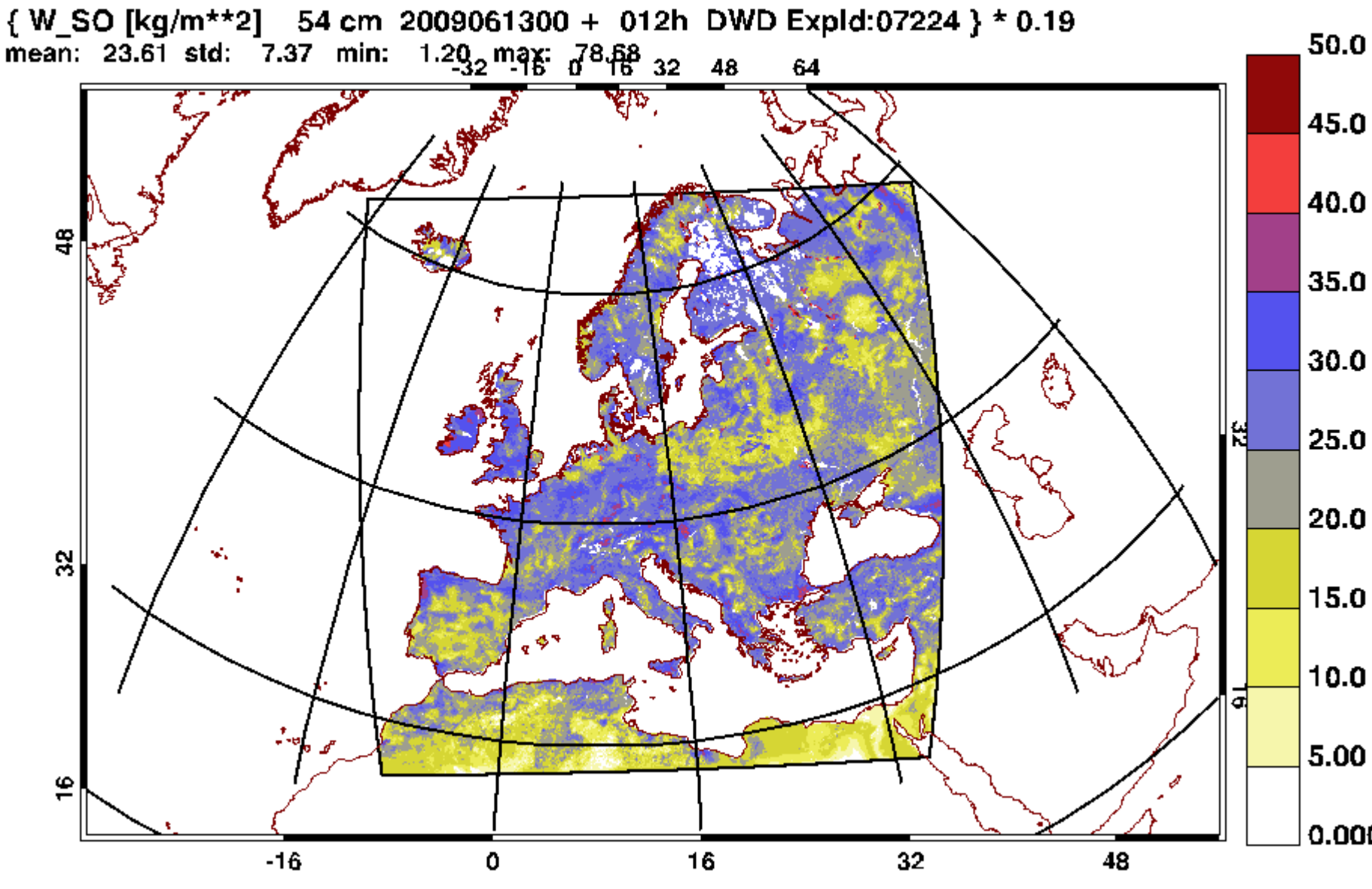
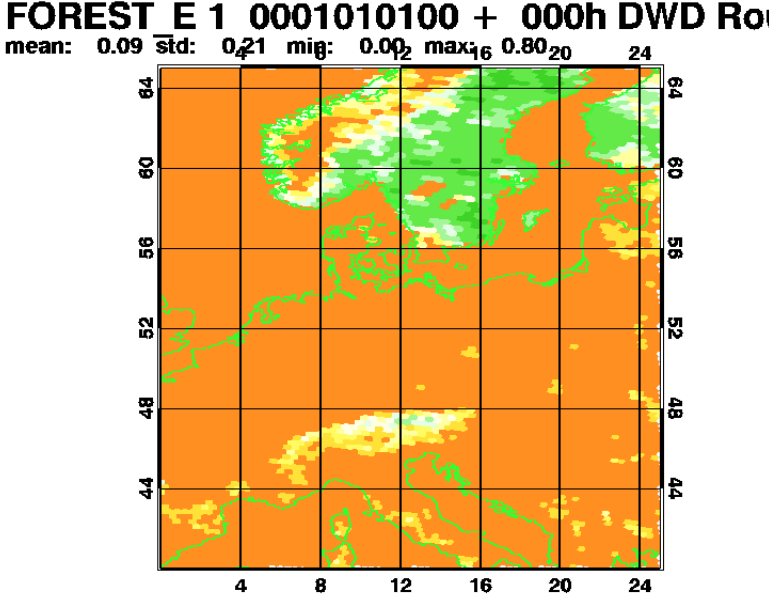
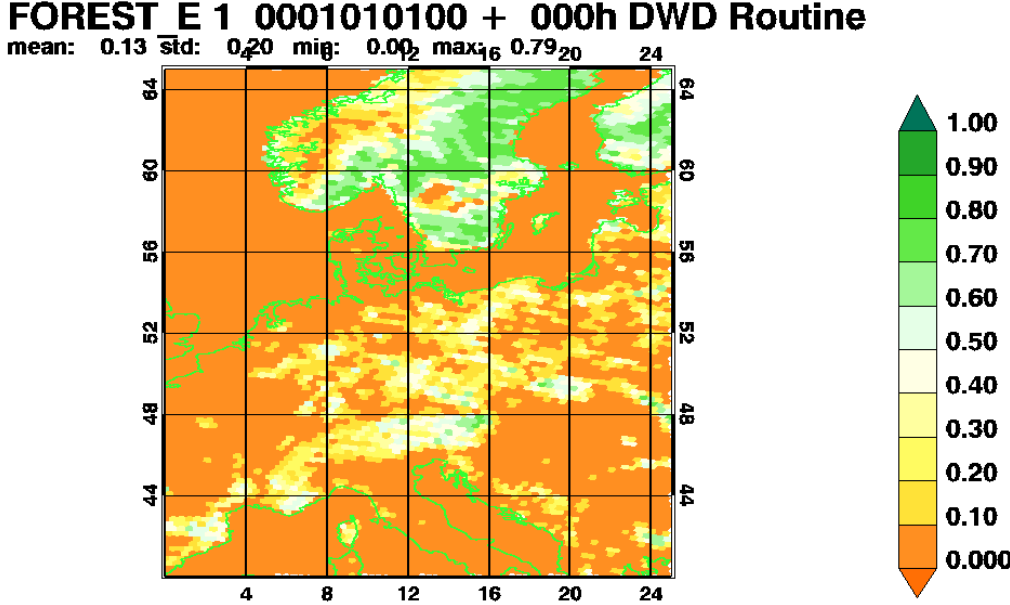




GME ni 256
Land Use Data: **GLCC**



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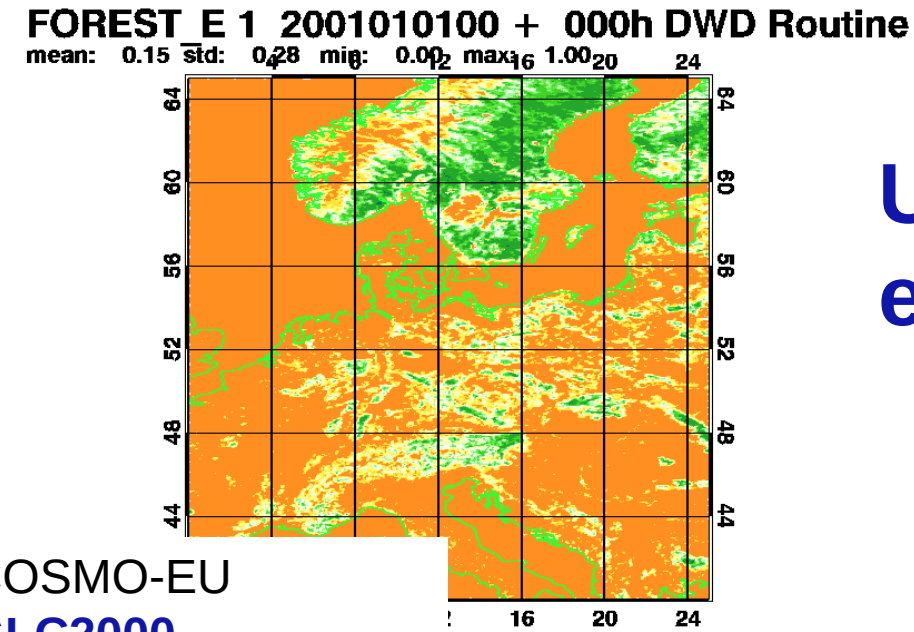
Land Use Data: **GLC2000**

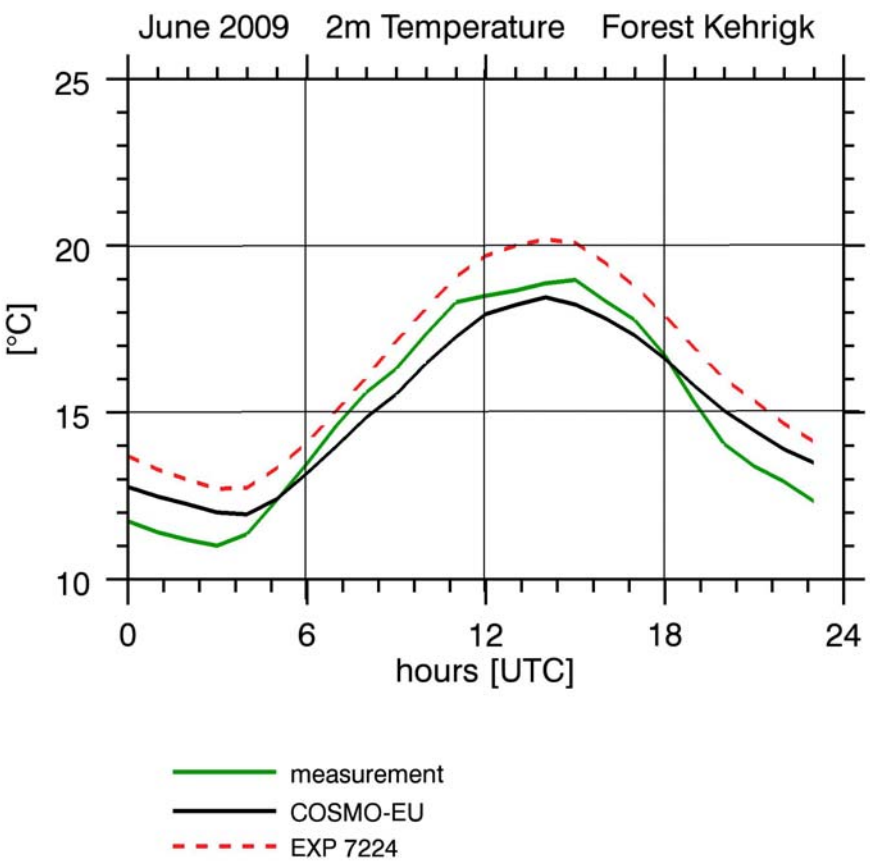


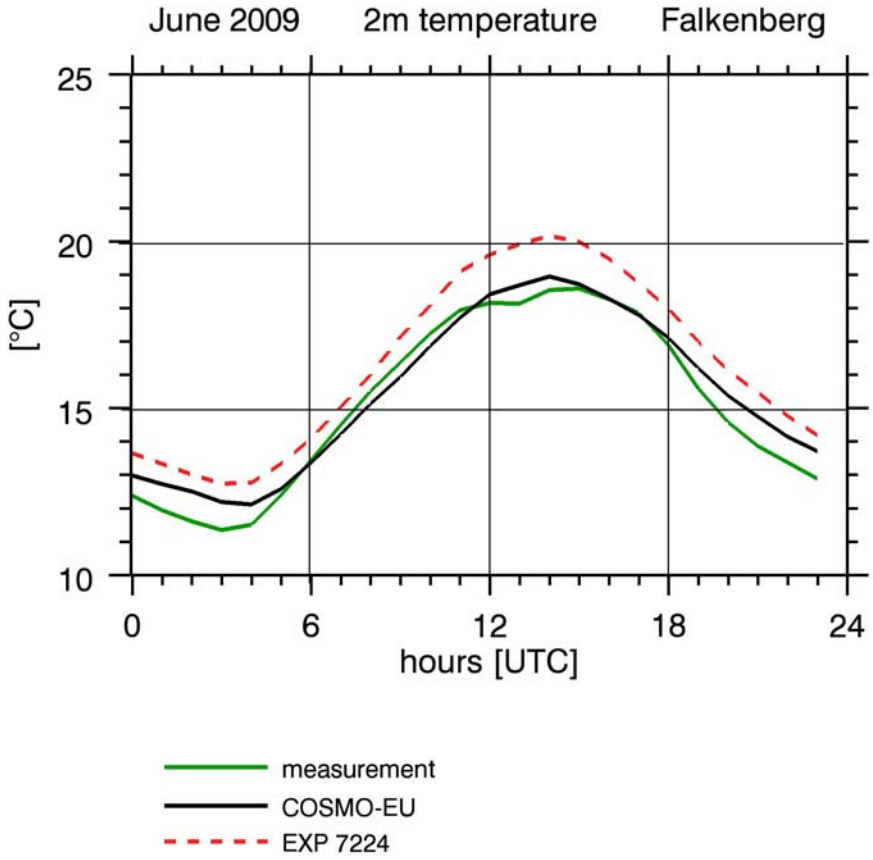
COSMO-EU
GLC2000

Uncertainties in external Parameters

Comparison of Exp 7224 with routine COSMO-EU in June 2009 for Falkenberg and Forest sites

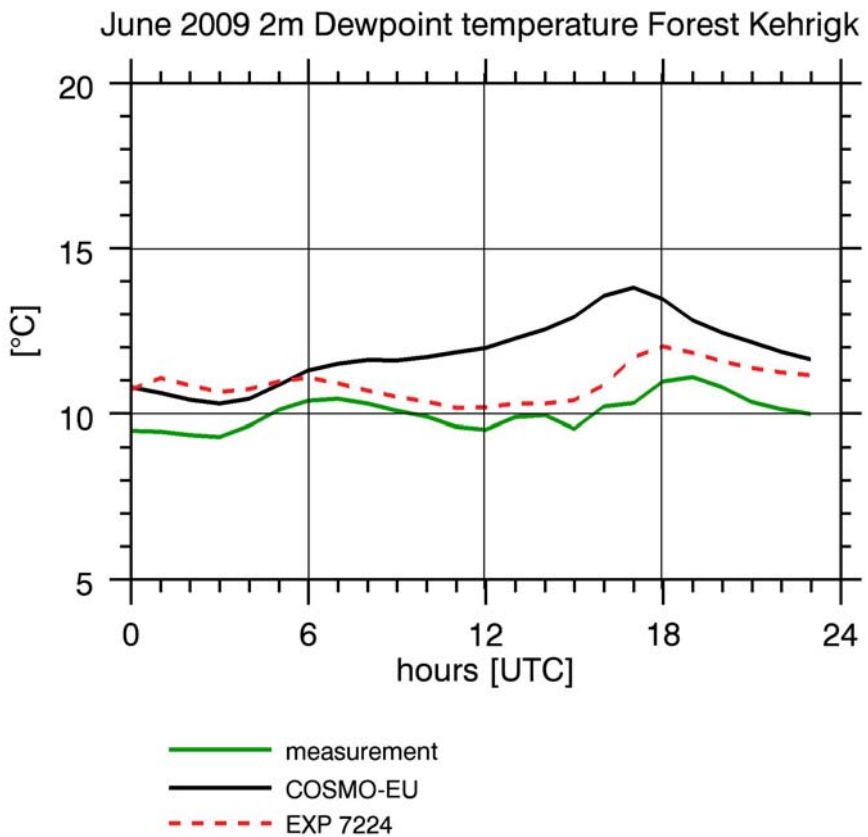
2m - Temperature

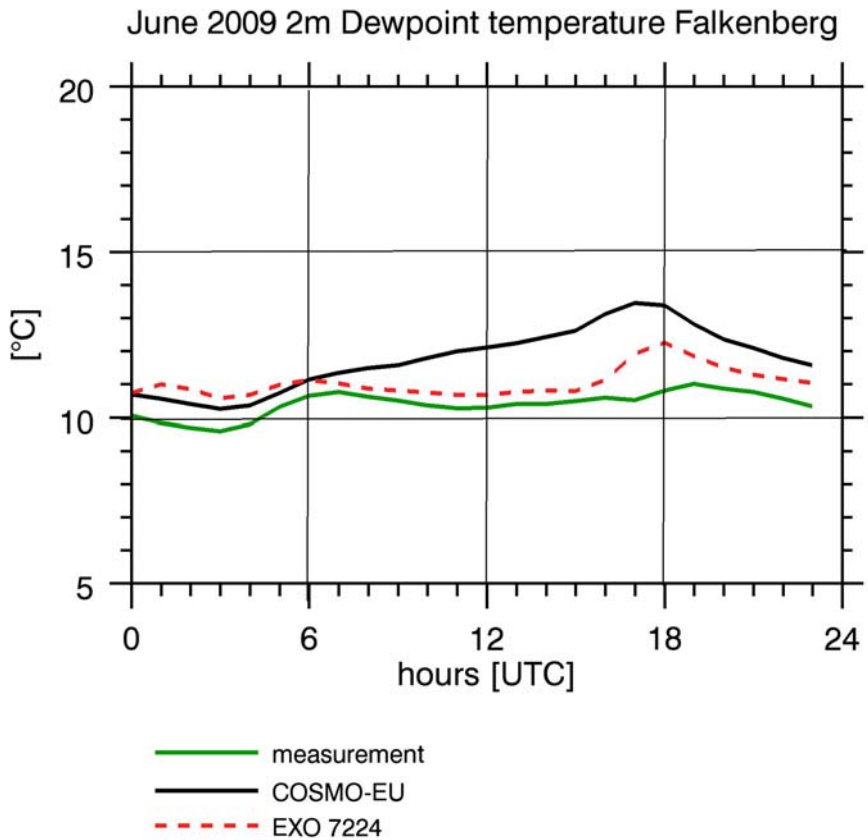




A5 = Experiment 7224

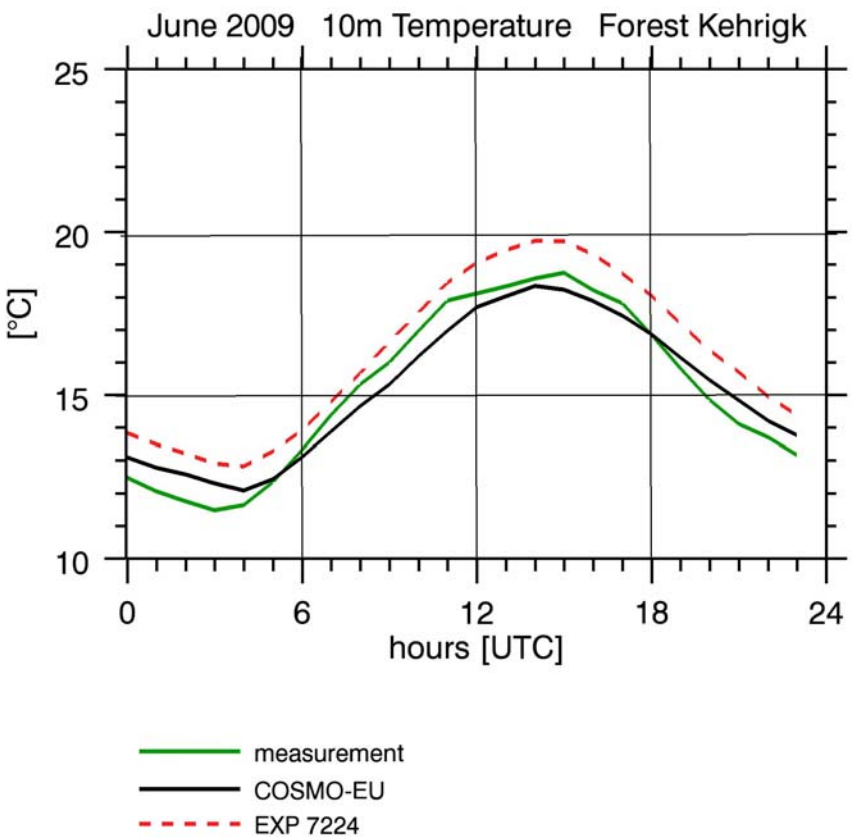
2m – Dewpoint Temperature

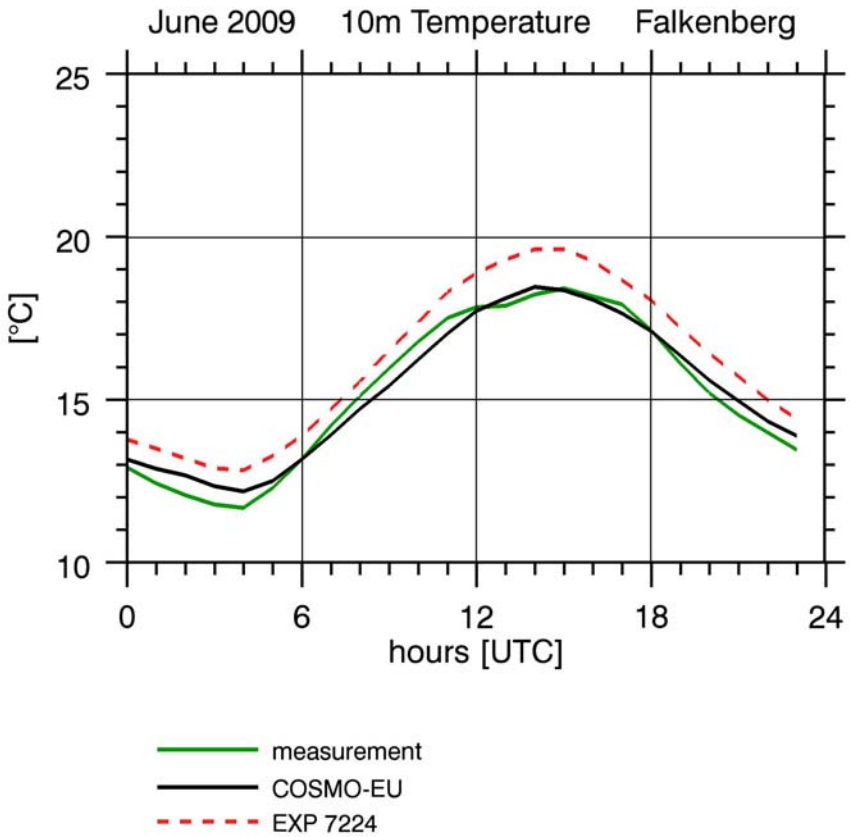




A5 = Experiment 7224

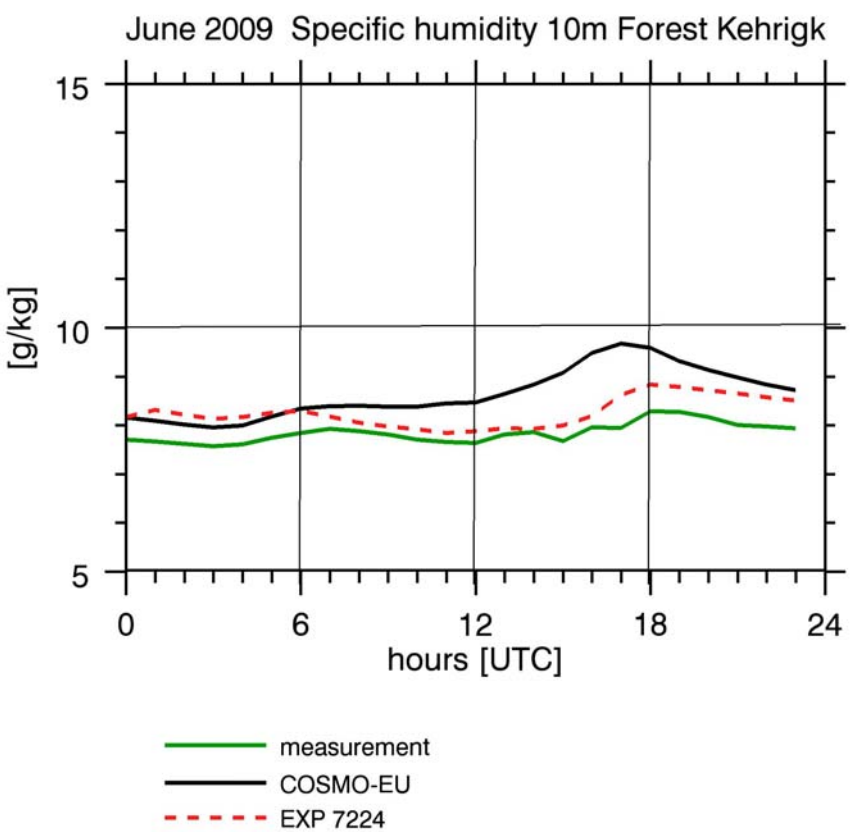
10m - Temperature

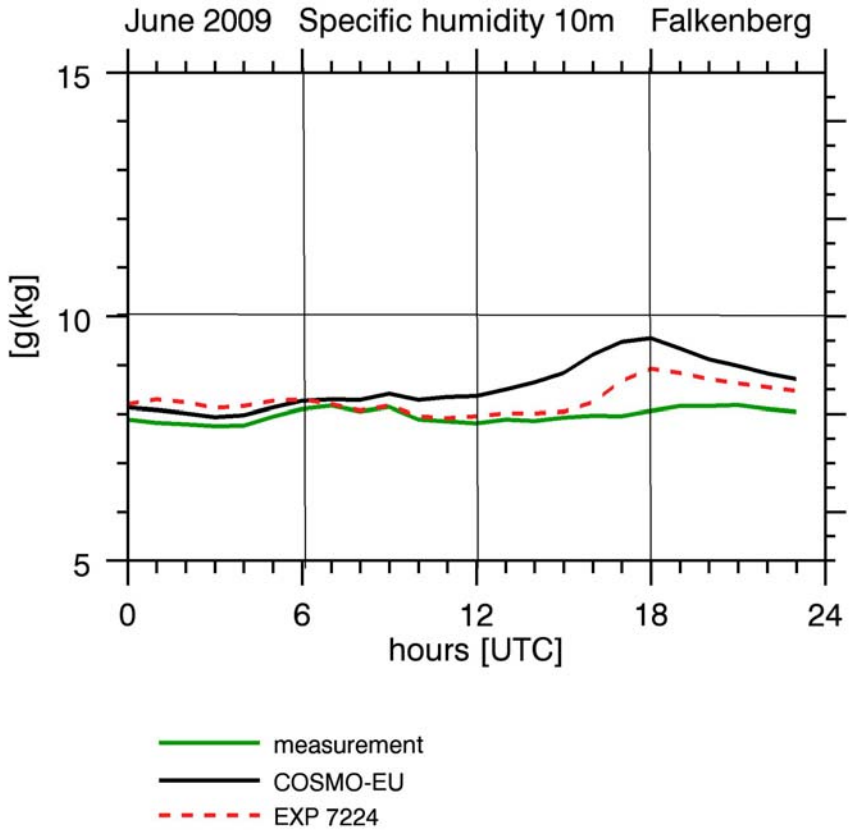




A5 = Experiment 7224

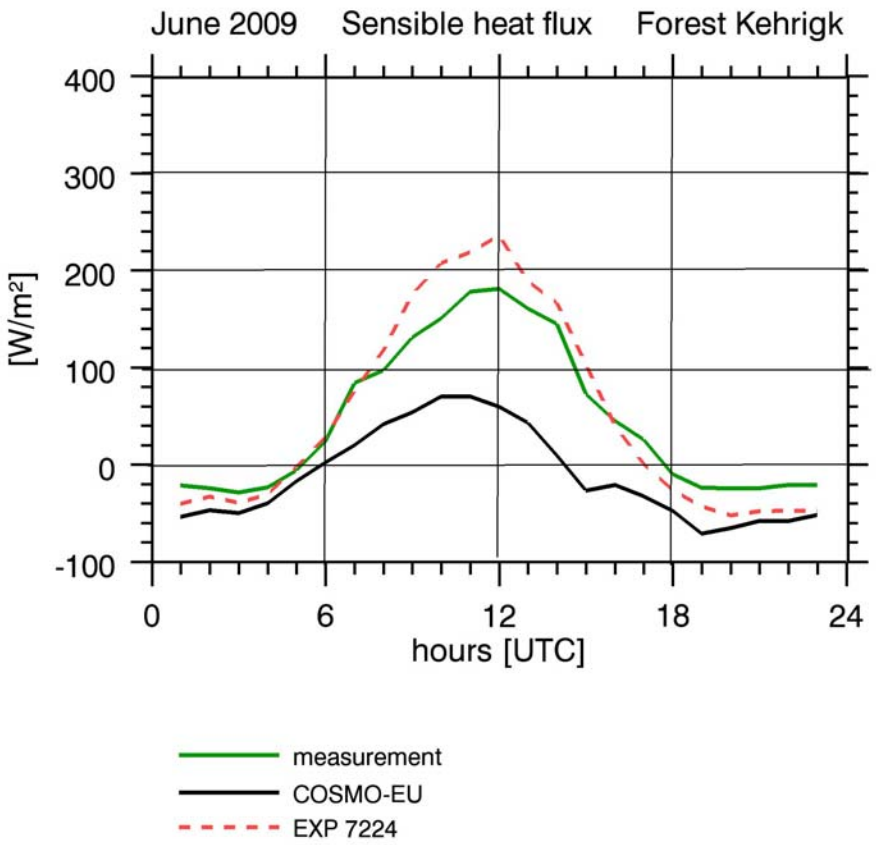
10m – Specific Humidity

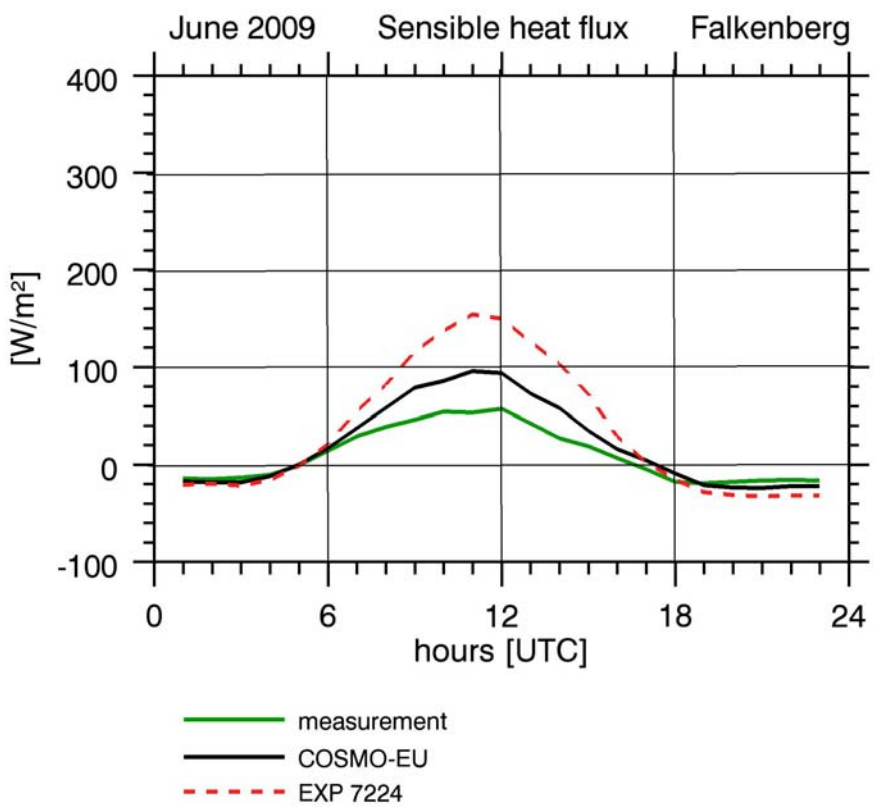




A5 = Experiment 7224

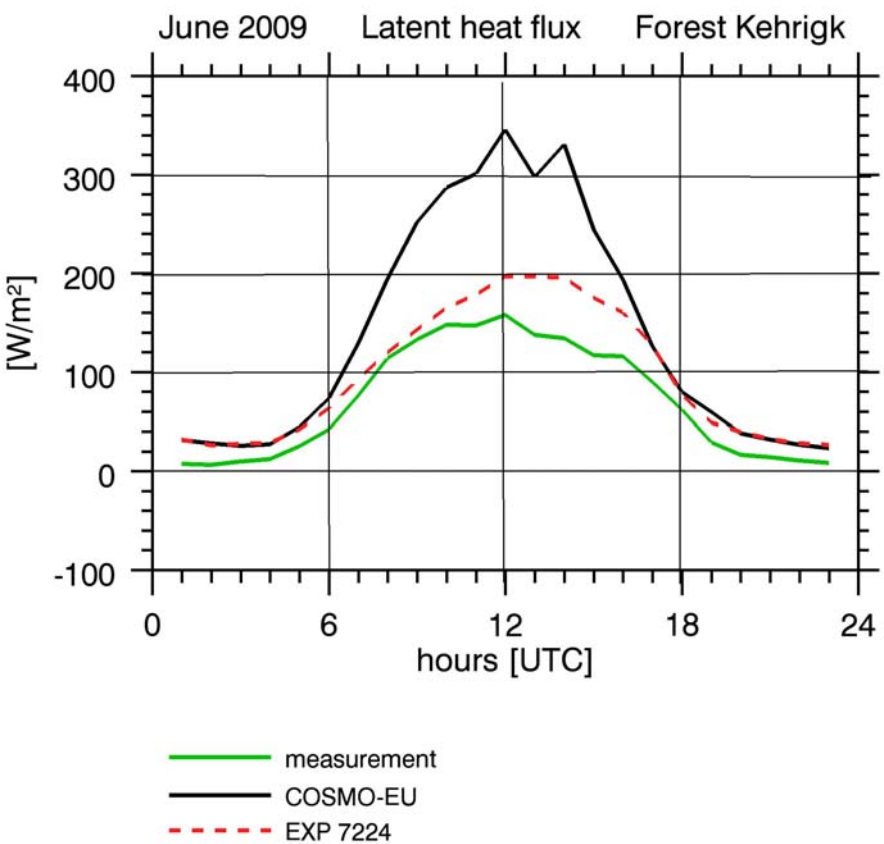
Sensible Heat Flux

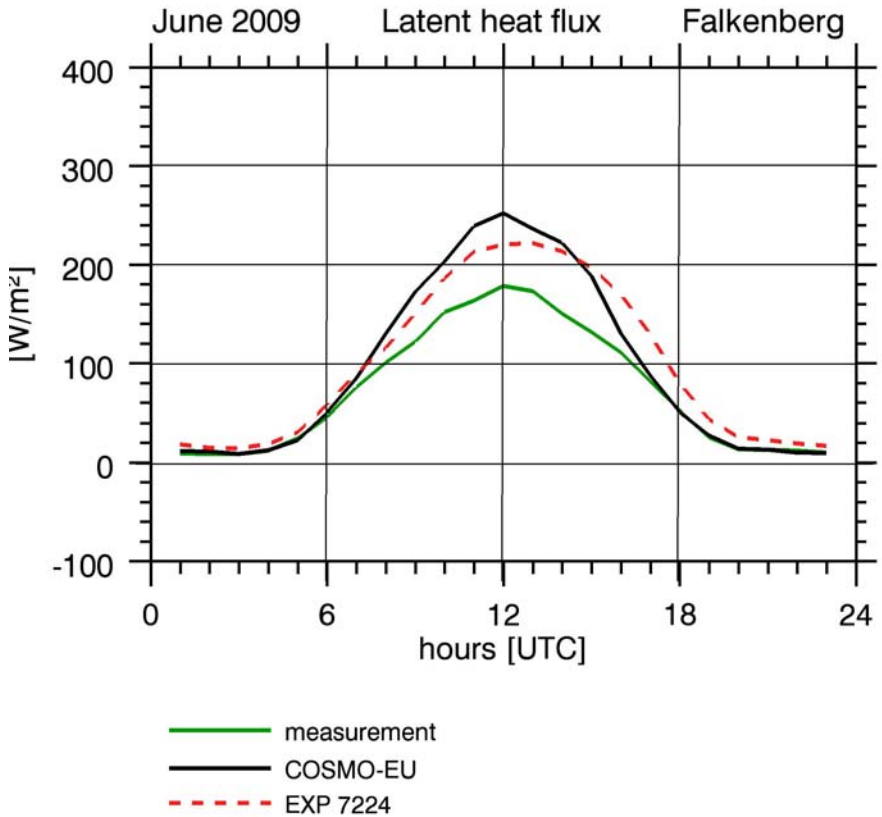




A5 = Experiment 7224

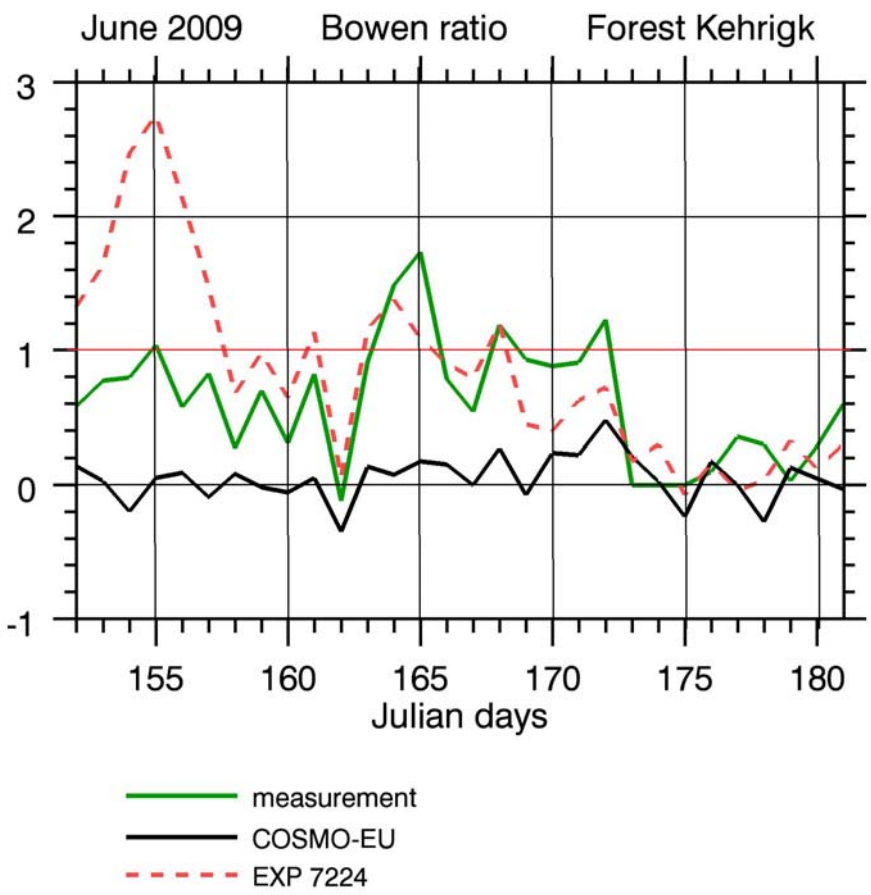
Latent Heat Flux

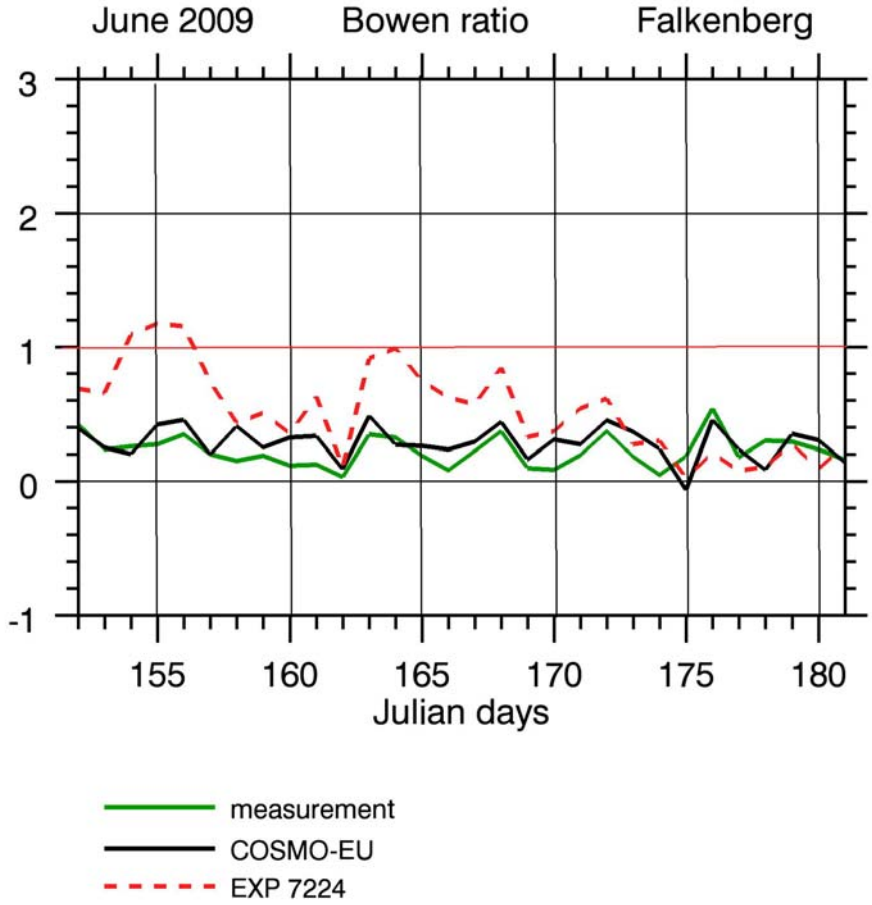




A5 = Experiment 7224

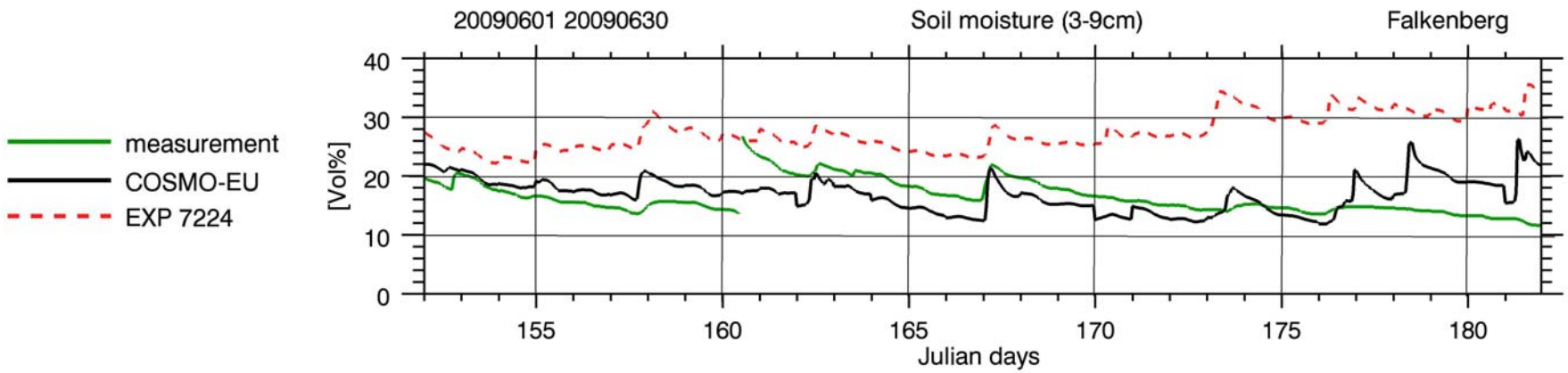
Bowen ratio

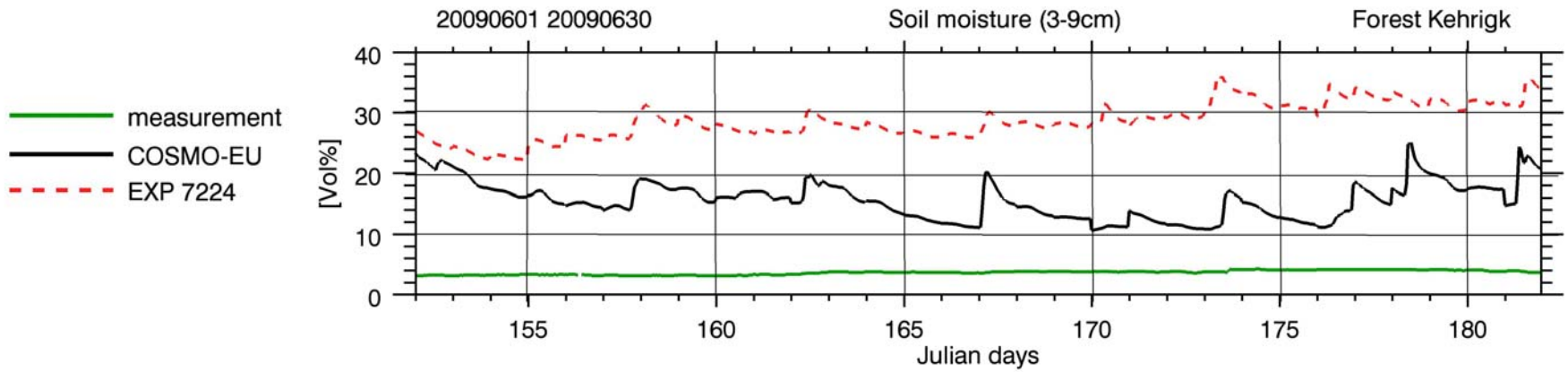




A5 = Experiment 7224

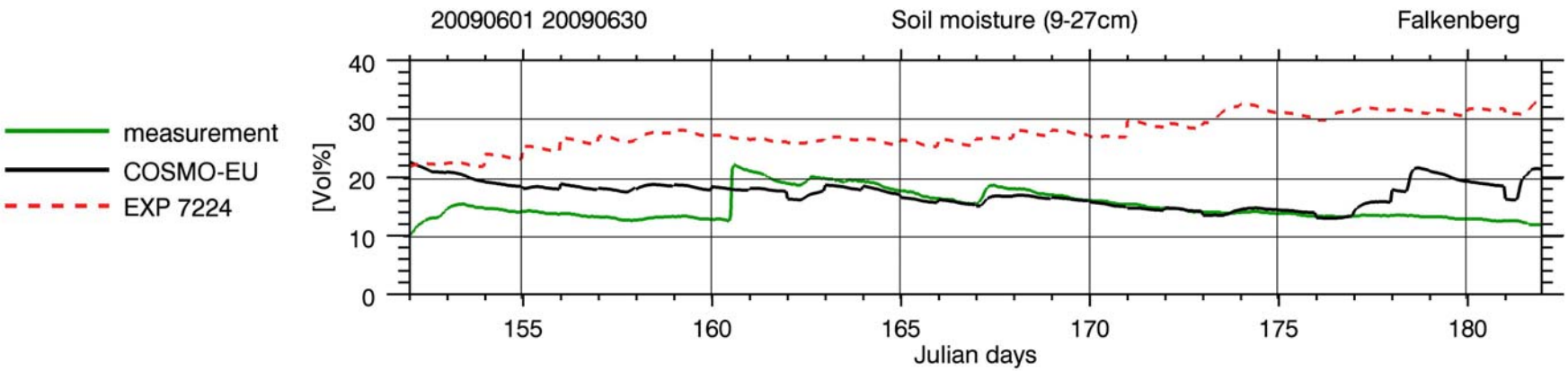
Soil Moisture 6cm

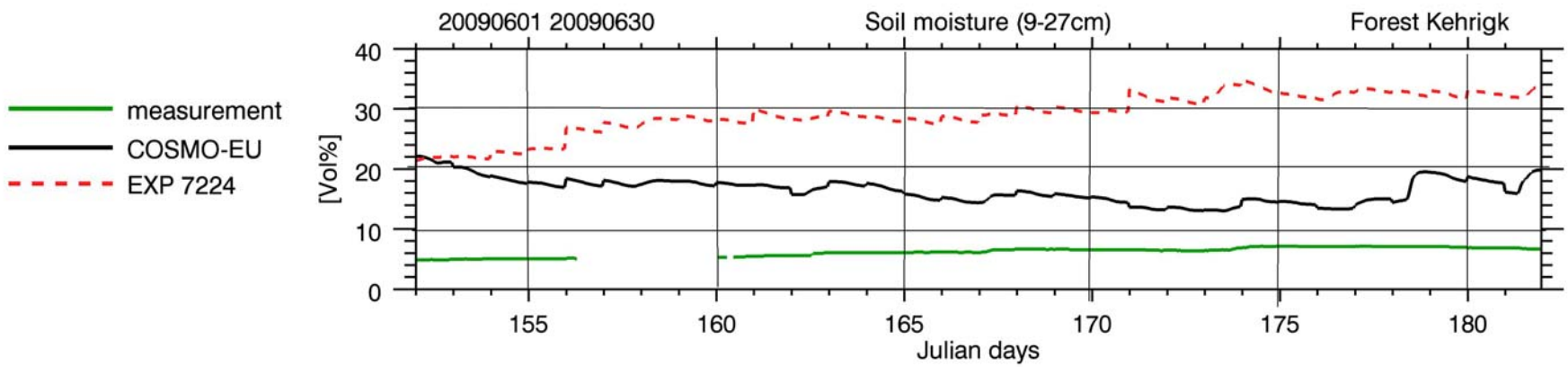




A5 = Experiment 7224

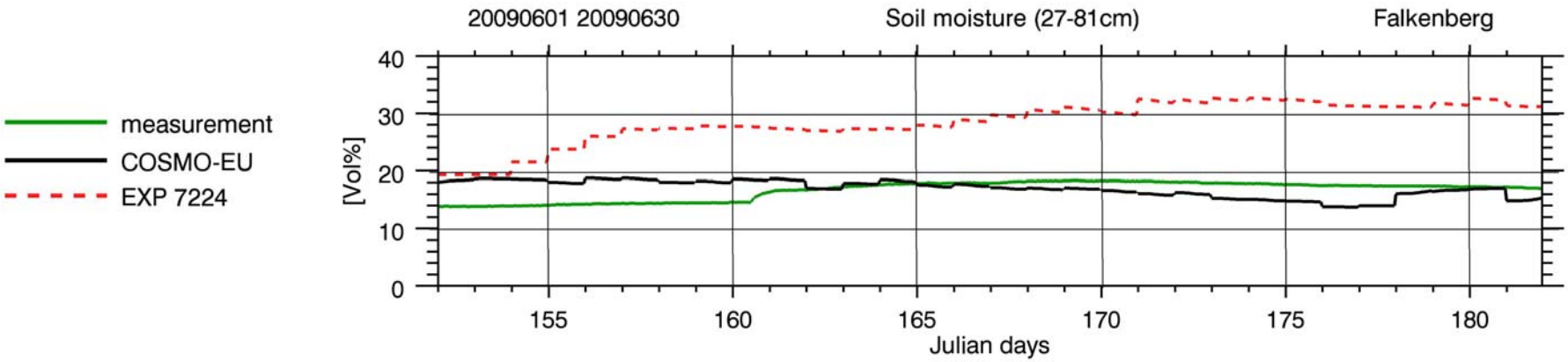
Soil Moisture 18cm

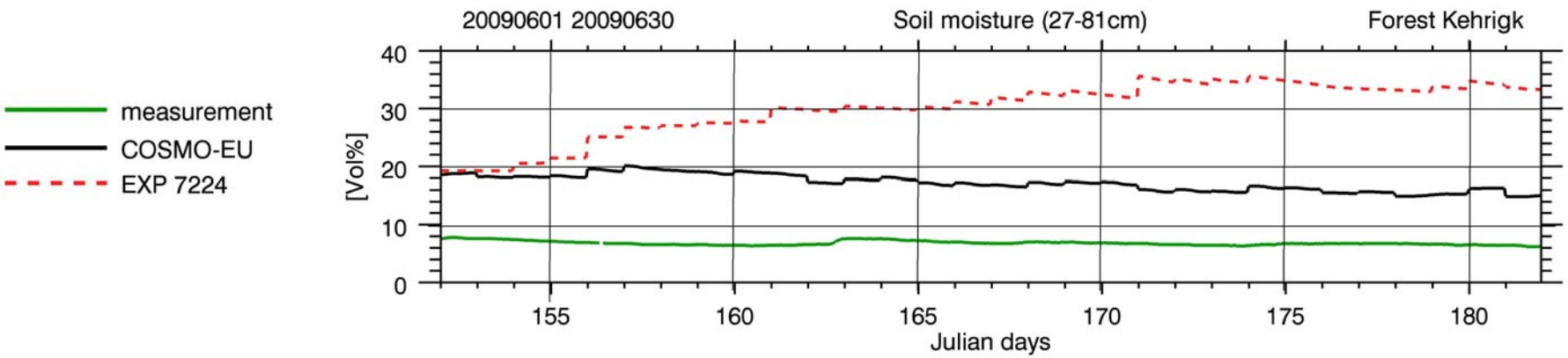




A5 = Experiment 7224

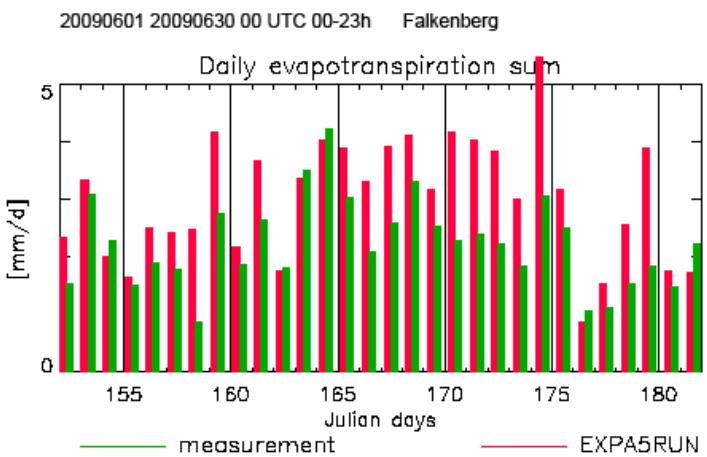
Soil Moisture 54cm

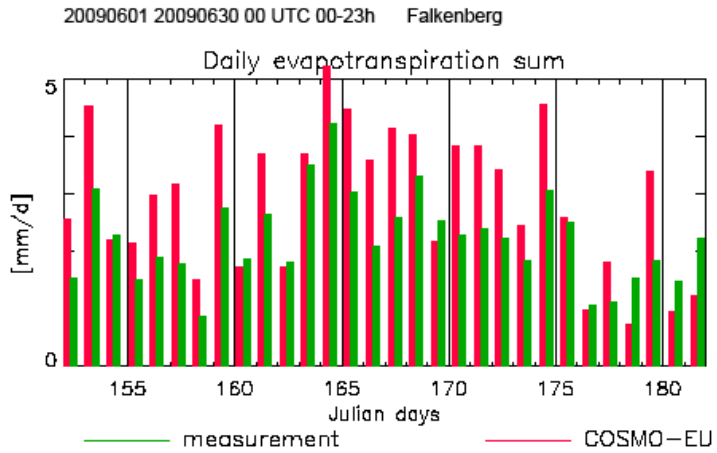


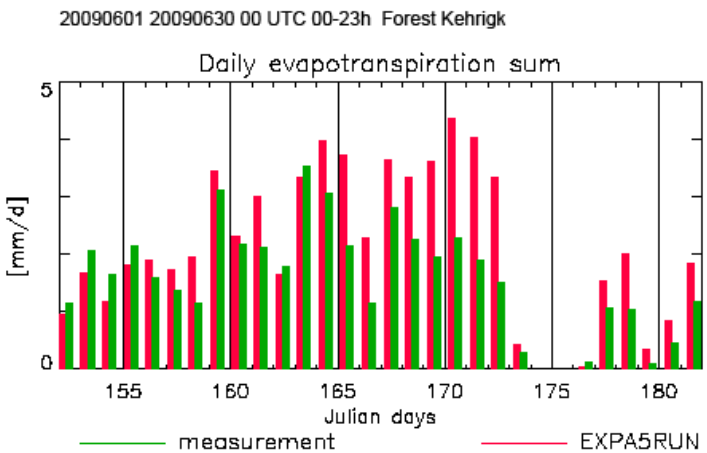


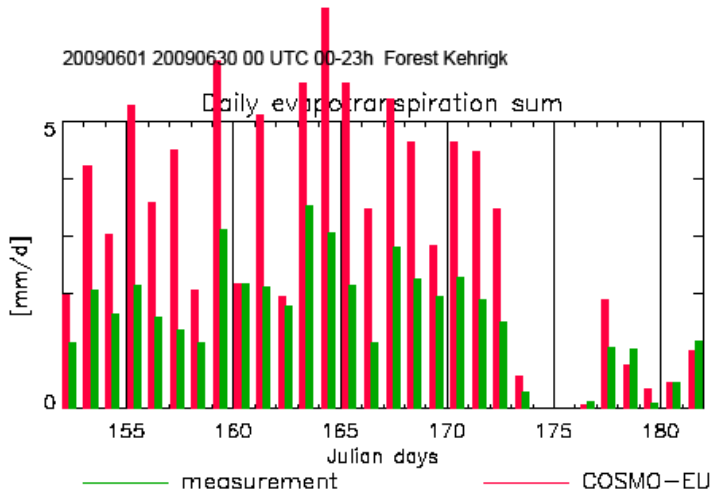
A5 = Experiment 7224

Evapotranspiration

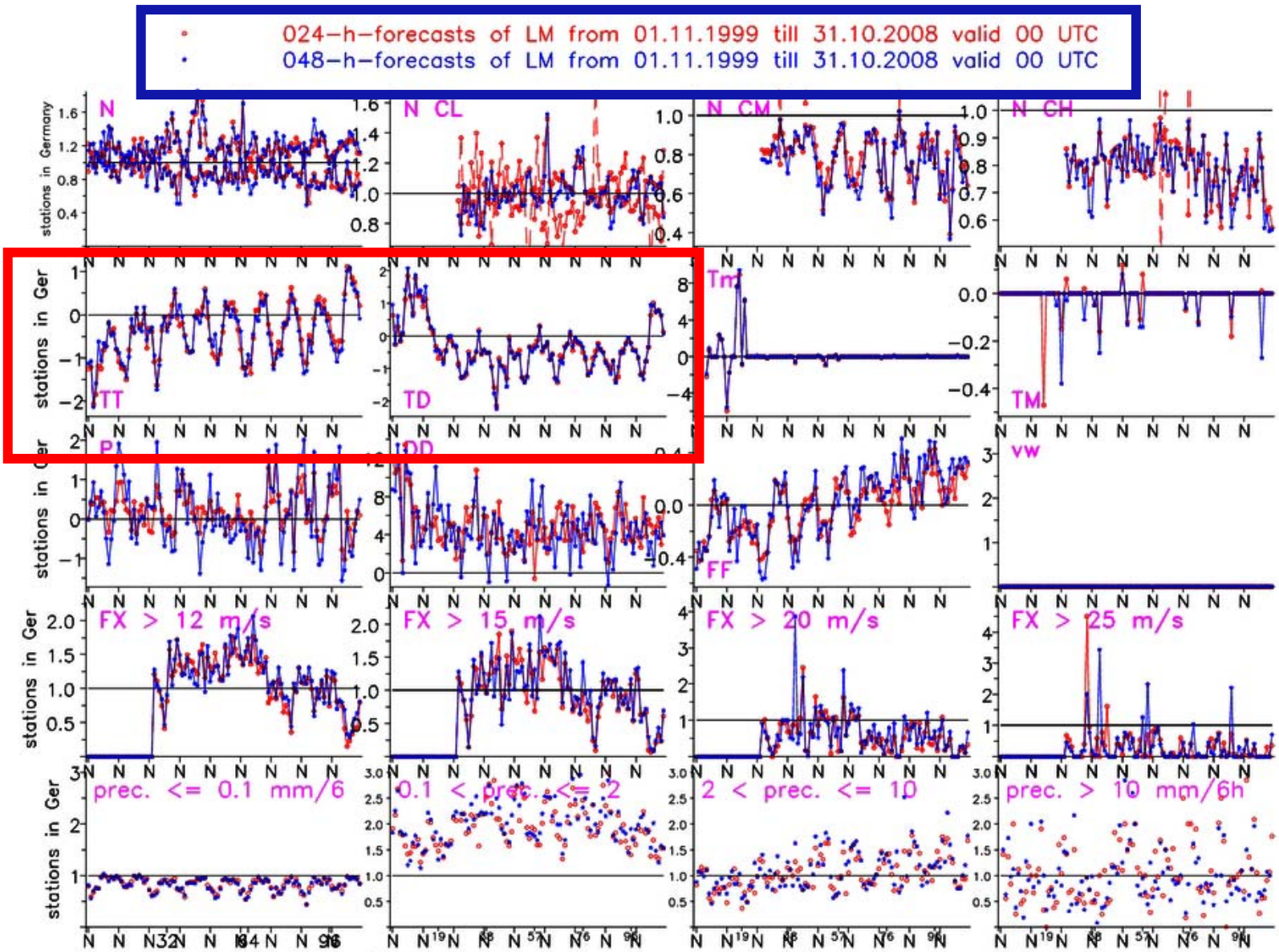








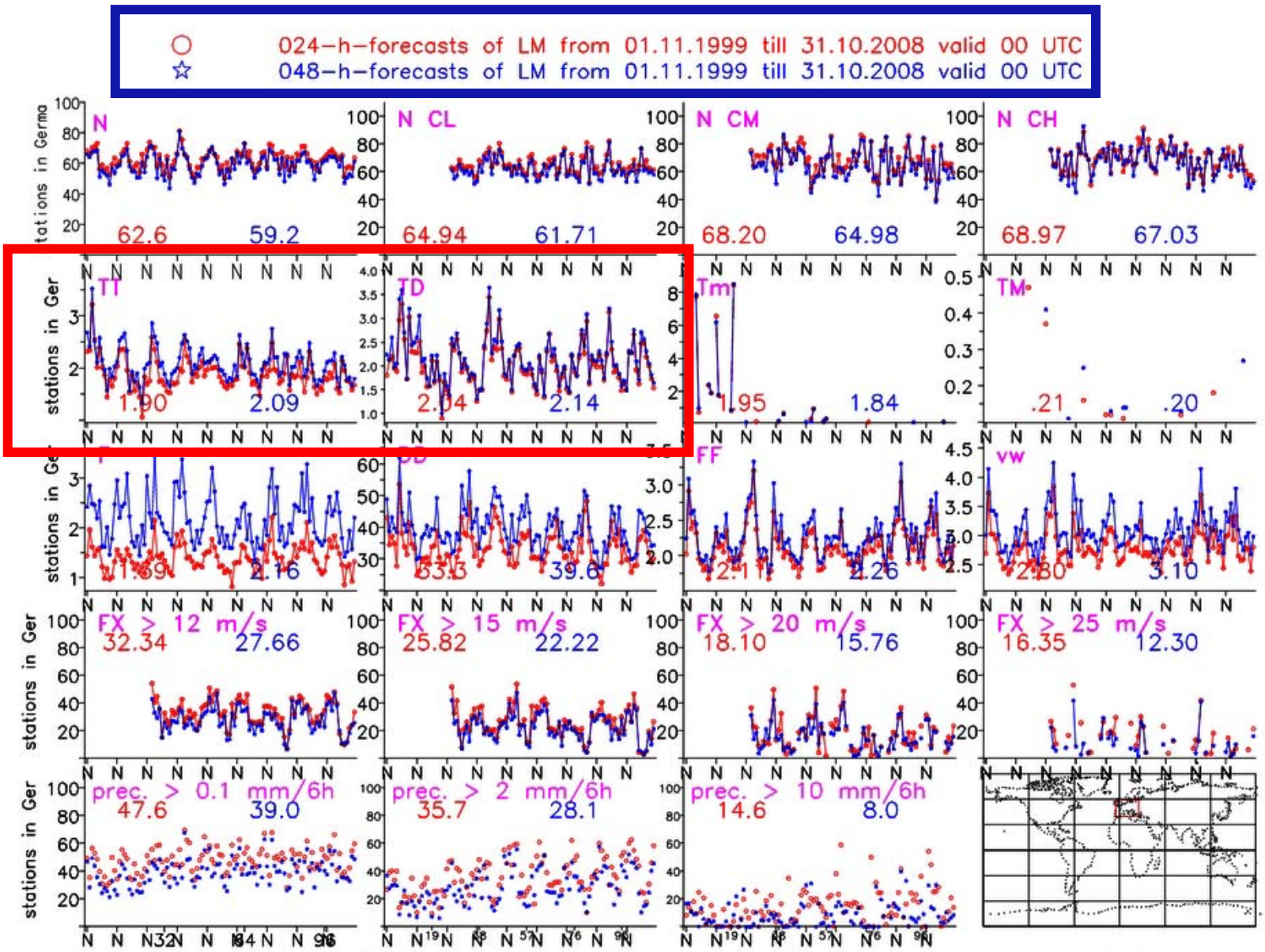
Long term verification - CEU Bias



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

frequency bias for cloud covers (-: 0-2/8, - -: 7-8/8), gusts

Long term verification - CEU RMSE



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

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

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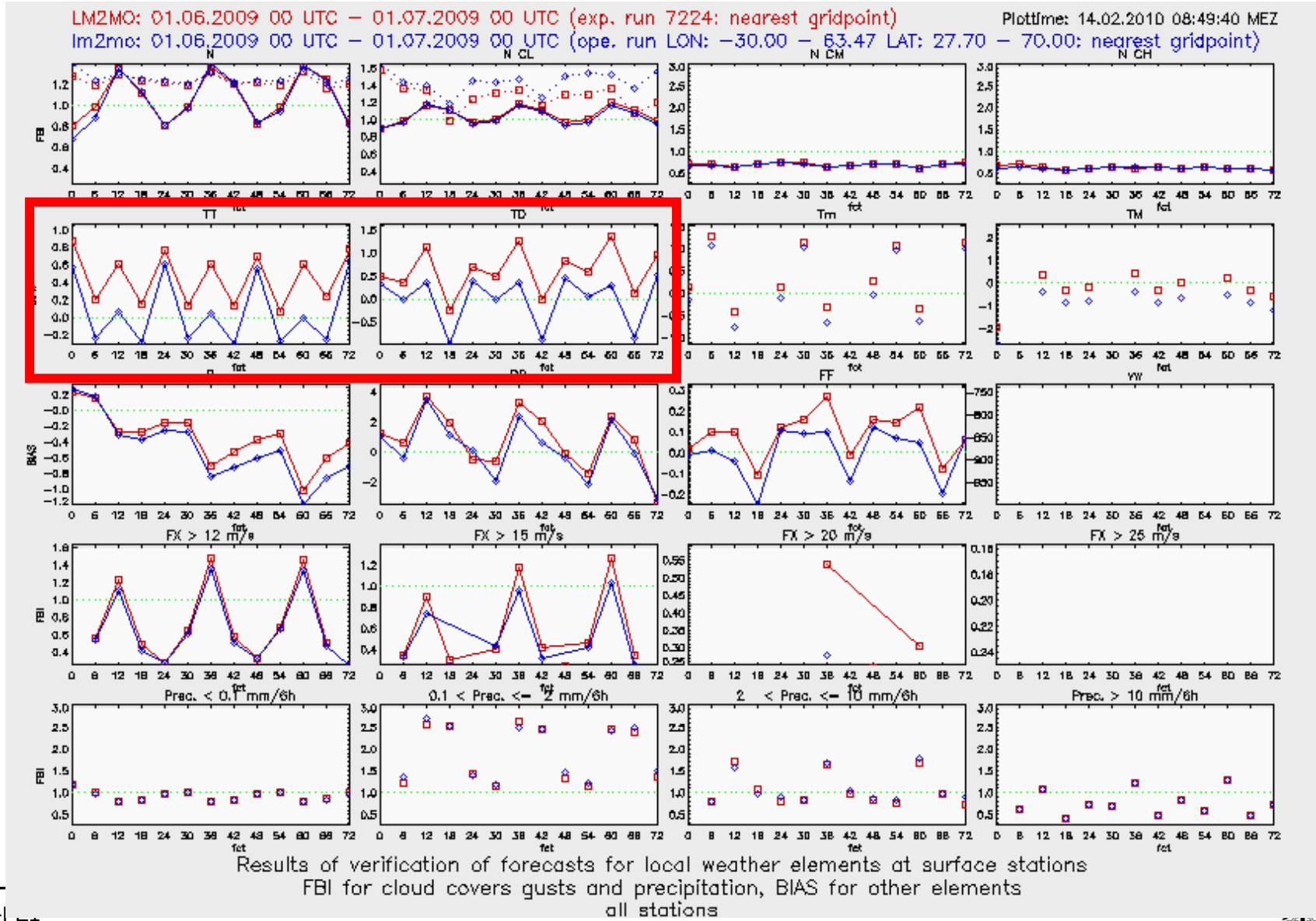
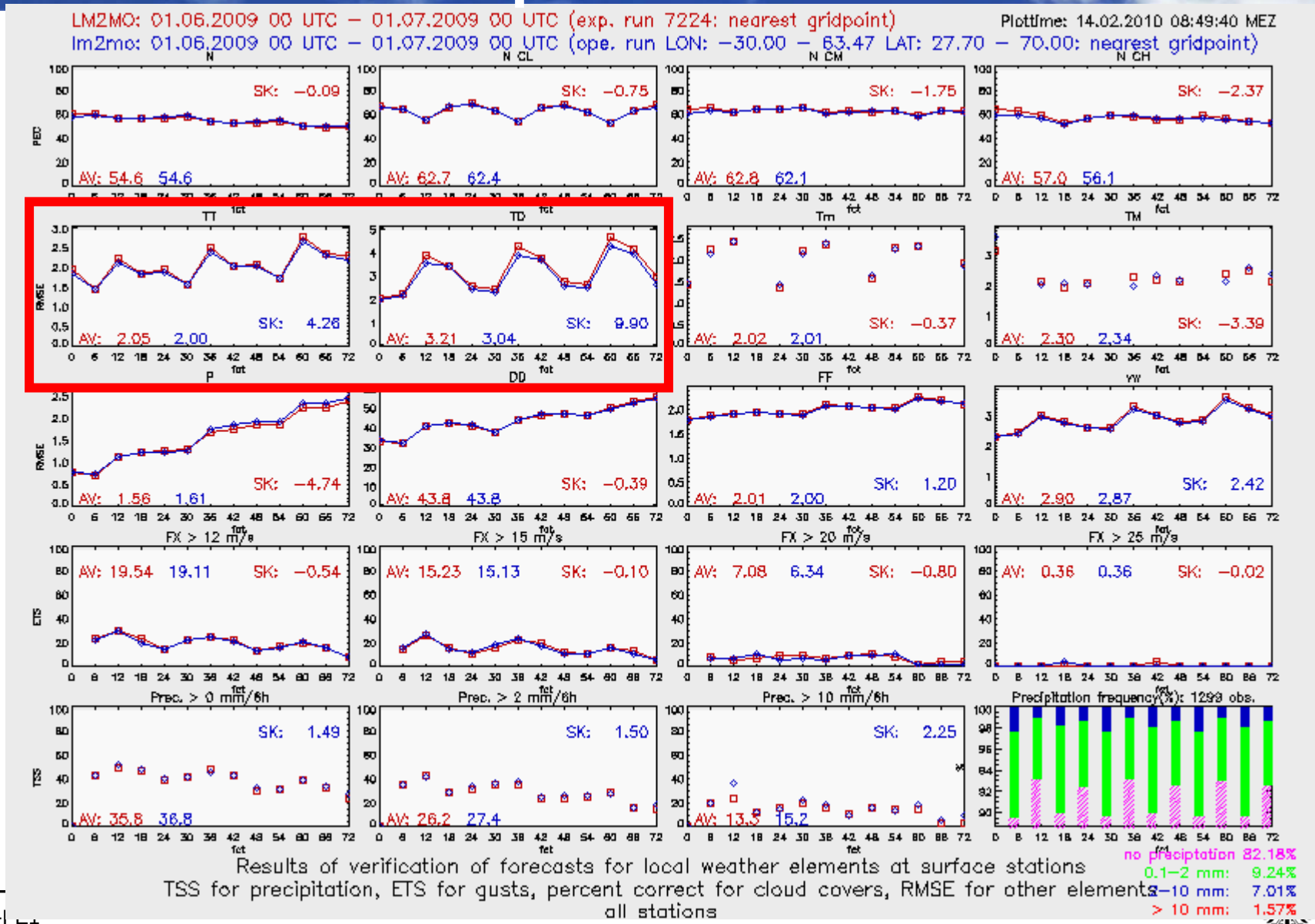
Verification Exp 7224 Bias



Results of verification of forecasts for local weather elements at surface stations
FBI for cloud covers gusts and precipitation, BIAS for other elements
all stations

Deutscher Wetterdienst
Verification Exp 7224 Bias



Summary and Conclusions

- Tested combination of external parameters and TERRA adaptions could lead to increase in PRS/LAI ratio

- Impact: less evapotranspiration, dry and warm PBL

- SMA tries to compensate T2M-Bias, wet soil