Max-Planck-Institut für Meteorologie

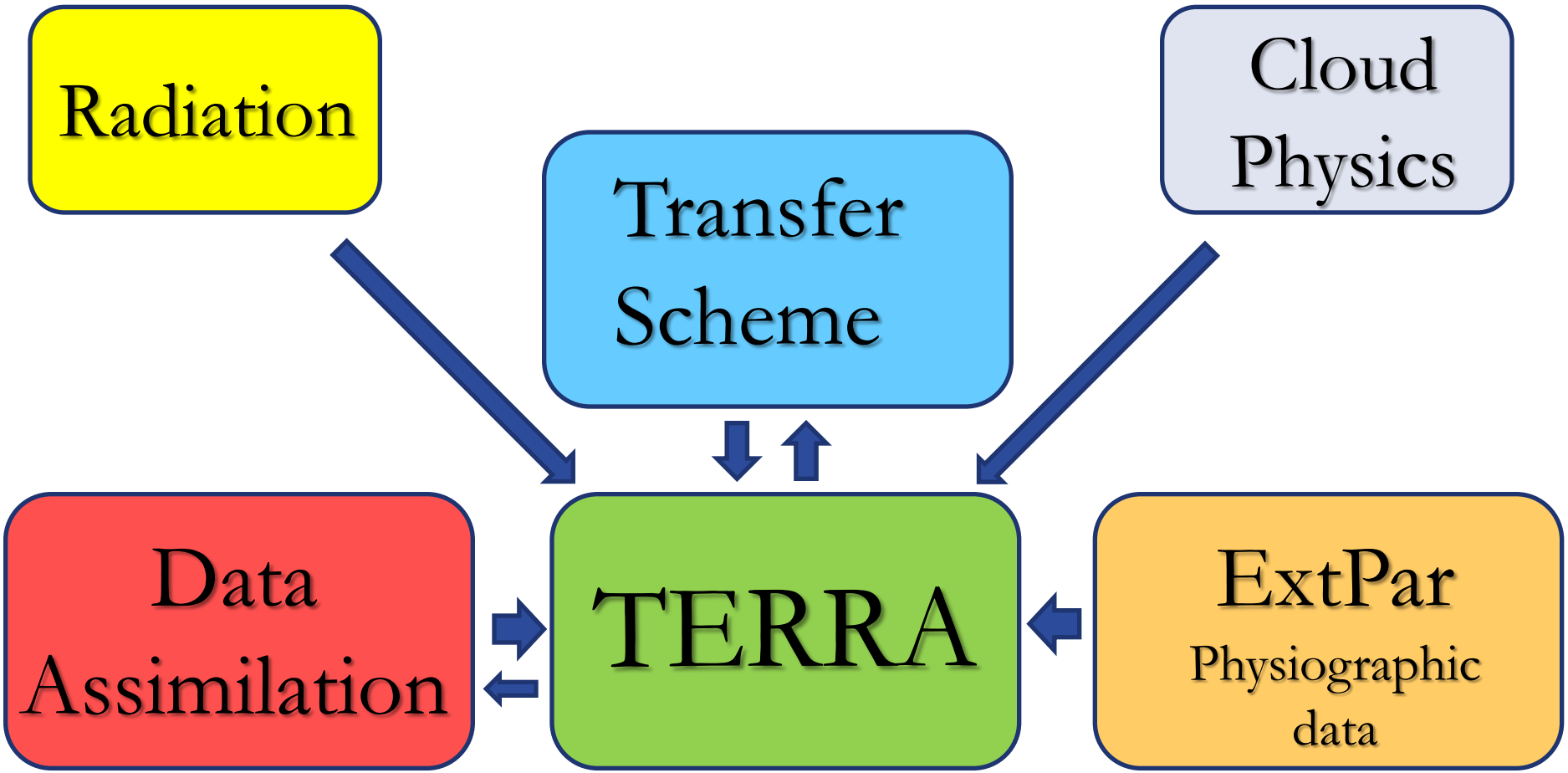
CONSORTIUM FOR SMALL SCALE MODELING
COSMO
Deutscher Wetterdienst
Wetter und Klima aus einer Hand
DWD

TERRA

Soil Vegetation Atmosphere Transfer across Models and Scales

COSMO/CLM/ART - User Seminar, WG3b, March 2015

TERRA – Dependencies

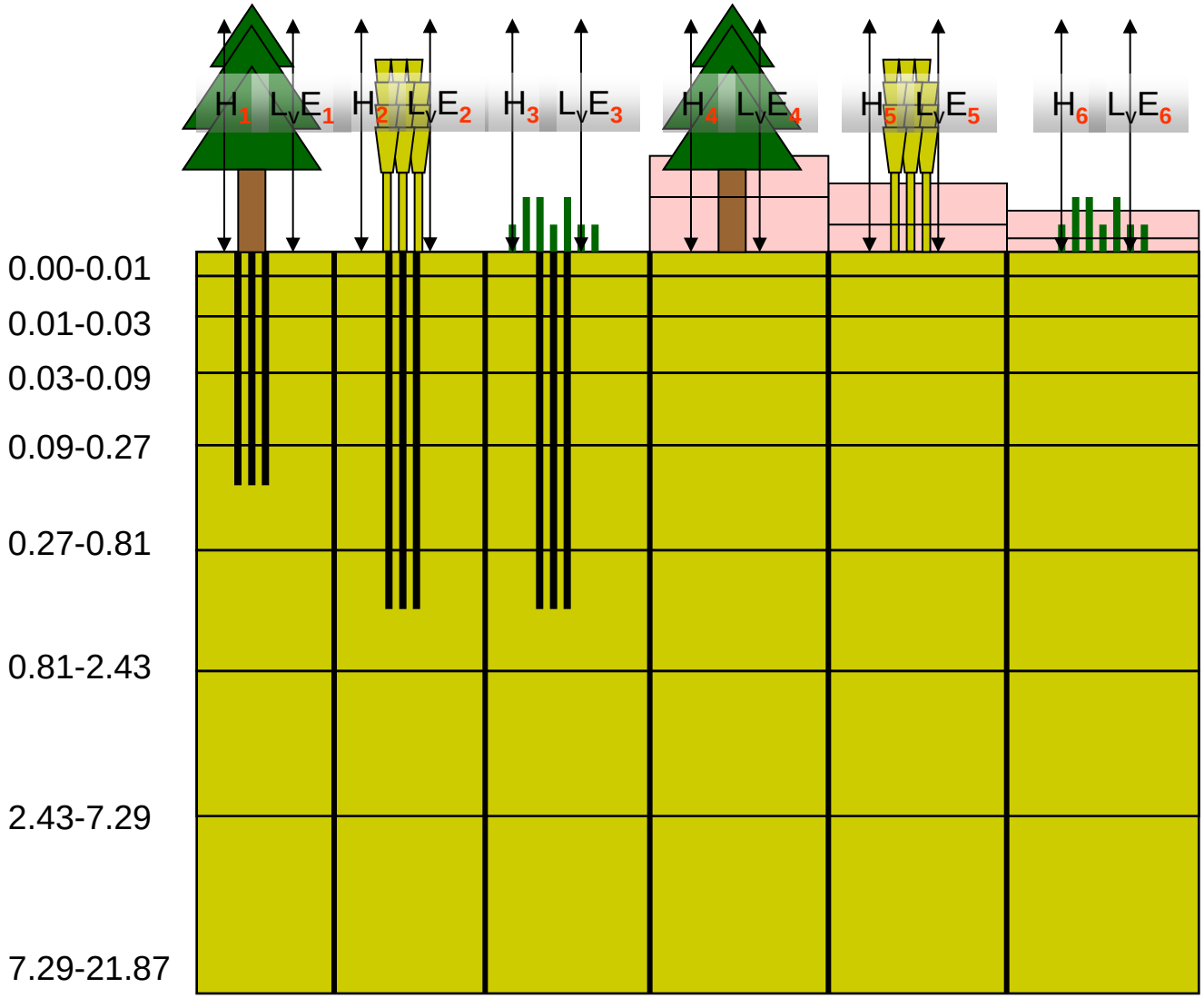


TERRA – Status

Demand for ICON soil model developments results from COSMO/GME drawbacks of the scheme

- TILE approach 

TERRA Tiles


H1 LvE1
H2 LvE2
H3 LvE3
H4 LvE4
H5 LvE5
H6 LvE6
0.00-0.01
0.01-0.03
0.03-0.09
0.09-0.27
0.27-0.81
0.81-2.43
2.43-7.29
7.29-21.87

TERRA – Status

Demand for ICON soil model developments results from COSMO/GME drawbacks of the scheme

- TILE approach 

TERRA – Status

Demand for ICON soil model develpments results from COSMO/GME drawbacks of the scheme

- TILE approach
- Multi-Layer Snow model
- Improved soil heat conduction
- Improved snow cover diagnostics
- Advanced look-up table for land-use parameters
- Exponential root density profile

TERRA – Status


```
lnd_nml   ntiles = 1
lmulti_snow      = .false.
itype_heatcond   = 2
idiag_snowfrac = 2
lsnowtile        = .false.
lseaice          = .true.
llake            = .true.
itype_lndtbl     = 3
itype_root       = 2
```

- TILE approach implemented
- Multi-Layer Snow model improved
- Improved soil heat conduction
- Improved snow cover diagnostics
- Advanced look-up table for land-use parameters
- Exponential root density profile

TERRA – Outlook

Stronger coupling between TERRA , data assimilation and surface transfer scheme

- TILE approach in data assimilation 
- Snow analysis (Multi-Layer-Snow) + TILEs 
- COST-ES1404 Snow 

TERRA – Outlook

Working Group 3

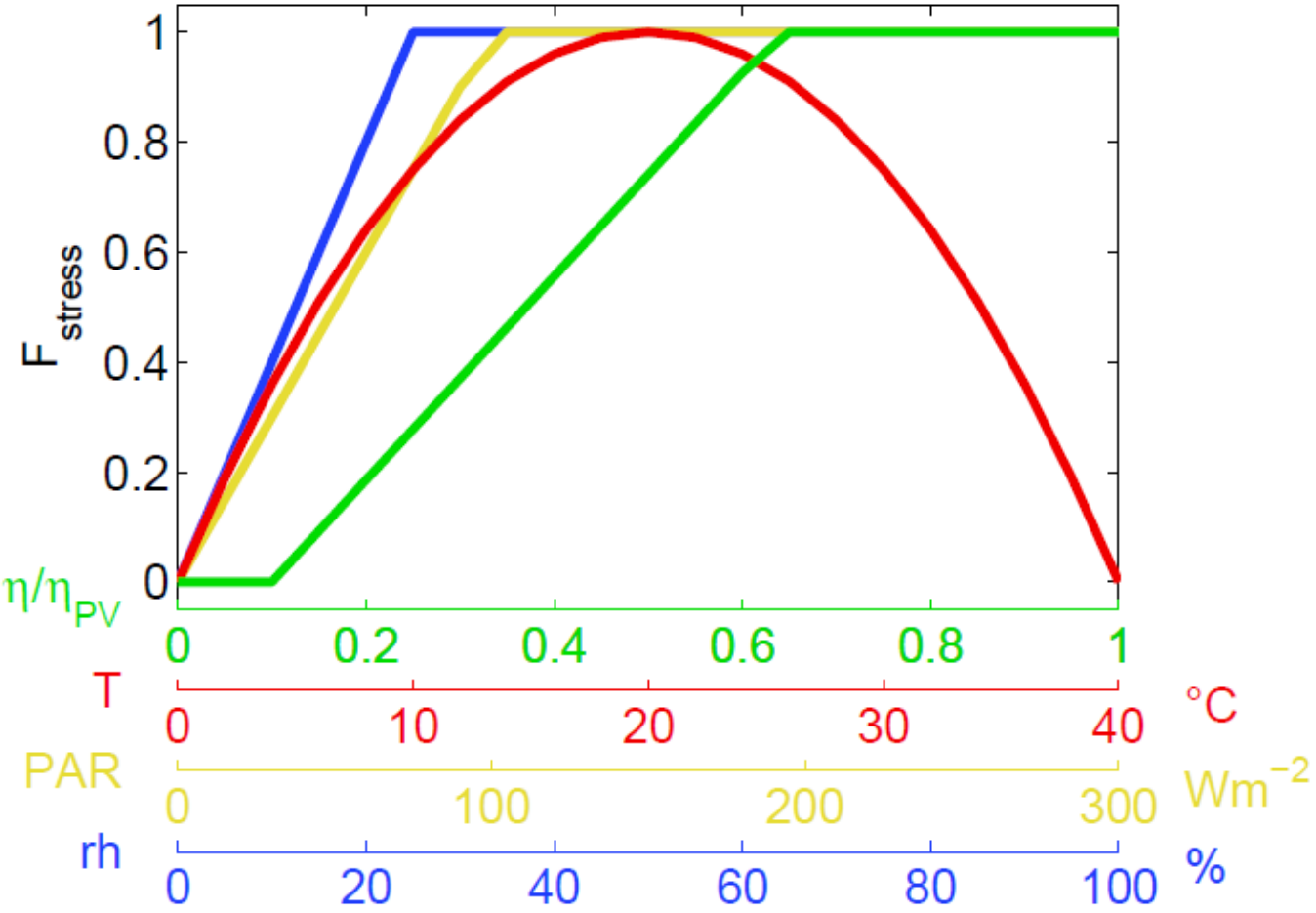
- Review of DA methods for snow
- combining remote sensing with in-situ measurements
- including national measurement networks

TERRA – Outlook

Stronger coupling between TERRA , data assimilation and surface transfer scheme

- TILE approach in data assimilation 
- Snow analysis (Multi-Layer-Snow) + TILEs 
- COST-ES1404 Snow 
- Resolved roughness layer for canopy 
- Consideration of ambient humidity in plant stomatal resistance 

TERRA – Outlook



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

(Ament, 2006)

TERRA – Outlook

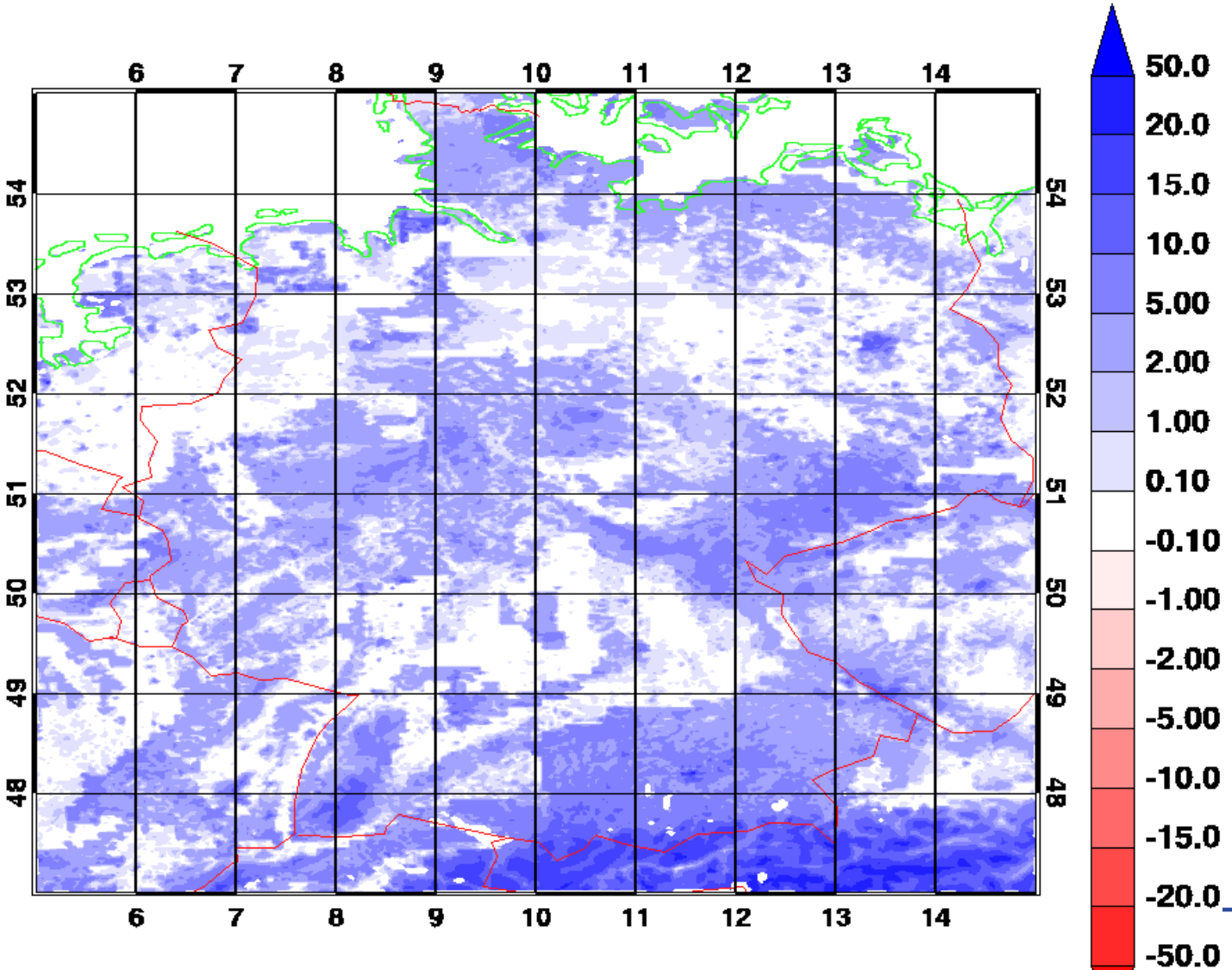
Stronger coupling between TERRA , data assimilation and surface transfer scheme

- TILE approach in data assimilation 
- Snow analysis (Multi-Layer-Snow) + TILEs 
- COST-ES1404 Snow 
- Resolved roughness layer for canopy 
- Consideration of ambient humidity in plant stomatal resistance 
- Improved physiographic data (SRNWP collaboration) 
- Common interface (JSBACH,CLM, Veg3d) and offline mode

Revised Infiltration

- COSMO-DE changed land-use data set 20120418
- Enhanced LAI in GlobCover increased evapotranspiration
- Problem: dry out of root zone soil possible
- Shutdown of latent heat flux
- Solution: Enhanced infiltration parameterization
- Experiment start 2013040100 – 5 months assimilation
- Full experiment start 2014051000 for summer 2014 V5.0.1.1

Revised infiltration



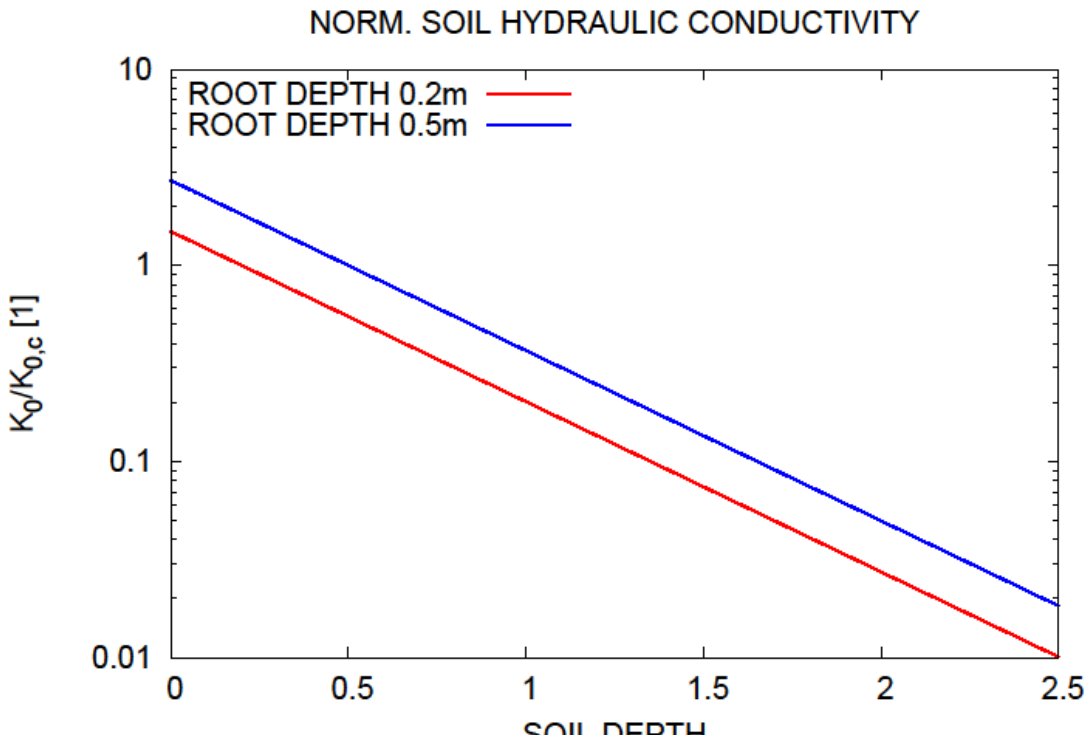
Revised infiltration

$$I'_{max} = \begin{cases} f_r \, S_{orc} \, \rho_w K_0(z) & : \; T_{sfc} \le T_0 \\ 0 & : \; T_{sfc} > T_0 \end{cases} \qquad (10.3$$

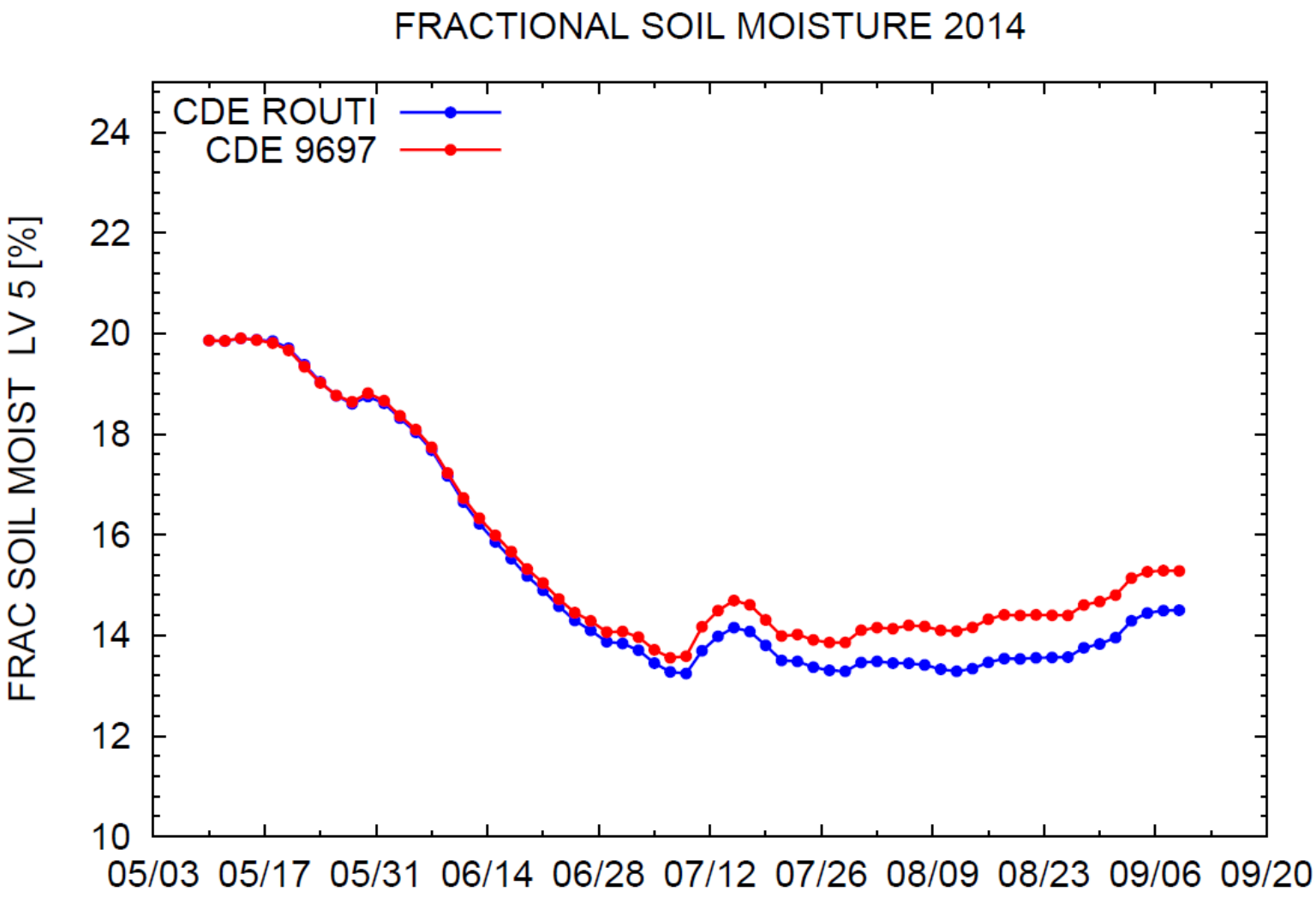
$$K_w(w_l) = K_0(z) \exp\left[K_1 (w_{PV} - \bar{w}_l)/(w_{PV} - w_{ADP}) \right]$$

$$K_0(z) = K_{0,c} e^{-f(z-d_c)}$$

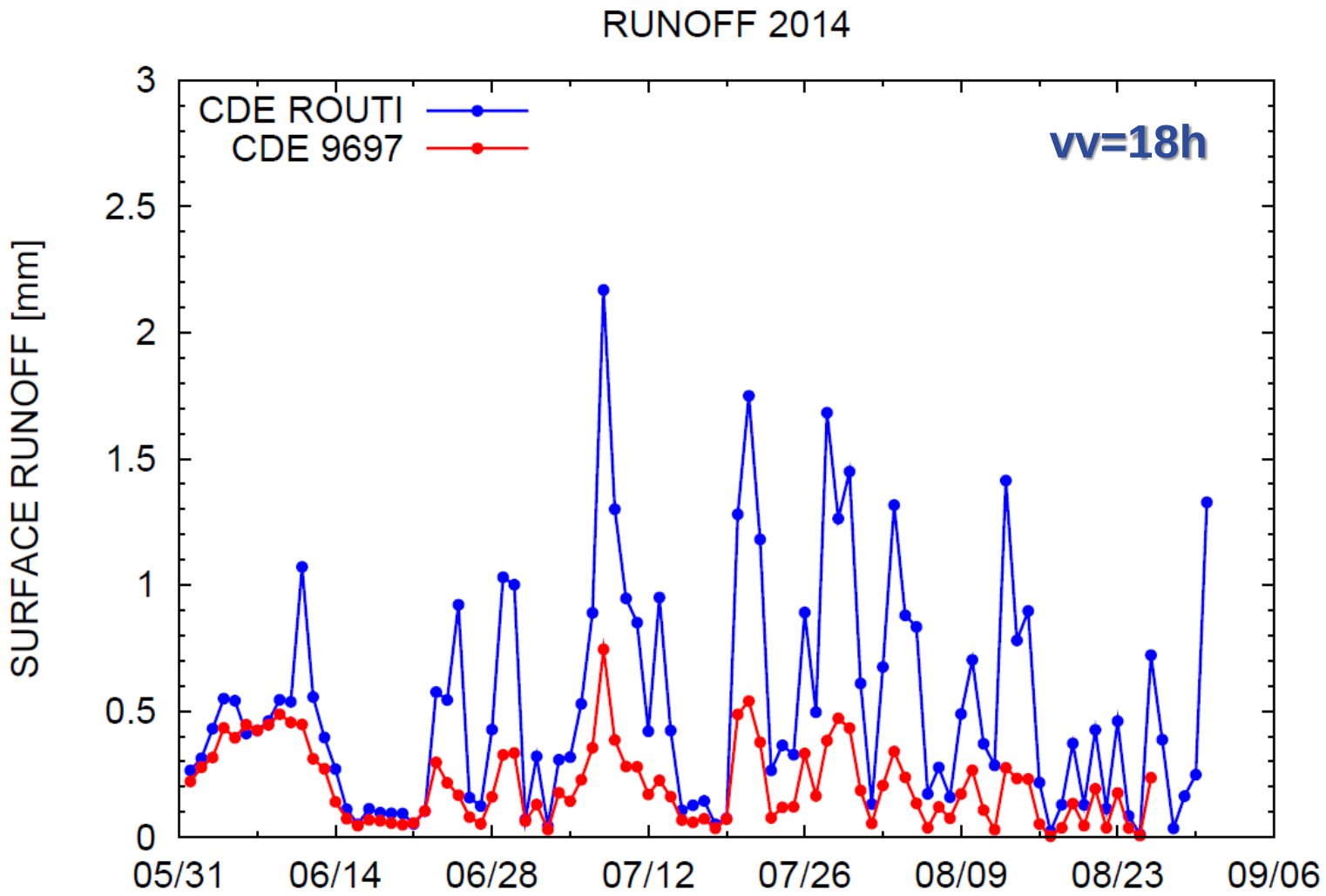
Profile of sat. hydr. conductivity, Decharme (2006)



Revised infiltration
CDE- domain average



Revised infiltration
CDE- domain average



Revised infiltration
CDE- Verification

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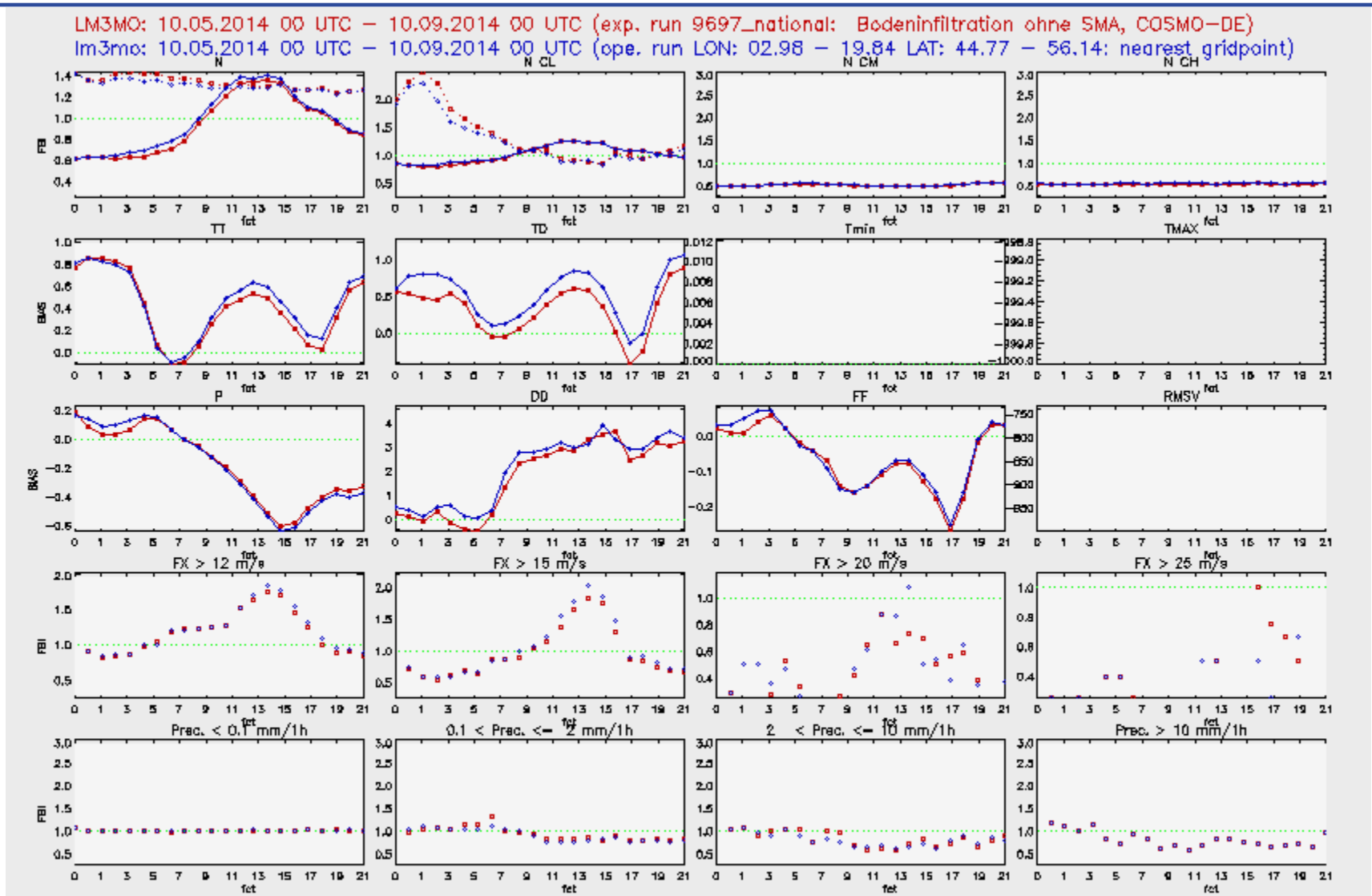

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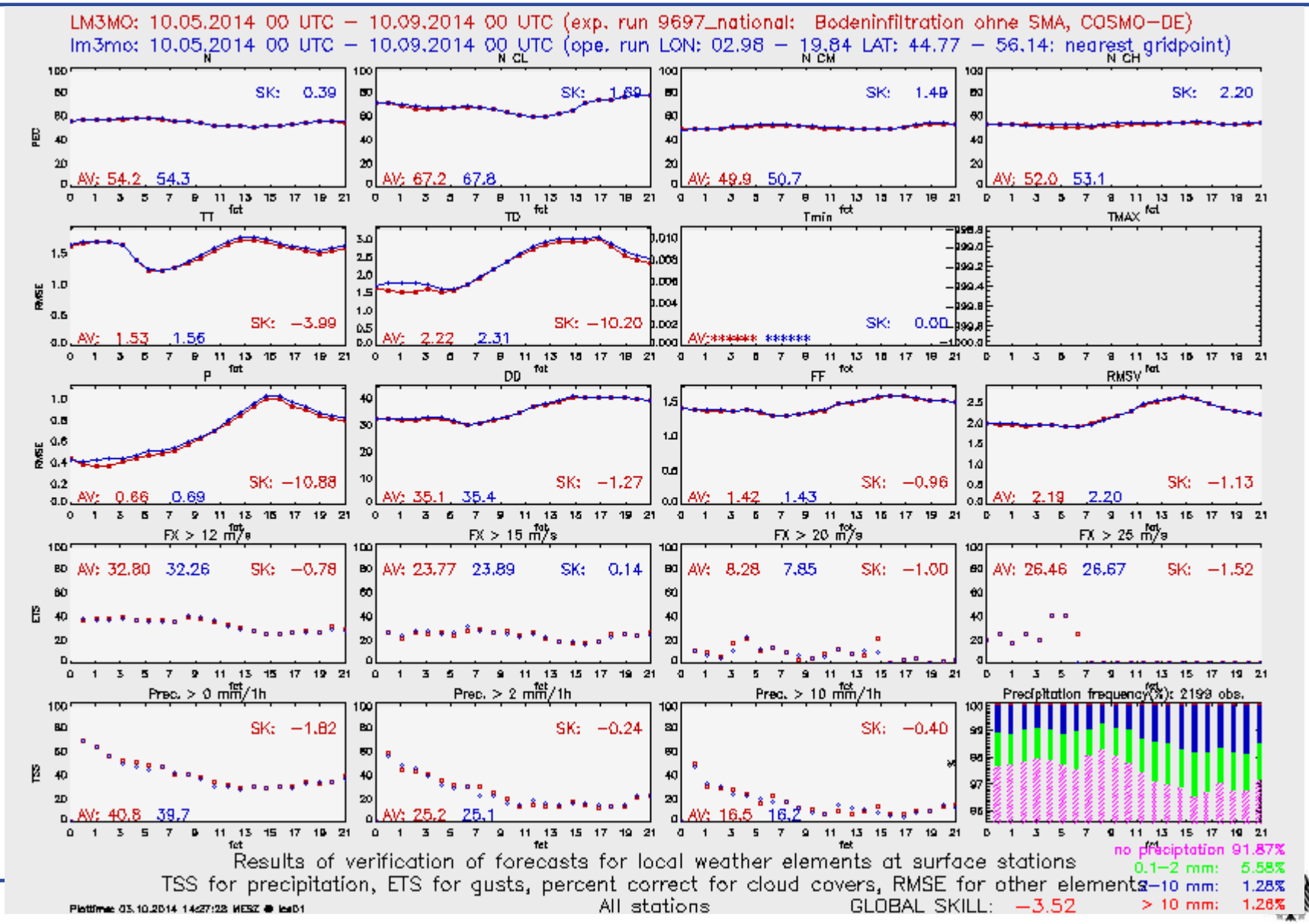
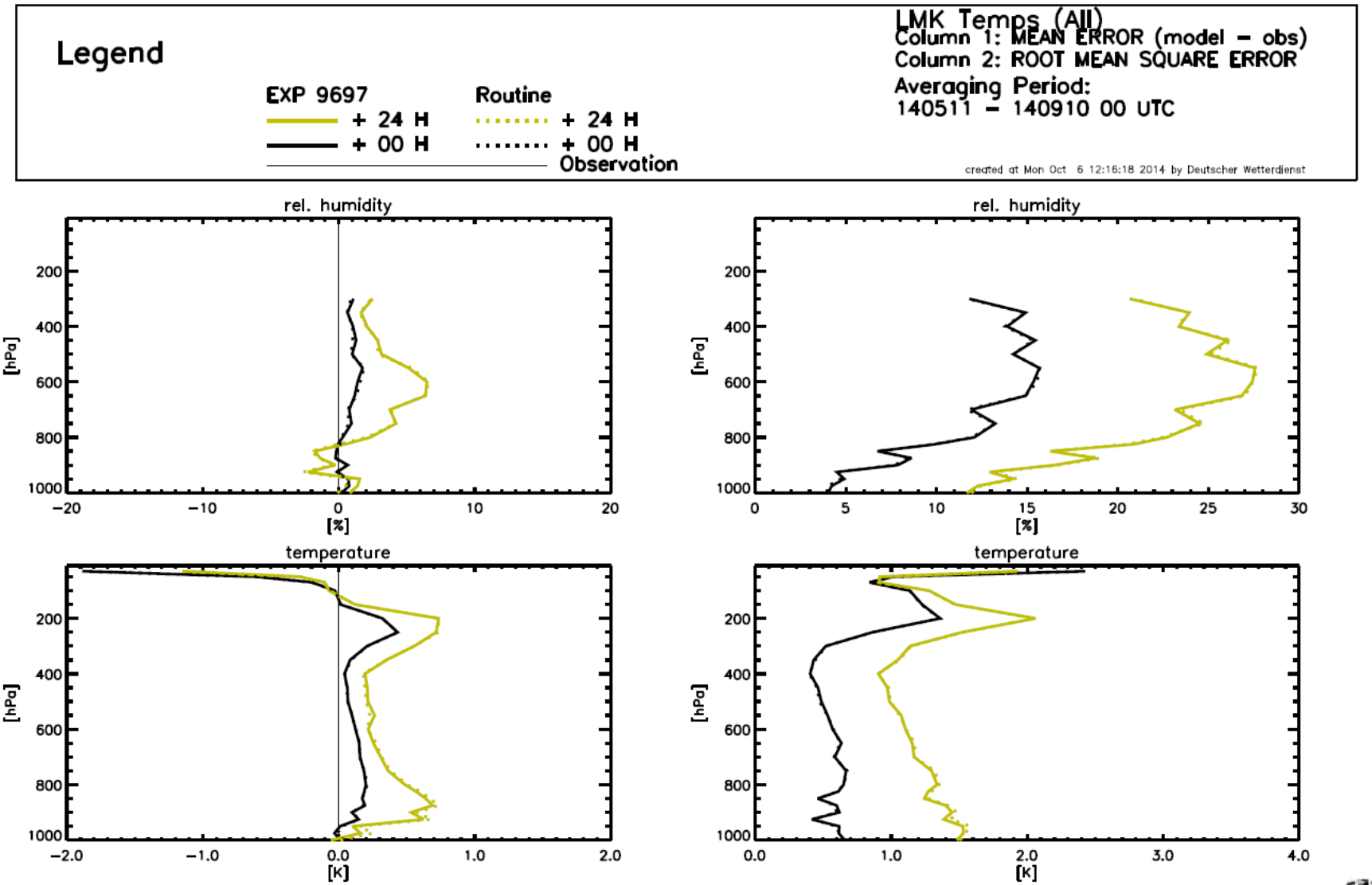


Revised infiltration
CDE- Verification



Revised infiltration
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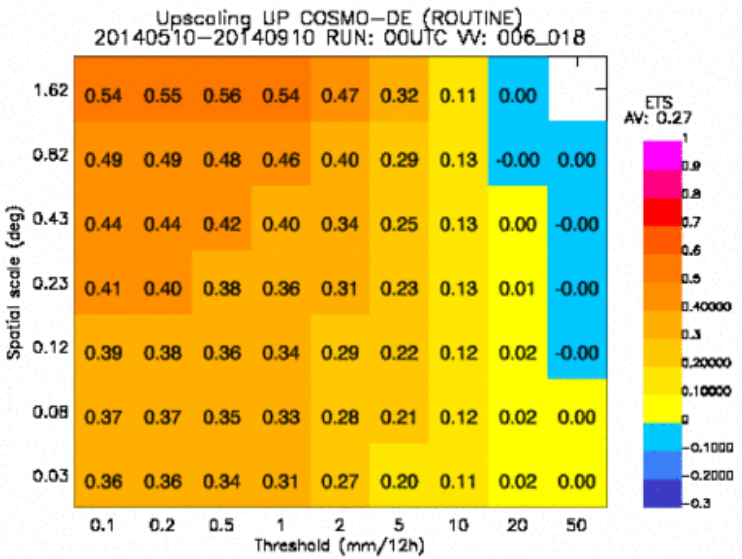
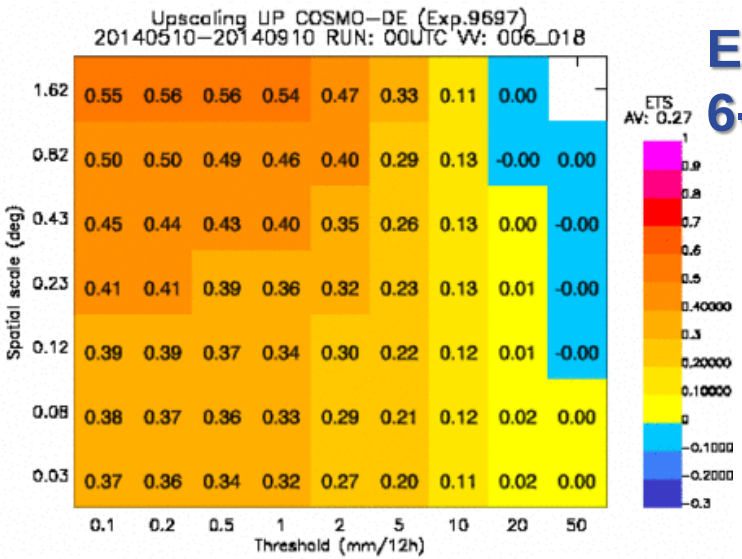
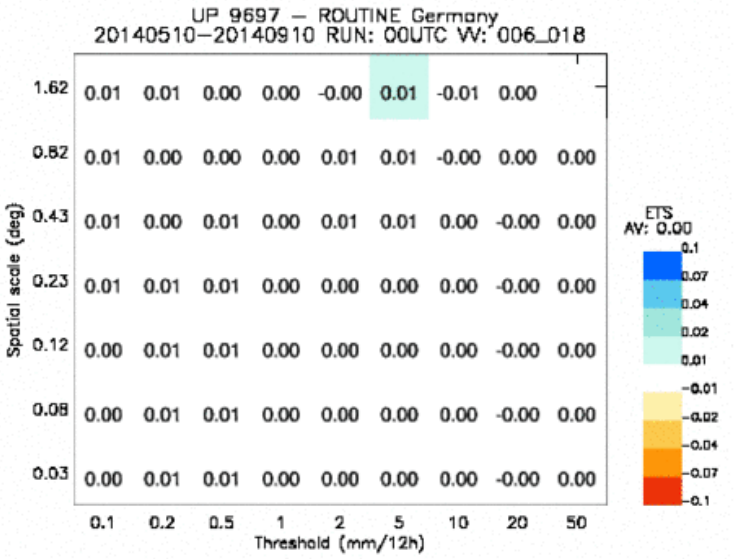
ETS Precip 6-18 UTC







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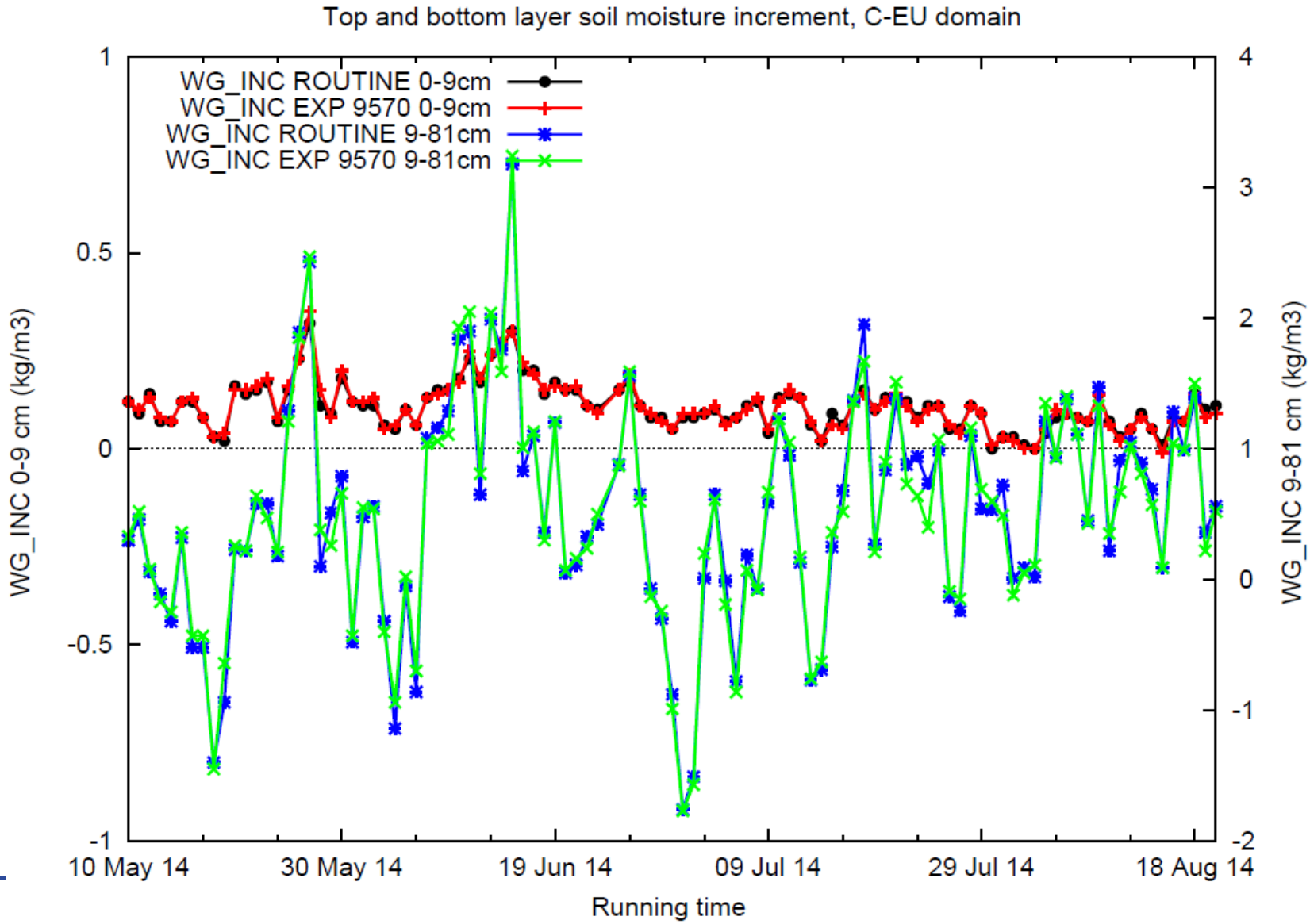
ICON-Meeting, Hamburg, 2015

Revised infiltration
CEU- SMA increments



Revised infiltration
CEU- Verification

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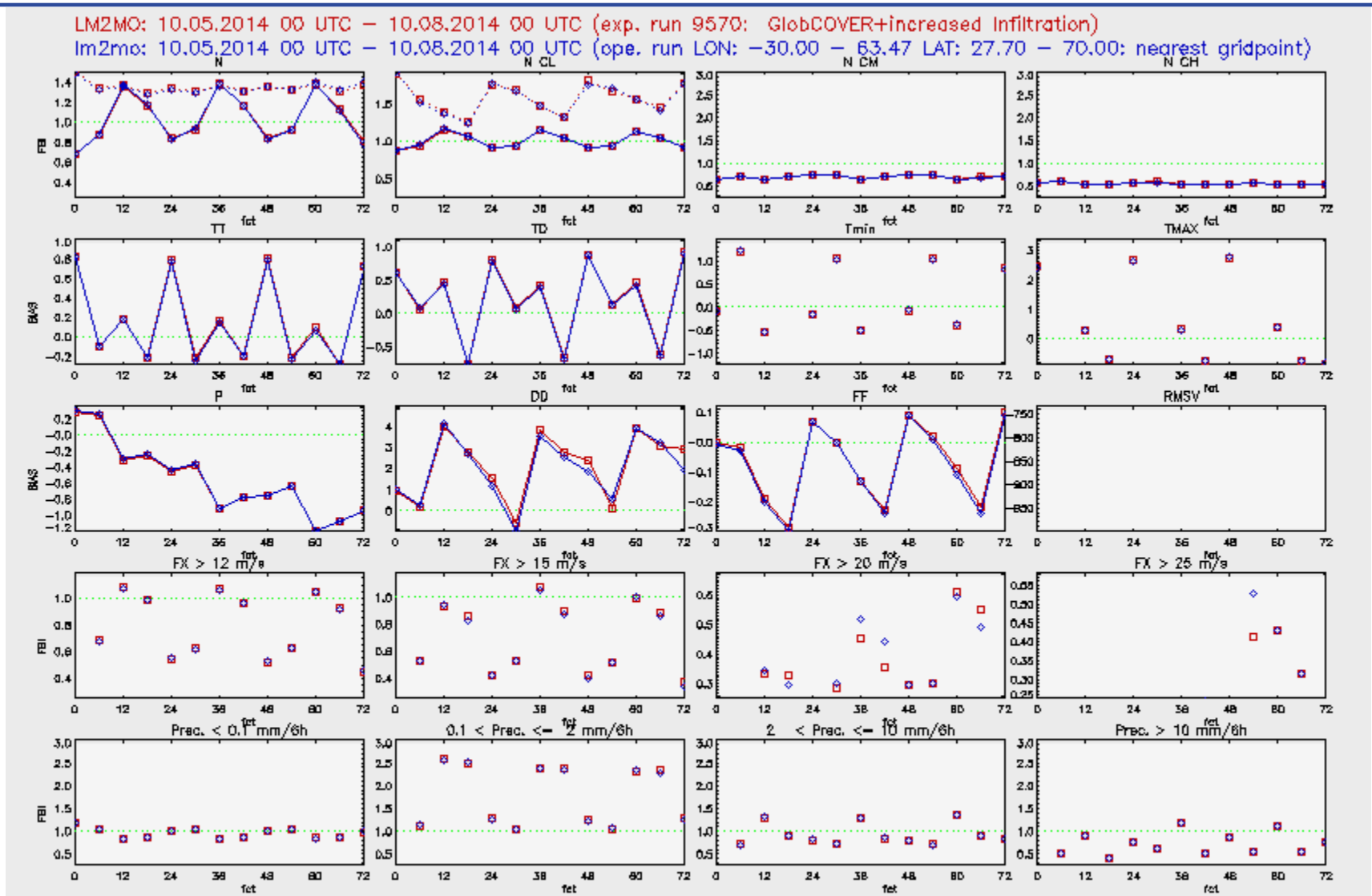

Revised infiltration
CEU- Verification

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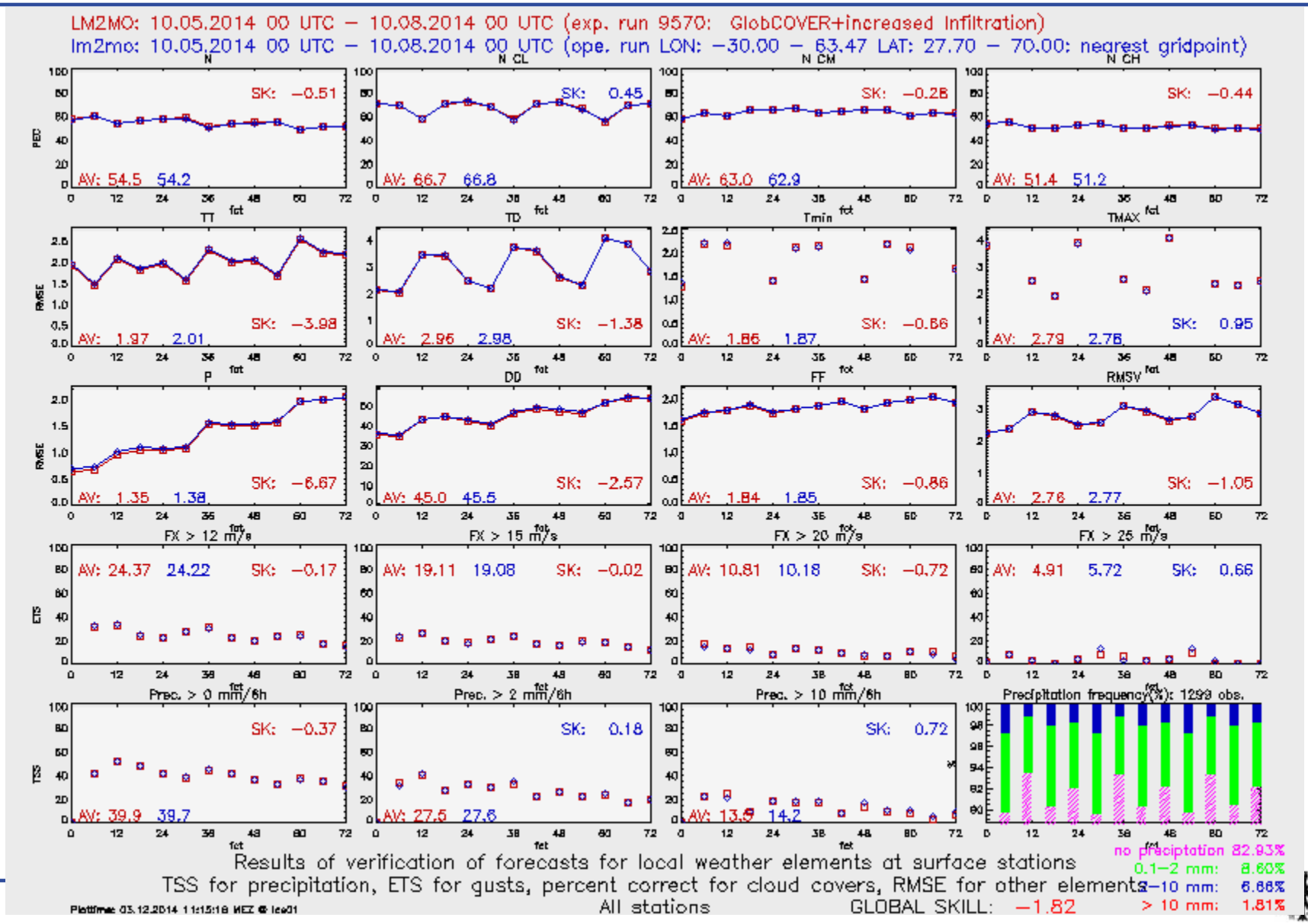

Revised infiltration
CEU- Verification

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