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

# Towards an unified land-surface scheme

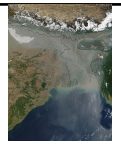
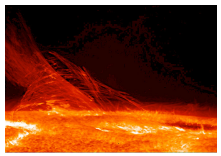
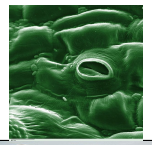
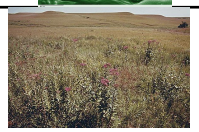
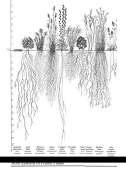
## Results from global and limited are experiments

J. Helmert, H. Asensio, G. Vogel, M. Lange, B. Ritter

# Motivation

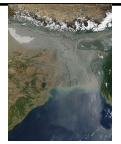
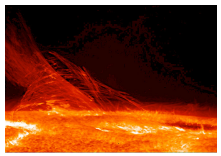
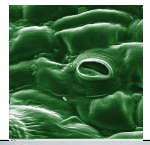
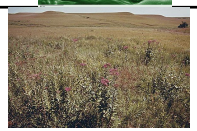
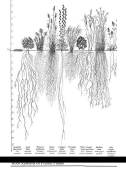
- Taking into account results from COSMO experiments during COLOBOC
- Consider operational soil-moisture analysis in GME
- Using one configuration of external parameters and soil physics for COSMO and GME
- Testbed for ICON

# Model configuration

| parameter / model | COSMO | GME | GME EXP |
|---|---|---|---|
| aerosol  | fixed | climatology | climatology |
| emissivity  | const. | field | field |
| vegetation cycle  | empirical function | NDVI climatology | NDVI climatology |
| minimum stomatal resistance  | const. | GLC2000 | ECOCLIMAP |
| vegetation albedo  | const. | const | field |
| root profile  | uniform | exponential | exponential |

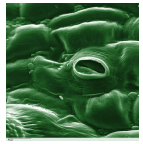
*source of pictures: wikipedia*

# Model configuration: EXP

| parameter / model | COSMO | GME |
|---|---|---|
| aerosol  | climatology | climatology |
| emissivity  | field | field |
| vegetation cycle  | NDVI climatology | NDVI climatology |
| minimum stomatal resistance  | ECOCLIMAP | ECOCLIMAP |
| vegetation albedo  | field | field |
| root profile  | exponential | exponential |

*source of pictures: wikipedia*

# External Parameters GME



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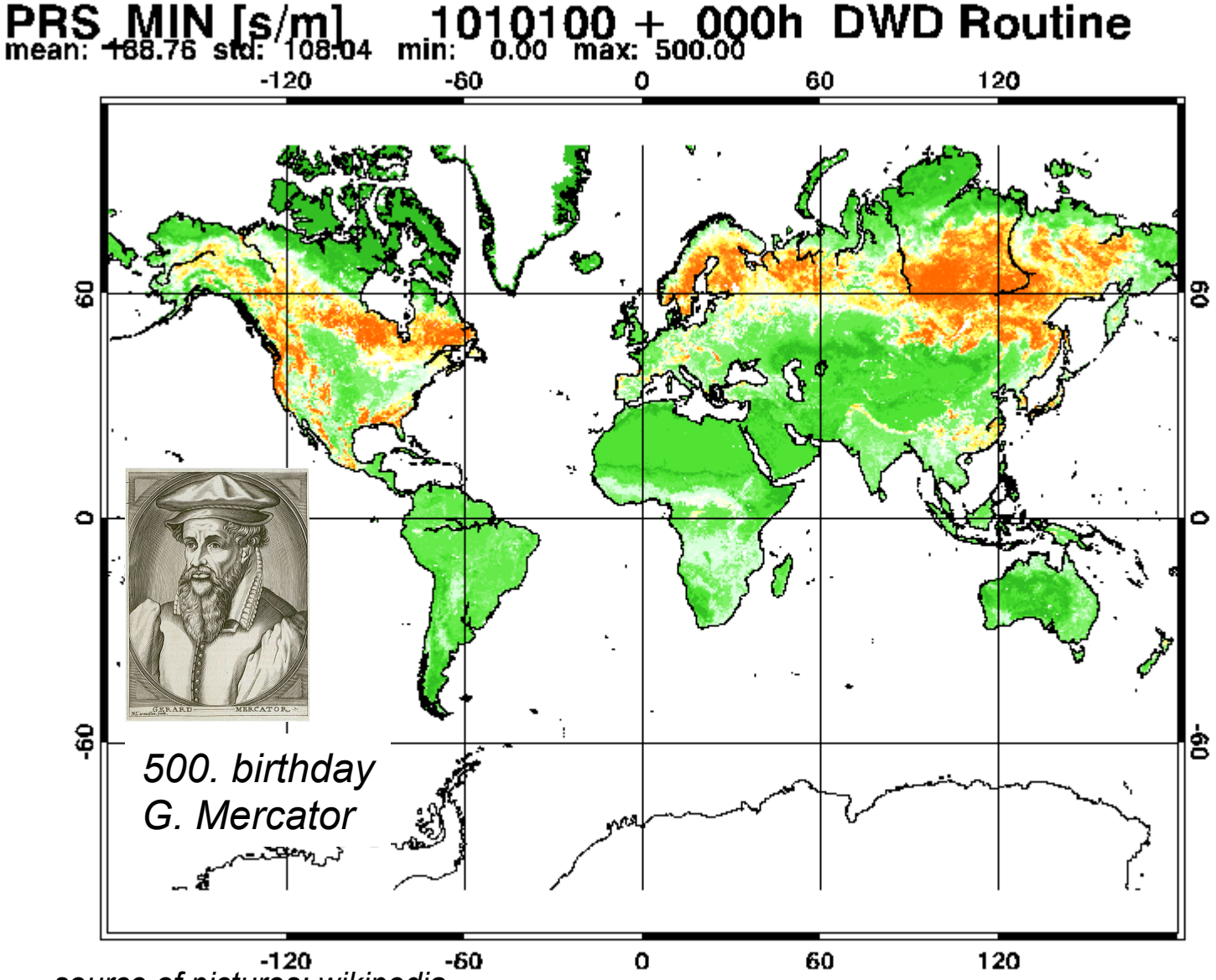
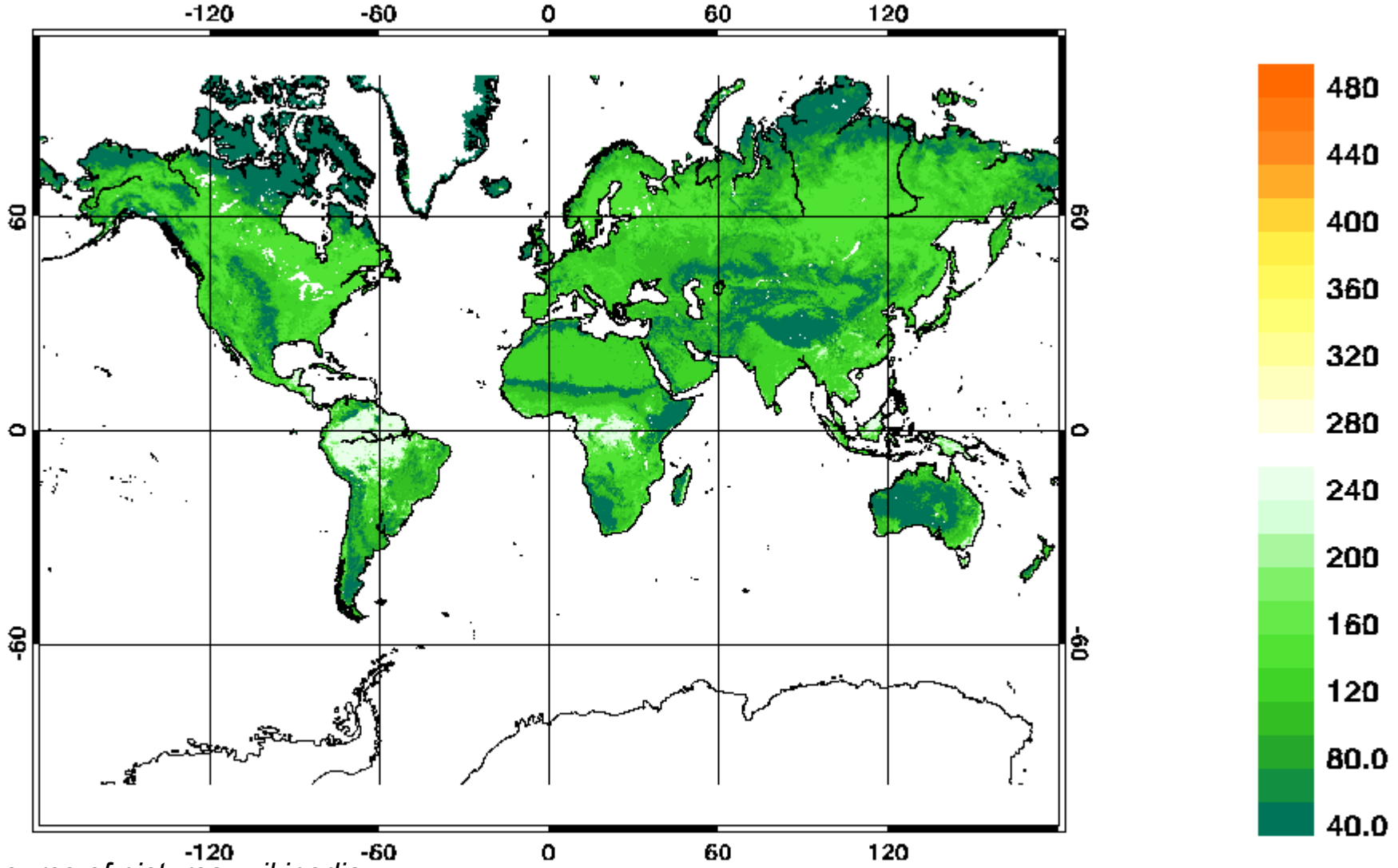



*source of pictures: wikipedia*

# External Parameters GME

Deutscher Wetterdienst
Wetter und Klima aus einer Hand

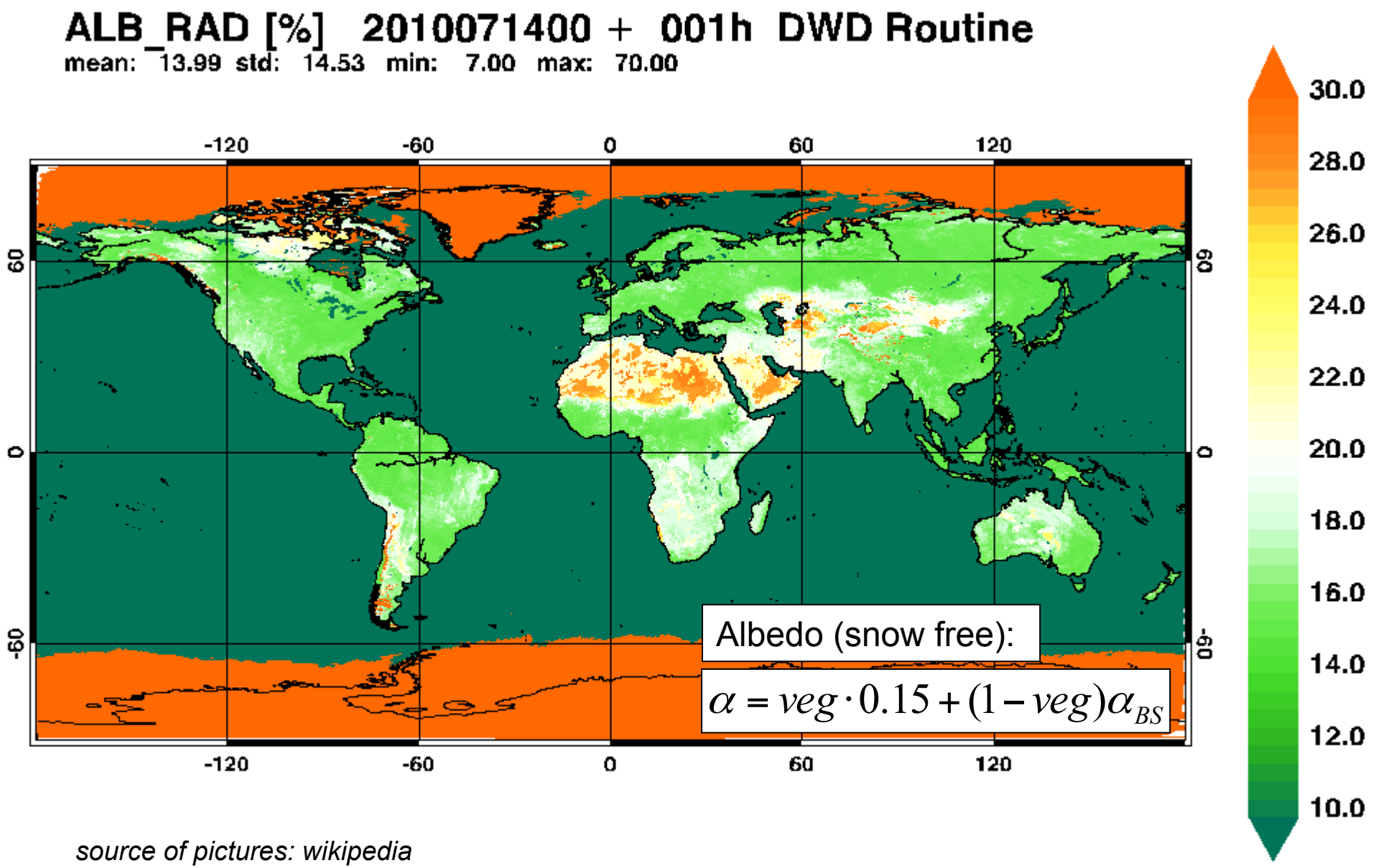
PRS_MIN [s/m] 1010100 + 000h DWD EXP 1009
mean: 105.06 std: 59.55 min: 0.00 max: 250.00




*source of pictures: wikipedia*

# Vegetation albedo ROUTI

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




*source of pictures: wikipedia*

# Vegetation albedo EXP

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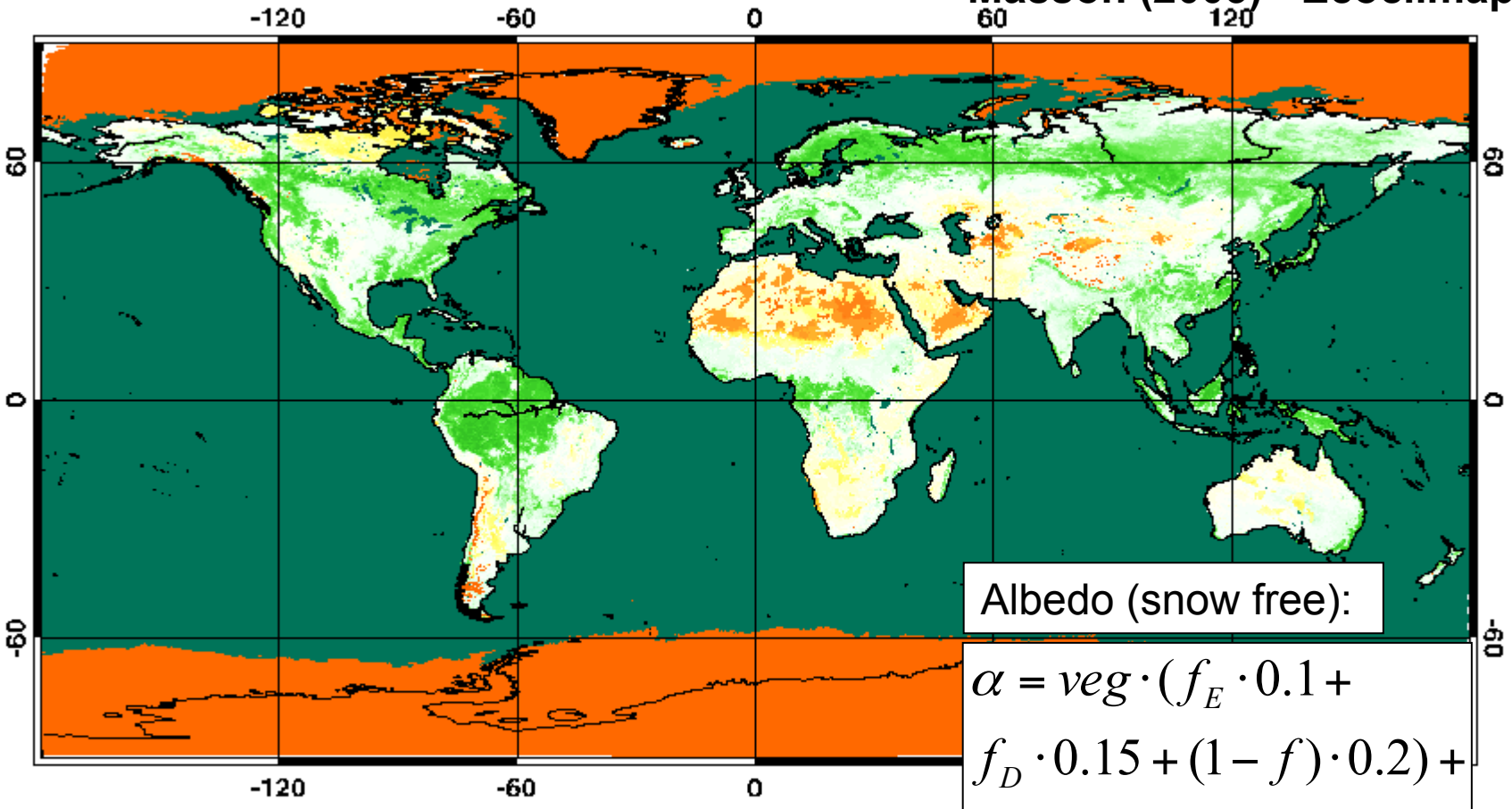
Wetter und Klima aus einer Hand
DWD

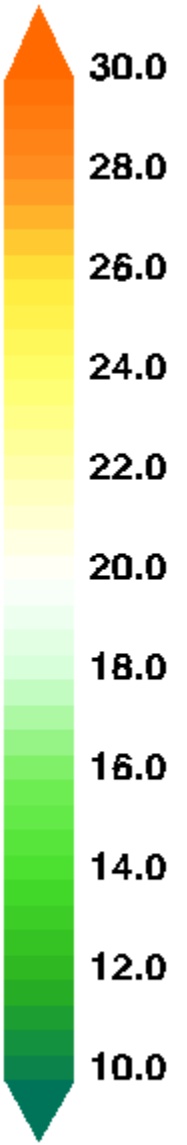
**ALB_RAD [%] 2010071400 + 001h DWD Routine**

mean: 14.39 std: 14.67 min: 7.00 max: 70.00

**EXP 1009**

**Masson (2003) - Ecoclimap**



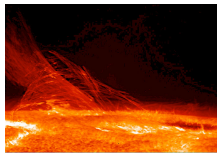
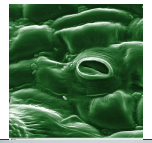
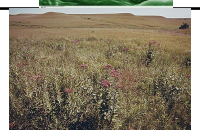
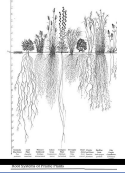




Albedo (snow free):

$$\alpha = veg \cdot (f_E \cdot 0.1 + f_D \cdot 0.15 + (1 - f) \cdot 0.2) + (1 - veg) \cdot \alpha_{BS}$$

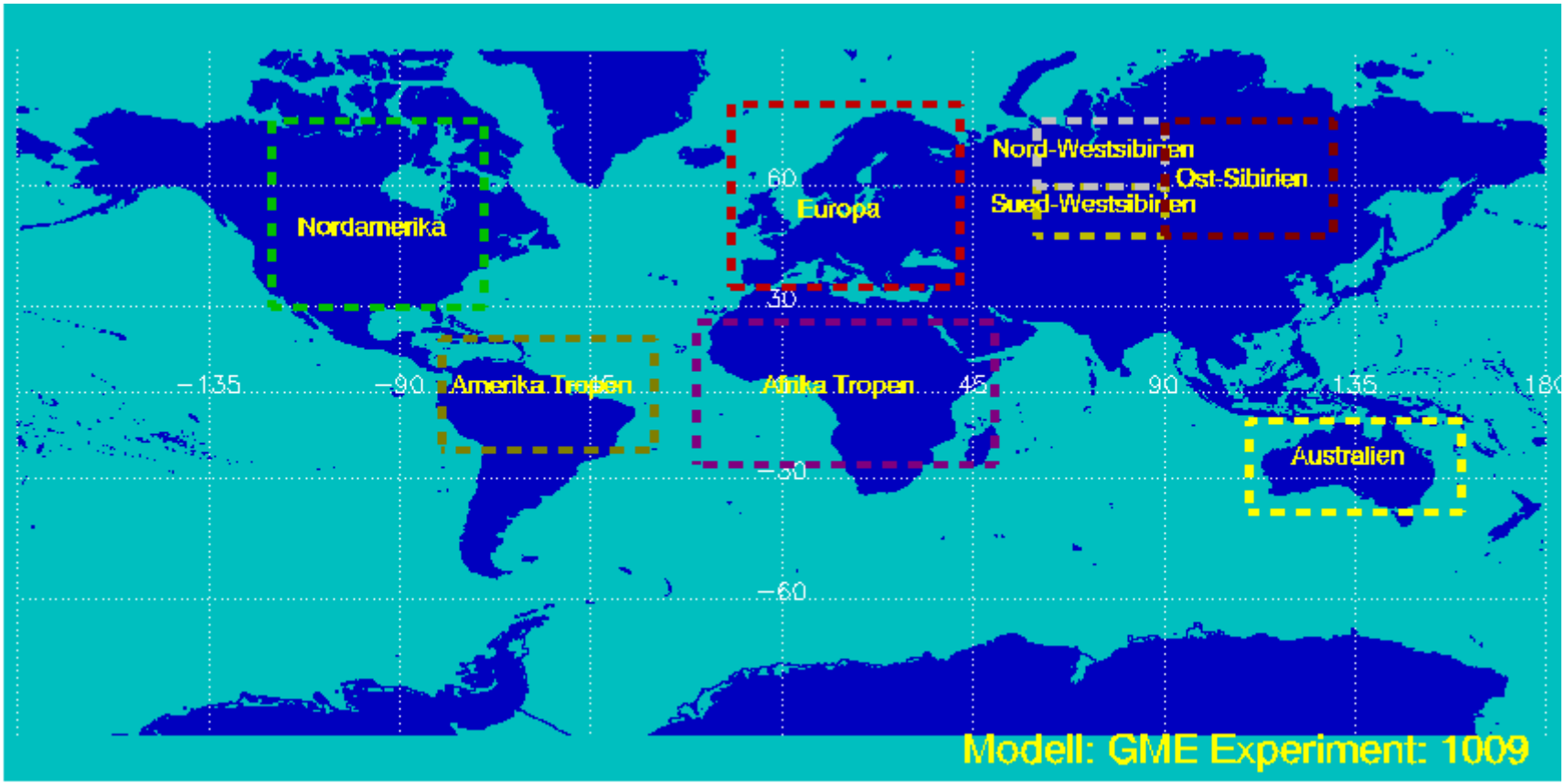
*source of pictures: wikipedia*

# Model configuration: Goal

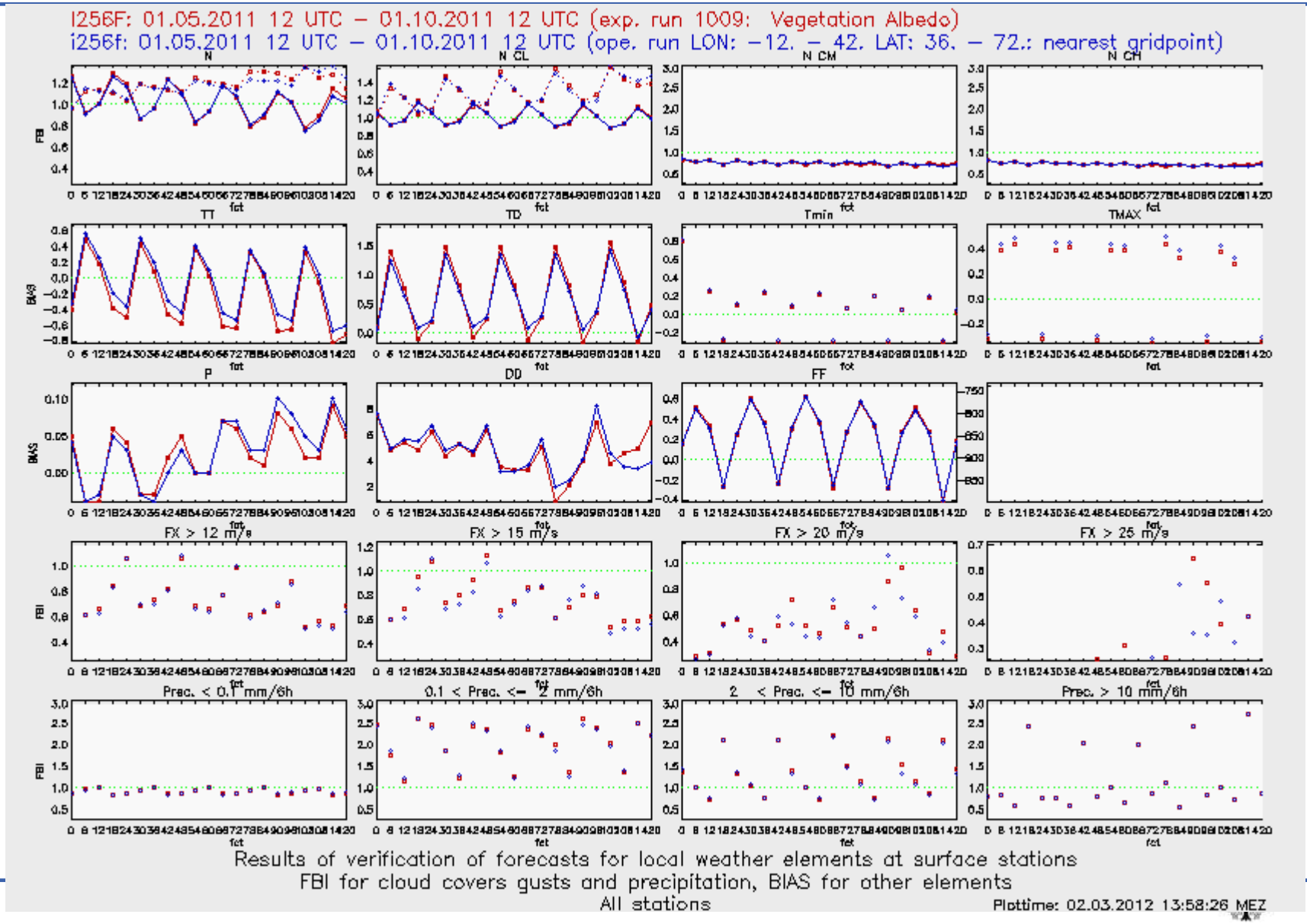
| parameter / model | COSMO / ICON |
|---|---|
| aerosol  | climatology |
| emissivity  | field |
| vegetation cycle  | NDVI climatology |
| minimum stomatal resistance  | ECOCLIMAP |
| vegetation albedo  | field |
| root profile  | exponential |

*source of pictures: wikipedia*

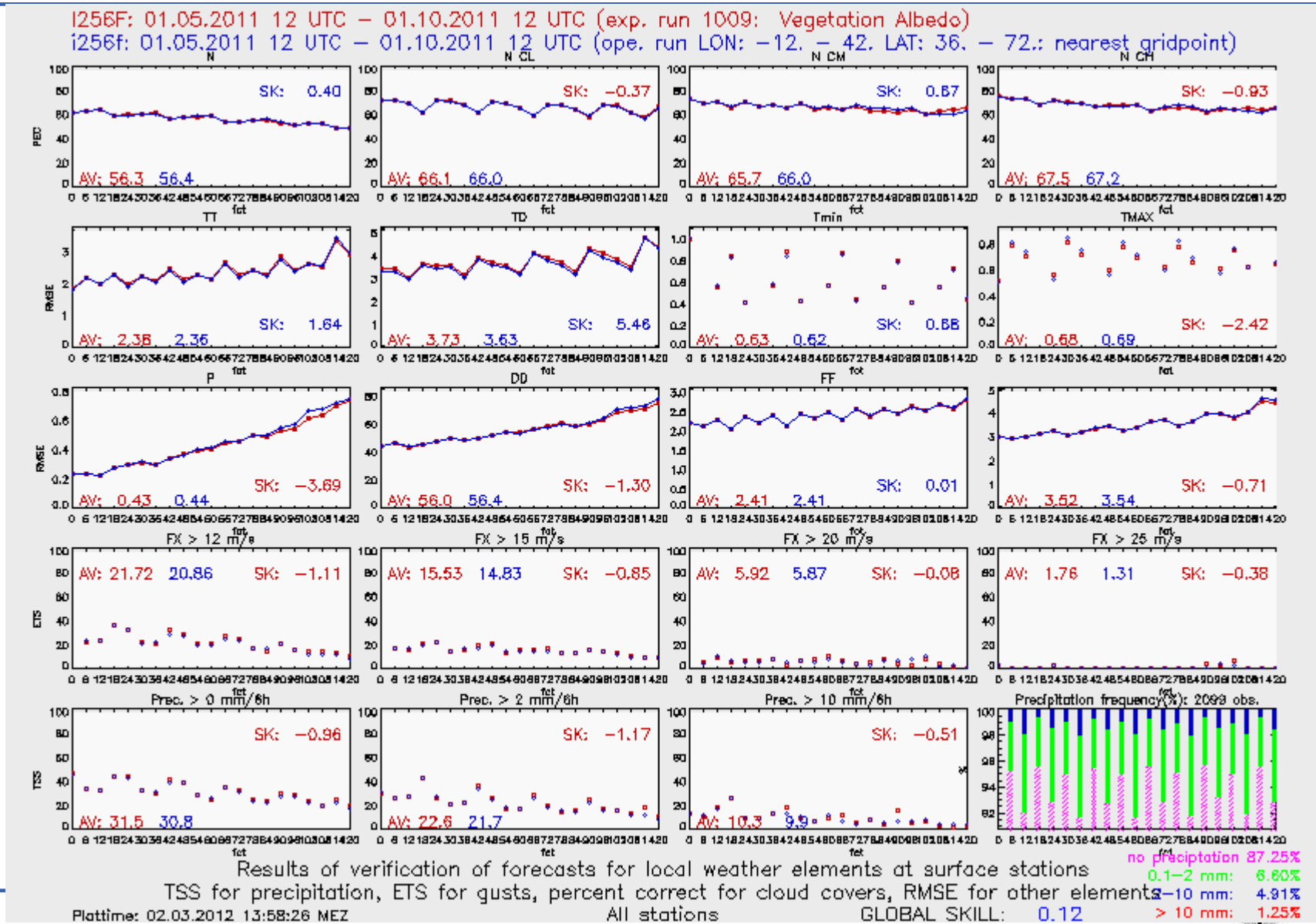
# Global Verification



# Global Verification
# Europe 12 UTC



# Global Verification
# Europe 12 UTC



# Global Verification

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## EXP 1009 ECOCLIMAP+ALBEDO SMA 01.05.2011-01.10.2011 00 UTC i256f

| Region / Global Skill Score | GME 00 UTC | GME 12 UTC |
|---|---|---|
| Europe | 2.07 | 0.12 |
| East Sibiria | 0.81 | -0.88 |
| North America | 0.62 | -1.44 |
| Tropics Africa | 0.2 | 0.19 |
| Tropics America | 1.12 | 0.87 |
| Australia | 0.46 | 0.07 |

# Global Verification

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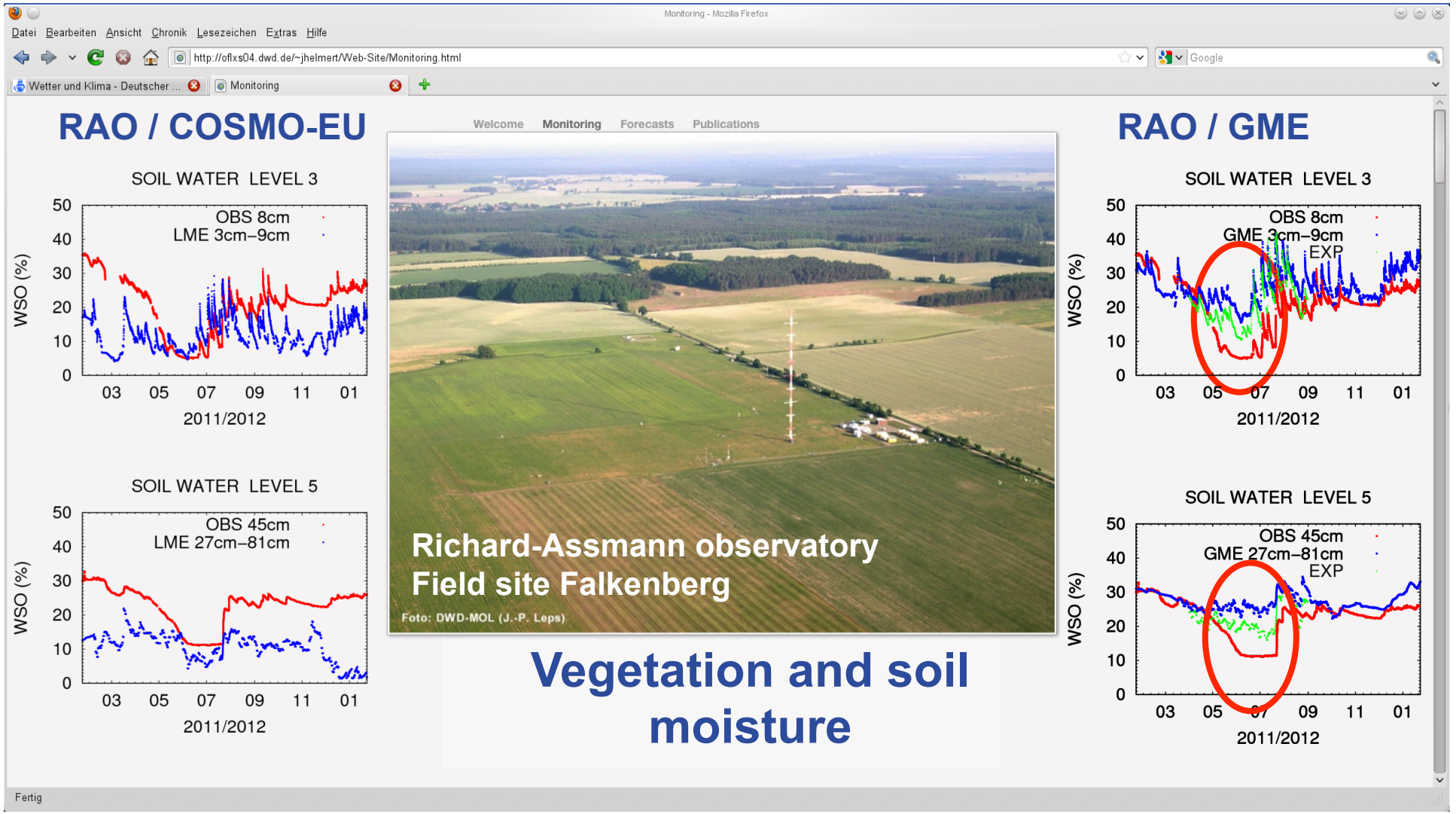
# Monitoring, Validation

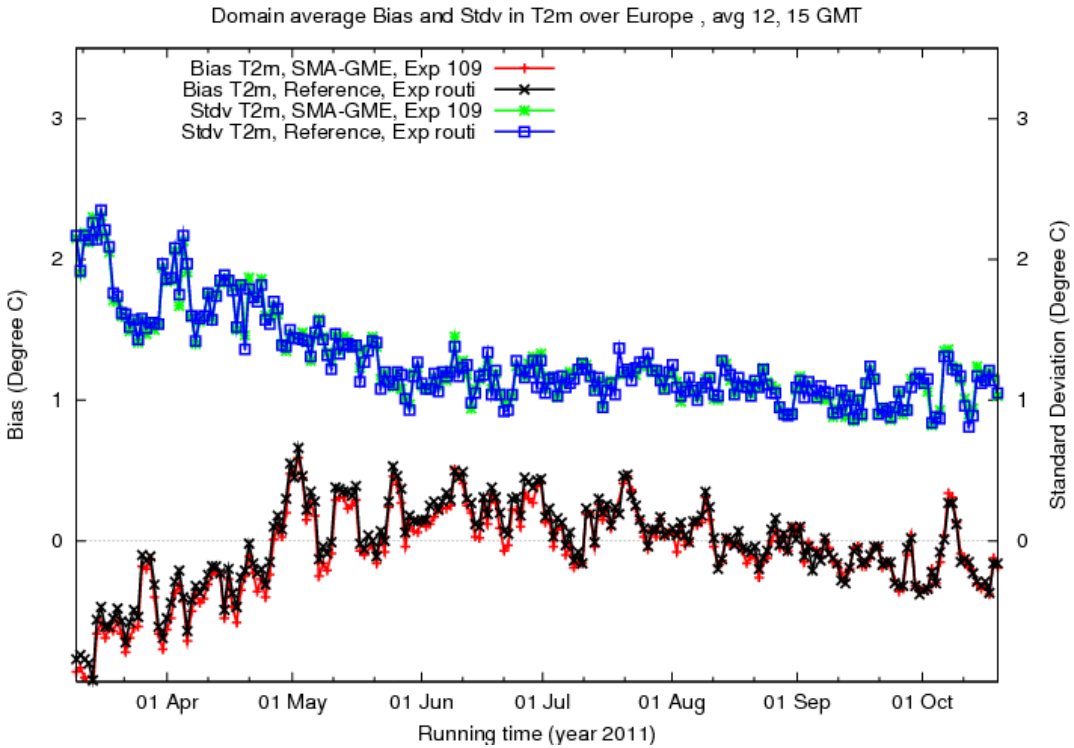
Deutscher Wetterdienst
Wetter und Klima aus einer Hand



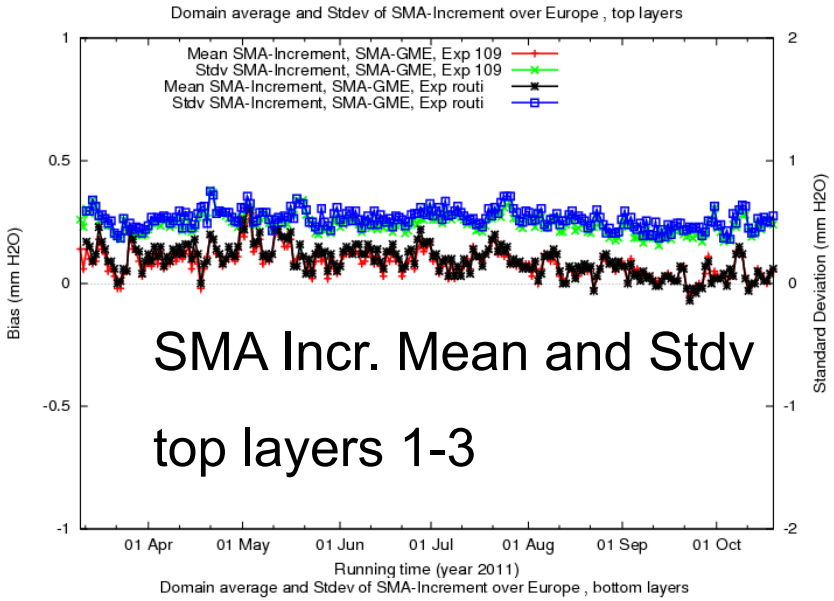

Experiment: Adaption of vegetation parameters

# Monitoring, Validation

## Europe

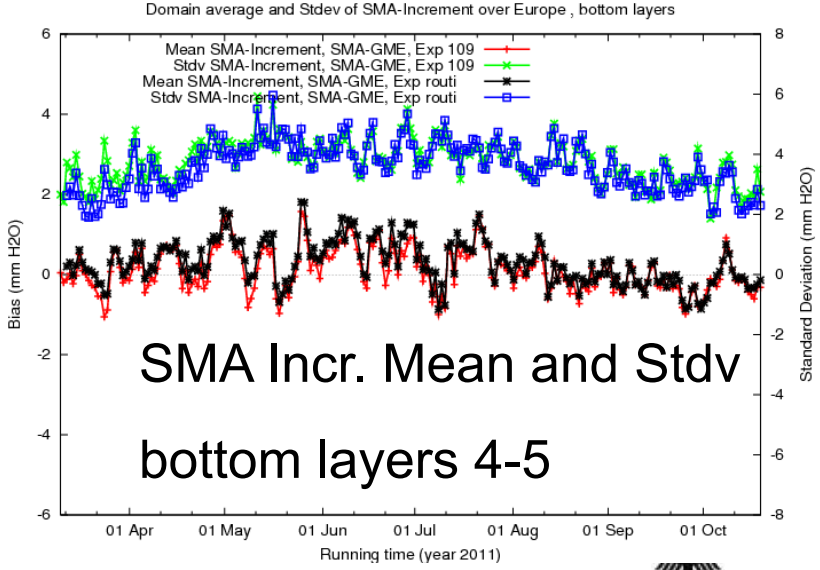



T2M Bias and Stdv




SMA Incr. Mean and Stdv

top layers 1-3

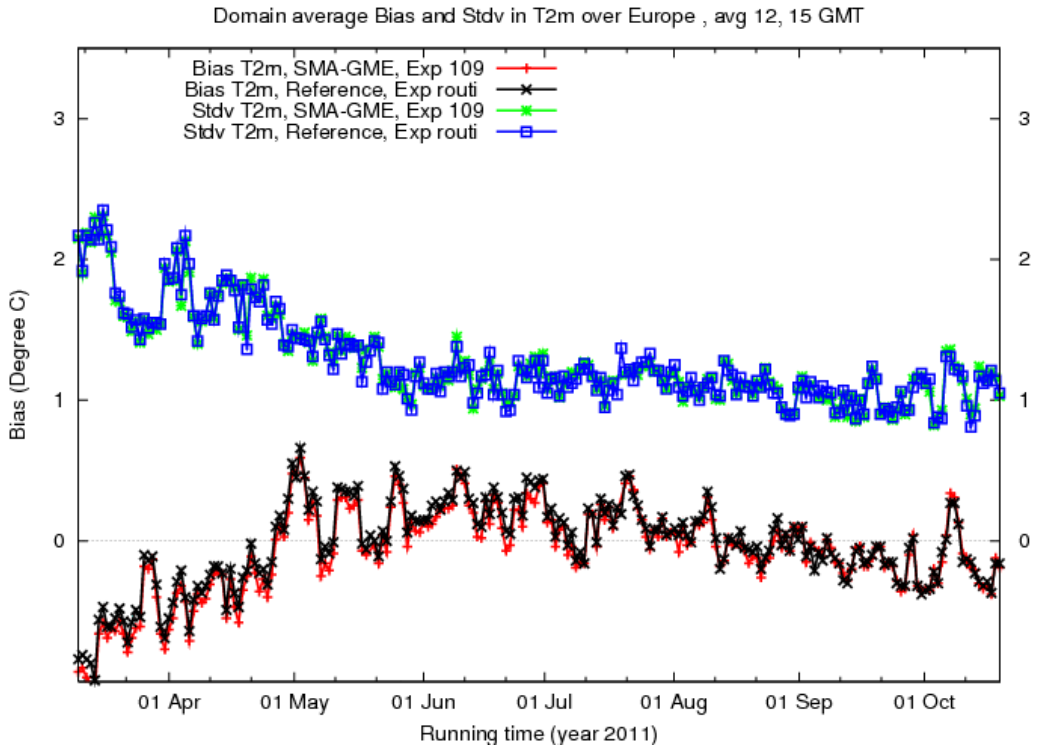



SMA Incr. Mean and Stdv

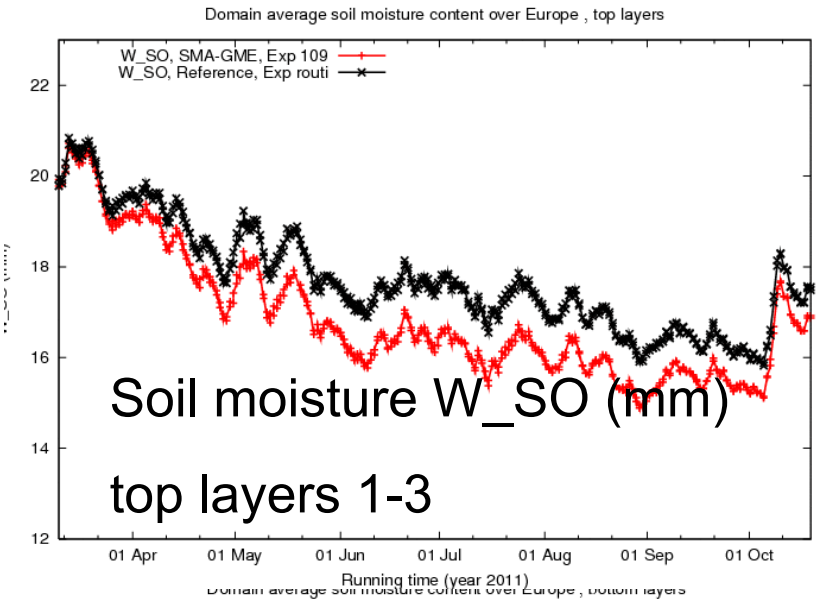
bottom layers 4-5

# Monitoring, Validation

## Europe

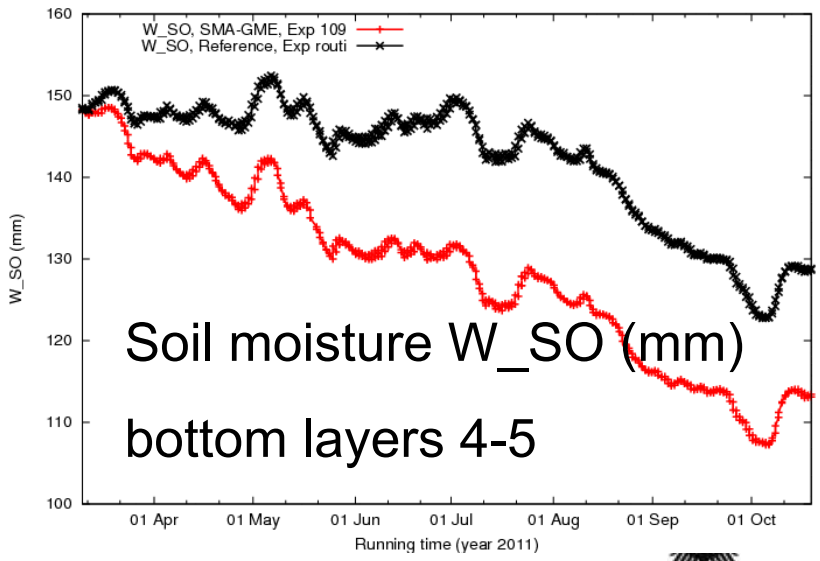



T2M Bias and Stdv




Soil moisture W_SO (mm)

top layers 1-3




Soil moisture W_SO (mm)

bottom layers 4-5

# COSMO-EU

# Monitoring, Validation

Deutscher Wetterdienst
Wetter und Klima aus einer Hand

Monitoring - Mozilla Firefox

Datei Bearbeiten Ansicht Chronik Lesezeichen Extras Hilfe

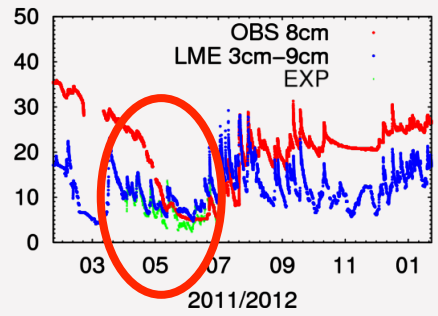
http://oflxs04.dwd.de/~jhelmert/Web-Site/Monitoring.html

Wetter und Klima - Deutscher ... | Monitoring

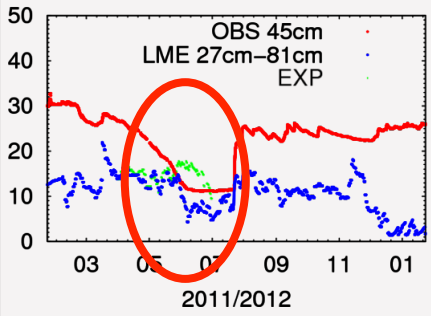
Welcome Monitoring Forecasts Publications

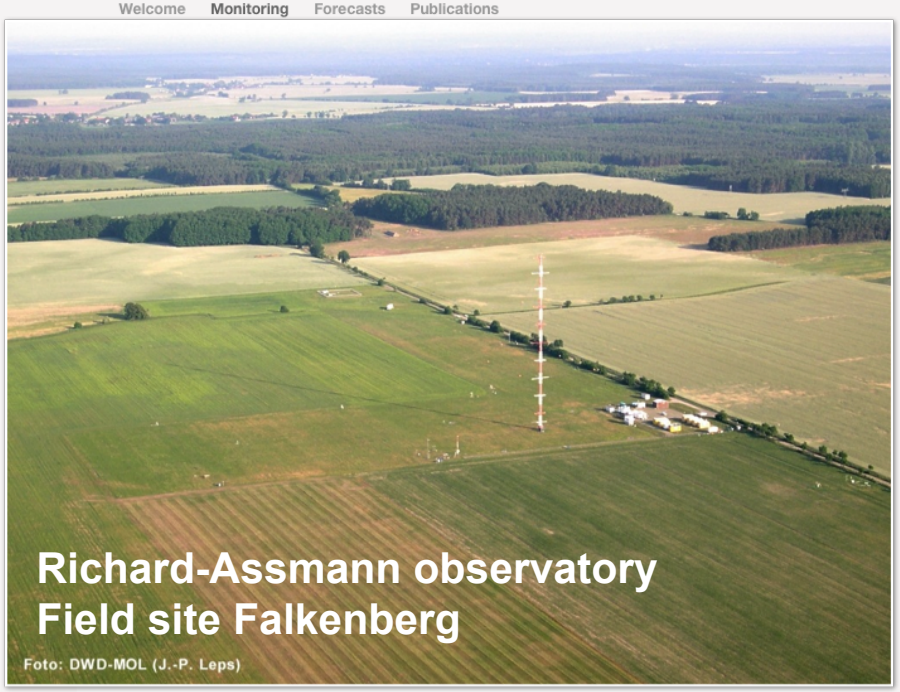
## RAO / COSMO-EU

SOIL WATER LEVEL 3



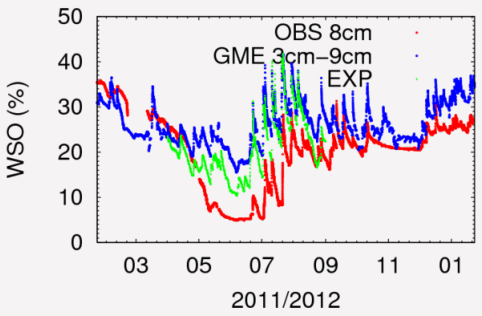

SOIL WATER LEVEL 5



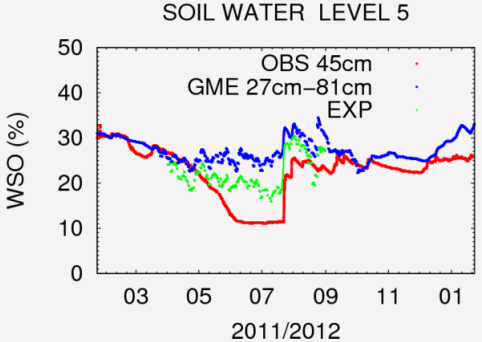




## RAO / GME

SOIL WATER LEVEL 3




SOIL WATER LEVEL 5



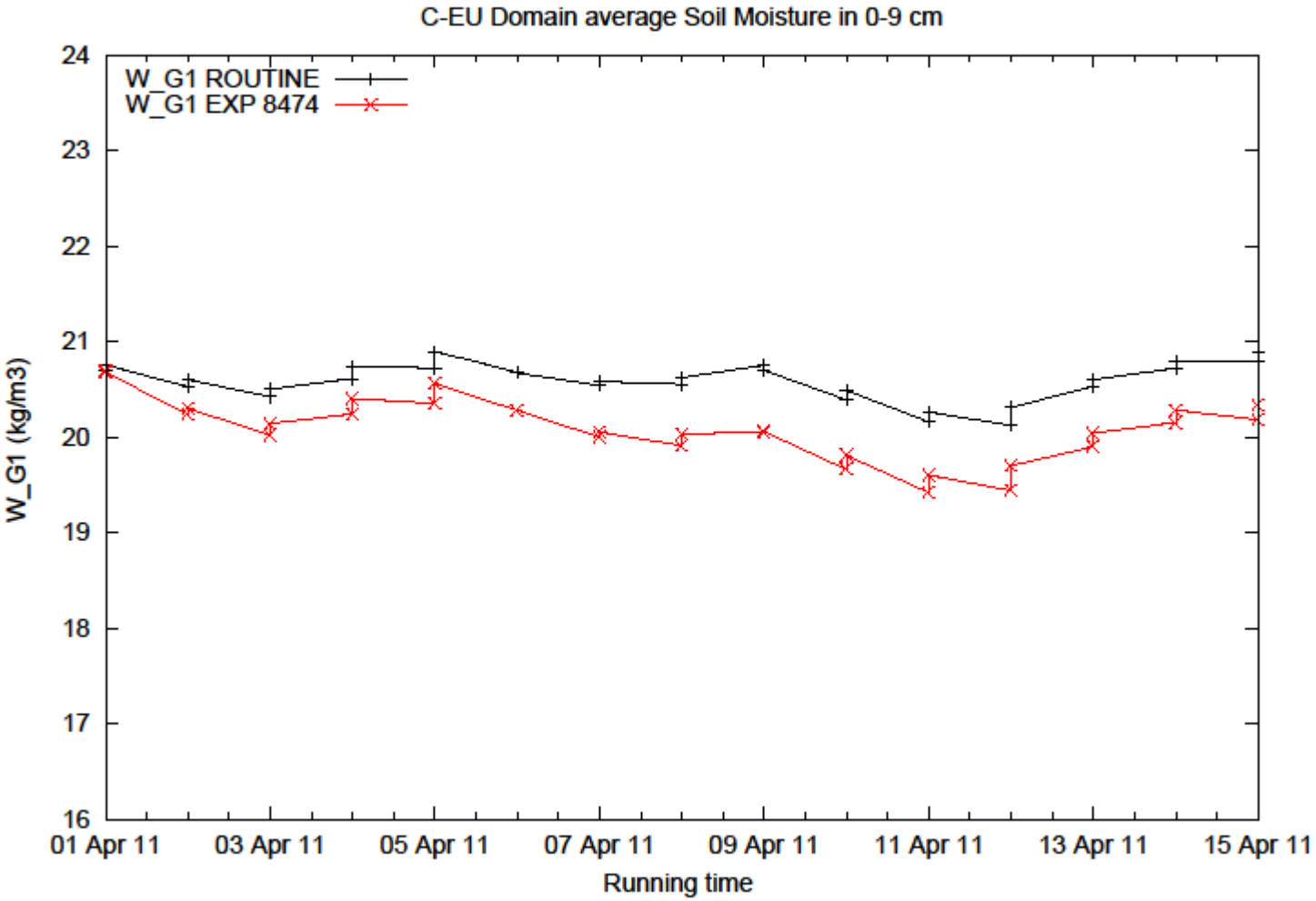

Fertig

## Vegetation and soil moisture

**Experiment: Adaption of vegetation parameters**

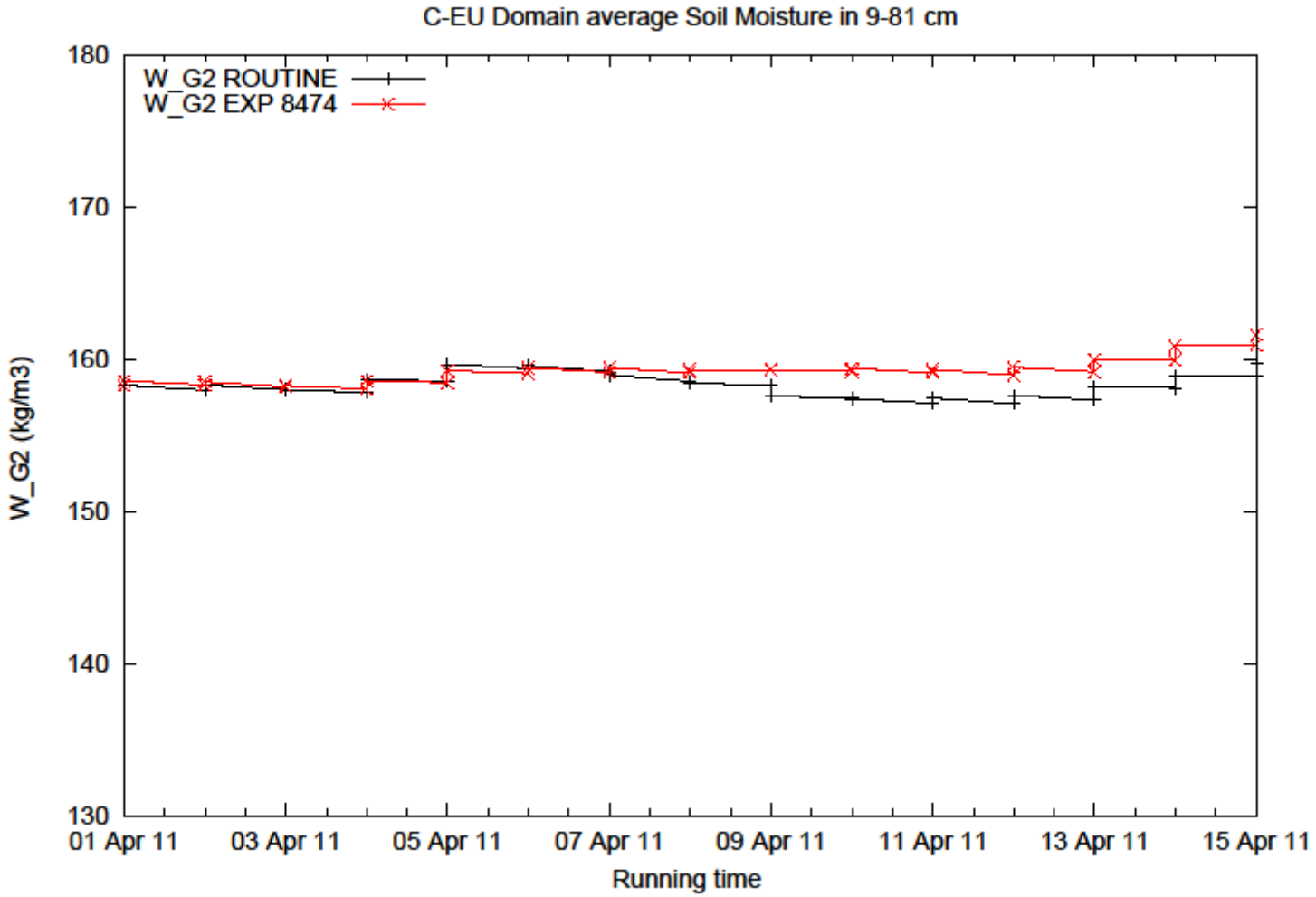
# Monitoring

## COSMO-EU domain average top soil



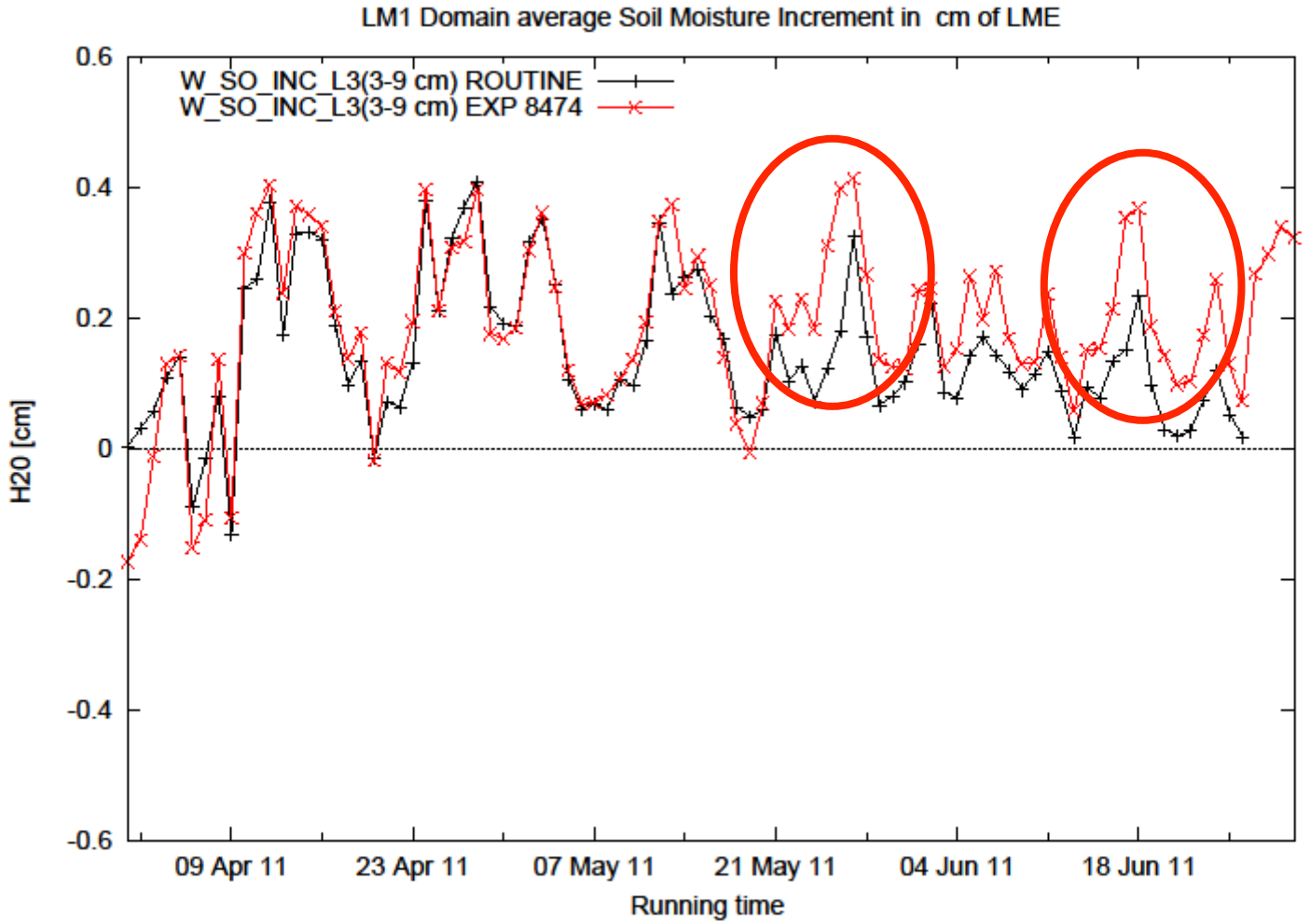
# Monitoring

## COSMO-EU domain average bottom soil



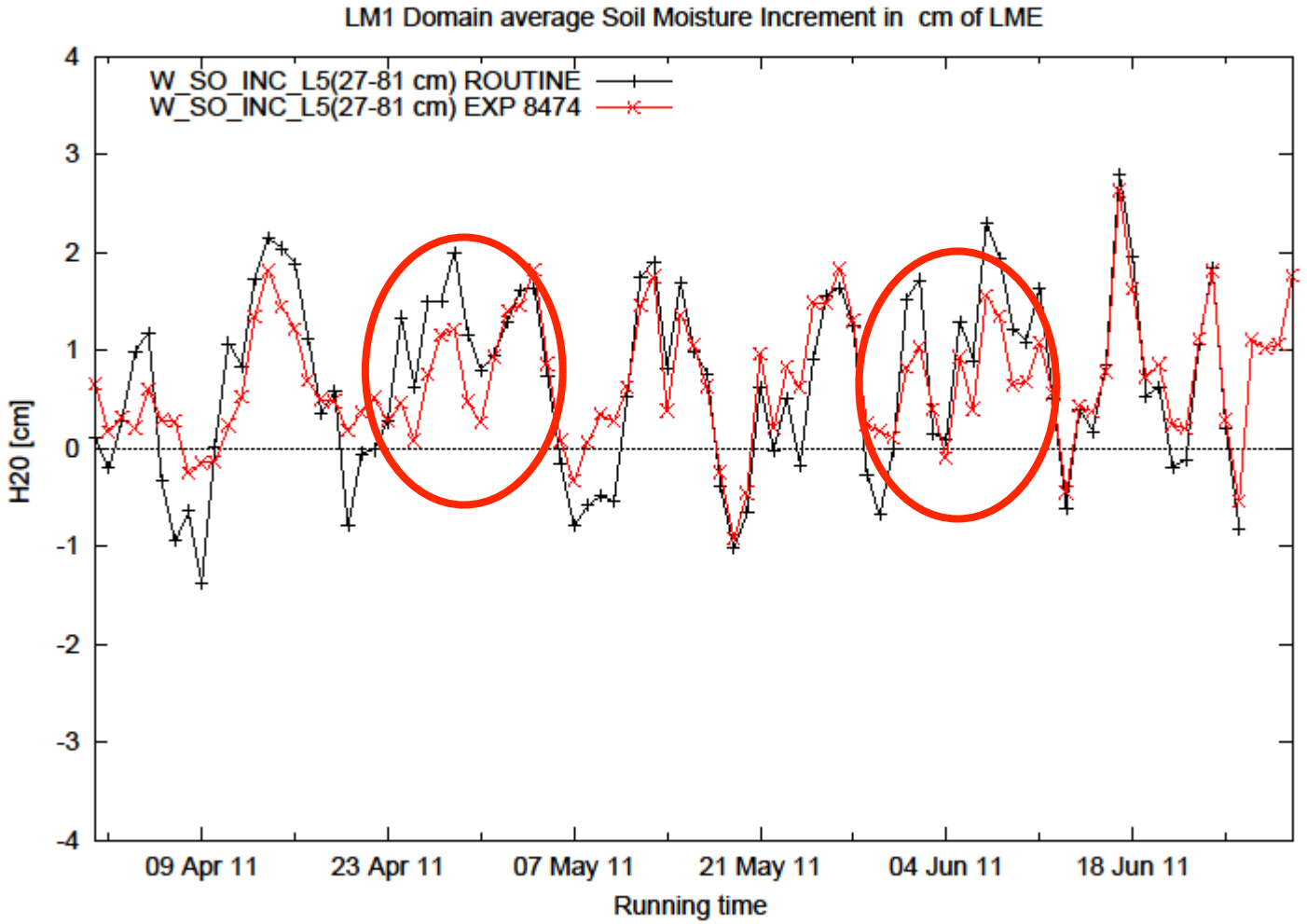
# Monitoring

## SMA increments LM1 domain average top soil



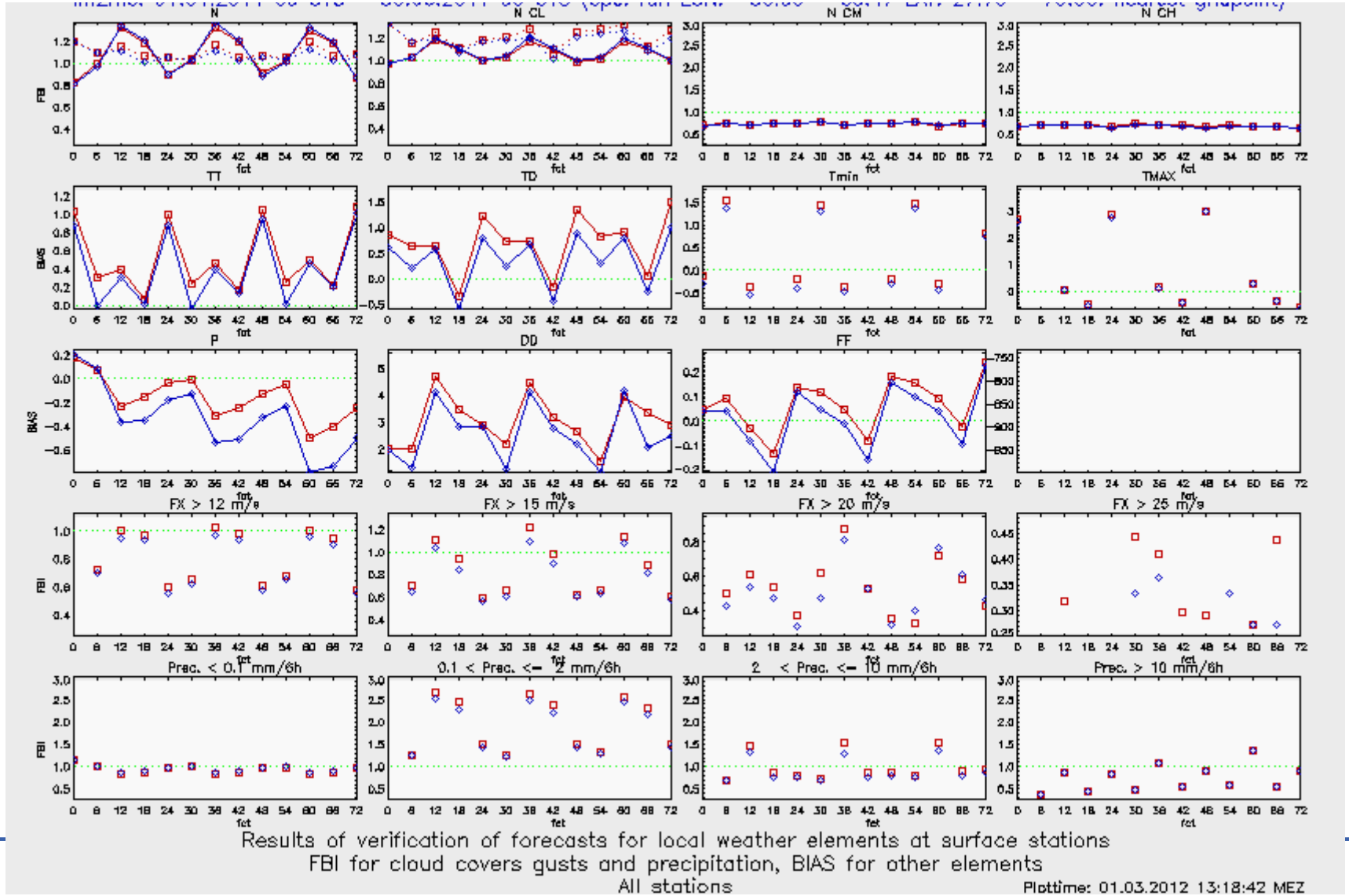
# Monitoring

## SMA increments LM1 domain average bottom soil



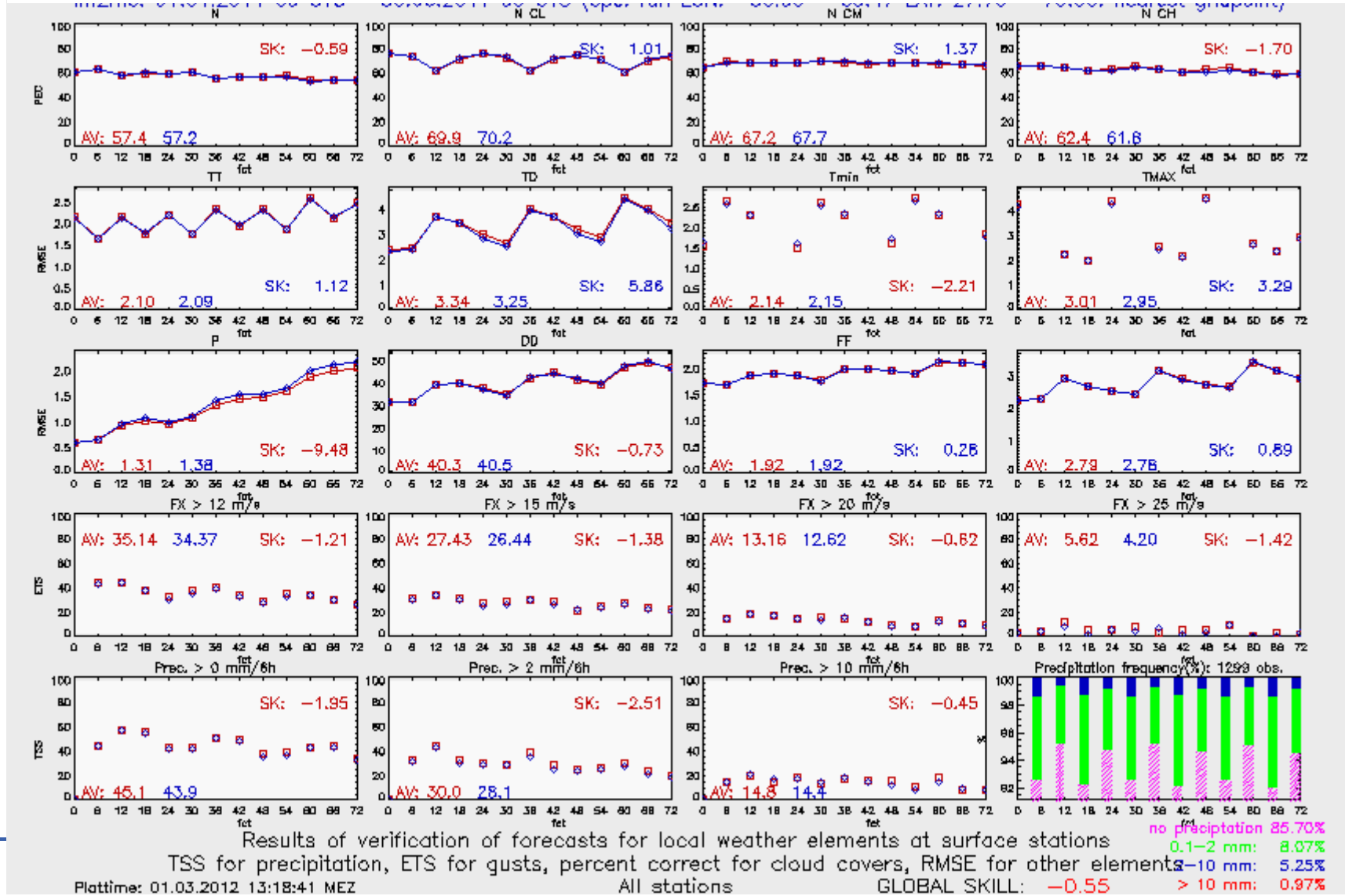
# Verification CEU BIAS

## EXP 8474 ECOCLIMAP+ALBEDO SMA 01.04.2011-30.06.2011 00 UTC



# Verification CEU RMSE

## EXP 8474 ECOCLIMAP+ALBEDO SMA 01.04.2011-30.06.2011 00 UTC



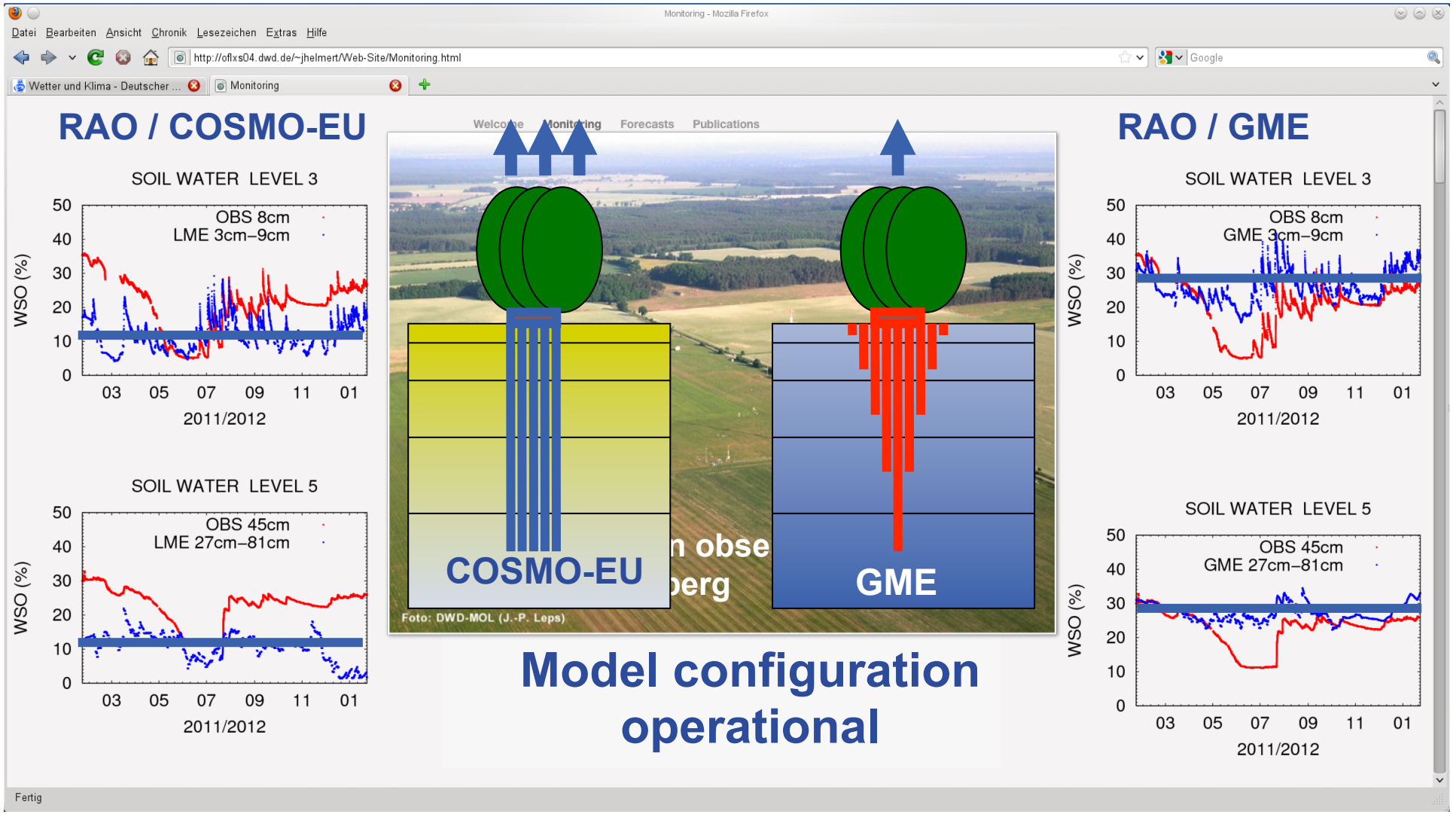
# Regional Verification

**EXP 8474 ECOCLIMAP+ALBEDO SMA 01.04.2011-30.06.2011 00 UTC**

| Region / Global Skill Score | 00 UTC |
|---|---|
| **COSMO-EU domain** | **-0.55** |
| **Germany** | **-0.44** |

**neutral positive**

# Conclusions



# Conclusions

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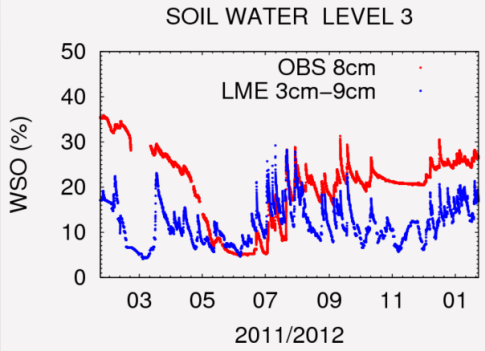
Monitoring - Mozilla Firefox

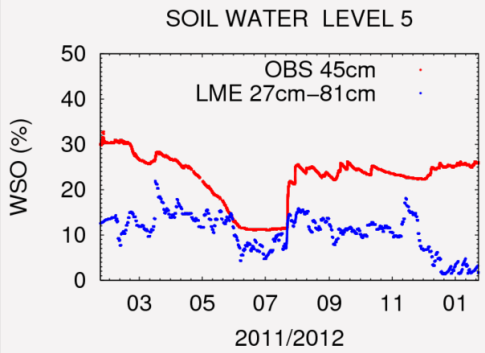
Datei Bearbeiten Ansicht Chronik Lesezeichen Extras Hilfe

http://oflxs04.dwd.de/~jhelmert/Web-Site/Monitoring.html

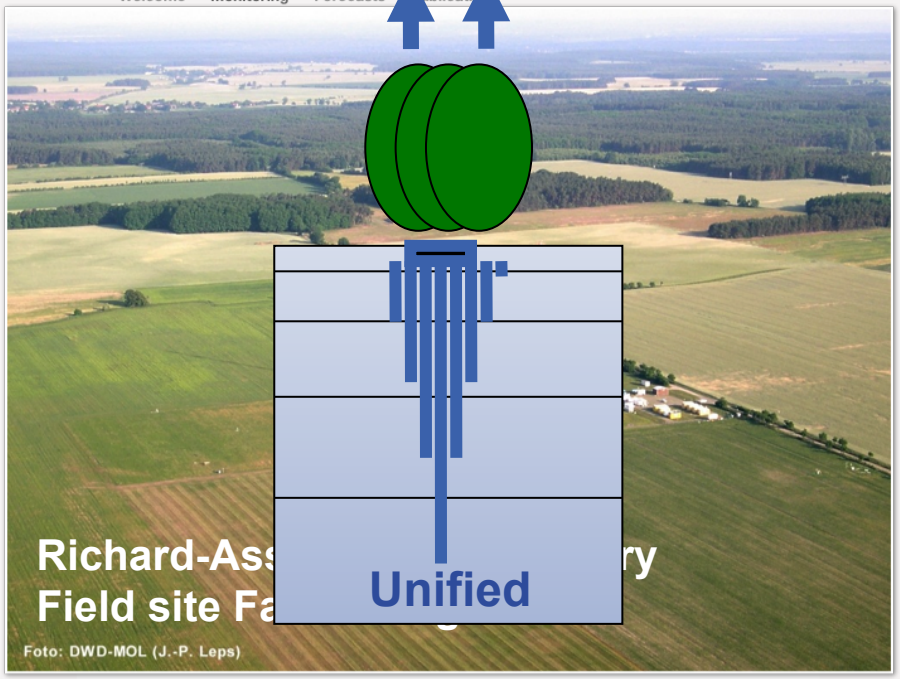
Wetter und Klima - Deutscher ... | Monitoring

## RAO / COSMO-EU

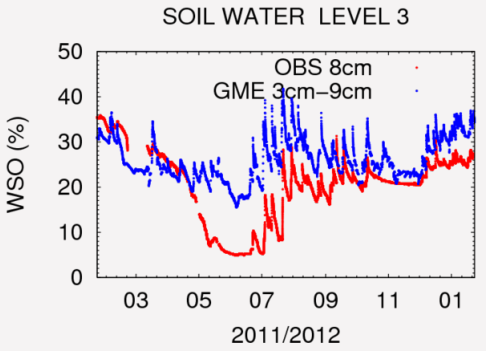


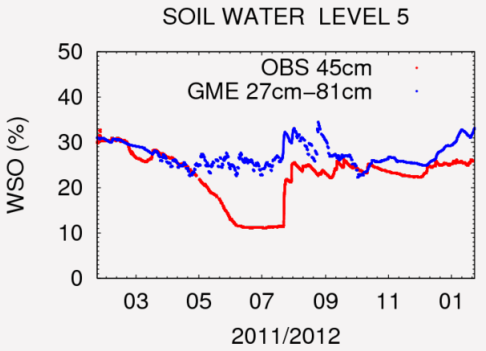




Welcome Monitoring Forecasts Publicati




## RAO / GME




## Model configuration experiment

Fertig

# Conclusions and Outlook

- Unified global and limited area soil physics and external parameters configuration in a soil moisture analysis (SMA) environment

- Impact on screen level variables was found to be weak, but ...

- ... improved representation of soil processes (annual soil water cycle in GME)

- Testbed configuration for the ICON model development

# Thank you

# Monitoring, Validation, Development

Monitoring - Mozilla Firefox

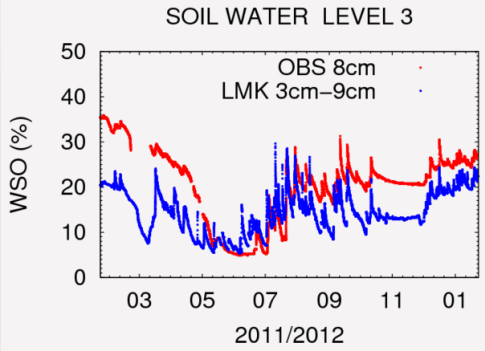
Datei Bearbeiten Ansicht Chronik Lesezeichen Extras Hilfe

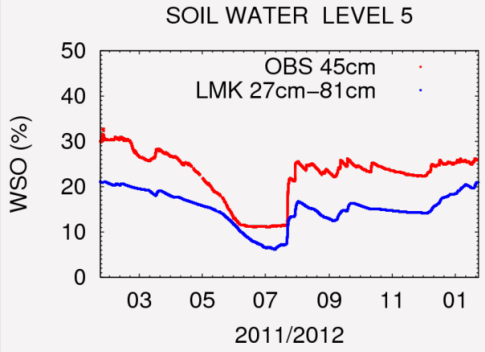
http://oflxs04.dwd.de/~jhelmert/Web-Site/Monitoring.html

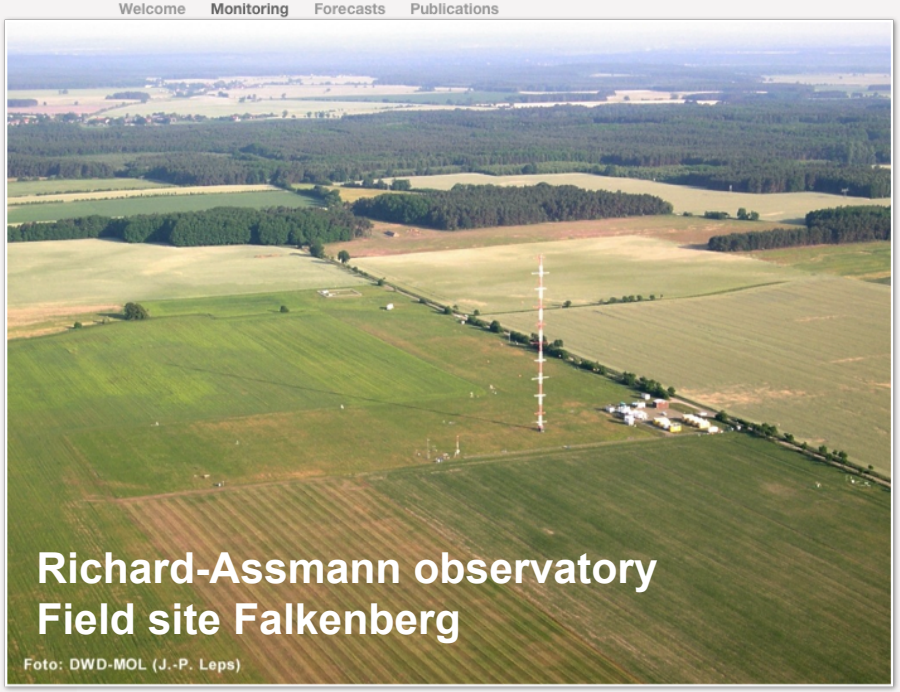
Wetter und Klima - Deutscher ... | Monitoring

Welcome Monitoring Forecasts Publications

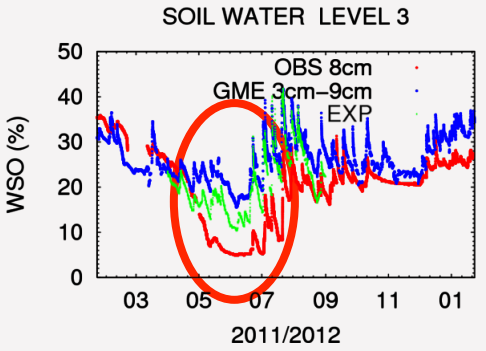
## RAO / COSMO-DE

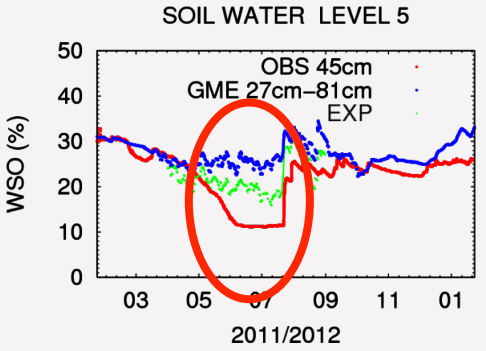



## RAO / GME




## Vegetation and soil moisture

Fertig

**Experiment: Adaption of vegetation parameters**

# Ein globaler Skill-Score (10.03.2005)

$$SKSC = \frac{SCORE(Modell\,2) - SCORE(Modell\,1)}{SCORE(Ideal) - SCORE(Modell\,1)}$$

$$RV = 1 - \frac{RMSE^2_{Modell\ 2}}{RMSE^2_{Modell\ 1}}$$

$$GLSS = \frac{1}{N}\sum_{i=1}^{N} SKSC(i)$$

**Summierung über die Vorhersagezeiträume K und Elemente M N=M*K mit gleichem Gewicht**

$$GGLSS = \frac{1}{\sum_{j=1}^{M} gew_j} \sum_{j=1}^{M} \sum_{i=1}^{K} gew_j SKSC^i_j$$

**Summierung über die Vorhersagezeiträume K und Elemente M mit elementspezifischem Gewicht**

# Mögliche Verteilung von Gewichten (Vorschlag von B. Anger, Modifikation U.Damrath, Dezember 2011)

| Element | Gewicht |
|---|---|
| Gesamtbedeckungsgrad | 1. |
| Windgeschwindigkeit | 2. |
| Windrichtung | 1. |
| Temperatur 2m | 2. |
| Taupunktdifferenz 2m | 2. |
| Bodendruck | 2. |
| Minimumtemperatur 2m | 1. |
| Maximumtemperatur 2m | 1. |
| Niederschlag | 2. (Jede Klasse 2./3.) |
| Bedeckungsgrad tiefe Wolken | 0.35 |
| Bedeckungsgrad mittelhohe Wolken | 0.15 (Geringeres Gewicht wegen Inkosistenz zwischen Modell- und Beobachtungsdefinition) |
| Bedeckungsgrad hohe Wolken | 0 (Kein Gewicht wegen Inkosistenz zwischen Modell- und Beobachtungsdefinition) |
| Böen | 1. (Jede Klasse 0.25) |
| Vektorwind | 0. (Redundanz zu Windrichtung und Windgeschwindigkeit) |

**Wind & Druck: 6**

**Temperaturen: 6**

**Wolken & Niederschlag: 3.5**