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Overview of WG3b activities

Jean-Marie Bettems / MeteoSwiss

COSMO General Meeting
Lugano, September 12th , 2012



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TERRA and external parameters at DWD

J.Helmert / DWD

Developments

parameter / model

aerosol



COSMO

Fixed
(Tanre)

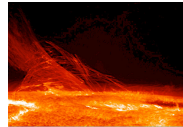
COSMO new

Climatology
(Tegen)

GME

Climatology
(Tegen)

emissivity



Constant

Field
(land use based)

Field
(land use based)

vegetation cycle

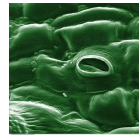


Empirical
function

NDVI
climatology

NDVI
climatology

minimum stomatal resistance



Constant

Field
(ECOCLIMAP)

Field
(ECOCLIMAP)

vegetation albedo

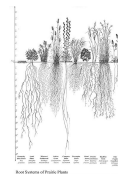


Constant

Field
(forest)

Constant

root profile



Uniform

Exponential

Exponential

minimum turbulent diffusion
tkhmin, tkmmin (m**2/s)

1., 1.

0.1, 0.1

0.4, 1.

History

- Operational implementation in **GME** :
vegetation climatology (2007),
aerosol climatology (2009)
- New **EXTPAR** software for external parameters
Numerical experiments within the **COLOBOC** project (2009-2011)

- Experiments in parallel-suite of **COSMO-EU 29.03.-21.08.2012**
(Reduced minimum diffusion coeff. since 19.06.2012)
- Experiments in parallel-suite of **COSMO-DE 23.04.-21.08.2012**
(Reduced minimum diffusion coeff. since 19.06.2012)

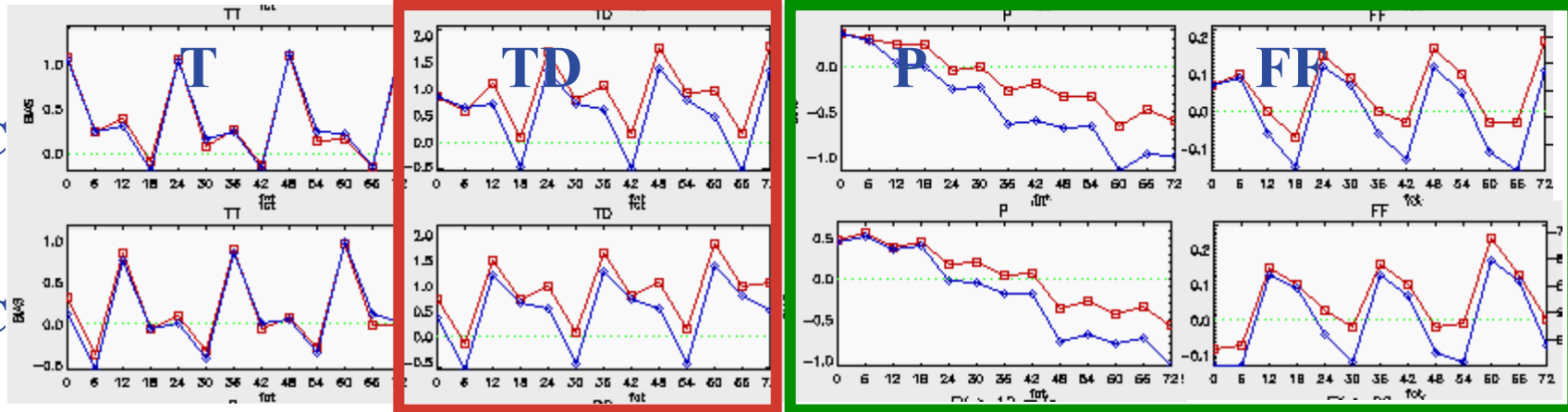
COSMO-EU , 19.07 – 19.08

ROUTI vs. ROUTP

BIAS

00 UTC

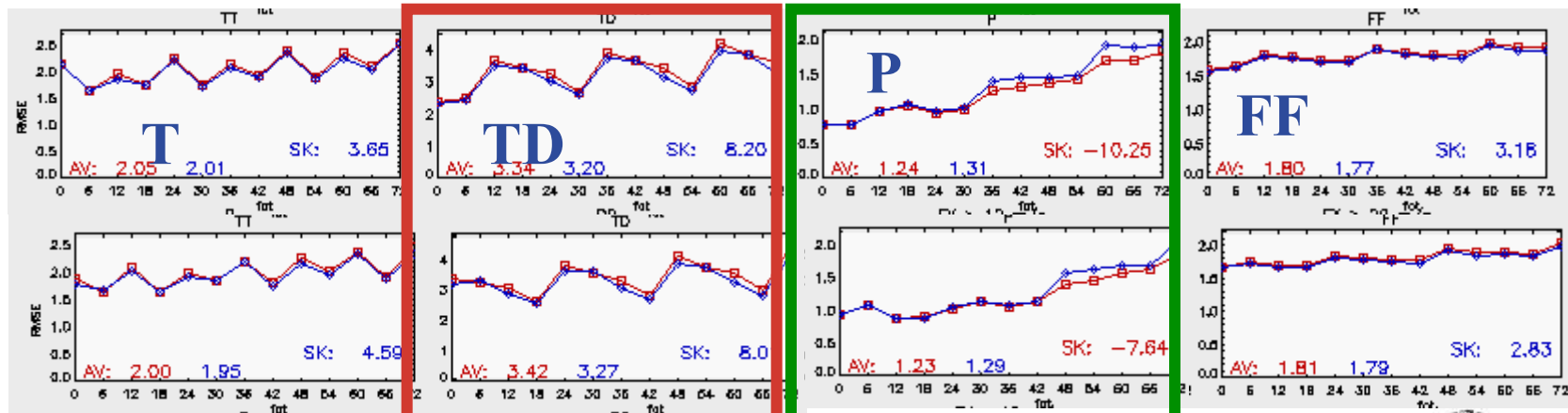
12 UTC



RMSE

00 UTC

12 UTC



Results

- More **realistic** physics package
- **Unified** package between GME and COSMO
- Improves **robustness** of forecasts in severe weather situations
(consistency between successive runs)

- **Degraded** RMSE for T_2M and TD_2M
- **Improved** scores for pressure, mean wind bias and strong gusts

Other aspects

- MODIS based climatology of **surface albedo** (5km grid)
 - Neutral impact in COSMO-EU experiments
- Revision of **rainfall interception** is underway
 - Implemented, performance is being evaluated
- High resolution **soil data** (HWSD), heterogenous soil
 - Currently no resources available
 - Status of work in the CLM community unclear



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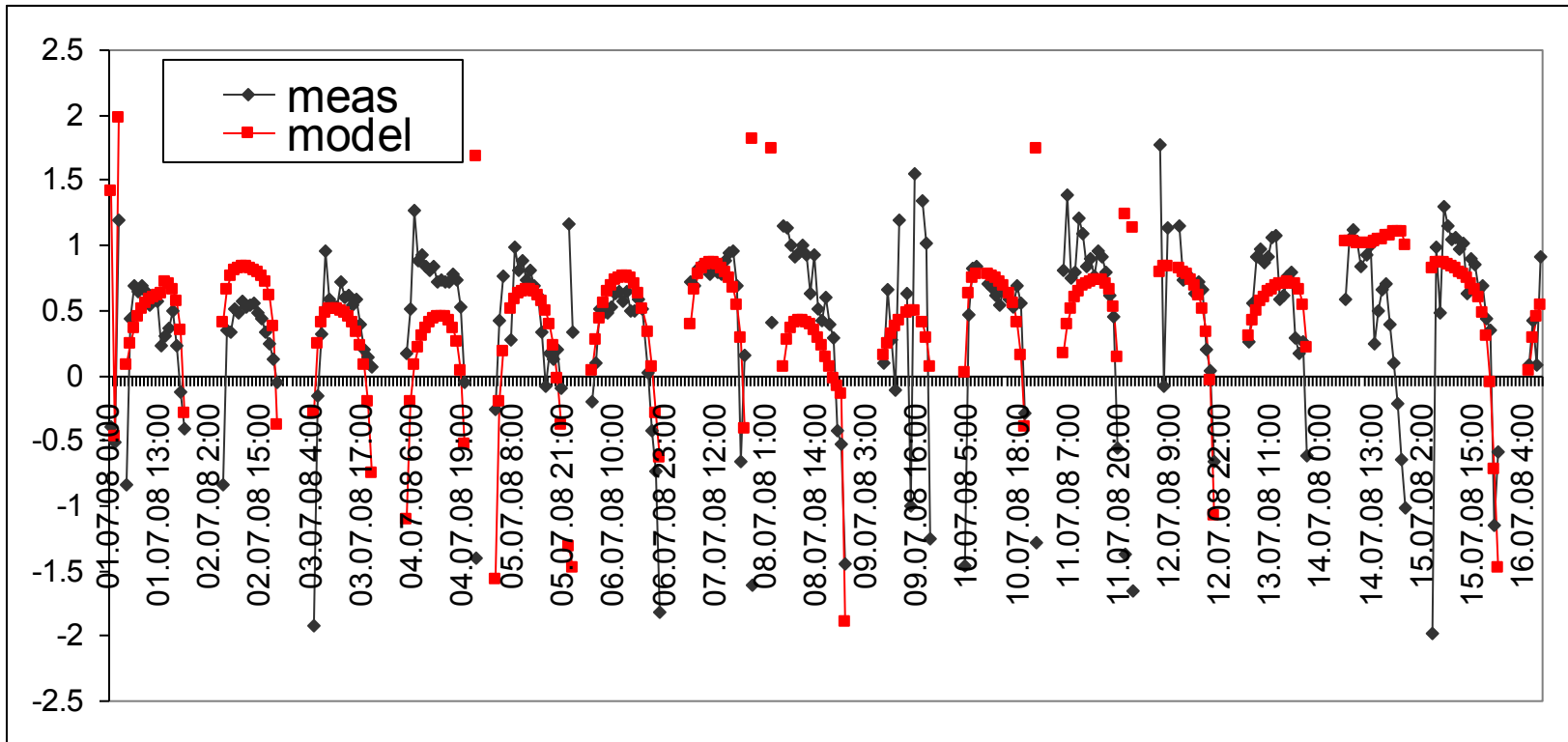
Parameterization of mire in TERRA (COSMO PT)

A.Yurova / RHM

- ✓ Compilation of a **database** of the mire distribution based on satellite vegetation classification (GEM, Bartalev) and national peat surveys (Vompersky et al.)
- ✓ Prescription of **peat thermal properties** in TERRA with dependencies of thermal conductivity on soil water content using the organic soil thermal conductivity database
- ✓ Formulation of a **shallow water table** and modified **evapotranspiration**

- More advanced parameterization is **needed** for the vertical structure of **hydraulic conductivity and diffusivity**
- **Dynamic ground water table** available has a consequence of this PT

Results: Bowen ratio Degero Stormyr mire, July 2008, SCLM simulations





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Consistent treatment of root parameterization

G.Vogel / DWD

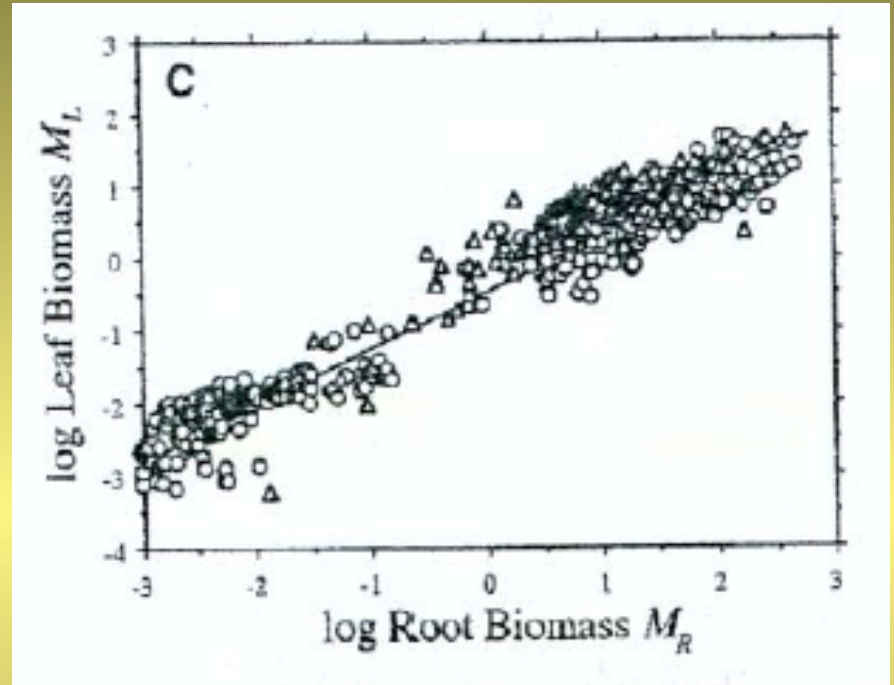
Root parameterization

Science 22 (2002), Vol. 295 no. 5559 pp. 1517-1520

Global Allocation Rules for Patterns of Biomass Partitioning in Seed Plants

Brian J. Enquist^{1,2*} and Karl J. Niklas³

A general allometric model has been derived to predict intraspecific and interspecific scaling relationships among seed plant leaf, stem, and root biomass. Analysis of a large compendium of standing organ biomass sampled across a broad sampling of taxa inhabiting diverse ecological habitats supports the relations predicted by the model and defines the boundary conditions for above- and below-ground biomass partitioning. These canonical biomass relations are insensitive to phyletic affiliation (conifers versus angiosperms) and variation in averaged local environmental conditions. The model thus identifies and defines the limits that have guided the diversification of seed plant biomass allocation strategies.

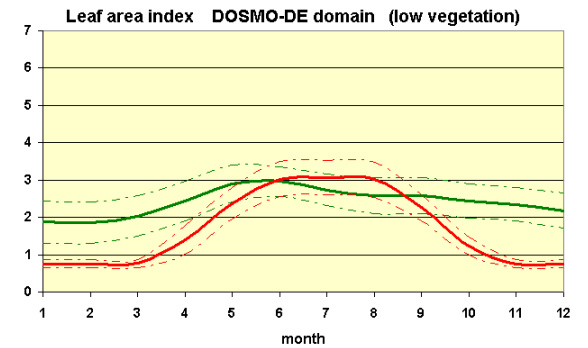
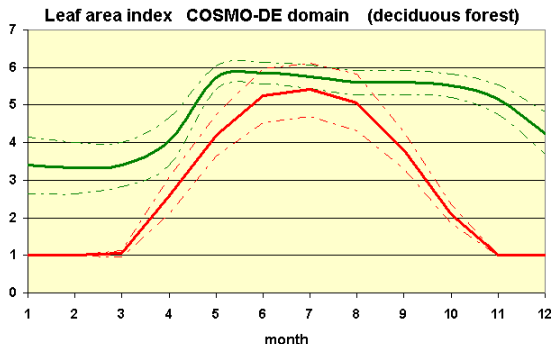
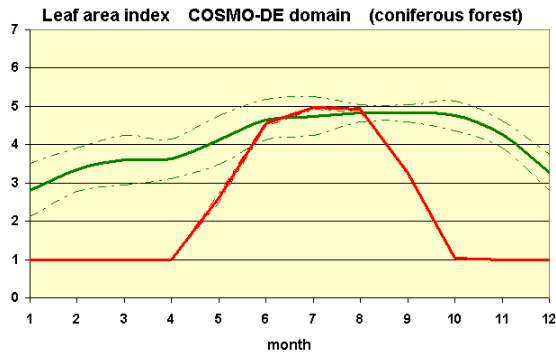


$$M_R \propto M_L^{4/3}$$

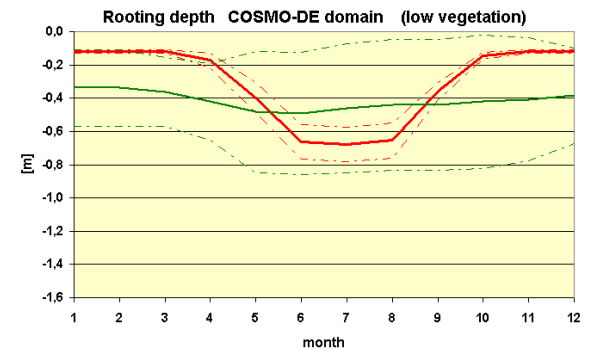
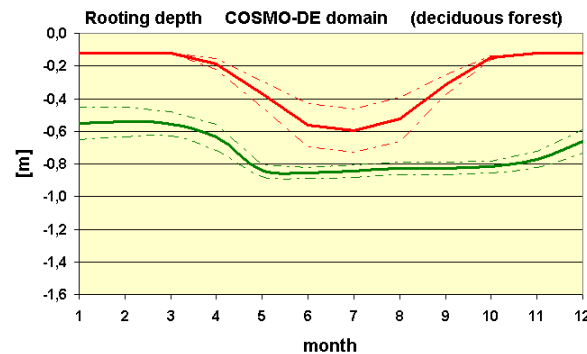
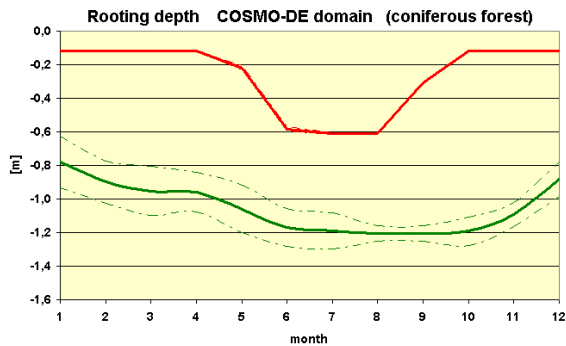


Root parameterization

Leaf area index



Root depth



- Current parametrization
- Arora and Boer (2003)



Root parameterization

- Based on an approach by Arora and Boer (2003) the **annual cycle of the rooting depth** is made consistent to LAI and plant cover by scaling the total root biomass with the ndvi-ratio.
- The current **transpiration scheme** of the TERRA module will be adapted to the new root parameterization.





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Snow and tiles

E.Machulskaya / DWD

Snow fraction

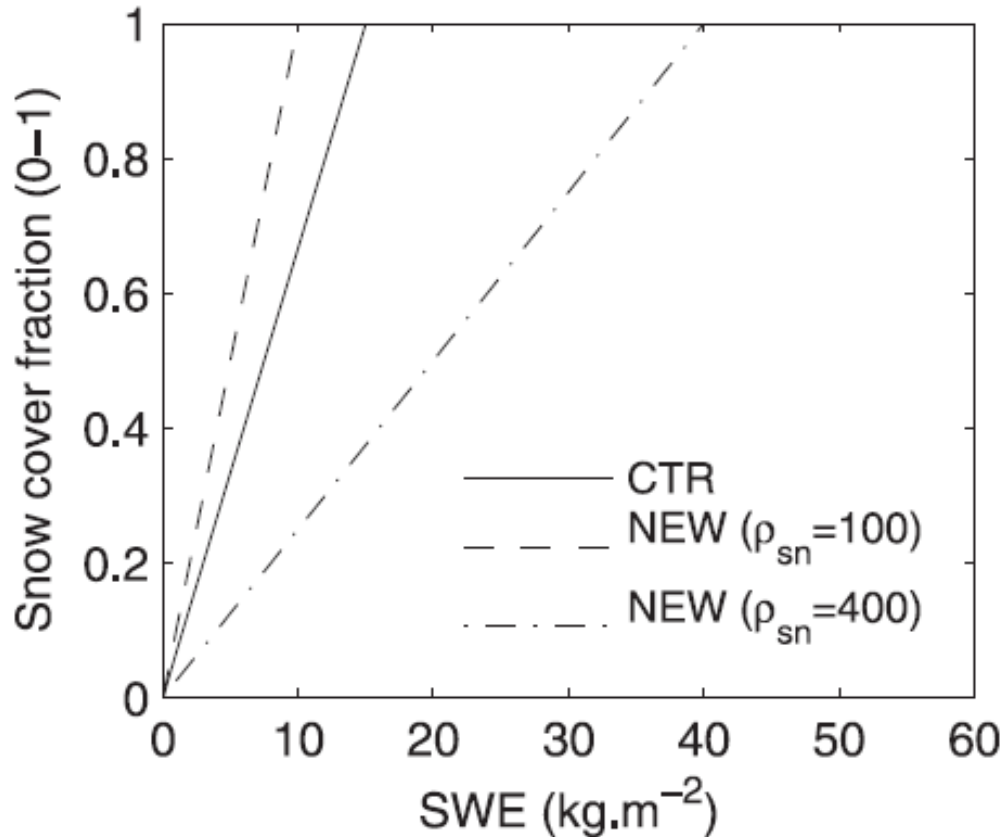


FIG. 2. Snow cover fraction as function of SWE as in the original HTESSEL snow scheme [solid line, Eq. (A2)], and new [Eq. (8)] for snow densities of 100 (dashed line) and 400 (dashed dotted line) kg m⁻³.

Dutra et al. (2010)

$$f_{sn} = \text{MIN}\left(\frac{W_{sn}}{W_{cr}}, 1\right)$$

$$W_{cr} = 15\text{mm}$$

$$f_{sn} = \text{MIN}\left(\frac{W_{sn} / \rho_{sn}}{0.1}, 1\right)$$

$$f_{sn} = \text{MIN}\left(\frac{H_{sn}}{H_{cr}}, 1\right)$$

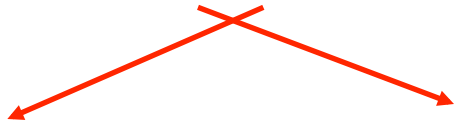
$$H_{cr} = 0.1\text{m}$$



Distribution of the solar radiation

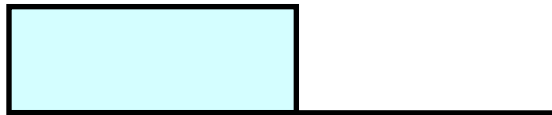
$$\text{Albedo : } a = fa_{\text{snow}} + (1-f)a_{\text{soil}}$$

$$R_{\text{sol}} = I(1-a)$$



$$R_{\text{sol}}$$

$$R_{\text{sol}}$$



f

$1-f$

$$R_{\text{sol}} = I(1-a)$$



$$R_{\text{sol-snow}} = I(1-a_{\text{snow}})$$

$$R_{\text{sol}}(1-a_{\text{snow}})/(1-a)$$

$$R_{\text{sol-soil}} = I(1-a_{\text{soil}})$$

$$R_{\text{sol}}(1-a_{\text{soil}})/(1-a)$$



f

$1-f$

- The dependence of **snow fraction** on snow height looks physically based; verification scores for COSMO-EU are positive; the new formulation is recommended.
- Experiments with **multi-layer snow model** are being performed, the results look satisfactory.
- **Tile approach** for snow is implemented into COSMO, the results of the experiments are being analysed. Full implementation is currently done for ICON.
- New **partitioning of the incoming solar radiation** between snow-covered and snow-free parts can be introduced; verification scores are neutral as compared to the routine.



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Other developments in the COSMO community



Developments at MeteoSwiss

- A master student will work at MeteoSwiss for **5 months**, starting next week
 - The primary goal is to integrate the highly resolved topographic data **ASTER** (dx=30m) in the **EXTPAR** software
 - Depending on the remaining resources, more aspects of the external parameters could be tackled: parameters for **topo corrected radiation**, **scale separation** z_0 / SSO
- Testing of a MODIS calibrated **phenology model** to better represent the inter-annual variability of the start of the vegetation season (R.Stöckli)



Developments at RHM

- **1d model** driven by SYNOP data for calculating snow water equivalent and **snow density** profiles
- Additional **plant level** (forest canopy) included in TERRA to **improve T2m skill in presence of partial snow cover**



Developments at IMGW

- Collaboration with the Institute of Agrophysics Polish Academy of Science to **replace TERRA with a completely new module**
 - Project planned for the period **08.2012 – 2015**
 - About **15** people involved



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Overview of ongoing land model developments within the CLM-Community

Synthesis collected by E. Davin
Sept. 2012



SOILVEG – TERRA

Person/institution in charge	Description of development	Version	Status
B. Ahrens (Uni Frankfurt)	New numerics for the Richards equation (necessary for multiple soil horizons and moving water tables)	Already implemented in TERRA stand-alone; will be tested in COSMO-CLM	Implementation in TERRA stand-alone in its final testing phase; implementation in COSMO-CLM in 2012
B. Ahrens (Uni Frankfurt)	Carbon cycle	Will be implemented first in TERRA stand-alone	to be finished June 2012 (stand-alone version)
B. Ahrens (Uni Frankfurt)	Dynamic vegetation	Will be implemented first in TERRA stand-alone	To be started in 2012
S. Schubert (PIK)	Urban scheme BEP (Martilli et al. 2002)	?	?
K. Trusilova (DWD)	Urban scheme TEB (Masson 2001)	COSMO-CLM v?	End 2012
H. Wouters (KU Leuven)	Urban parameterization into TERRA_ML (this includes thermal roughness lengths parametrization with the help of new stability functions momentum and heat. Albedo, emissivity and momentum roughness length will be derived from satellite data to represent urban surfaces)	TERRA stand-alone 4.11	Early 2013
J. Volkholz (PIK)	River routing model	?	?



SOILVEG – Community Land Model

Person/institution in charge	Description of development	Version	Status
E. Davin (ETHZ)	Community Land Model coupled to COSMO-CLM as subroutine	COSMO4.8-CLM11 CLM3.5	Implemented and evaluated
E. Davin (ETHZ)	Community Land Model coupled to COSMO-CLM using OASIS3 coupler	COSMO4.8-CLM19 CLM3.5/CLM4	Implemented and in testing phase, evaluated version end 2012



SOILVEG – VEG3D

Person/institution in charge	Description of development	Version	Status
G. Schaedler (KIT)	VEG3D coupled to COSMO-CLM as subroutine	COSMO4.8-CLM7	Implemented and under testing
G. Schaedler (KIT)	VEG3D coupled to COSMO-CLM with OASIS coupler	?	Planned



SOILVEG REQUEST

- Any **interest by the COSMO community** for some of these developments should be announced soon enough to plan the transfer of responsibility
- In this case a **focal point** should be nominated **within COSMO**, and this person should closely follow the concerned SOILVEG development



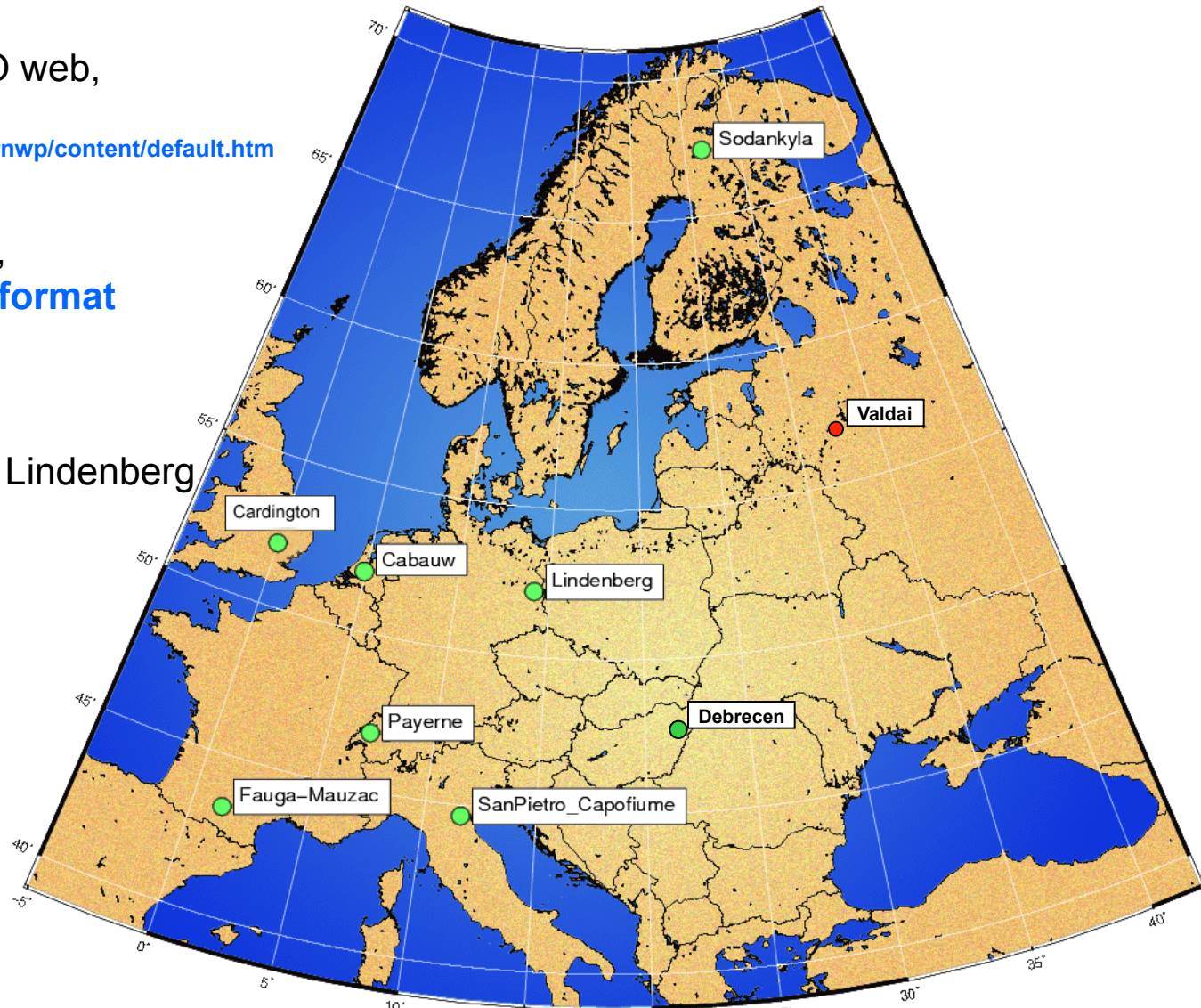
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SRNWP data pool



Data pool action

- Access from COSMO web, password protected
<http://www.cosmo-model.org/srnwp/content/default.htm>
- Currently **8 sites**, data from **2006-2011**, in a **common ASCII format**
- **Soil, surface** and **BL** observations
- Work done at DWD / Lindenberg (C.Heret)





Data pool action

Status

- Data available from start of the action to end 2011 for **Payerne** (CH), **Capofiume** (IT), **Fauga-Mauzac** (FR), **Lindenberg** (DE)
- Waiting for 2011 data from **Debrecen** (HU), **Cabauw** (NL)
- Waiting for error correction of 2011 data from **Sodankyla** (FI)
- Sever quality issues with **Cardington** data (GB)

- Agreement for one new site **Valdai** (RU)

- **Use these data and send us feedback**
(srnwp_data_pool@cosmo-model.org) !
- **Lobbying at the next EWGLAM meeting**
(data quality, importance of this action) !



Thank you for your attention!