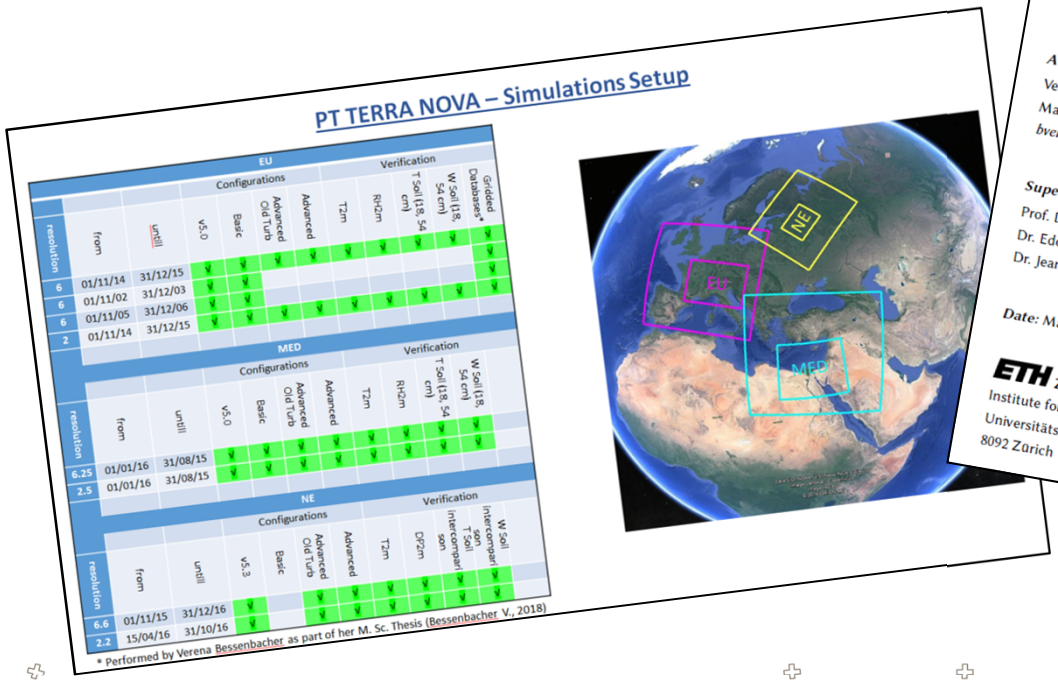
Overview of the COSMO surface activities

COSMO surface team (WG3b)
J.M. Bettems et al.

PT TERRA Nova, 09.2016 – 02.2019

Y. Ziv / IMS (PTL), V. Bessenbecher / ETHZ

- Compare different **recent** versions and configurations of **TERRA**, on different target domains
- Compare COSMO-TERRA with COSMO-CLM (Community Land Model), MSc ETHZ




IAC Institute for Atmospheric and Climate Science

Master Thesis

Comparison of COSMO-TERRA and COSMO-CLM² in weather mode for summer heat extremes

Author:
Verena Bessenbacher
Master Programme Atmospheric and Climate Sciences (D-ERDW)
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Supervisors:
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Dr. Edouard Léopold Davin, Land-Climate Dynamics, IAC, ETH *edouard.davin@env.ethz.ch*
Dr. Jean-Marie Bettems, APND, MeteoSwiss, *jean-marie.bettems@meteoswiss.ch*

Date: May 31, 2018

ETH Zürich
Institute for Atmospheric and Climate Sciences
Universitätsstrasse 16
8092 Zürich

PT TERRA Nova, 09.2016 – 02.2019

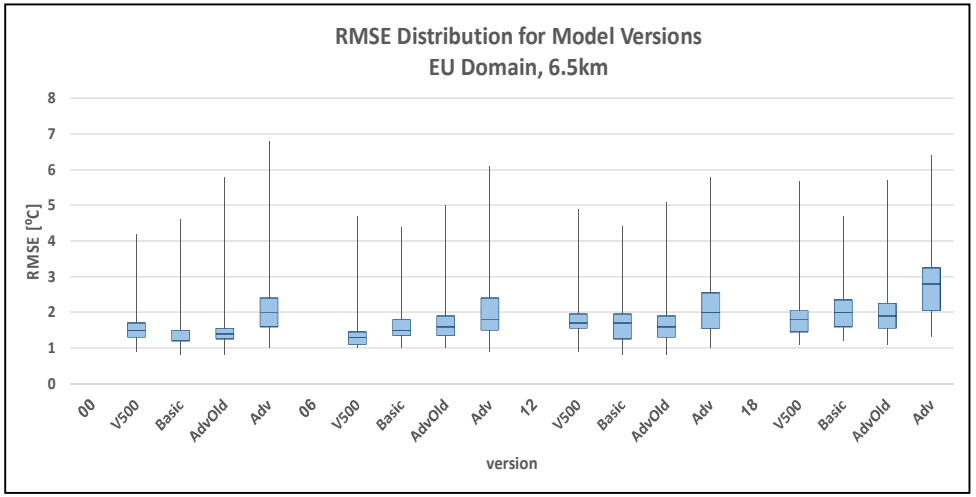
Y. Ziv / IMS (PTL), V. Bessenbecher / ETHZ

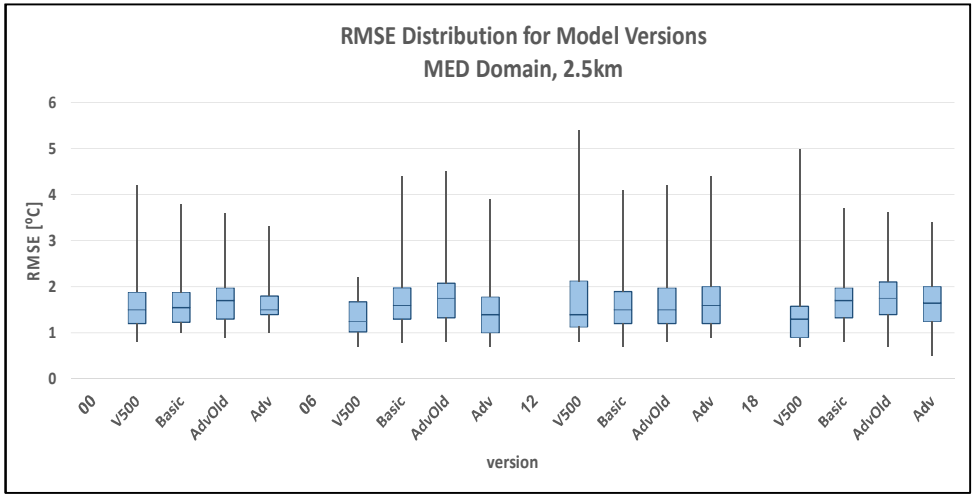
- Project is finished
- **Final report** available on COSMO web site

- Tested configurations
  - **2 models** (COSMO-TERRA, COSMO-CLM)
  - **3 domains** (Central Eu, Eastern Med, North-Western Ru)
  - **4 configurations** (v5.0, v5.05 conservative / advance & old turb / advanced & new turb)
- Used resources
  - 7 COSMO contributors + 3 colleagues from ETH Zurich (COSMO-CLM2 community)
  - **IMS, RHM, MCH, DWD, ETHZ**
  - 24 years of weather simulation

PT TERRA Nova, 09.2016 – 02.2019

Verification – 2m temperature RMSE for 3 domains and 4 time of days

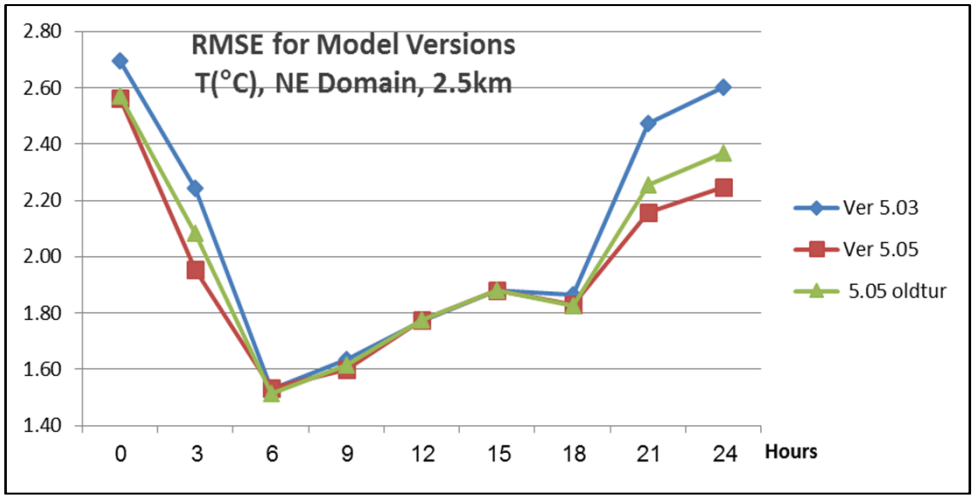




2m Temperature RMSE in 3 domains:

EU 6km (top-left), MED 2.5km (top-right), NE 2.2km (bottom-right).

In EU domain Advanced configuration performs the worst, while in MED domain Advanced configuration is somewhat better. In NE domain Advanced configuration has the lowest RMSE.



PT TERRA Nova, 09.2016 – 02.2019

Y. Ziv / IMS (PTL), V. Bessenbecher / ETHZ

Main **findings**

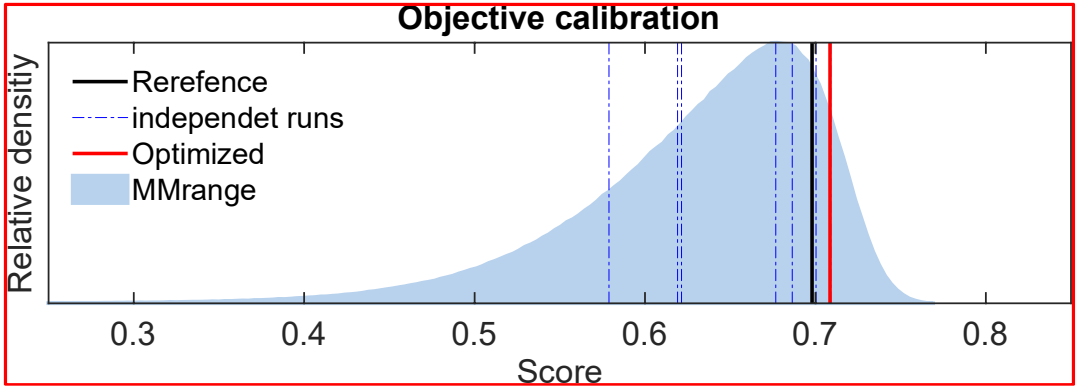
- **All** TERRA configurations exhibit similar performances,
  but ***detailed*** **performances depend on target areas**
- **All** v5.05 TERRA configurations perform reasonably
  (in particular no significant soil drying in advanced v5.05 …)
- Decreased performance of TERRA fluxes with increased **vegetation** density
- Superior **CLM fluxes** do **not** translate into improved near surface temperature
  (model tuning targets TERRA, compensation of old aerosol climatology errors
  only in TERRA)

PP CALMO-MAX, 06.2017 – 09.2020

A. Voudouri / HNMS (PPL)

CALMO methodology is recognized as a relevant approach

- *Two published papers in refereed papers and two more submitted (Atm. Research)*
- ***Call for contribution** to a special 'Atmosphere' issue "Evaluation and Optimization of Atmospheric Numerical Models"*
- *Similar research by Duan, Q. et al. 2017., BAMS*
- *Used at ETHZ for climate run calibration (**new proposal in preparation**)*
- *Is being applied at B-TU (**calibration of COSMO with new dycore**, A.Will)*



PP CALMO-MAX, 06.2017 – 09.2020

A. Voudouri / HNMS (PPL)

A **one year extension** has been granted, **09.2019-09.2020**.

PP team is working hard to provide the following **deliverables** :

- Clear demonstration of benefit measured by standard verification scores *(COSMO-1 or another COSMO configuration)*
- Optimization of the method *(MM fitting strategy, parameter space partition, coarser resolution, smaller domain…)*
- Standard procedure on model parameter documentation put in place *(in particular for ICON-LAM)*
- Comprehensive and clear user manual *(in particular about the Meta-Model)*
- Draft future activities after PP ends *(support users in calibration activities)*

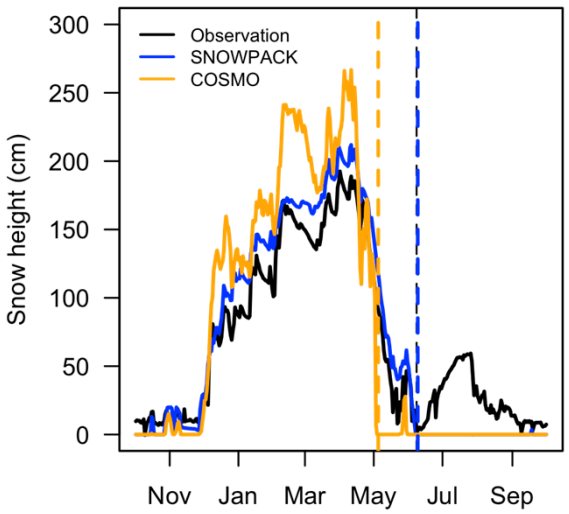
PT SAINT

A multi-layer snow cover scheme for numerical weather and climate models Sascha Bellaire[1], Michael Lehning[1,2] & Jean-Marie Bettems[3]

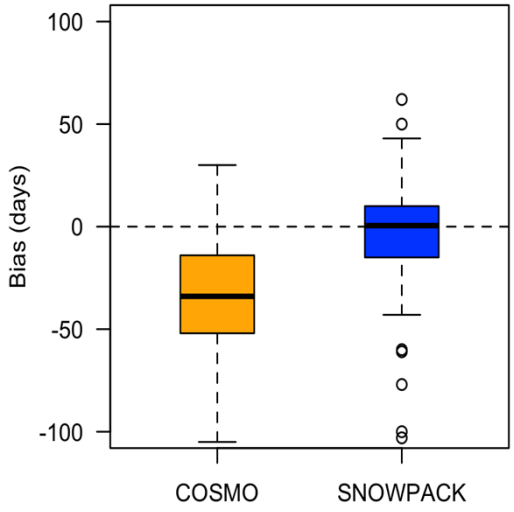
- PT SAINT: Joined project of MeteoSwiss and SLF
- Start: July 2017 ; **Ends June 2020; Possible extension to December 2021**
- Goal: New 'operational' multi-layer snow cover scheme for NWP models COSMO and ICON.
- **'Limited' SNOWPACK version:**
  - Max. 10 Layers
  - 'Heat conduction'
  - Phase changes (SNOWPACK)
  - Water transport (SNOWPACK)
  - Settling/Compaction
  - …

- Promising initial results in terms of snow cover evolution and properties.
- Comparable to SNOWPACK.
- Intensive validation pending, but …
- … so far it is numerically stable even on larger domains, i.e. varying snow cover

Weissfluhjoch



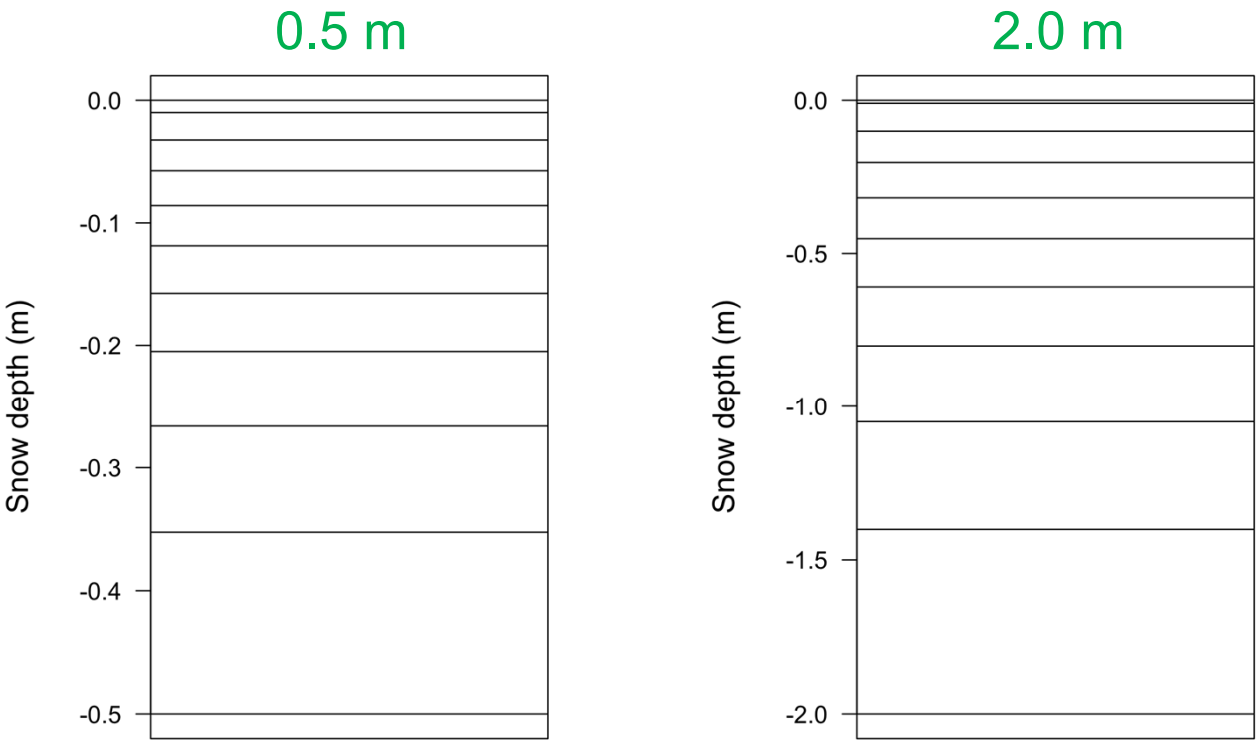
IMIS



PT SAINT

A multi-layer snow cover scheme for numerical weather and climate models Sascha Bellaire[1], Michael Lehning[1,2] & Jean-Marie Bettems[3]

The Scheme: Multi-layer snow cover scheme (MLS; Layering)



General Structure:

- **Maximum 10 (default) snow layers.**
- **Fixed first layer thickness 0.01 m.**
- **Logarithmic increase of layer thickness with depth.**

Limitations:

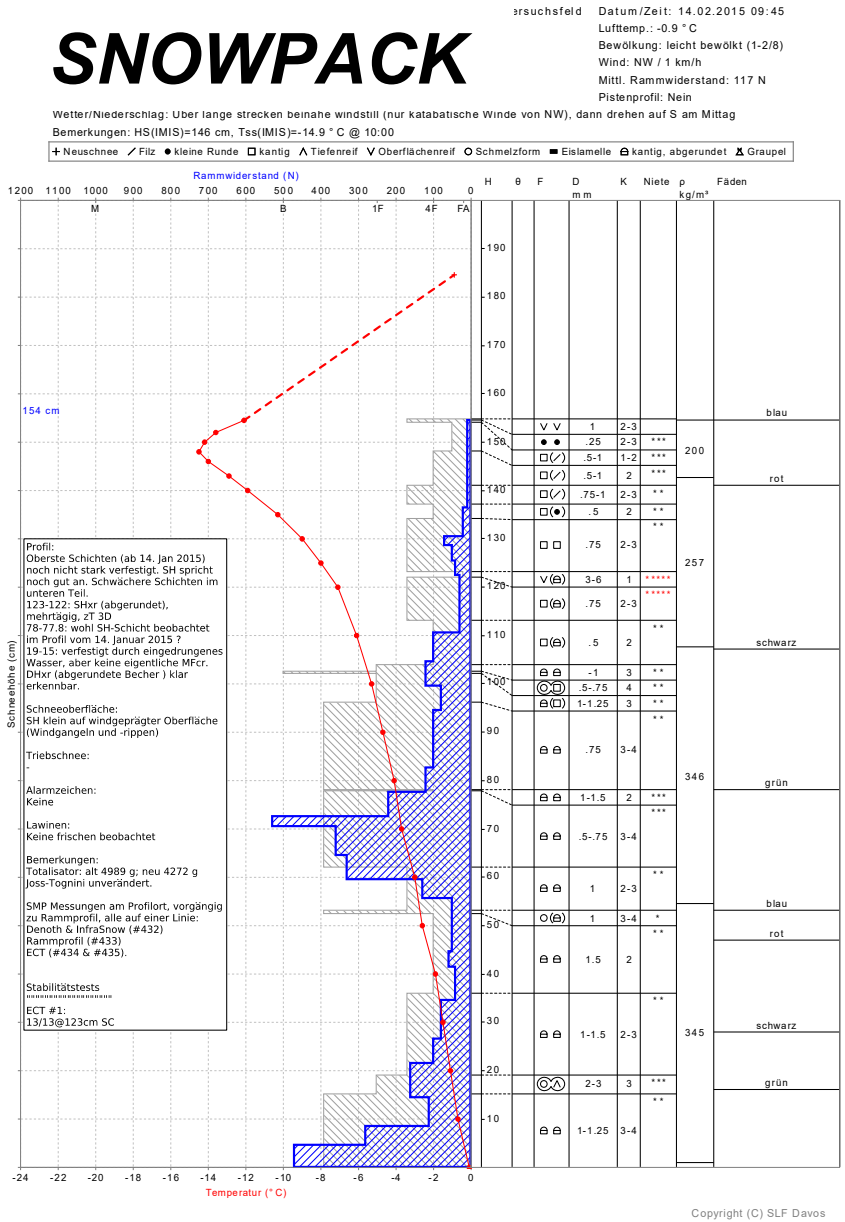
- **No layer smaller than 0.01 m after re-meshing.**
- **Special treatment for snow depth < 0.05 m, i.e. single layer snow cover scheme.**

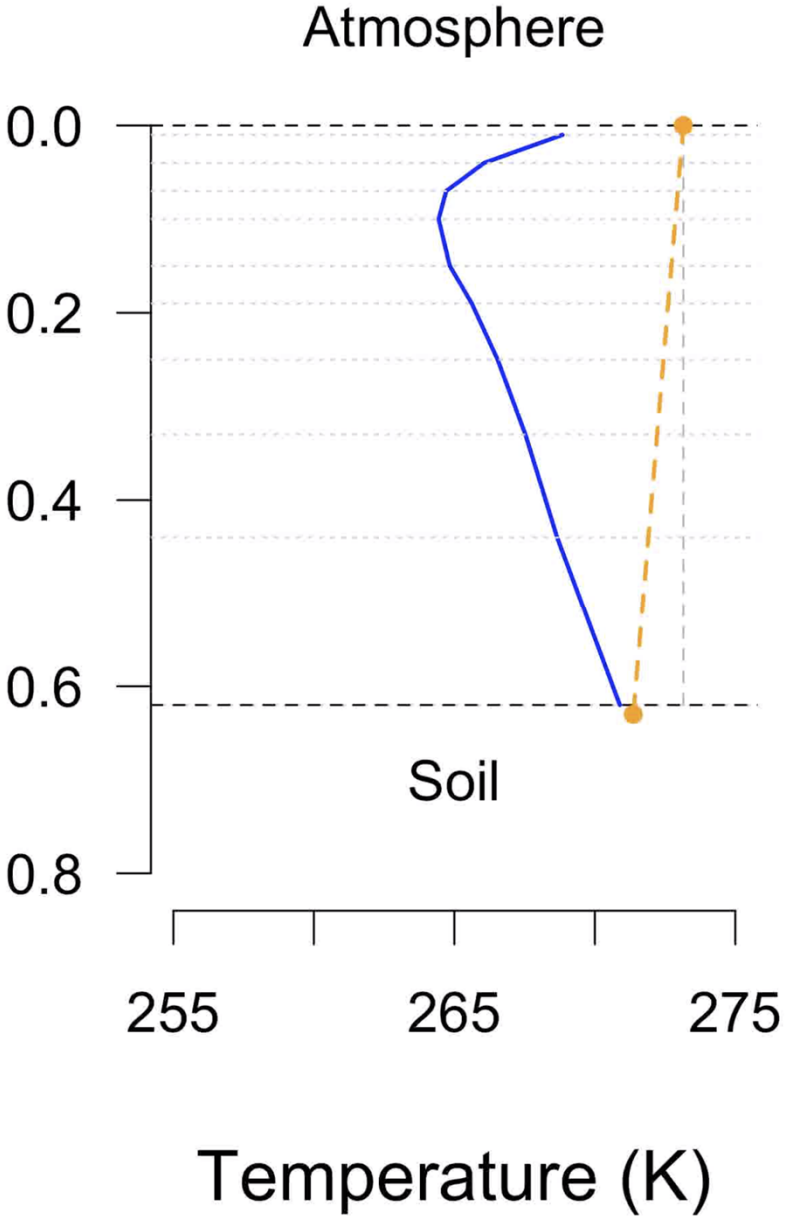
PT SAINT

A multi-layer snow cover scheme for numerical weather and climate models

Sascha Bellaire[1], Michael Lehning[1,2] & Jean-Marie Bettems[3]

SNOWPACK

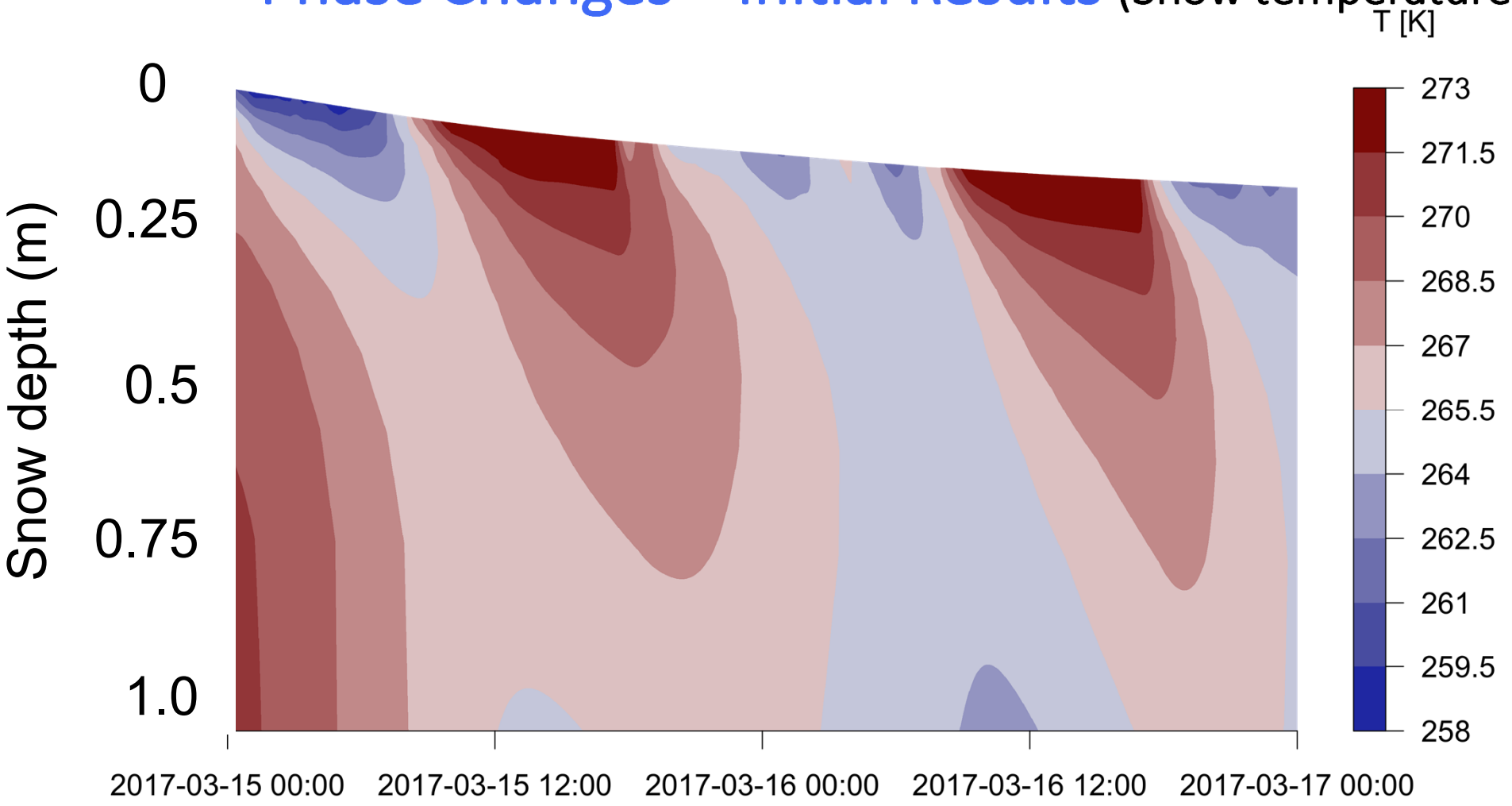




PT SAINT

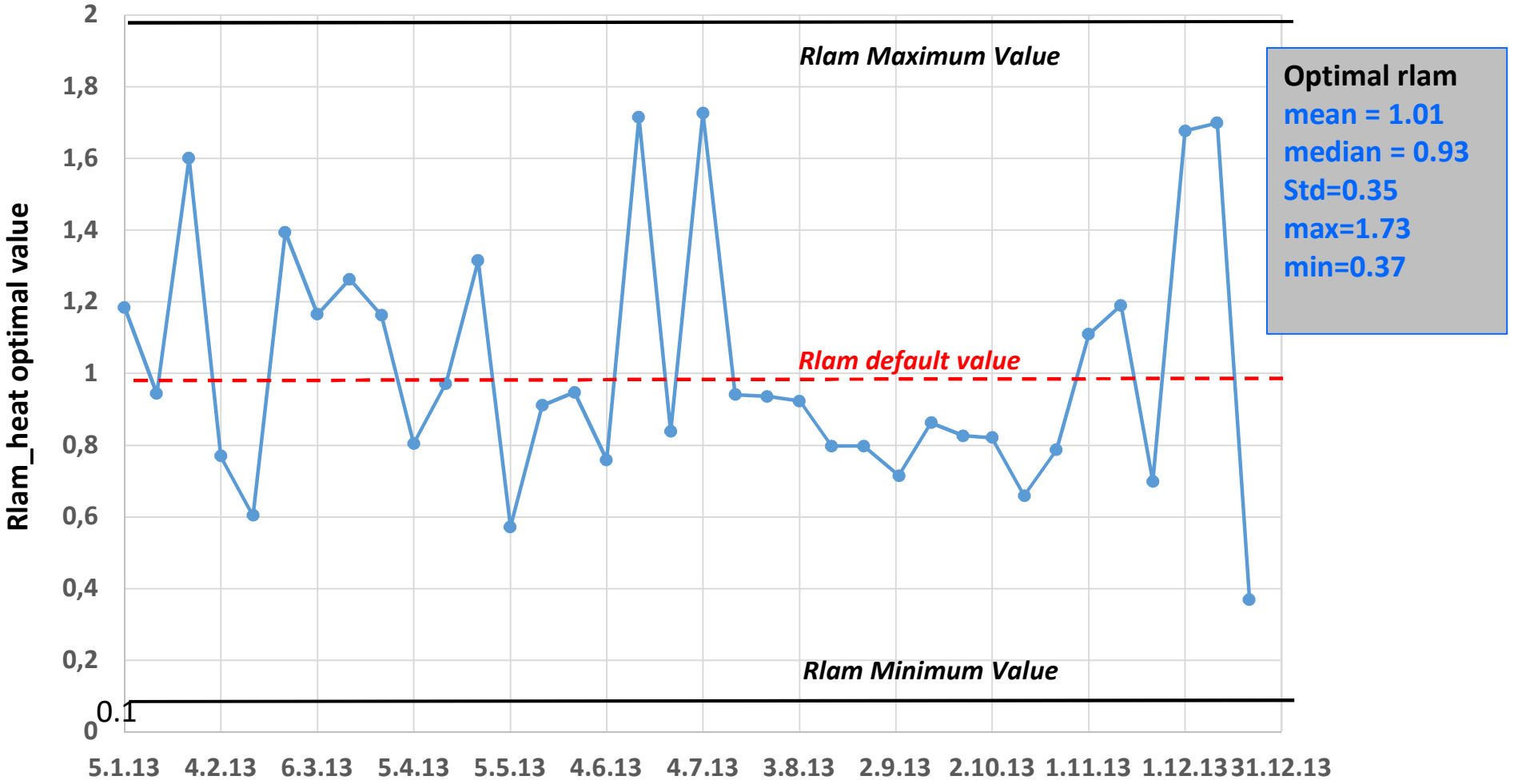
A multi-layer snow cover scheme for numerical weather and climate models Sascha Bellaire[1], Michael Lehning[1,2] & Jean-Marie Bettems[3]

Phase Changes – Initial Results (Snow temperature)



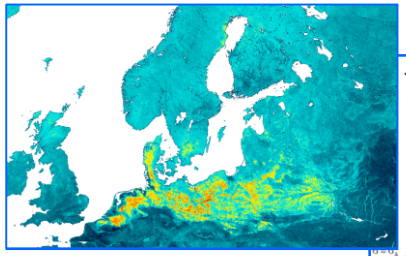
PP CALMO-MAX

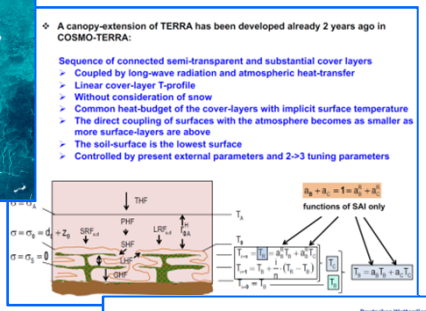
***Optimal rlam_heat** for COSMO-1, one year hindcast, 10 days optimal*

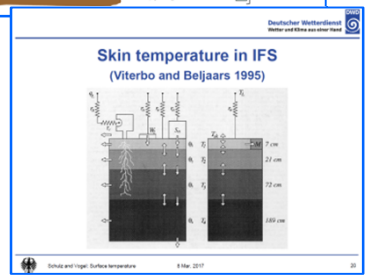


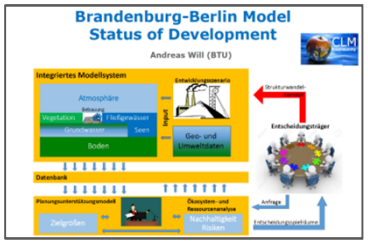
rlam_heat : scaling factor for the thickness of the laminar boundary layer for heat

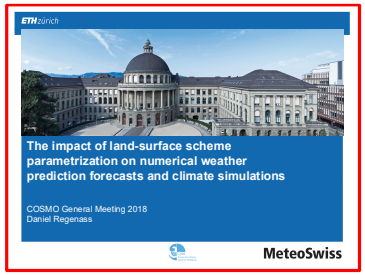
More TERRA activities







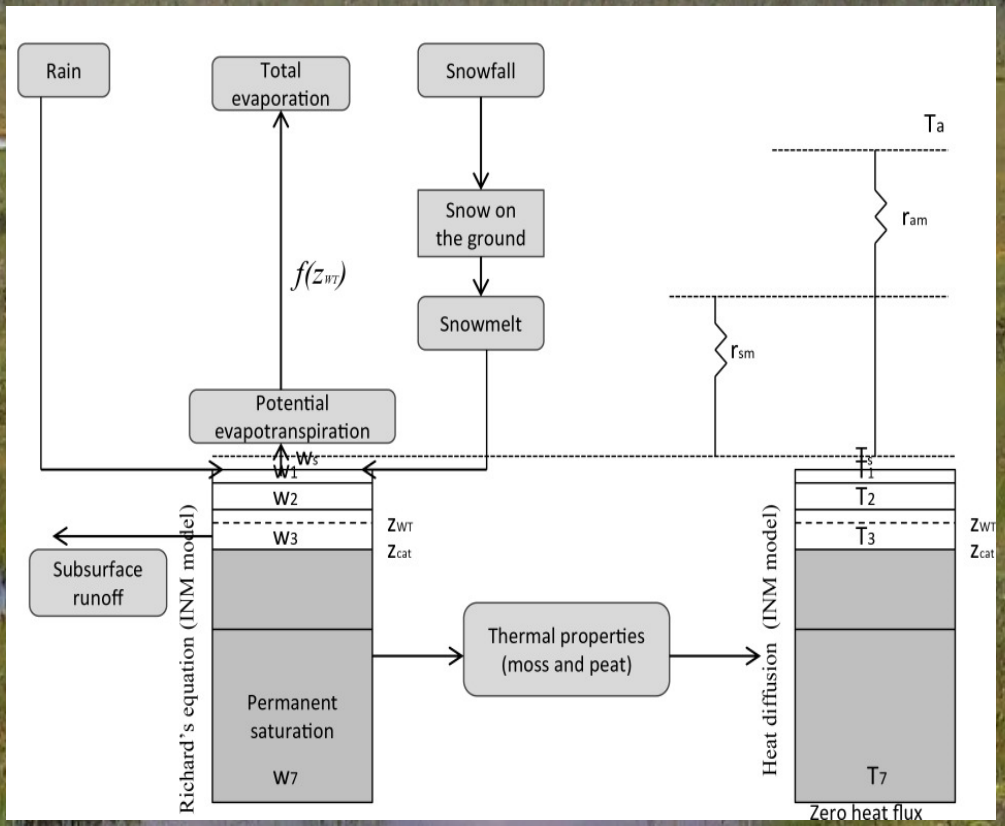




- Juergen Helmert / DWD (**TERRA SCA**), implementation of global high-resolution **soil information** in TERRA, Peatlands/Mires
- Matthias Raschendorfer / DWD, **re-formulation** of surface processes in the frame of **PT ConSAT**
- Jan-Peter Schulz / DWD, **bare soil** evaporation and **skin temperature** (effects of **vegetation**)
- Andreas Will / **BTU**, support for vertically **inhomogeneous** soil types (e.g. from HWSD or BUEK 200 data set) by re-writing the Richards equation.
- PhD thesis at **ETHZ**, Daniel Regenass
  - **Catchment** water balance as a **validation** tool
  - Comparing Schlemmer et al. 2018 **hydrology** with standard hydrology
- DFG project at **Uni Giessen** with **2 PhD's**, lead by Merja Tölle
  - Eva Nowatzki, working on **dynamic vegetation** (phenology model) that accounts for seasonal influences and inter-annual variability
  - Mingyue Zhang, working on land surface **data set** (including winter and summer crop)

Peatlands in TERRA (J. Helmert et al.)

Réserve naturelle de la tourbière, France - Wikipedia

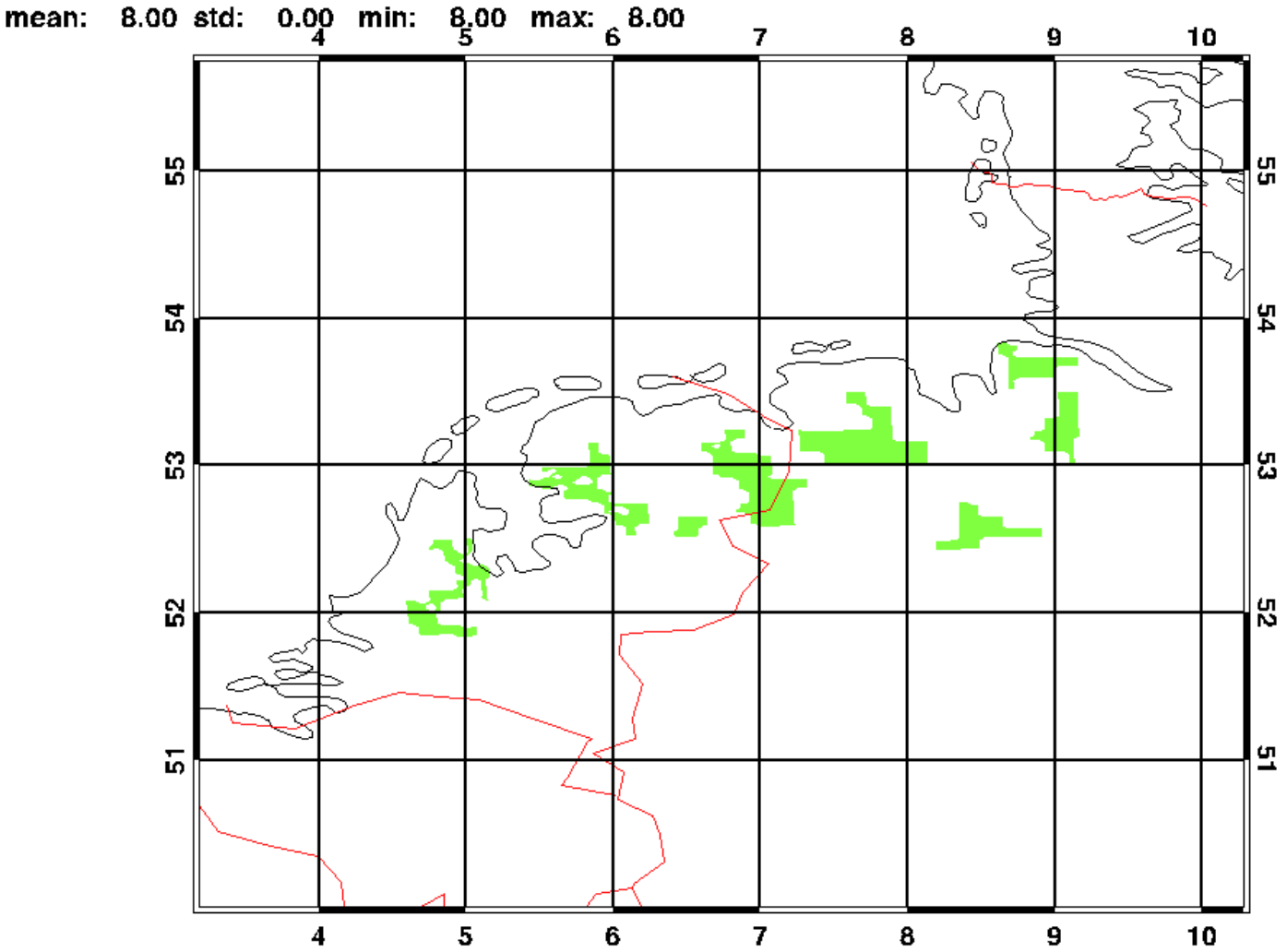


- Modification in TERRA: Yurova et al., 2014

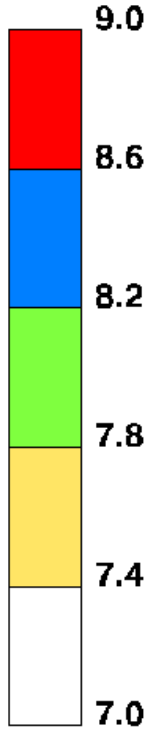
Evaporation
- Soil heat conductivity
- Soil water budget

Bog - St-Daniel sector - Frontenac National Park (Québec, Canada) -Wikipedia

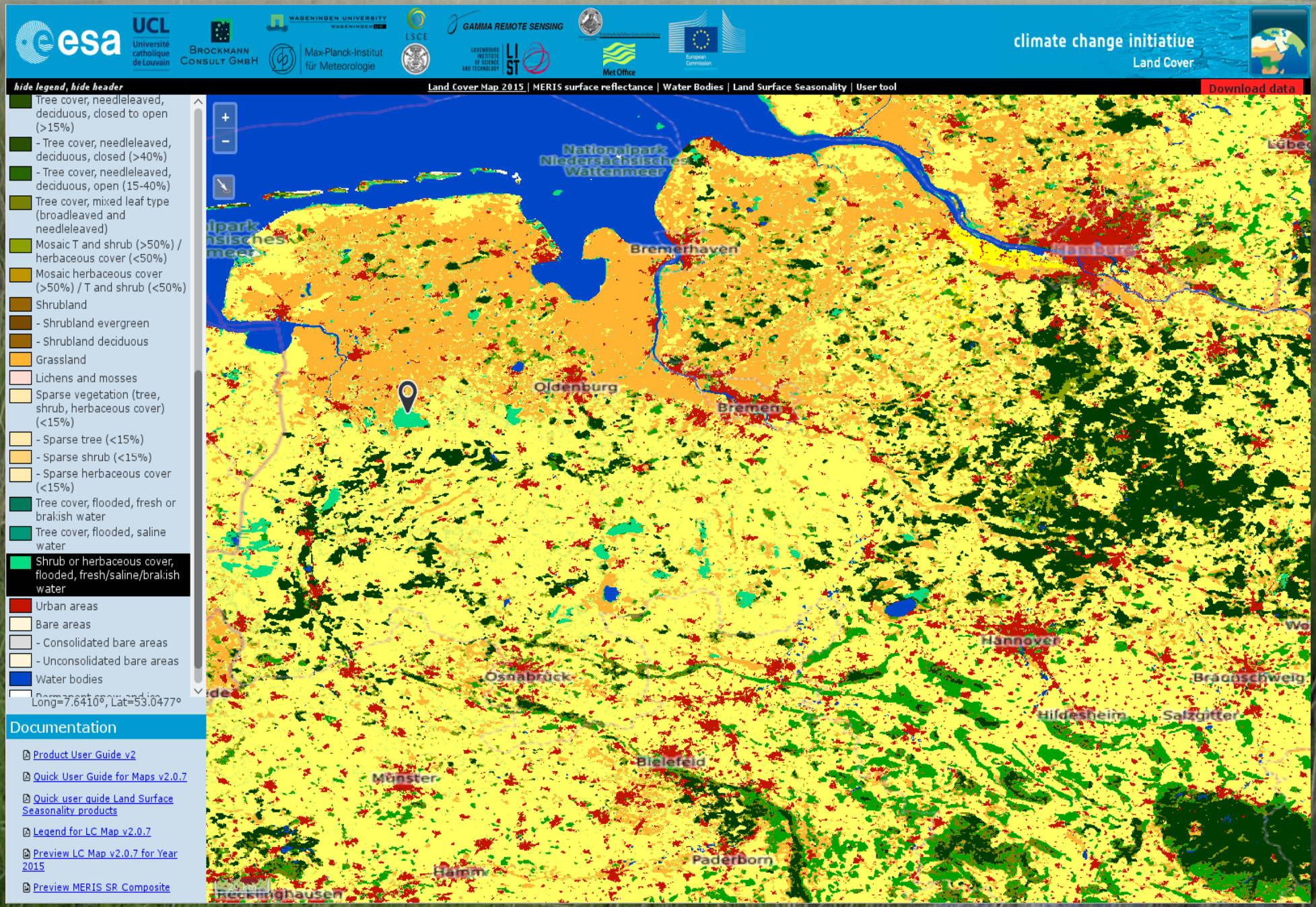
Peatlands – LAM Geospatial data



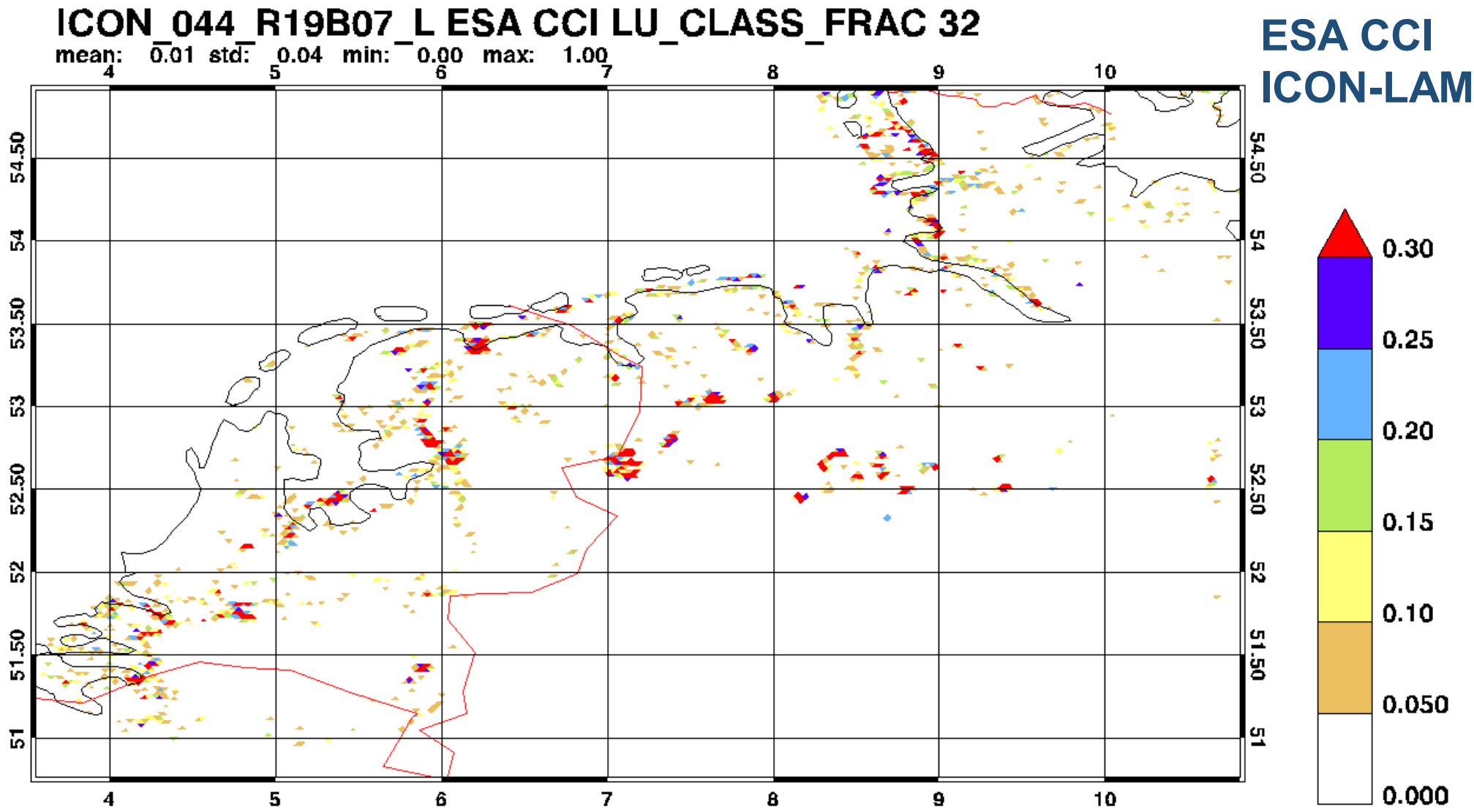
COSMO-D2 FAO Soil



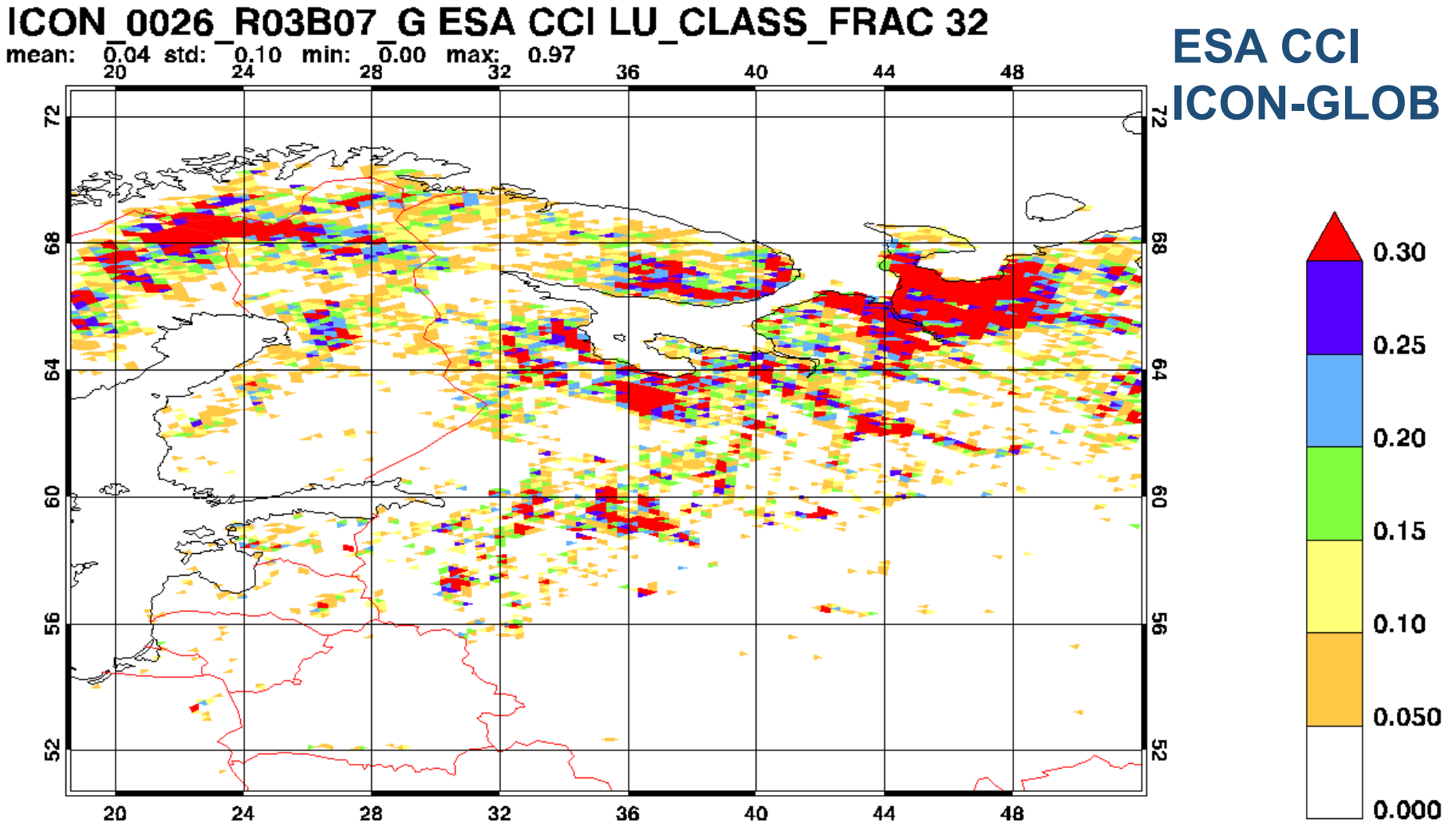
Geospatial data for peatlands



Peatlands – LAM Geospatial data



Peatlands – ICON-Global R03B07



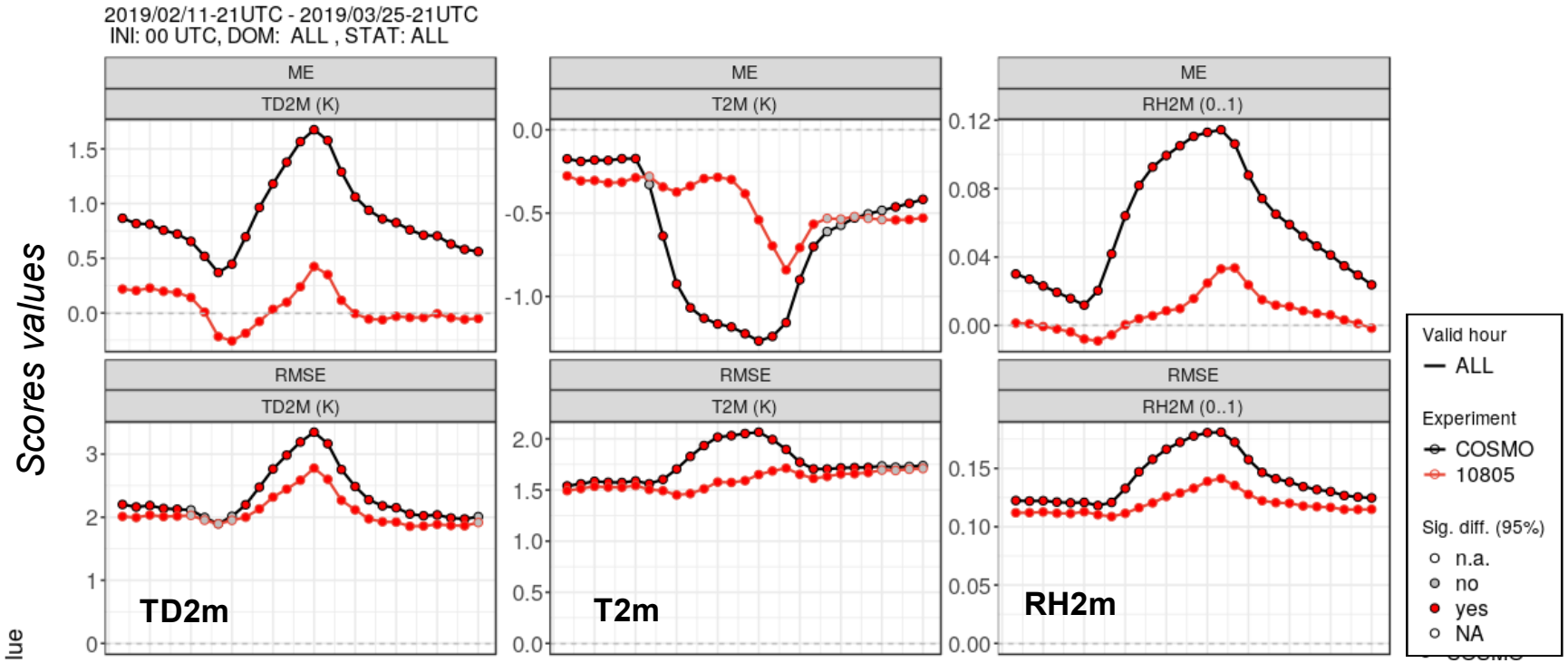
Improved processes in the land surface model TERRA:

Bare soil evaporation und skin temperature

Jan-Peter Schulz[1] and Gerd Vogel[2]

[1]Deutscher Wetterdienst, Offenbach, Germany
[2]Deutscher Wetterdienst, Lindenberg, Germany

COSMO General Meeting, 9 - 12 Sep. 2019, Rome, Italy



Validation COSMO-D2 experiment 10805

Simulation period: 11 Feb. – 25 Mar. 2019 (six weeks)

itype_evsl = 4 : New bare soil evaporation
itype_root = 2 : Exponential root profile
cwimax_ml = 0.0005 : Interception reservoir activated
itype_heatcond = 3 : Soil thermal conductivity dependent on moisture
itype_canopy = 2 : Skin temperature

Significant improvement of scores ! Recommended new configuration !

EXTPAR

Releases history

- **v5.0** (19.11.2018)
  - First unified release merging COSMO 4.0 and DWD 2.10 developments
  - Fully ICON capable
  - With full regression suite (at CSCS & MPI-H)
- **v5.1.1** (21.06.2019) is the most recent production release
  - Many bugs fixes
  - New skin conductivity parameter (SKC), derived from land use

- **Release notes** on https://github.com/C2SM-RCM/extpar/blob/master/ReleaseNotes.md
- **Planning** on https://github.com/C2SM-RCM/extpar/issues
- Updated **user manual**

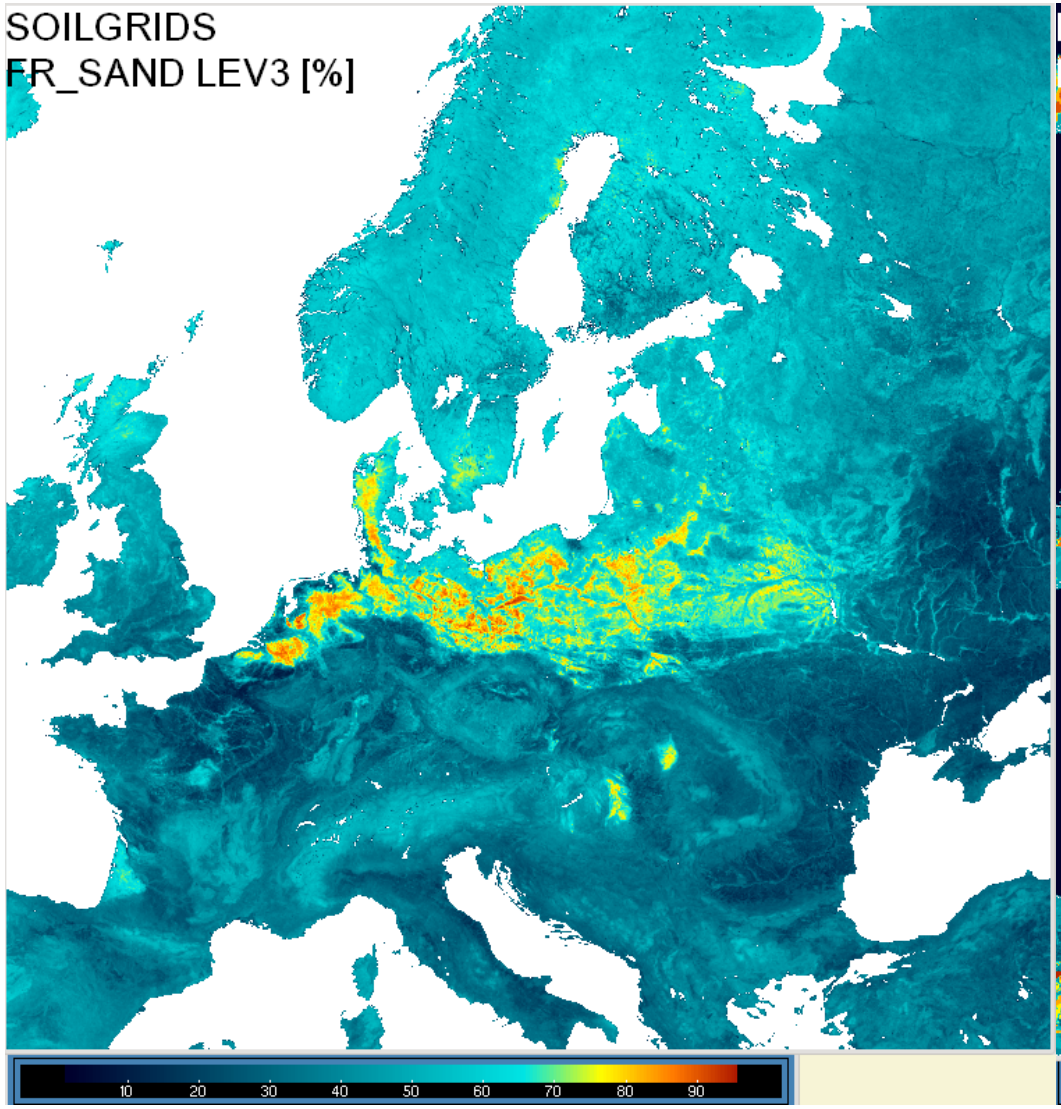
EXTPAR

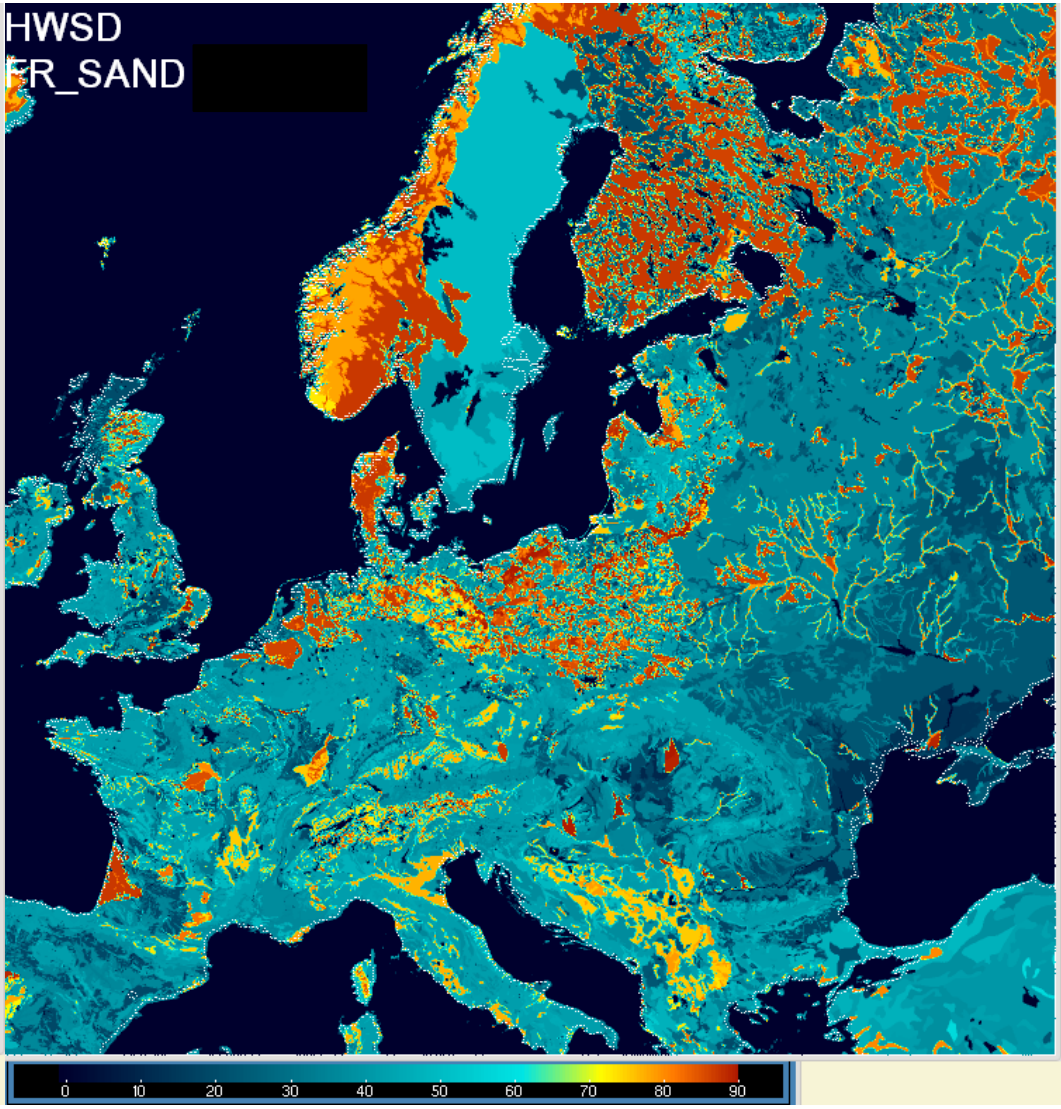
Miscelleanous

- **Only** NetCDF output
  (Due to limited resources, focus on NetCDF as native format for both input and output.
  If needed, generation of GRIB fields using external software)
- **On-line** generation of external parameters possible through WebPEP
  (https://tools.clm-community.eu/web_pep/docs/readme.html, based on v5.1.1)
- New external parameters for **urban** model will be prepared in the frame of AEVUS 2
  (if PT accepted by StC)
- Investigate the usage of ESA-CCI LandCover (**land use**), soilgrids (**soil type**),
  CAMEL **emissivity,** Tandem-X DEM data (**high resolution topography**)

SoilGrids

Deutscher Wetterdienst
Wetter und Klima aus einer Hand





Data set choice is crucial!

ESA CCI Land-Use

Deutscher Wetterdienst
Wetter und Klima aus einer Hand

esa climate change initiative
European Space Agency

ESA | CCI | aerosol | cloud | cmug | fire | ghg | glaciers | ice sheets | land cover | ocean colour | ozone | sea ice | sea level | sst | soil moisture

Land cover

Navigation

- About ESA CCI
- About the CCI LC Project
- Project plan
- Resources
  - Download CCI LC Products
  - Product descriptions
    - MERIS surface reflectance time series
    - Land cover maps
    - Seasonality products
    - Global Water Bodies product
    - CCI-LC user-tool
  - Newsletters
  - Scientific communications
  - Validation
  - Documents
  - Image galleries
  - Publications
- Support

Consortium

UCL Université catholique de Louvain – Brockmann Consult GmbH – Wageningen University

Home » Resources » Product descriptions

Land cover maps

Submitted by Anonymous on Wed, 2014-10-01 15:58

Three global LC maps for the 2000, 2005 and 2010 epochs

The CCI-LC team has successfully produced and released its 3-epoch series of global land cover maps at 300m spatial resolution, where each epoch covers a 5-year period (2008-2012, 2003-2007, 1998-2002). These maps were produced using a multi-year and multi-sensor strategy in order to make use of all suitable data and maximize product consistency. The entire 2003-2012 MERIS Full and Reduced Resolution (FR and RR) archive was used as input to generate a 10-year 2003-2012 global land cover map. This 10-year product has then served as a baseline to derive the 2010, 2005 and 2000 maps using back- and up-dating techniques with MERIS and SPOT-Vegetation time series specific to each epoch.

In order to meet the user requirement set in this project, the map proposes a legend based on the UN Land Cover Classification System (LCCS) with the view to be as much as possible compatible with the GLC2000, GlobCover 2005 and 2009 products. The level of thematic details was found to be improved with respect to previous global LC products. Each map is characterized by a set of quality flags.

For more information on the products, go to: http://maps.elie.ucl.ac.be/CCI/viewer.

User login

Username: *

Password: *

Log in

- Request new password

Search

Search this site:

Search

External parameters change with time!

SNOWE

Status

- SNOWE is a complete software package to prepare the snow water equivalent and snow density fields required by the COSMO model.
  - *Innovative aspect is the use of observation driven 1d snow model at SYNOP*
    sites to derive the full characteristics of the snow pack
- Maintained and **further developed** by **RHM**
- Available on COSMO web site, incl. documentation
  - *Latest release is version 2 (October 2017)*
  - ***Upgrade** planned in **October 2019***

SNOWE

Status

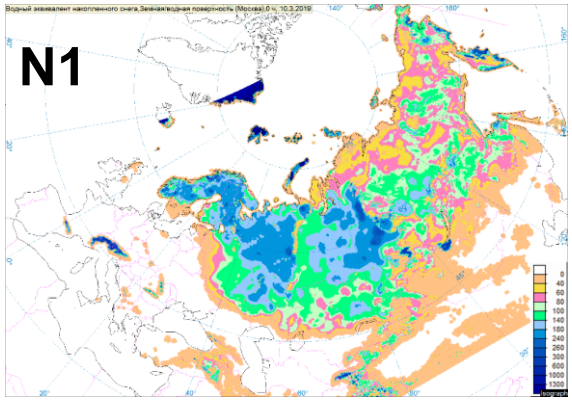
Recent developments

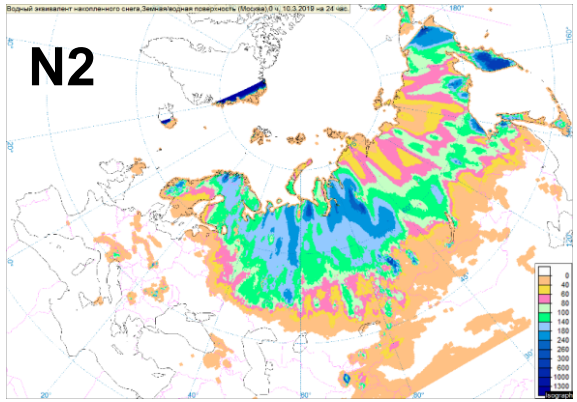
- *Improvement of 1d-snow model*
- *Add possibility to use **ICON** first guess*
- *Comprehensive **validation** (full winter 2018-2019 on Eurasian continent, see next)*
- *Work on-going to improve the **Optimal Analysis** scheme*

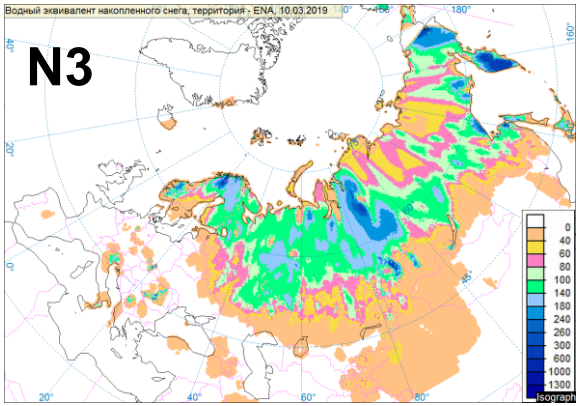
- SNOWE based **data set** available for **all** European stations for 2018-2019 *(on COSMO web site)*
- Possible **COSMO action** (PT / PP), will be discussed at next ICCARUS

SNOWE

An example







Snow Water Equivalent for 10/03/2019

First panel (N1) : ICON SWE
Second panel (N2) : SNOWE using ICON first guess
Third panel (N3) : SNOWE using COSMO-Ru cycle

- *N2 and N3 have close verification scores (river discharges), better than N1*
- *Note that complex topography aspects are (currently) not considered*