Schweizerische Eidgenossenschaft
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CONSORTIUM FOR SMALL SCALE MODELING
COSMO

WG3b
Activity Review

Jean-Marie Bettems / MeteoSwiss

COSMO General Meeting
Wroclaw, September 9th , 2015

PP and PT

- **PP CALMO**
  - Objective calibration of COSMO model
  - **Extended for one more year, till 09.2016**

- **PT SNOWE**
  - Improve analysis of snow water equivalent
  - **End now**

- **PT Terra SAnta**
  - Bring TERRA Stand Alone code up to speed with latest COSMO release in both aspects of physical schemes and coding standards.
 - **New PT**

Developments at DWD
# (J. Helmert)

TERRA / ICON – Status

- **Tile** approach implemented

- **Multi-layer snow** model implemented, still technical issue with GRIB 2

- Improved **soil heat conduction** (itype_heatcond=2)

- Improved **snow cover diagnostics** (idiag_snowfrac=2)

- Advanced **look-up table** for land-use parameters (itype_lndtbl=3)

- **Exponential root** density profile (itype_root=2)

- Vertically inhomogeneous soil: impact of **organic components** on hydraulic and thermal processes within root zone (*JULES land-surface model)*

- **Tile** approach in data assimilation

- **Snow analysis** for multi-layers snow, incl. tiles

- 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**
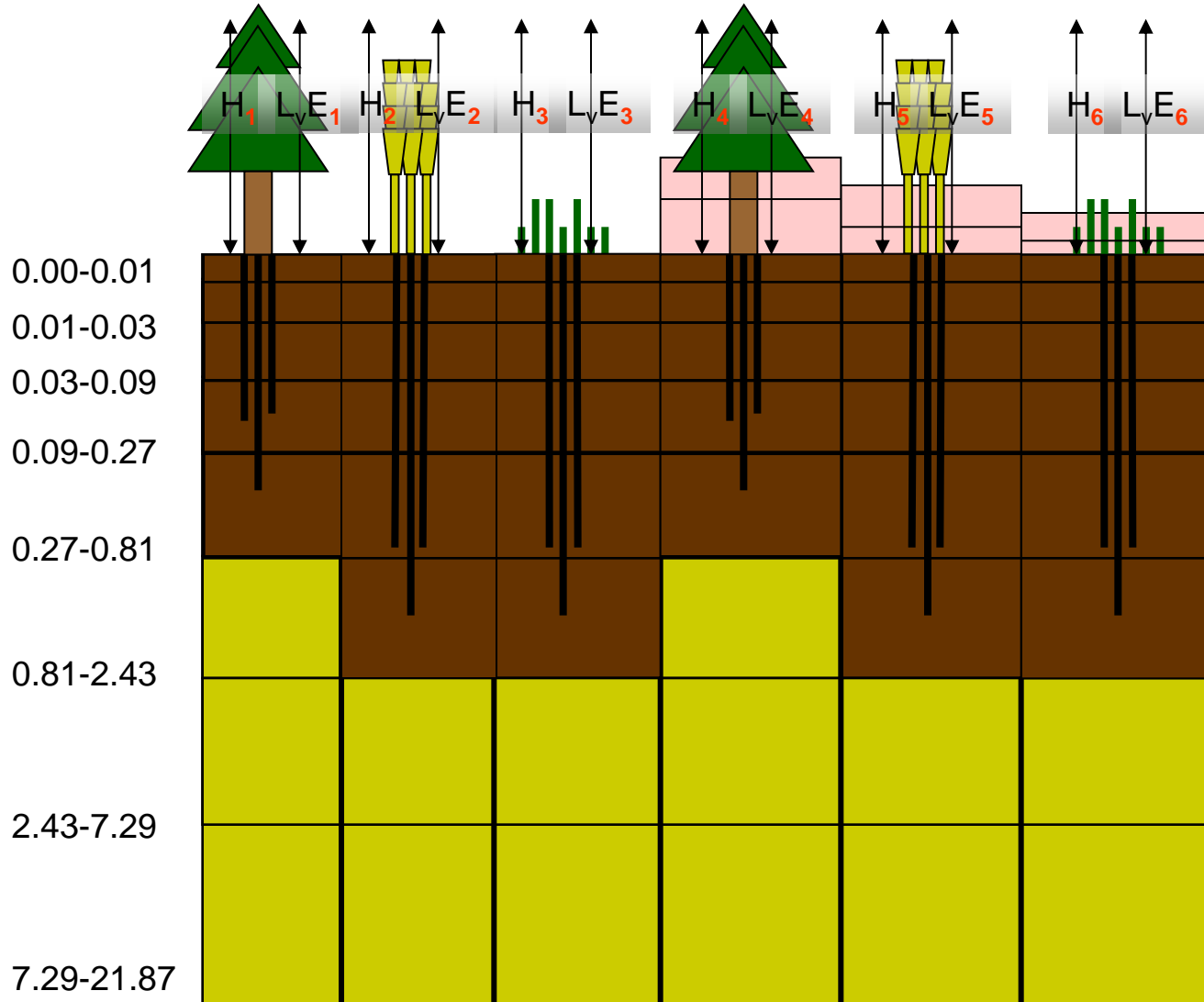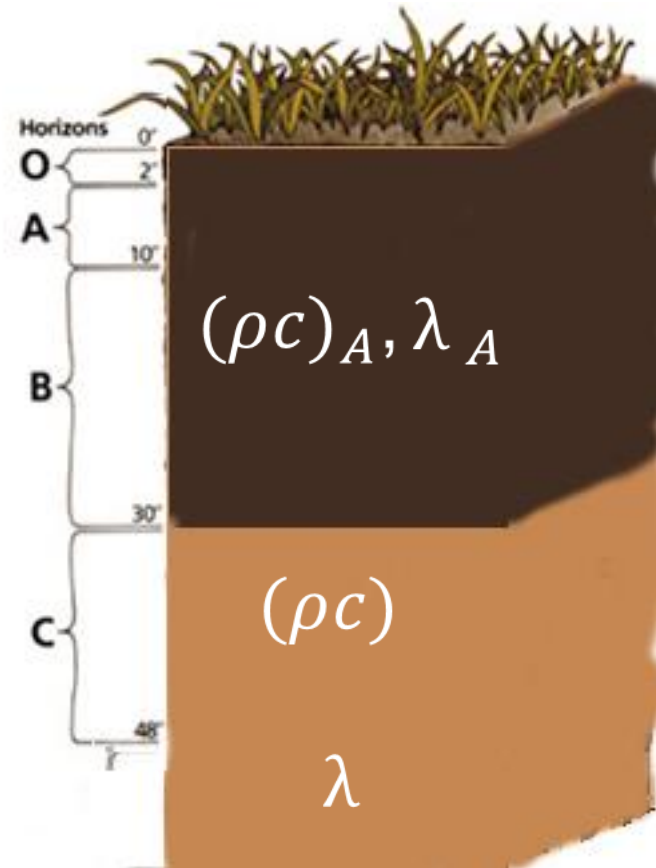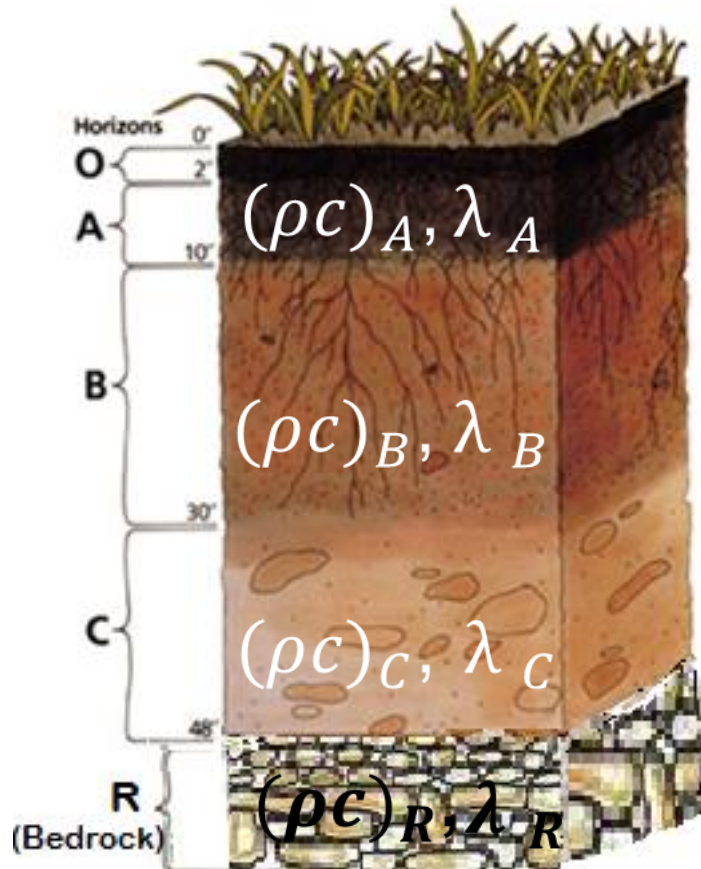
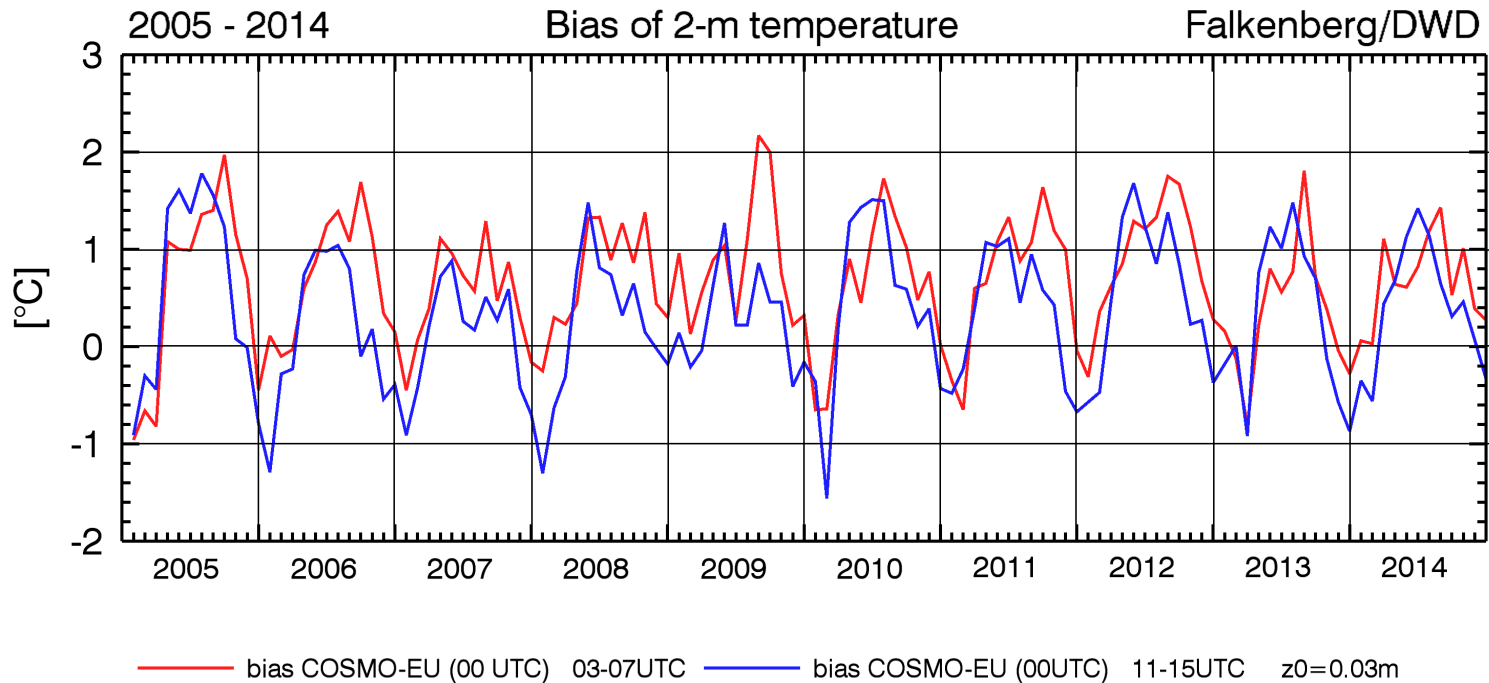**Soil hydraulic & thermal properties typically depend on soil depth**

- Further model developments and experiments

    - **Urban** impact

    - **HWSD** in COSMO-D2,

    - Testing of **mires**

    - Treatment of **snow** by COST ES1404

- **External parameters:** consolidation of data within SRNWP and global forecasting centers (NOAA action)
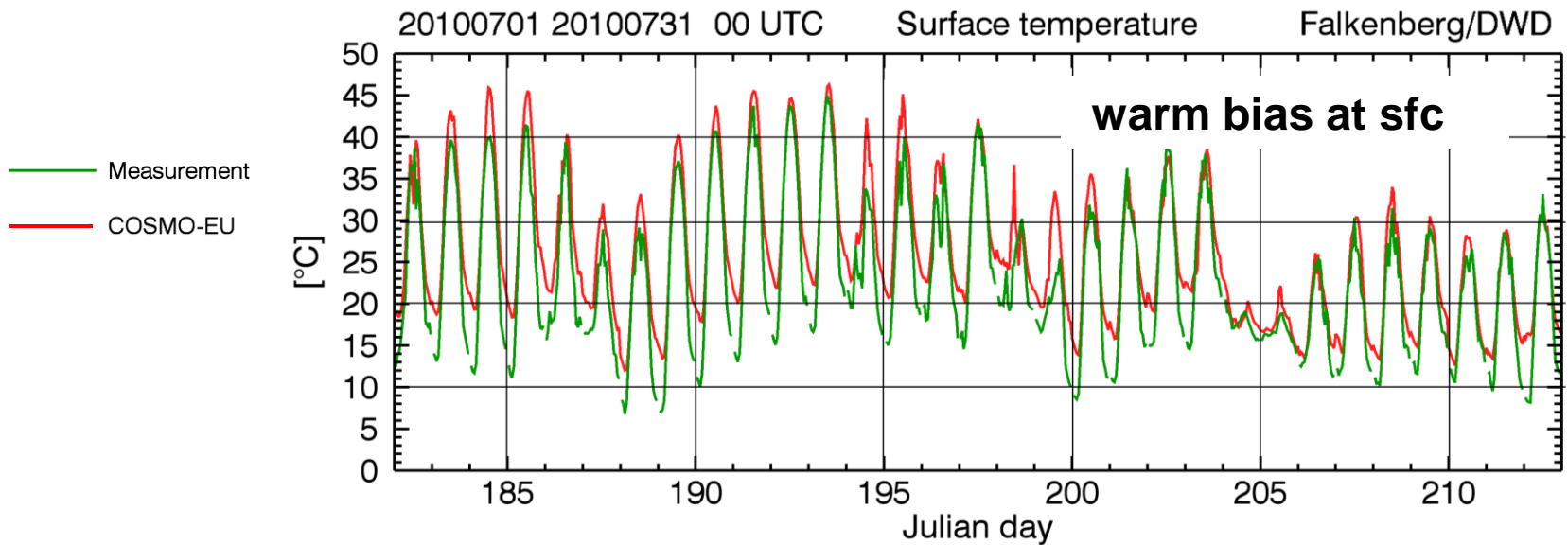
Vegetation shading
(G. Vogel, JP. Schulz)

→ COSMO-EU : T2m warm bias in summer

COSMO-EU: Falkenberg July 2010

20100701 20100731 00 UTC Temperature 10m Falkenberg/DWD

warm bias at 10m

20100701 20100731 00 UTC Surface temperature Falkenberg/DWD

warm bias at sfc

Measurement
COSMO-EU
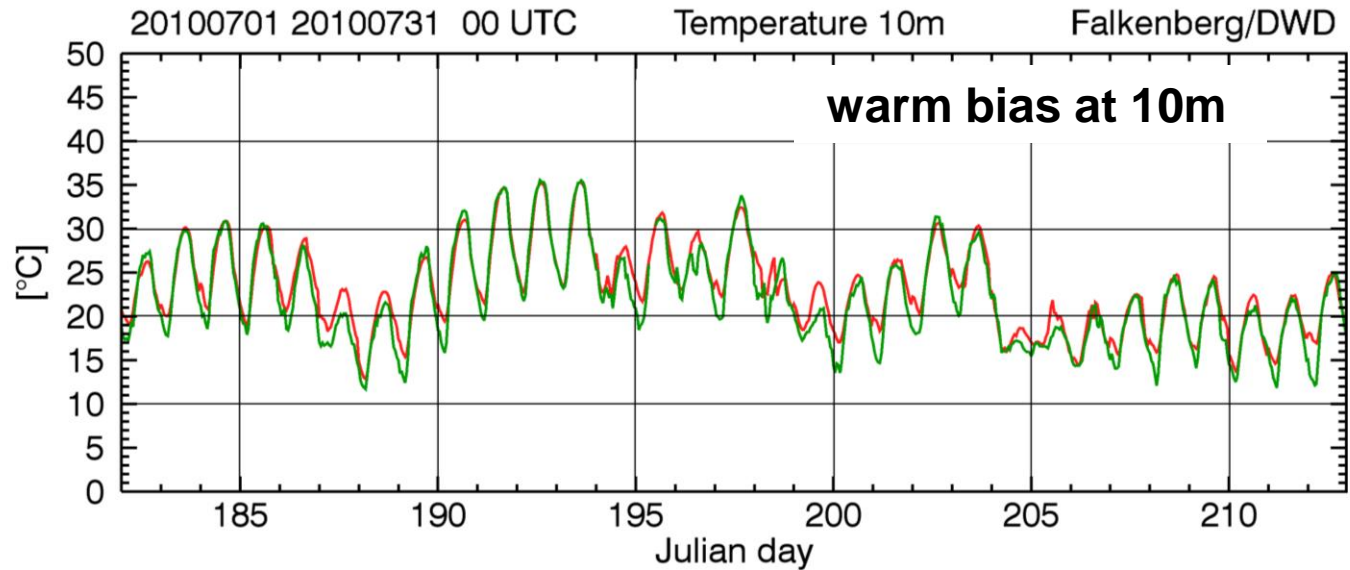
Offline TERRA: Falkenberg 2 - 4 July 2010

Soil temperature (-6cm) and Bare soil temperature (-6cm) plots showing Measurement (green solid), Reference (blue dash-dot), and Johansen (red dashed) curves over Julian day 183–186.
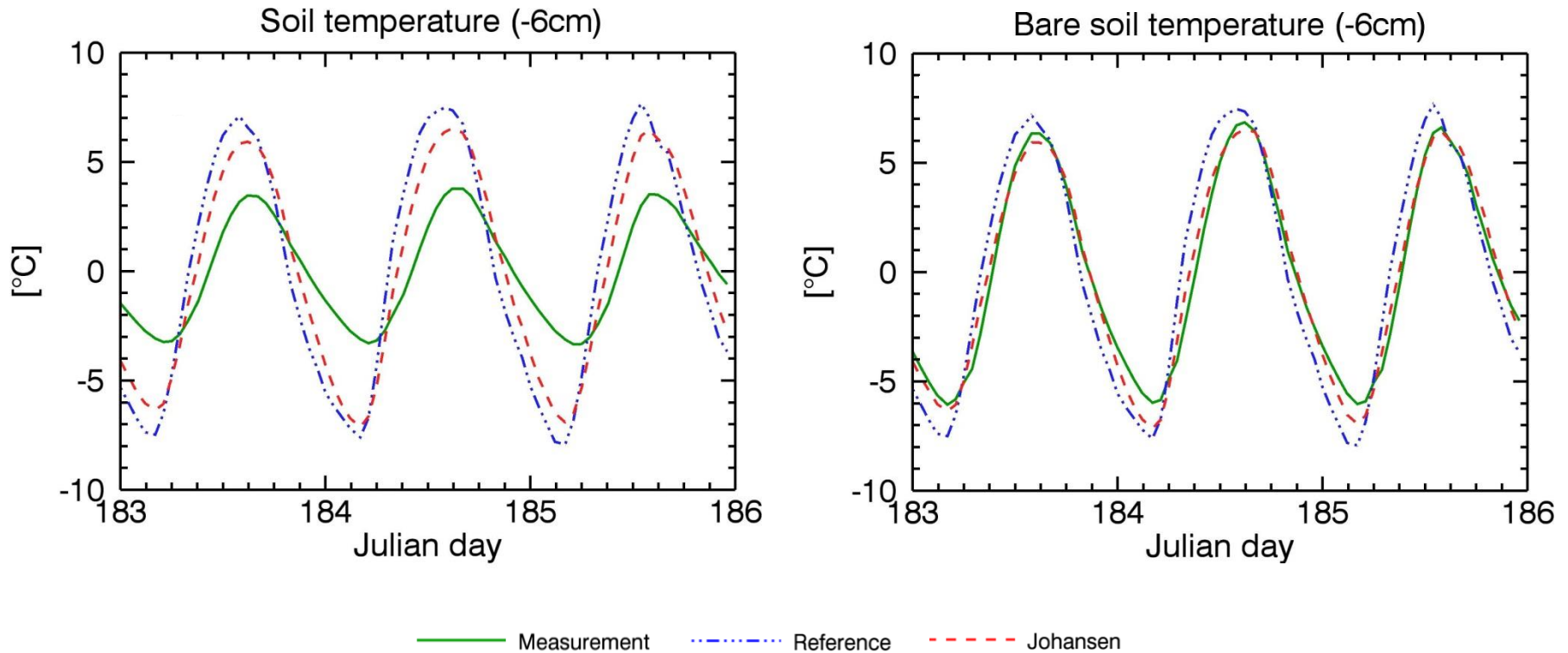
- ➢ **Diurnal temperature range reduced by improved thermal soil conductivity**
- ➢ **But... shading (even by grass) has a much larger effect**

Offline TERRA & CLM: Falkenberg May 2008

20080513 20080520   Surface temperature   Falkenberg/DWD

(y-axis: [°C], 0 to 30; x-axis: Julian day, 134 to 142)

— Measurement (brightness temperature)
— TERRA 4.13 (temperature of top soil layer)
— CLM 3.5 (temperature of vegetation layer)
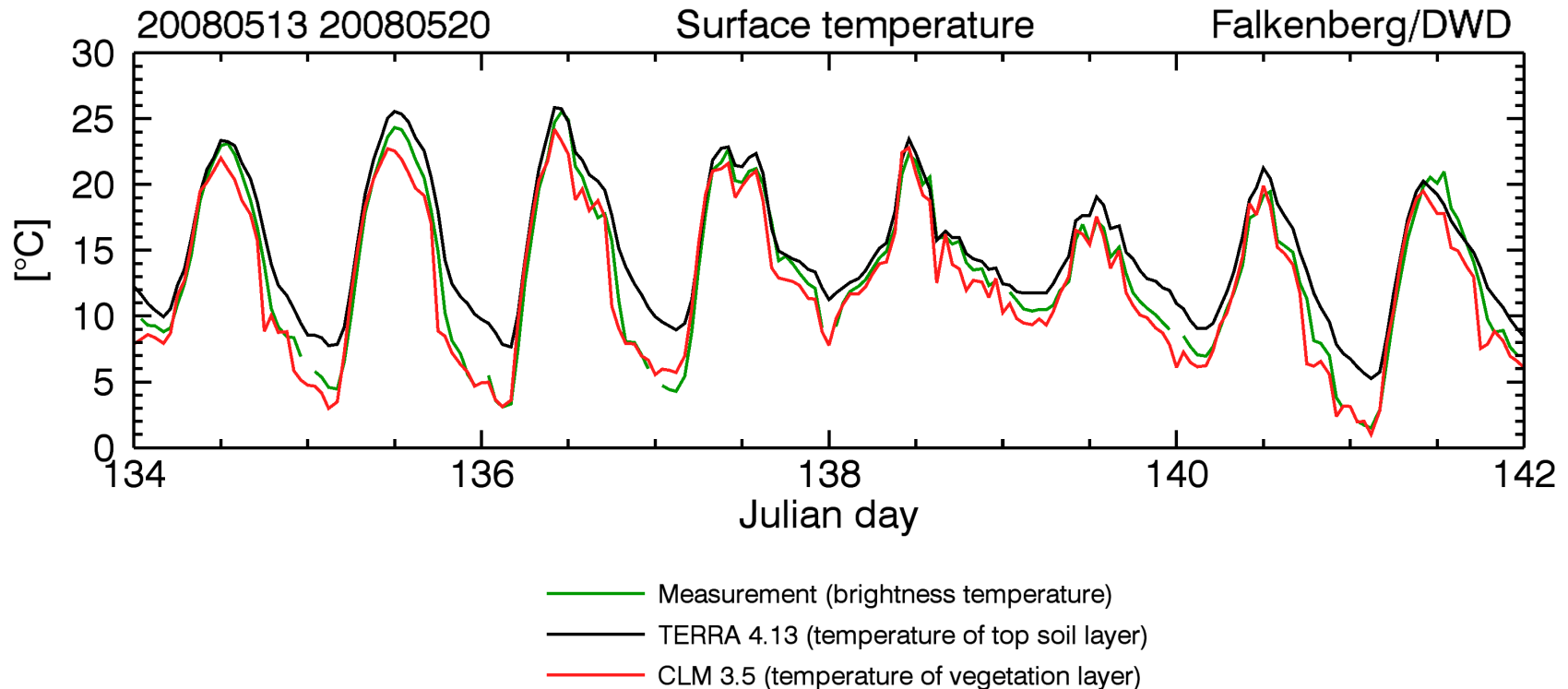
→ **The overestimation of the diurnal amplitudes of soil temperature in TERRA during summer is mainly caused by the neglected shading of the solar radiation due to the vegetation cover.**

Phenology
(JP. Schulz, G. Vogel, R.Stoeckli)

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DWD / MCH collaboration on phenology

- **Goal**
    - Implement a phenology model to capture the inter-annual variability and the decadal trends of the vegetation cycle in the COSMO model.

- **Context**
    - Reto Stöckli / MeteoSwiss developed a phenology model, calibrated on the basis of MODIS data
    - Jan-Peter Schulz / DWD started a different approach at Uni Frankfurt, based on Knorr et al. and on Polcher et al.

Inter-annual variability and decadal trends are important!
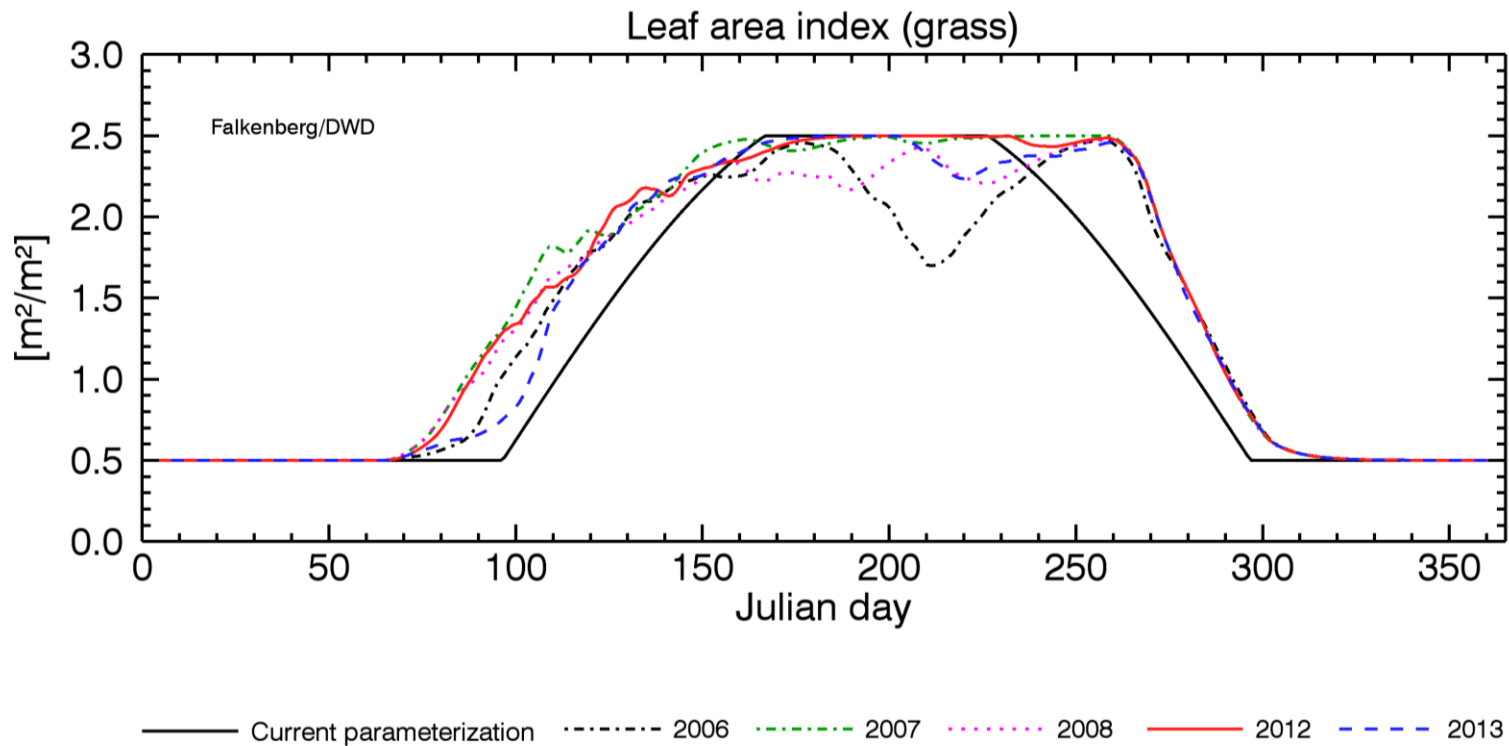
Vegetation state depends on

- *Temperature history since year start*

- *Day length*

- *Water availability*

- *NPP (net primary productivity)*

Budbreak of the horse chestnut in Geneva 1808–2015
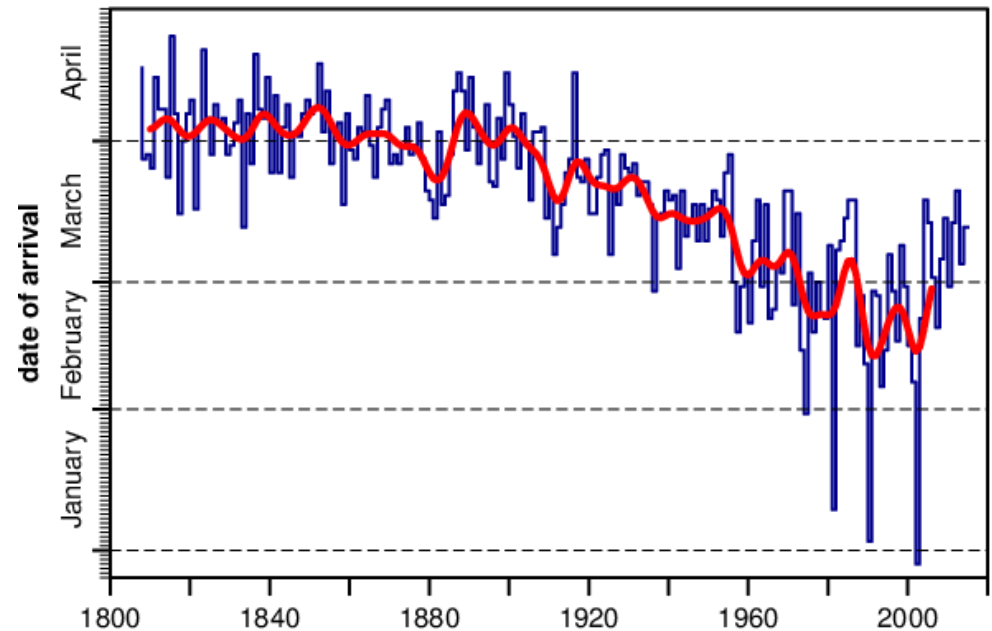
© MeteoSwiss

pheno.longts 0.22 / 11.06.2015, 05:05

Leaf area index (grass)

Falkenberg/DWD

Legend: Current parameterization — 2006 — 2007 — 2008 — 2012 — 2013
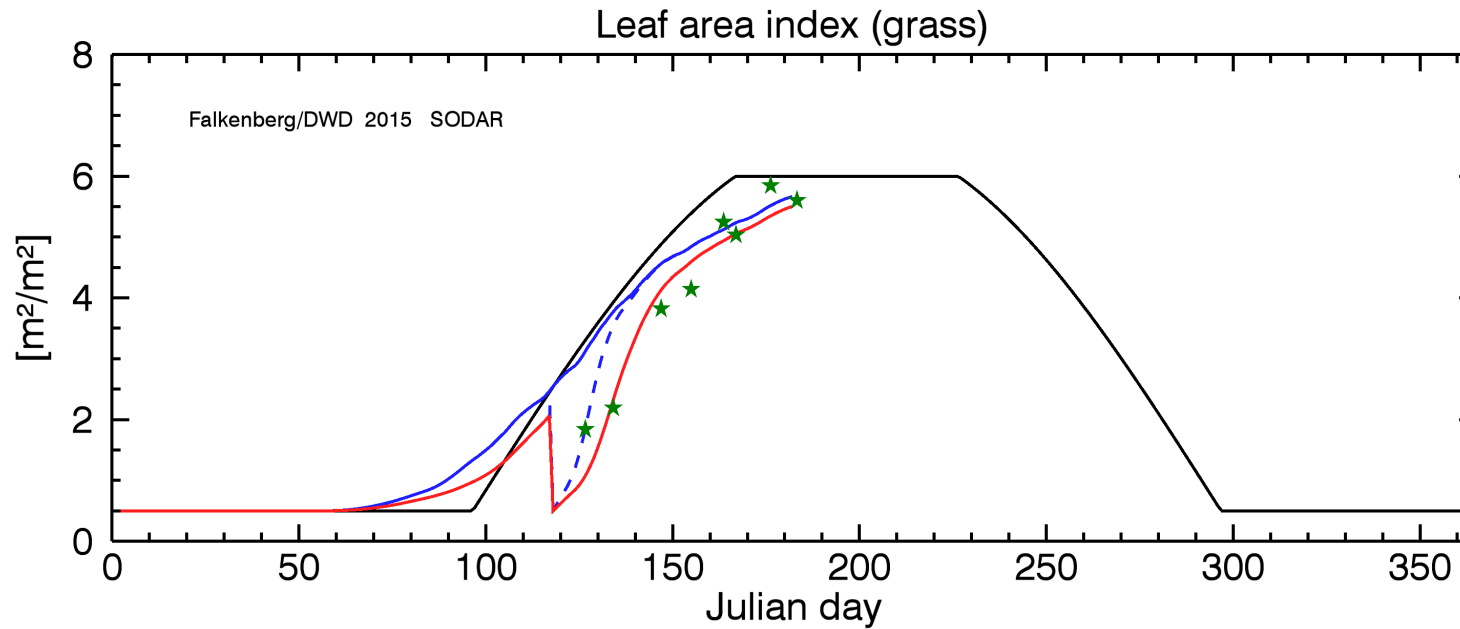
based on Stöckli et al. (2011) adapted LAI daylength vpd c3-grass

C3 grass tuned for Falkenberg
Stress functions: Temperature C3, day length C4, vapour pressure deficit 7,C4

Leaf area index (grass)

Falkenberg/DWD 2015 SODAR

——	Current parameterization
——	LAI adapted tmin c3 daylength avg c3+c4 vpd_min 7 vpd_max c4 c3-grass LAI_max=6 (SO58)
– – –	LAI adapted tmion c3 daylengthn avg c3-c4 vpd_min 7 vpd_max c4 c3-grass LAI_max=6 with mowning (SO60)
——	LAI adapted tmin c3 daylength avg c3+c4 vpd_min 7 vpd_max c4 grpwth rate*0.5 c3-grass LAI_max=5 with mowning (SW65)

based on Stöckli et al. (2011)

Conclusions

➢ With the current parameterization TERRA can not account for the inter-annual variability of the phenology.

➢ The approach by Stöckli et al. (2008, 2011) was implemented, which includes stress functions of temperature, but also of day length and water availability. It combines the concepts of threshold values (Polcher 1994) and of growth and decay rates (Knorr et al. 2010).

➢ The scheme was tested at three different sites. With some tuning, the site specific behaviour can be well described.

➢ The next steps are the inclusion of the full 35 plant functional types, and the implementation into the three-dimensional coupled model code.

Urban parameterization

H. Wouters, U. Blahac

TERRA-URB parameterization

- **Parameterization of two major urban effects**
  - Modified sensible and latent heat fluxes to represent urban „heat buffering" and paved surfaces
  - Anthropogenic heat emissions

- **Low level of complexity, yet the main features of urban heat islands are captured**
  - Urban pixels represented by *2 tiles*: paved (sealed), and non-paved (parks, …)
  - New *soil type* ‚paved'
  - *Modified radio of z0m / z0H*, representative for wind- and temperature profiles over cities
  - Two new *external parameters*: paved surface fraction (subset of urban fraction), yearly average anthropogenic heating
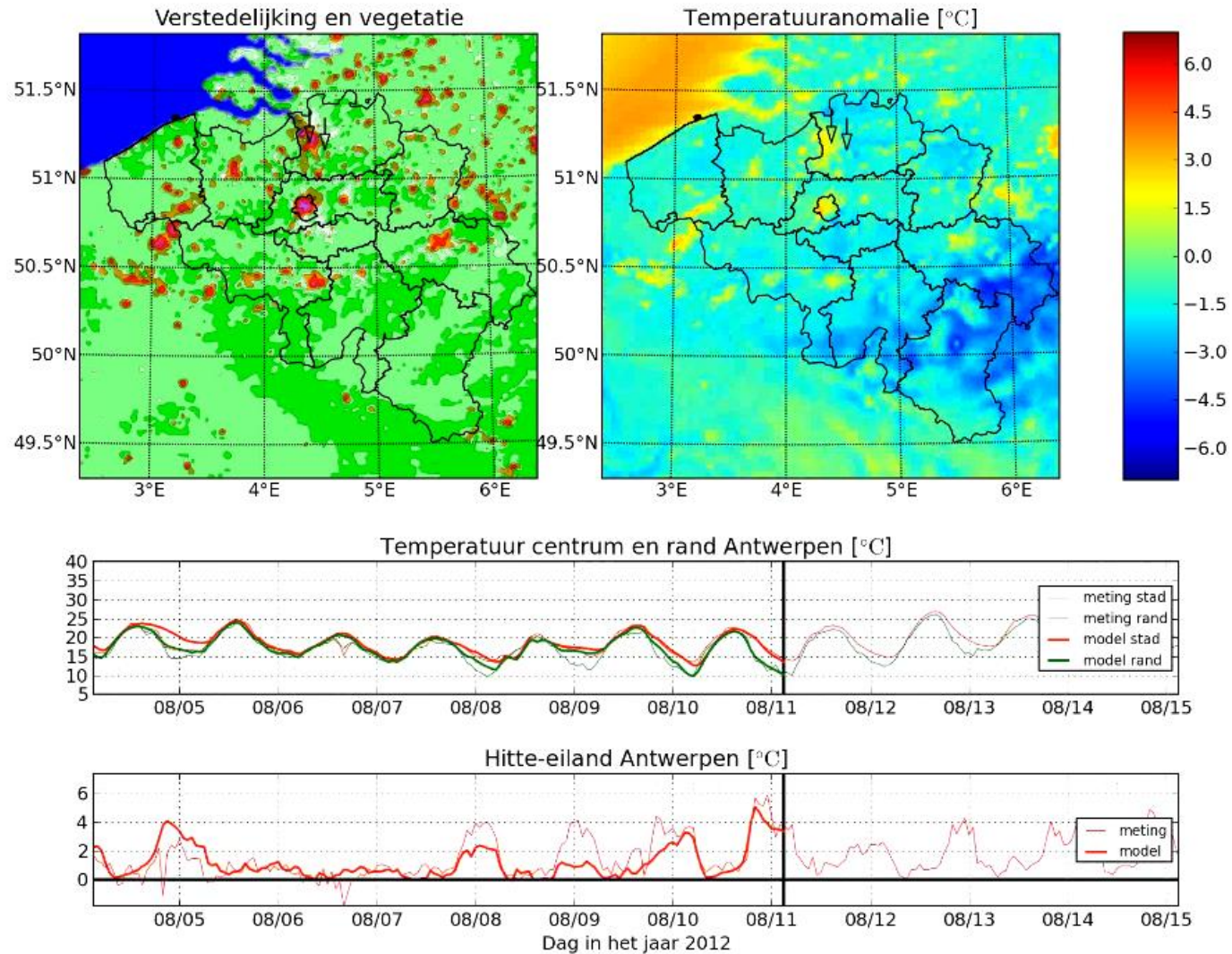
TERRA-URB parameterization

- **Status**
  - EXTPAR has been adapted (2 new parameters)
  - Code is available, experiments show reasonable simulation of heat island
  - Still some open issues (coupling with turbtran, tile averaging)
  - Target is to have a final implementation till mid-2016
  - Code reponsibility by Uli Blahak

TERRA-URB parameterization

Mire parameterization
A. Yurova, I. Rozinkina

TERRA-Mire parameterization

- **Status**
  - TERRA-Mire is ready at RHM, implemented in COSMO 5.0, and documented

- **Open issues**
  - Definition of mire locations
    (currently based on soil type; may need EXTPAR extension)

- **Plan**
  - Get final feedback from Juergen about these modifications
    (Juergen was involved in the development)
  - Send code to Uli S. for technical review
  - Produce a short scientific report on the impact of the mire parameterization
  - Review scientific and technical documentation
  - Define code responsibility

TERRA standalone
Yiftach Ziv (IMS)

PT Terra SAnta

Task1: Consolidation of TSA Source Code

- *Deliverables:* Mapping and prioritizing discrepancies in all aspects between TSA and COSMO TERRA module and a rewrite of the code accordingly.

Task2: Review and Possible Revision of the Transfer Scheme implemented in TSA (Louis scheme).

- *Deliverables:* Verification and possible implementation of the enhanced Transfer Scheme to TSA.

Task3: Estimating Spin-Up Time of TSA

- *Deliverables:* Document TSA spin-up time.

Task4: Verification of TSA and COSMO-TERRA vs. observations

- *Deliverables:* Report on skill scores for TSA and COSMO-TERRA and on TSA limitations.

Data pool

Data pool

- **NetCDF** format available (work in progress)
- Data set now open to **universities** and **R&D institutions**
- Still problems with **data quality** and **availability** for some sites: Fauga-Mauzac (FR), Cardington (UK) and Debrecen (HU)

- **Very limited usage of this data set …**

Thank you for your attention!