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CONSORTIUM FOR SMALL SCALE MODELING
COSMO

COSMO WG3b: Activity Review

Jean-Marie Bettems / MeteoSwiss

Offenbach, COSMO GM, September 2016

PP and PT

PP and PT (closed and current)

- **PP CALMO ,** 01.2013 – 12.2016, HNMS *(current)*
  - *Deliverable*: method to calibrate model parameters and improve forecast
  - *Open issue:* computing cost of the method (follow-up project?)

- **PT Terra SAnta,** 09.2015 – 09.2016, IMS *(closed)*
  - *Deliverable*: updated Terra standalone on COSMO web

- **PT Mire,** 09.2011 – 03.2013, RHM *(closed)*
  - *Deliverable*: improved forecast over mire (e.g. eastern Siberia)
  - *Action pending*: transfer mire code into official COSMO code

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PP and PT (closed and current)

- **PT SNOWE,** 09.2014 – 09.2015, RHM *(closed)*

  - Goal: *improve analysis of snow water equivalent*

  - Key feature: *off line 1D model to compute snow pack density*

  - Benefit: *positive impact on T2m at boundary of snow pack*

  - Deliverable: *full snow analysis package (incl. NOAA snow mask)*

  - Status

    - *Scientific documentation* in COSMO Newsletter 16

    - *Technical documentation* and *code* will be available on COSMO web

- Snow analysis package used in COSMO: DWD, RHM, MCH…

- Meeting planed at **next CUS** to define requirements and steps towards a possible future unified COSMO snow analysis
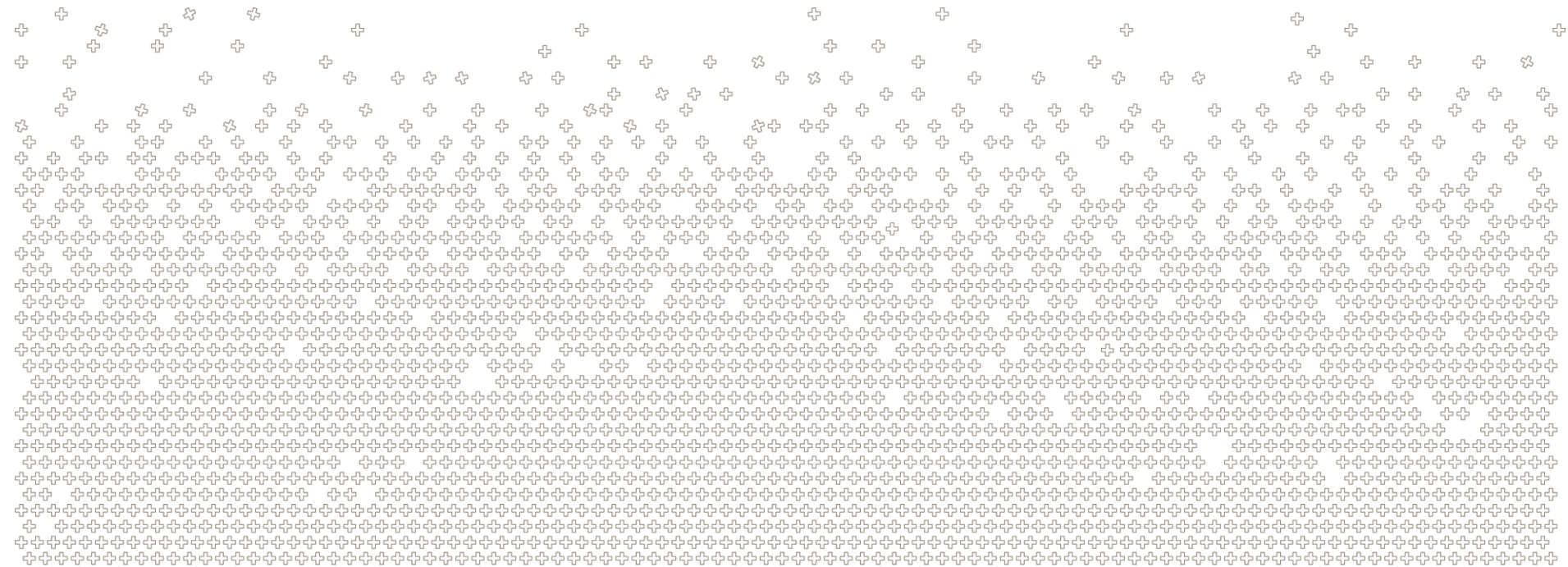
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PP and PT (new)

- **PT Terra Nova,** 09.2016 – 09.2017, IMS/RHM *(new)*

  - Goal: *assess forecast skill of COSMO coupled with the new common ICON / COSMO soil module.*

  - Method*:*

    - *Multiple domains (central Europe, Israel, NW Russia)*

    - *One summer and one winter period (free run to keep soil memory)*

    - *Standard verification & closer look at new developments (e.g. interception storage)*

    - *Closer look at special land use (e.g. forest, deserts)*

  - Computing resources*: ECMWF with MCH billing accounts!*

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TERRA

TERRA

- **Unified COSMO/ICON TERRA in COSMO v5.05 (Q42016)**

- … revision of **interception store** (G. Zängl)

- … resitance based **bare soil evaporation** (J.-P. Schulz)

- … **hydraulic and thermal conductivity** within root zone (J. Helmert)

- … some other **tunings** (desert, Greenland)

- … *without* tiles

- In addition to some other recent developments…

- … new multi layers **snow model** (lmulti_snow=.t.)

- … improved **soil heat conduction** (itype_heatcond=2)

- … **exponential root** density profile (itype_root=2)

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

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A new parameterisation of bare soil evaporation for the land surface scheme TERRA of the COSMO atmospheric model
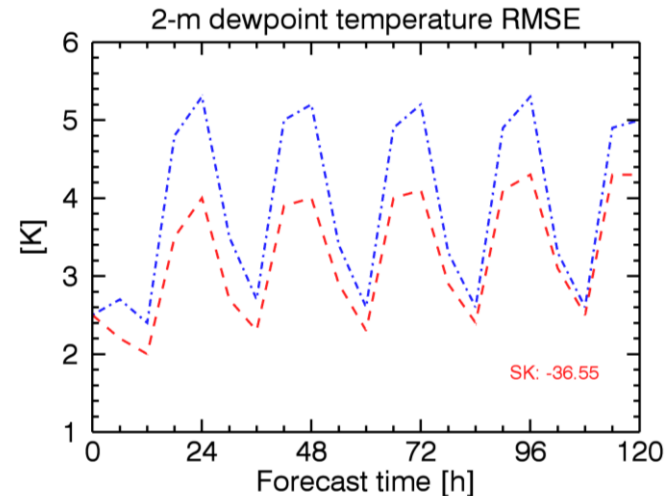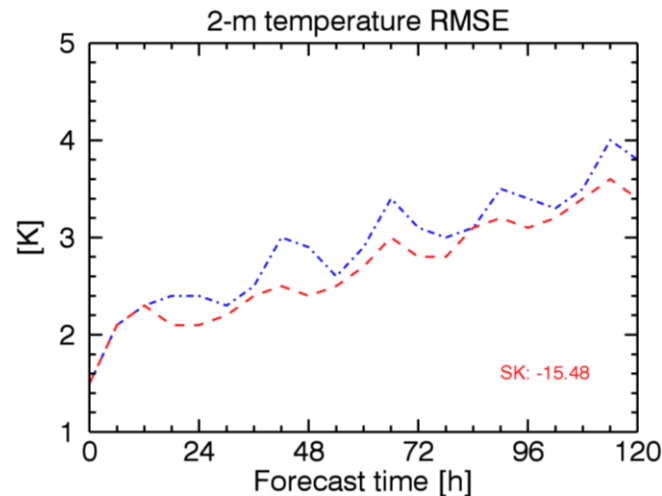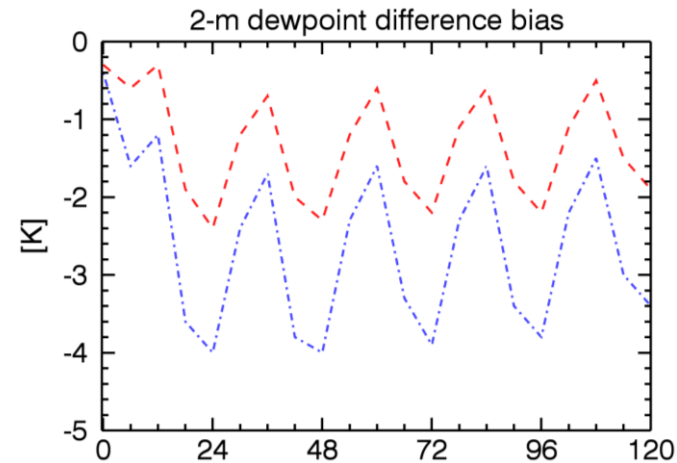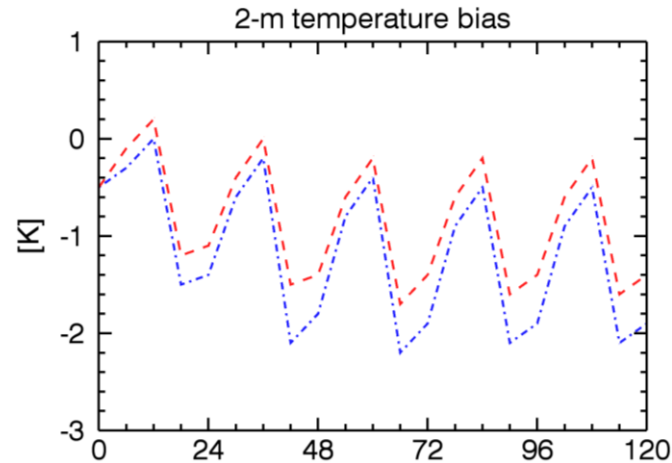
Jan-Peter Schulz[1] and Gerd Vogel[2]

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

COSMO / CLM / ART User Seminar, 7 - 9 Mar. 2016, Offenbach

ICON: NE America, January 2012, 00 UTC
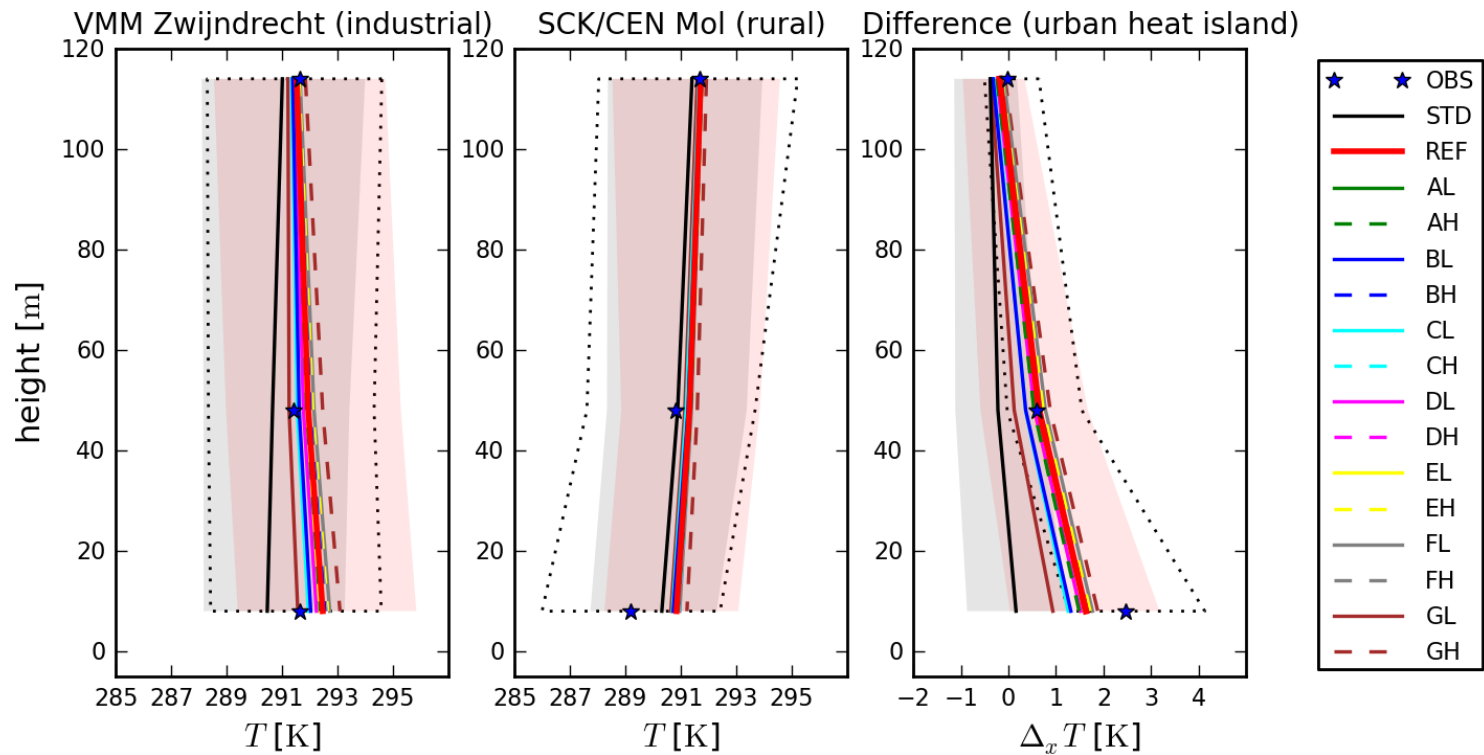

bias

RMSE

➤ *Cold bias and RMSE of 2-m temperature significantly reduced by resistance equ.*
➤ *Moist bias and RMSE of 2-m dewpoint difference substantially reduced*

TERRA-URB *(Wouters, H.)*

- Goal: *add cheap but realistic bulk parameterization of urban effects*

- Benefit: *variability of urban heat island well reproduced*

- Status: *peer reviewed paper in 'Geoscientific Model Development'*
  two new external parameters in EXTPAR
  code will be available in COSMO 5.05
  code responsibility by Uli Blahak / DWD

- Evaluation in progress at ARPA-Piemonte (Torino/Cira)

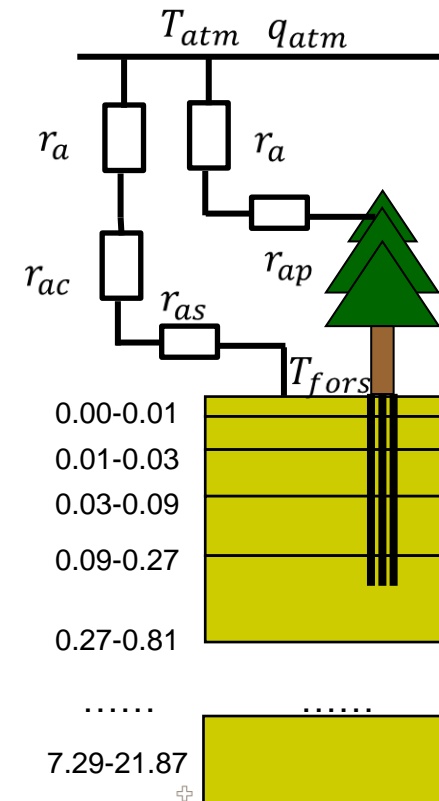- **A new PT will be proposed to further evaluate/consolidate TERRA-URB**

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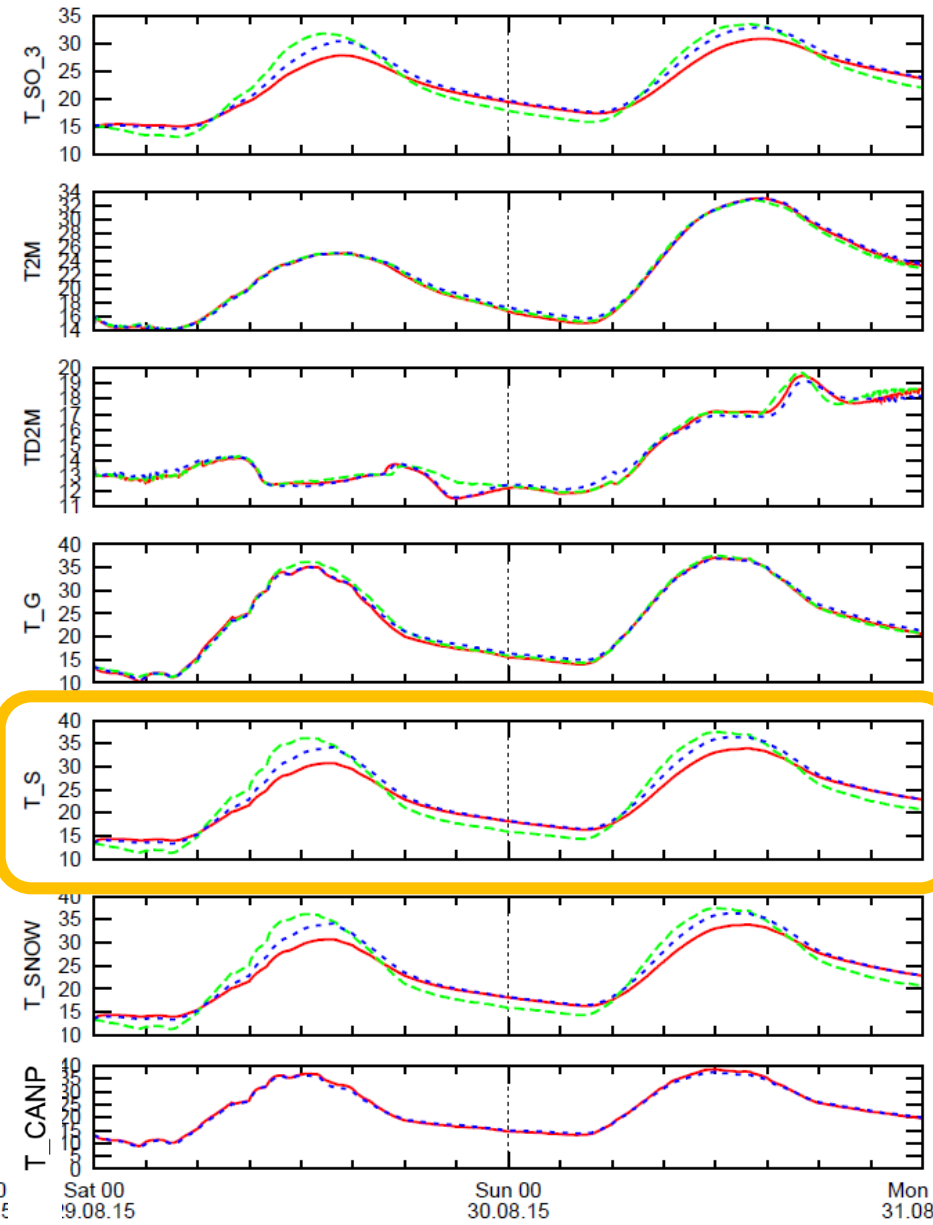# TERRA-URB *(Wouters, H.)*

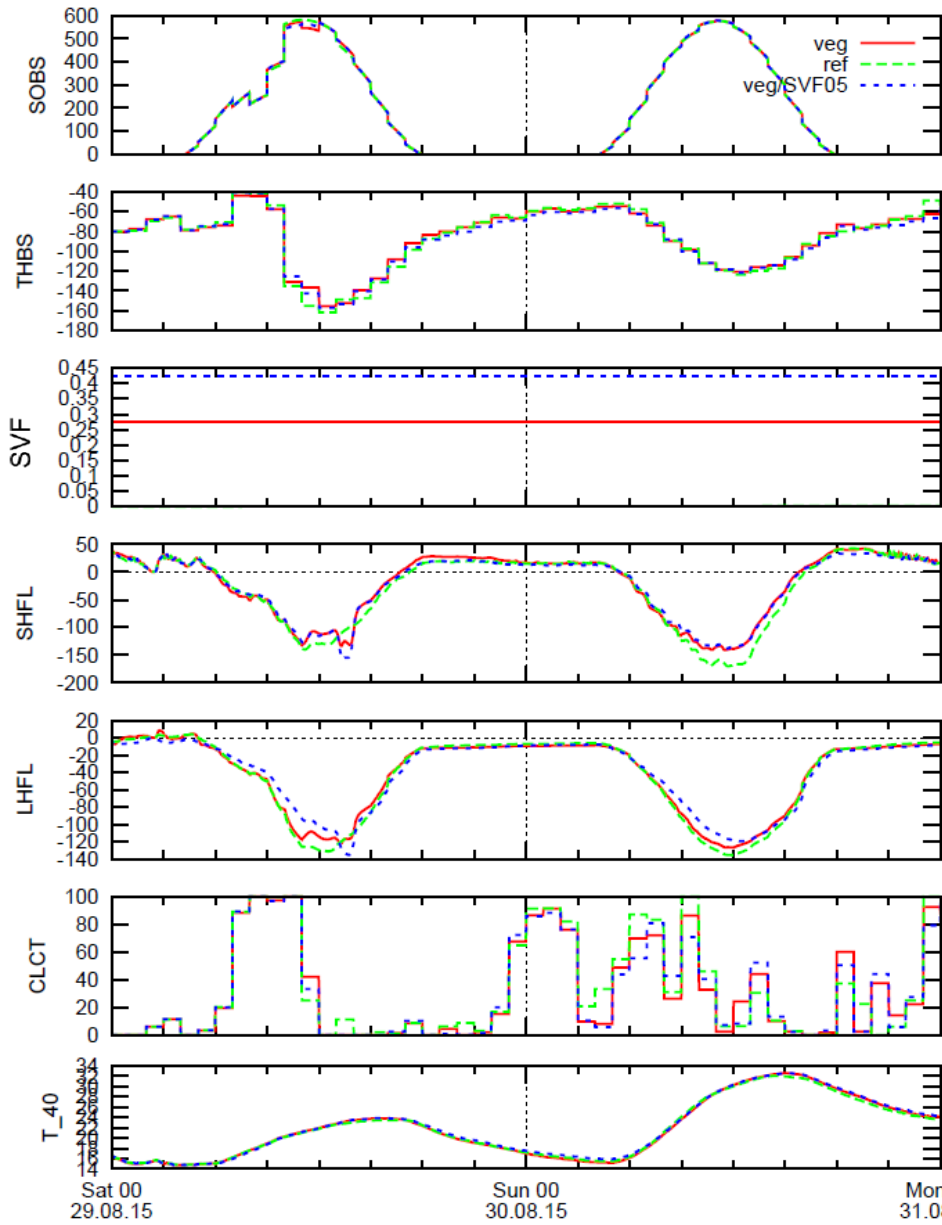**Observed (stars) and modelled (lines) nocturnal (0H) vertical profiles for industrial site in Zwijndrecht and the rural site in Mol, averaged for the summer period 2012/07/21 - 2012/08/20.**

TERRA – Outlook

- **New developments based on common COSMO/ICON module**
- … vegetation canopy

0.00-0.01
0.01-0.03
0.03-0.09
0.09-0.27
0.27-0.81
……
7.29-21.87

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Left column (top to bottom): SOBS, THBS, SVF, SHFL, LHFL, CLCT, T_40

Right column (top to bottom): T_SO_3, T2M, TD2M, T_G, T_S, T_SNOW, T_CANP

Legend:
- veg
- ref
- veg/SVF05

Sat 00
29.08.15

Sun 00
30.08.15

Mon 00
31.08.15

Falkenberg: Lat=52.18°N, Lon=14.08°E, H=70 m. Indices 329 357
Falkenberg: Lat=52.18°N, Lon=14.08°E, H=70 m. Indices 329 357
Falkenberg: Lat=52.18°N, Lon=14.08°E, H=70 m. Indices 329 357

File cosmo_160610_5.04b_veg/M_Falkenberg
File cosmo_160610_5.04b_ref/M_Falkenberg
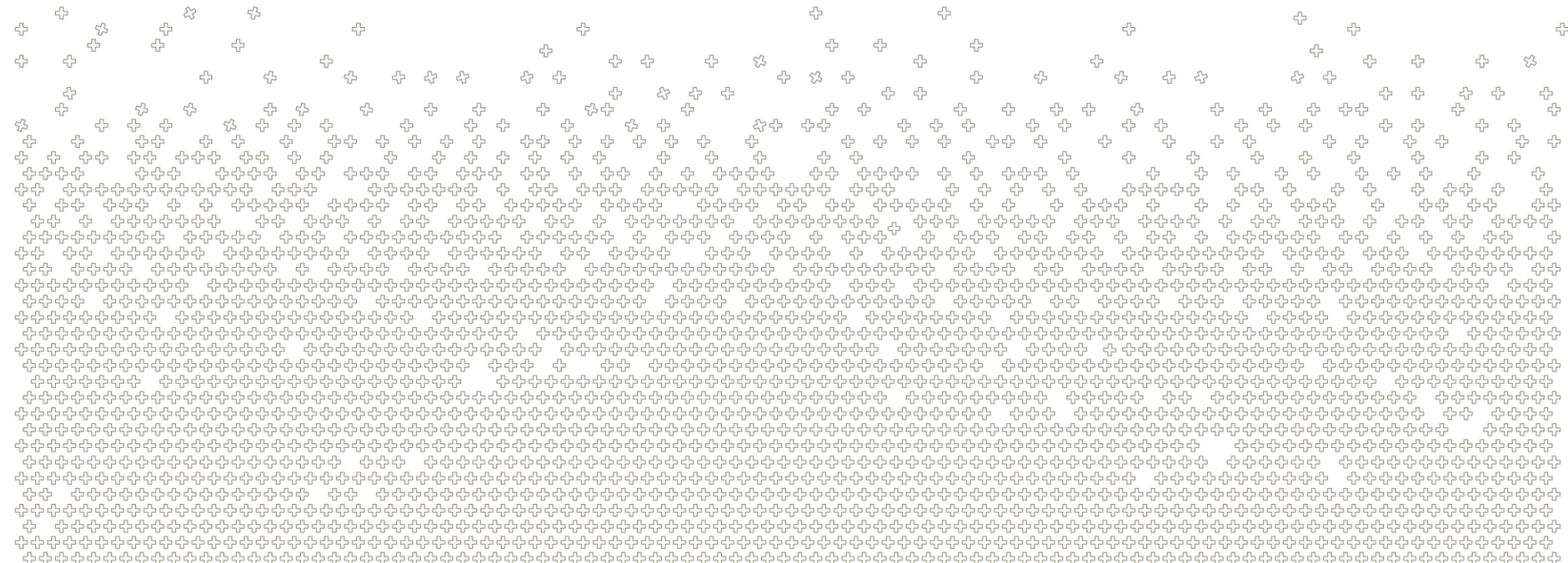File cosmo_160610_5.04b_veg/SVF05/M_Falkenberg

TERRA – Outlook

- **Work at IMGW**

  - Revisiting bare soil parameterization in TERRA

  - Peer reviewed paper in preparation (Tellus A)

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Some input from ETHZ

PRUDENCE → ENSEMBLES → EURO-CORDEX

Persistent systematic biases
(e.g., predominance of cold biases, southern Europe warm summer bias, overestimation of summer variability, see e.g. Kotlarski et al., 2014)

Is land surface processes representation the weak link in current RCMs?

TERRA – EURO-CORDEX

- **EURO-CORDEX: Historical ERAint-driven RCM runs over Europe (0.44 degree)**
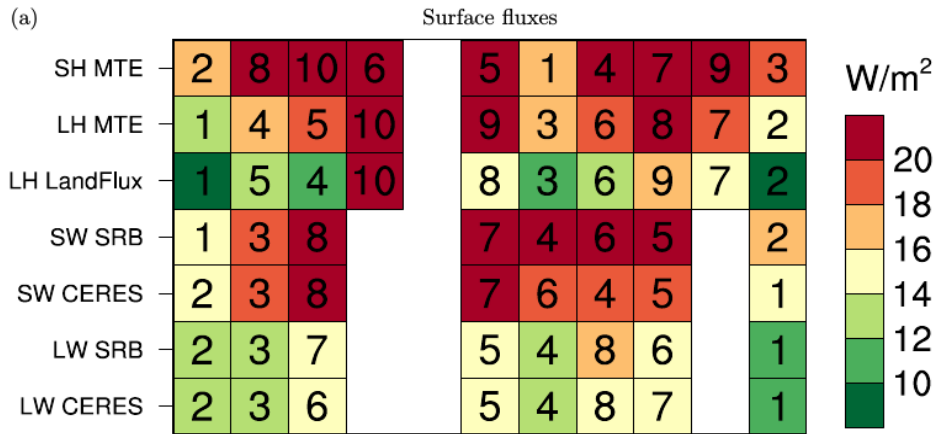 *Edouard Davin, Eric Maisonnave, Sonia Seneviratne / ETHZ*

Model	Institution	LSM
ALADIN 5.2	HMS	ISBA (Noilhan and Planton, 1989; Douville et al., 2000)
HIRHAM 5	DMI	(Hagemann, 2002)
WRF 3.3.1	IPSL-INERIS	NOAH (Ek et al., 2003)
RACMO 2	KNMI	(Balsamo et al., 2009)
HadRM 3P	MOHC	MOSES (Cox et al., 1999)
RCA 4	SMHI	(Samuelsson et al., 2006)
REMO 2009	MPI-CSC	(Hagemann, 2002; Rechid et al., 2009)
RegCM 4.3	ICTP	BATS (Dickinson, 1984)
COSMO-CLM 4.8.17	CLM-Community	TERRA_ML (Doms et al., 2011)
COSMO-CLM^2	ETH Zurich	CLM4.0 (Oleson et al., 2010; Lawrence et al., 2011)

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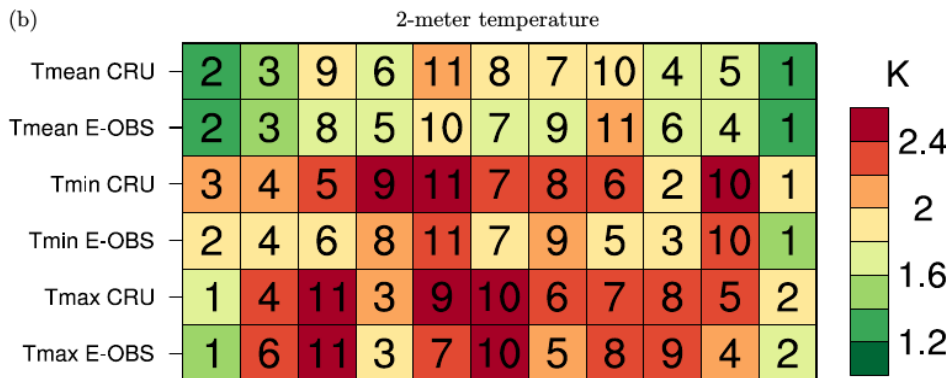
TERRA – EURO-CORDEX

- RMSE score integrating spatial and temporal performance (based on monthly means)
- Surface fluxes, temperature, precipitation
- Whenever possible several reference datasets are used

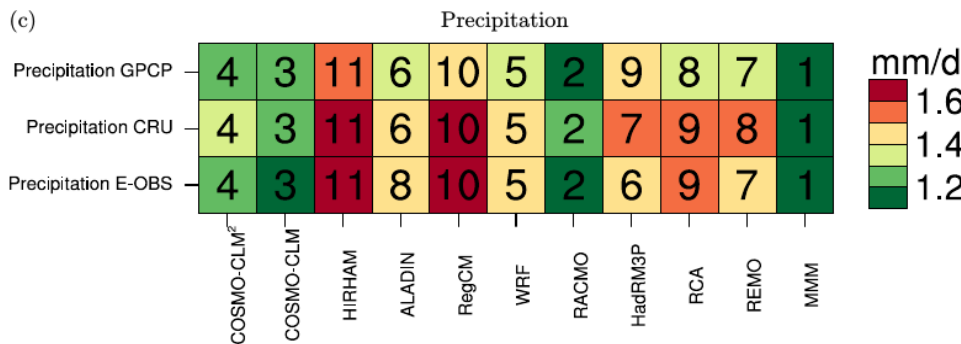| Dataset	Variables	Resolution	Time period	Reference
CRU TS3.22	2-m temperature precipitation cloud cover	0.5x0.5	1990-2008	(Harris et al., 2014)
E-OBS v11	2-m temperature precipitation	0.5x0.5	1990-2008	(Haylock et al., 2008)
GPCP2.2	precipitation	2.5x2.5	1990-2008	(Huffman et al., 2009)
FLUXNET MTE	latent heat sensible heat	0.5x0.5	1990-2008	(Jung et al., 2011)
LandFlux-EVAL	latent heat	1x1	1990-2005	(Mueller et al., 2013)
SRB3.0	shortwave radiation longwave radiation	1x1	1990-2007	(Zhang et al., 2015)
CERES	shortwave radiation longwave radiation	1x1	2001-2008	(Rutan et al., 2015)

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TERRA – EURO-CORDEX

Multi-scores ranking

- COSMO-CLM^2 outperforms COSMO-CLM and most other RCMs for surface fluxes and temperature

- No improvement for precipitation
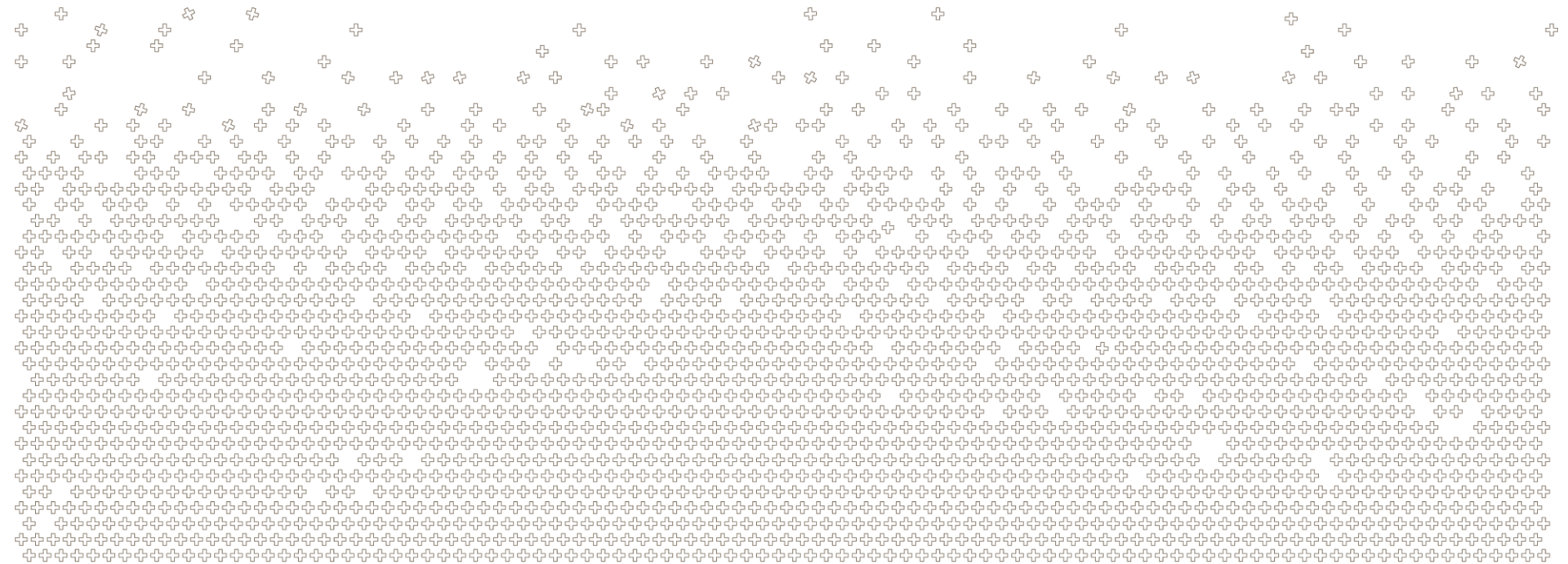
Some input from ETHZ...

- Paper in ,*Environmental Research Letters*' by E. Davin et al. clearly makes the point that COSMO-CLM^2 outperforms COSMO-CLM and most other RCMs for surface fluxes and temperature (without any expert tuning!)

- **How to transfer this knowledge into an improvement of the 'standard' COSMO configuration?**
  - A common project with ETHZ / MeteoSwiss / COSMO would be most welcome by Prof. S. Seniviratne…
  - … High resolution tests of COSMO/CLM, in NWP mode (concurrently to PT Terra Nova)
  - … Discussion at ETHZ on October 19th, input welcomed

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Support

EXTPAR

- MACv2 aerosol beeing implemented by D. Luethi & RHM
  (in particular for project T2(RC)2)

- Bug found in computation of SSO-THETA when topo smoothing
  is applied (EXTPAR @ DWD)

- D. Luethi will resign from the function of SCA for EXTPAR
  after completion of this task. Successor to be defined by StC.

SRNWP data pool

- **NetCDF** format available (work in progress)
- Data set now open to **universities** and **R&D institutions**
- Problems with **data quality** and **availability** for some sites

- Very limited usage!
- Action started at SRNWP level
  (questionary, cost evaluation, EUMETNET resources…)

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Thank you for your attention!