



Schweizerische Eidgenossenschaft
Confédération suisse
Confederazione Svizzera
Confederaziun svizra



Other WG3b activities

Jean-Marie Bettems / MeteoSwiss

COSMO User Seminar
Offenbach, March 4 , 2013



COSMO Web site

- All WG3b tasks must be **documented** on the COSMO web, in *COSMO tasks > Work Groups > WG3b > Work Plan*

<http://www.cosmo-model.org/content/tasks/workGroups/workPlan.htm?sqlPred=0:::3>

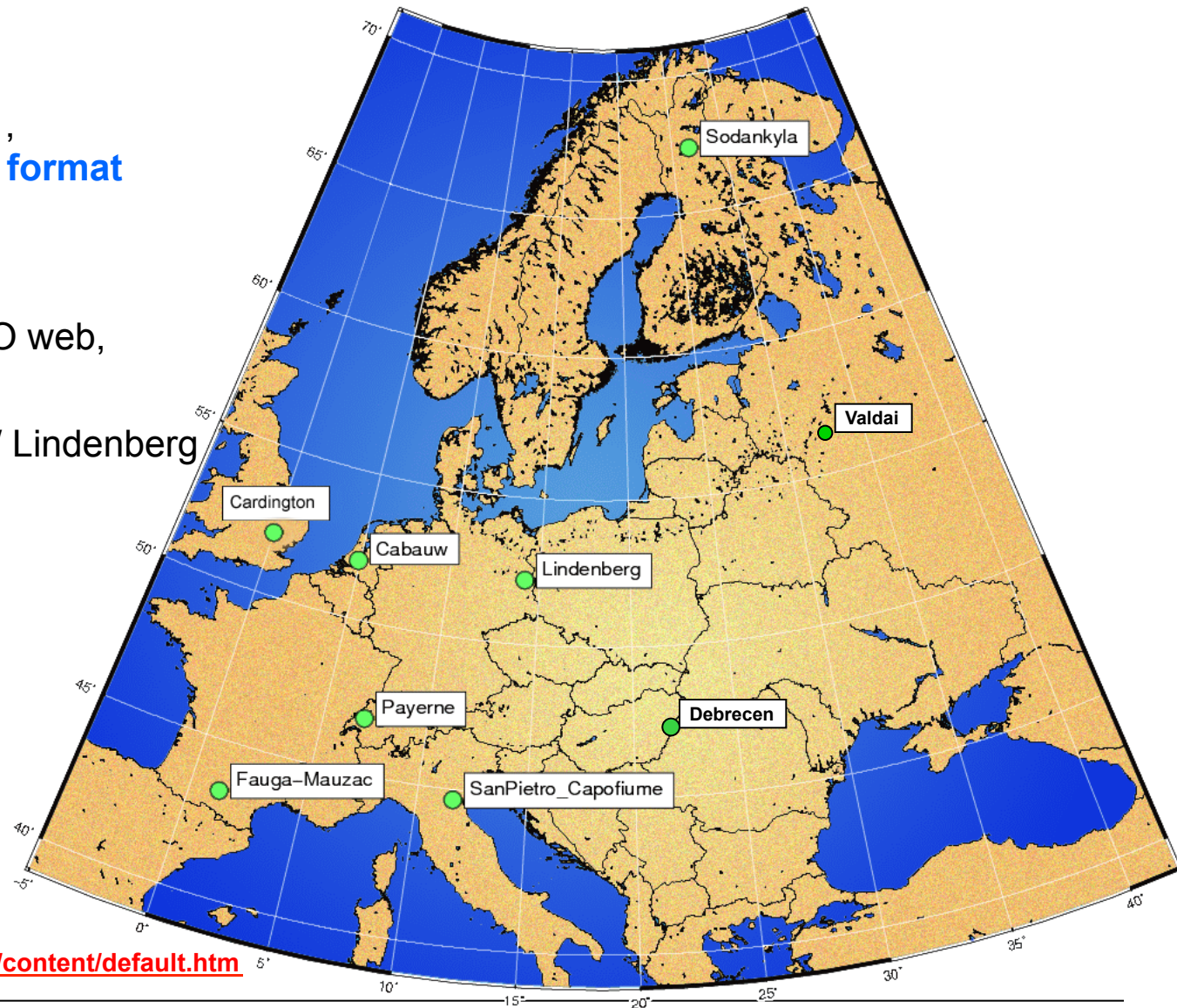
Note in particular

- Type of information (responsible person, description, status, expected delivery date ...)
 - Structure (TERRA, external parameters, support activities, CLM activities)
 - Link with model development page (coding standard, SMC decisions)
-
- These pages are now visible **without password**
 - This is still a **work in progress**
- Responsible persons must regularly **check** the content and **inform** the WG3b coordinator on any necessary changes



Data pool action

- Currently **9 sites**, data from **2006-2011**, in a **common ASCII format**
- **Soil**, **surface** and **BL** observations
- Access from COSMO web, password protected
- Work done at DWD / Lindenberg (C.Heret)



<http://www.cosmo-model.org/srnwp/content/default.htm>



Data pool action



- Four of the nine sites have large **gaps** of data
- Resources at Lindenberg for this action are **limited**
- Not all sites have enough observations to **close the energy budget** at the surface



- Data for 2006-2011 without gaps for **five** sites (Cap, Cab, Lin, Pay, Tou)
- The SRNWP expert team on soil and surface and the COSMO SMC fully **support and encourage** this activity
- Colleagues at Lindenberg agreed to **pursue this effort**

- **Use** these data! For example:
 - extend default set of COSMO model meteograms
 - routine inter-comparison of soil and surface fluxes
 - integrate in soil & BL developments
- **Report** all problems and wishes (mailing list), this will encourage the data provider to improve their measurements



External parameters

Work on EXTPAR

- Efficient implementation of parameters required for **topo corrected radiation** scheme (parameterization already available in COSMO code)
 - Topography related parameters based on **ASTER** instead of GLOBE data set (*optional*; see talk on Tuesday)
 - **Scale separation** to derive z0 and SSO related parameters (*optional*)
- New EXTPAR release combining DWD release 1.7 (OpenMP) and the above mentioned developments planned for **mid-April**

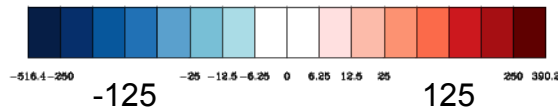
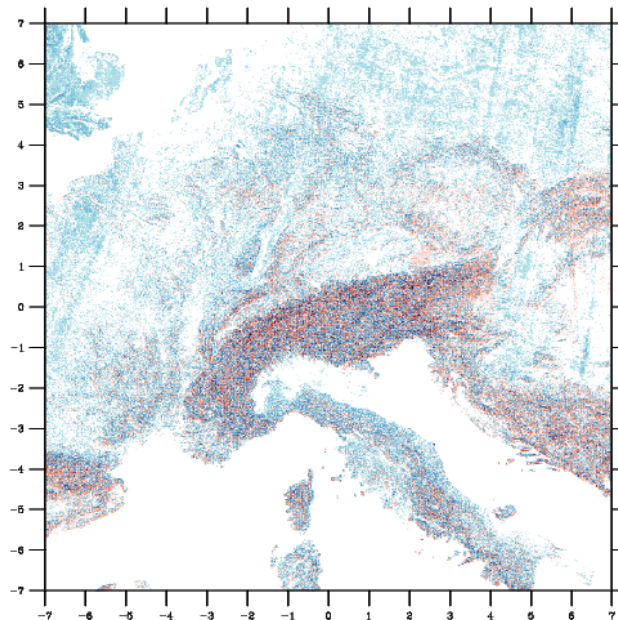


External parameters

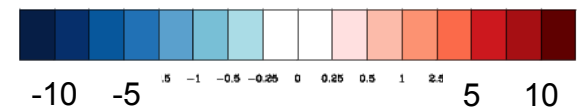
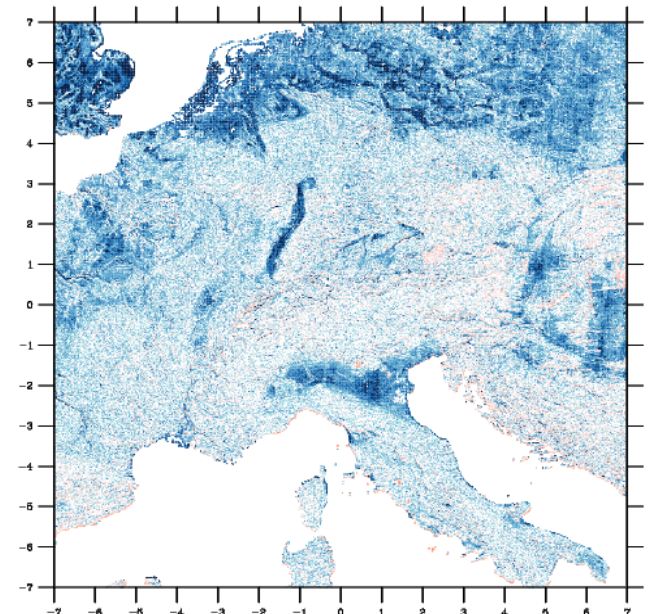
GLOBE versus ASTER

- Standard deviation of **subgrid scale orography** on 2.2km grid as produced by modified EXTPAR
- **Absolute** differences (links) and **relative** differences (right) between GLOBE based and ASTER based parameters

stddev of subgrid scale orography [m]



stddev of subgrid scale orography [%]





COSMO Priority Project CALMO

Motivation

- Many **unconfined parameters** in the COSMO model
- **Expert tuning** during model development, but for some specific model configuration and some specific target region
- **Is this expert tuning optimal?**
- **Is this expert tuning still valid for ...**
 - ... a new *target region* (e.g. Alps, Greece) ?
 - ... a new *model configuration* (e.g. horizontal or vertical grid refinement, new numerics, new soil module) ?



Eidgenössische Technische Hochschule Zürich
Swiss Federal Institute of Technology Zurich



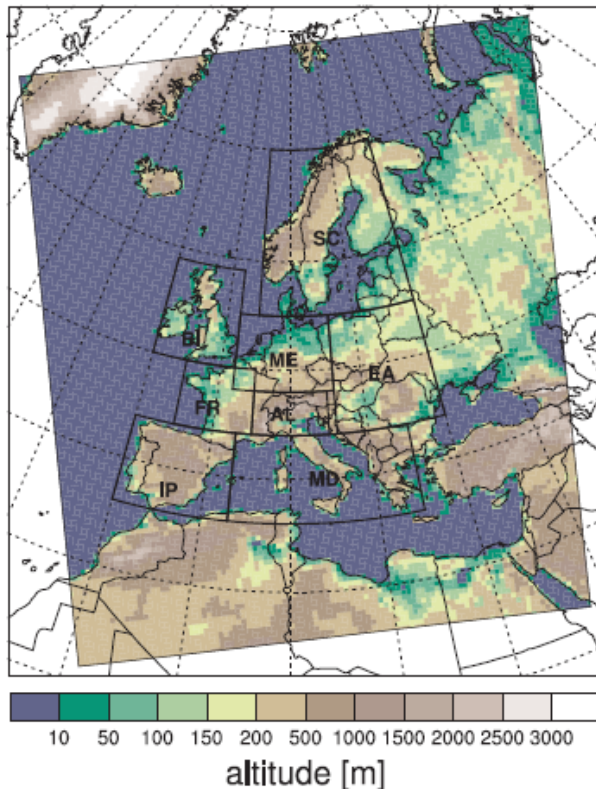
Systematic calibration of a regional climate model and implications for expert tuning

Omar Bellprat, Sven Kotlarski, Daniel Luethi, Christoph Schär

7.05.2012, Group Meeting

Validation framework

Domain and Topography COSMO-CLM



Model performance

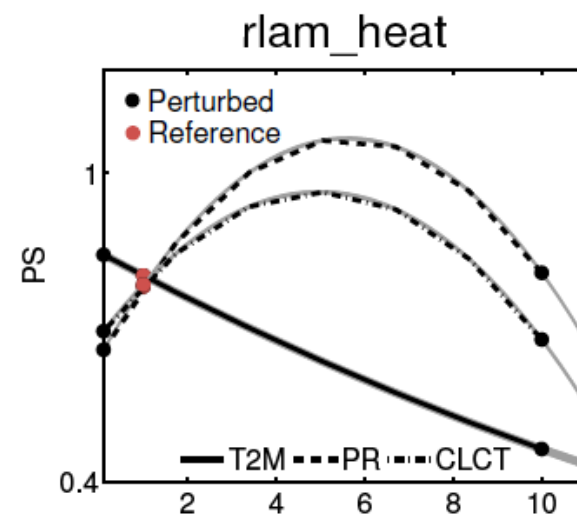
$$PI = \left\langle \frac{(m-o)^2}{(\sigma_o + \sigma_{iv} + \sigma_\epsilon)^2} \right\rangle,$$

$$PS = \exp(-.5 * \sqrt{PI})$$

Least-squares error of monthly timeseries for **T2M, PR and CLCT** and for all PRUDENCE regions. (Normal likelihood) m =model output, o =observations. σ_o =natural variability of observations. σ_{IV} =internal variability of CCLM, σ_{err} =uncertainty of observations.

Selected model parameters

- ▶ **rlam_heat**: Controls resistance of the laminar surface fluxes for heat.
- ▶ **qi0**: Threshold for auto-conversion from ice to snow.
- ▶ **entr_sc**: Entrainment rate of shallow convection.
- ▶ **uc1**: Controls relative humidity criterion in sub-grid cloud formation.
- ▶ **rootdp**: Uniform factor of the root depth field.



Minimum and maximum parameter value for rlam_heat

Non-linear regression

Fit a multivariate quadratic model in the parameter space (Neelin, 2011).

Meta-model

$$\Phi' = \vec{\mu} \cdot \vec{a} + \vec{\mu}^T \cdot B \vec{\mu} + \Phi_s$$

Φ : Model field (e.g. T2M, PR, CLCT), $\vec{\mu}$: Parameter vector, a , B : Coefficient matrices

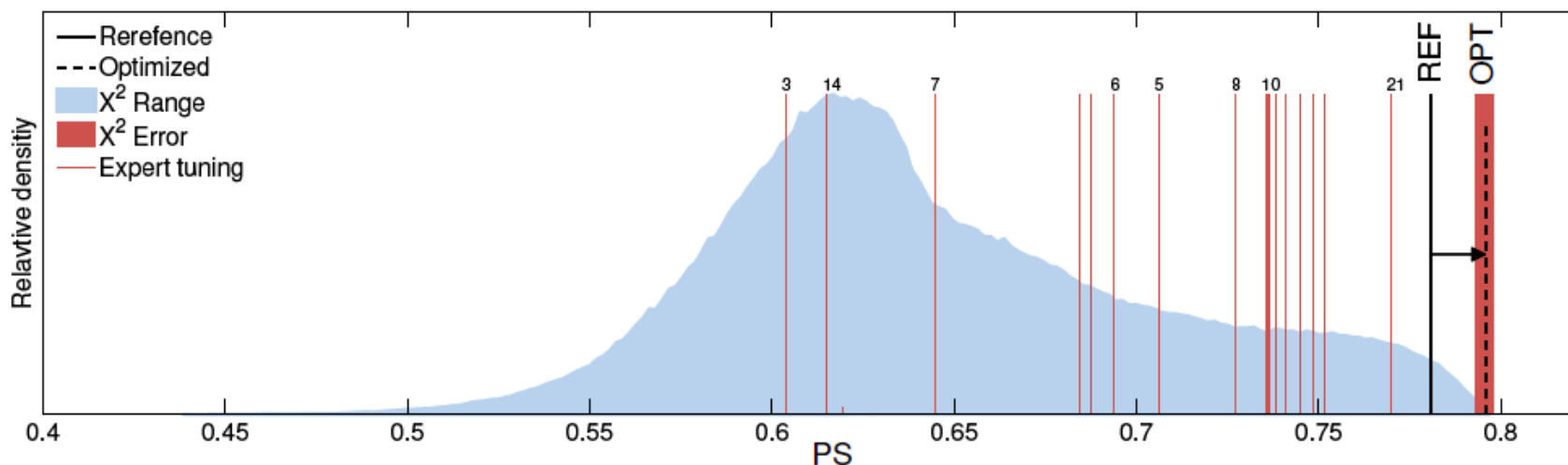
e.g. for 2 parameters: $\Phi' = \Phi_s + a_1 \mu_1 + a_2 \mu_2 + b_1 \mu_1^2 + b_2 \mu_2^2 + 2\mu_1 \mu_2$

Number of simulations for analytical solution = $N * 2 + N(N - 1)/2$.
For 5 parameters 20 simulations needed.

**Objective calibration
beats expert tuning!**

Systematic calibration versus expert tuning

Full performance range for the selected parameter ranges and expert tuning for CORDEX setup.



1 Mio. parameter combinations from a latin hyper-cube.

Much more efficient procedure and additional reduction of 10% of the error.



COSMO Priority Project CALMO

Goals

Answer the following questions:

1. How **practicable** is the calibration framework developed at ETHZ for NWP applications ? Which adaptations are necessary ?
2. How **sensitive** is the optimal parameters set with respect to the **model domain** (e.g. N. Europe, Alps, Mediterranean) ? Any **gain in model quality** observed with respect to the default configuration ?



COSMO Priority Project CALMO

Plan

Period

01.2013 – 12.2014

Tasks

- **Adaptation** of the existing method for NWP applications, in particular
 - Choice of performance function
 - Choice of model parameters sub-space to sample
 - Experimental set-up (simulation length, soil initial state ...)
- Sensitivity of optimal parameters to the choice of the **target region**
- Optimal methodology in terms of **computing time** and quality gain
- Documentation, including **scientific paper**



COSMO Priority Project CALMO

Status

- **Human resources** guaranteed : Antigoni V. (PL, HNMS), Federico G. (ARPA-SIMC), **Omar B.** (ETHZ), Jean-Marie B. (MeteoSwiss) – In particular Omar B. will be able to invest 6 months work in this project!
- **Computing resources** guaranteed : **1.5 Mio CPU hours** on rosa (CSCS) + additional resources on MeteoSwiss system
- Version 1.0 of **project plan** available
- **Kick-off meeting** 14-15 Feb. at MeteoSwiss
- On going:
 - documentation of **tuning parameters** (Federico G.)
 - literature review, **parameters sensitivity** (Antigoni V.)



Thank you for your attention!