



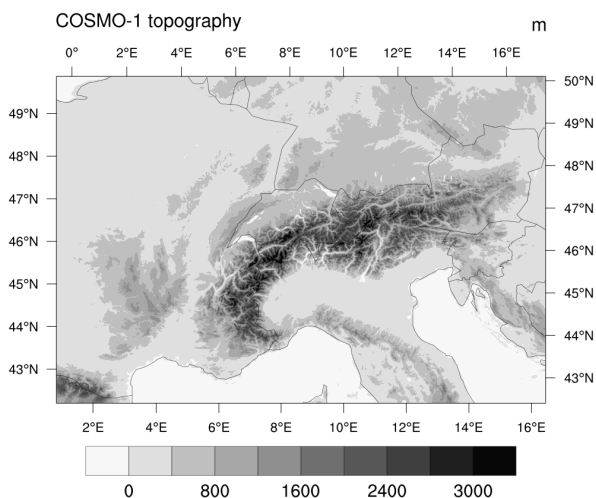
CALibration of the COSMO Model CALMO -MAX

Project participants*

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*with the contribution of Pirmin Kaufmann, Silje Soerland (ETHZ) and Andreas Will (BTU)

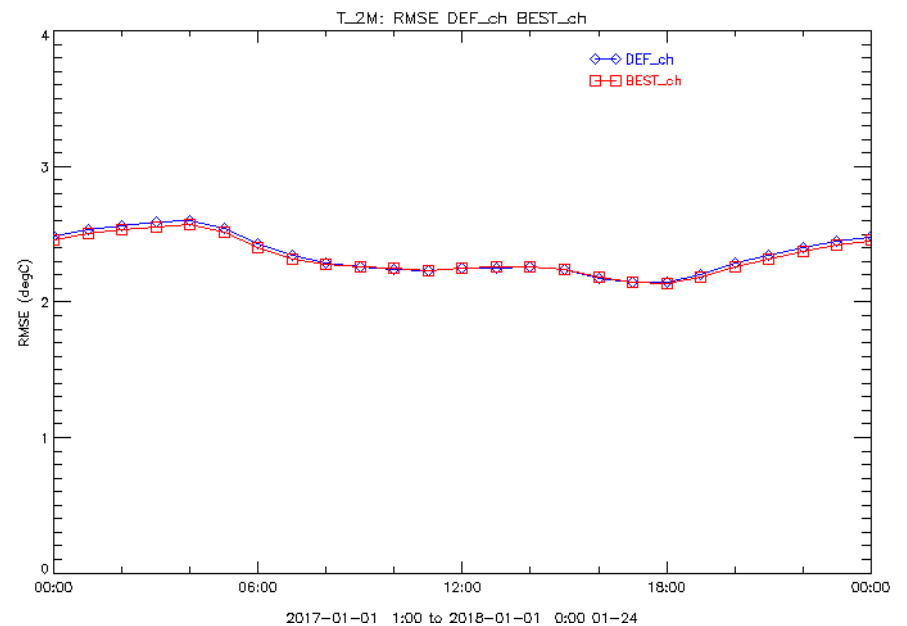
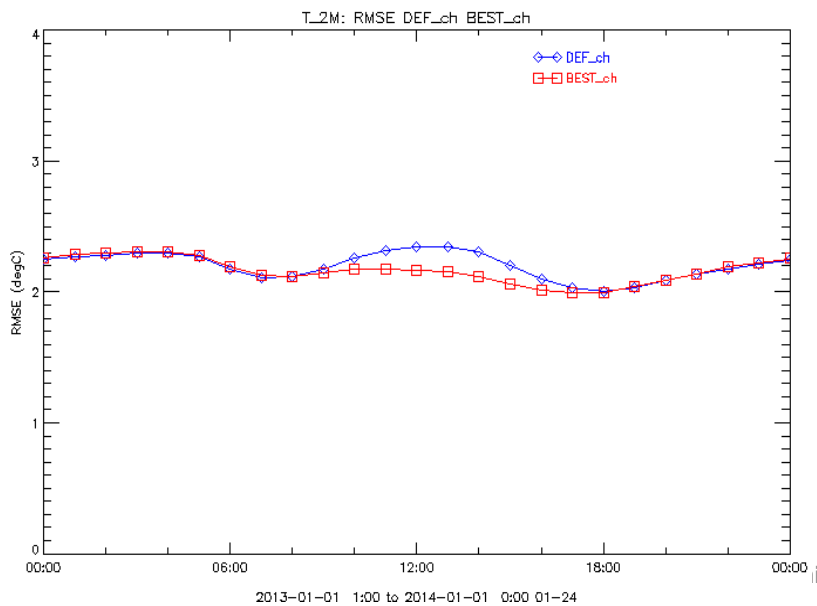
Calibration of COSMO-1



Acronym	Parameter	Parameter Range	Optimum value	ETHZ Value
Minimal diffusion coefficient for heat	tkhmin	[0.1, 0.4 , 1]	0.279	1.37
Factor for laminar resistance for heat	rlam_heat	[0.1, 1, 2]	0.9296	0.72
Parameter controlling the vertical variation of critical relative humidity for sub-grid cloud formation	uc1	[0, 0.8 , 1]	0.7686	0.75
Factor for vertical velocity of snow	v0snow	[10, 20 , 30]	18.95	25.6
Fraction of cloud water and ice considered by the radiation scheme	radfac	[0.3, 0.6 , 0.9]	0.6775	0.59

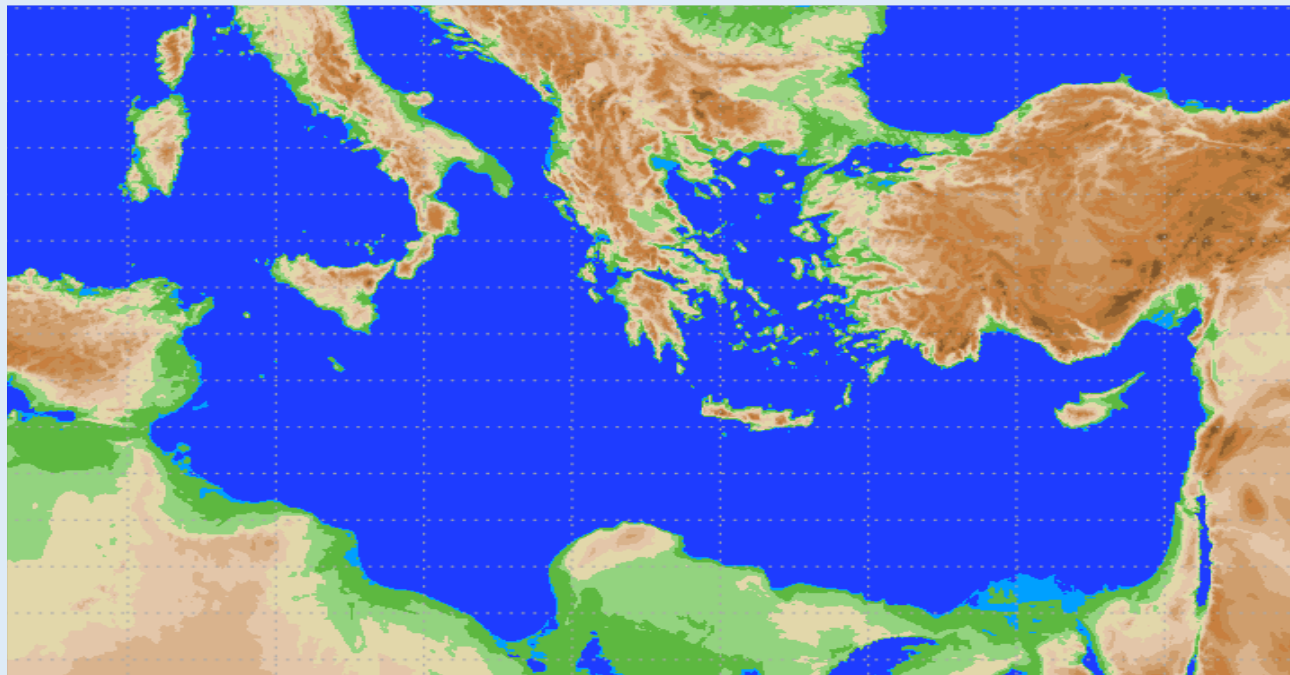
2m temperature for years 2013 and 2017

Year	2013		2017	
Measure T2m	DEF	BEST	DEF	BEST
ME	0.043	0.128	0.236	0.143
RMSE	2.2	2.1	2.35	2.33
MINMOD	-28.67	-28.67	-29.64	-28.77
MINOBS	-28.7		-29.5	
MAXMOD	38.43	37.41	40.0	40.0
MAXOBS	37.1	37.1	36.9	



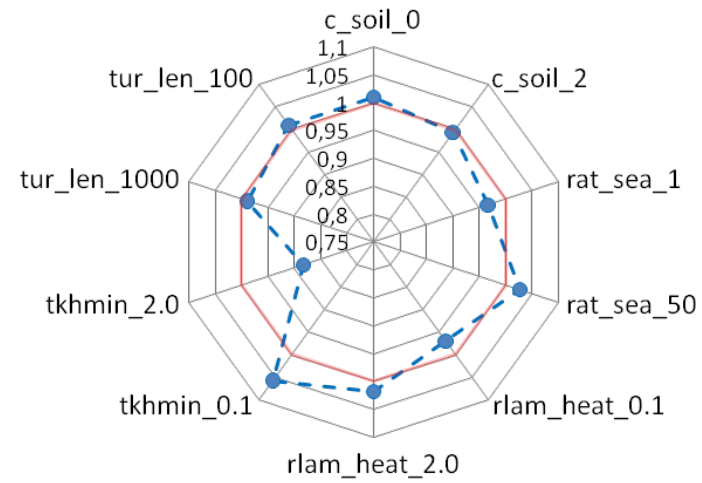
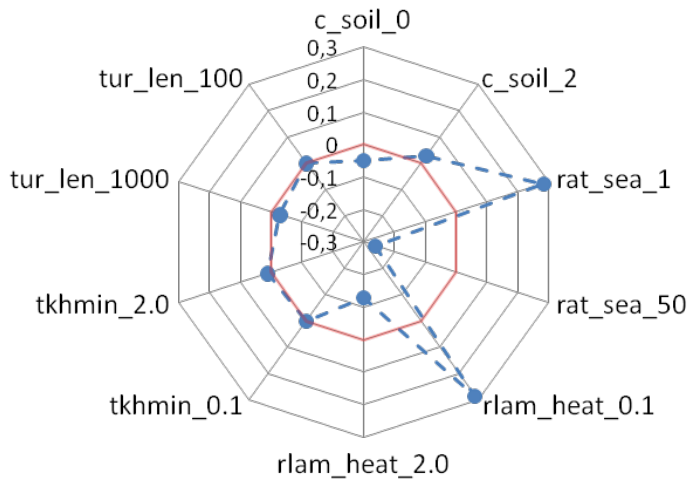


Calibration over the Mediterranean

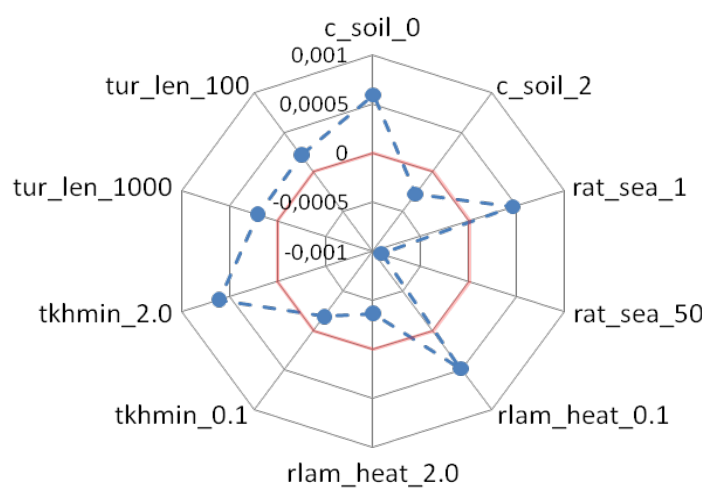
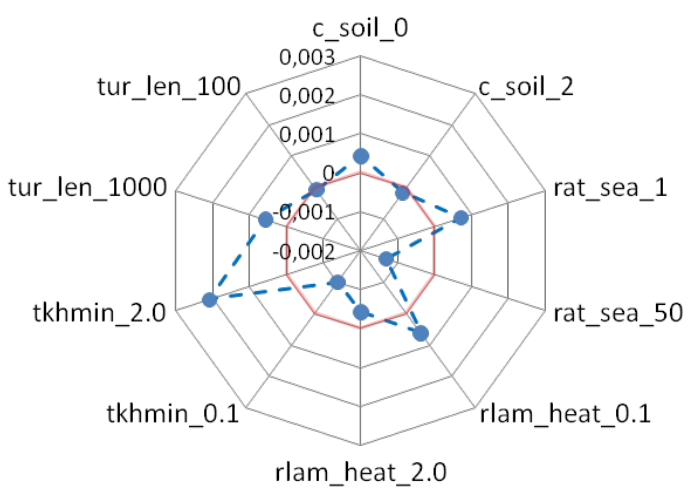


PARAMETER	INTERPRETATION	RANGE	TEST VALUES (default)
rat_sea	ratio of laminar scaling factors for heat over sea	1-100	1, 10, 50
rlam_heat	scaling factor of the laminar boundary layer for heat	0.1 – 10.0	0.1, 1.0, 2.0
tkhmin tkmmin	minimal value of diffusion coefficient for heat and momentum (kept equal)	0.0-2.0	0.1, 0.40, 2.0
tur_len	asymptotic maximal turbulent length scale (m)	10 – 10000	100, 150, 1000
c_soil	surface area index of evaporative soil surfaces (dependent on surface area density of the roughness elements over land , c_Ind)	0-c_Ind(2.0)	0, 1, 2

Sensitivity experiments



$$\frac{(<TOT_PREC>_{TEST} - <TOT_PREC>_{DEFAULT}) / <TOT_PREC>_{DEFAULT}}{(<TMAX_2M - TMIN_2M>_{TEST} - <TMAX_2M - TMIN_2M>_{DEFAULT}) / <TMAX_2M - TMIN_2M>_{DEFAULT}}$$



$$\frac{(<TMIN_2M>_{TEST} - <TMIN_2M>_{DEFAULT}) / <TMIN_2M>_{DEFAULT}}{(<TMAX_2M>_{TEST} - <TMAX_2M>_{DEFAULT}) / <TMAX_2M>_{DEFAULT}}$$



Remarks— CALMO based next PP

- **Improvement** on diurnal cycle of T2m even for a well-tuned configuration
- Strong **dependency** of parameters **optimum** on **the time** of the year
- **Variation** of the optimum **reflects dependency** on the atmospheric flow or weather pattern
- Methodology is “**model independent**” and can be applied to any NWP or climate model.

CALMO-Next.....

- Cost reduction in terms of **computational cost** with respect to **model performance** improvement
- **Synchronize** the COSMO and the ETHZ **developments**.
- **Cottbus** department of mathematics to: (a) propose a **new approach on MM** (b) perform **calibration on the new dynamical core**
- Use calibration to check **robustness of parameterization schemes** e.g. do similar optimum parameter values define confidence interval of the parameterization scheme?
- List of **unconfined and ‘tuned’ parameters** correlated to model variables is **needed**
- **Human resources** missing



Documents and deliverables

- ✓ Detailed description of the parameters convergence (used in optimization method)
- ✓ Technical report No 42
- ✓ Contribution to the 20th COSMO Newsletter (submitted)
- ✓ Meta model available at ECMWF

- **Pending**
 - Manuscript in peer review journal
 - CALMO-MAX final report

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