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CALMO Session
Agenda-Day1
Monday 13h30-18h00 : CALMO, chair A. Voudouri

13:30-13:35 Opening, JM Bettems

13:35-14:15 Progress report of CALMO , A.Voudouri

14:15-15:15 Meta-model status- recent developments, P.Khain

15:15-15:30 Observations used, F. Grazzini, P.Khain

15:30- 16:15 Status of COSMO-2 calibration P.Khain, A.Voudouri

16:15-16:30 Coffee break

16:30-17:00 A Method for the Priority Hierarchy of CALMO Tests, E.Avgoustoglou

17:00-17:30 Analysis of results using COSMO-2, all

17:30-18:00 COSMO-1 calibration: Part I, all

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CALMO Session
Agenda-Day2
Tuesday 14h00-19h15 : CALMO, chair A. Voudouri

14:00-14:45 COSMO-1 calibration: Part II, all
14:45-15:30 Steps towards CALMO end, all
15:30-15:45 Data Storage, JM Bettems, A. Voudouri
15:45-16:45 C-MAX: The new PP proposal based on CALMO, all & WG3a
16:45-17:15 Coffee break
17:15-18:15 Dissemination of work (Final report, papers), all
18:15-19:15 C-MAX Roadmap

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CALibration of the COSMO MOdel CALMO

Progress report

antigoni.voudouri@hnms.gr

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CALMO TASKS

Task 0: Administration and support

- Regular monthly web conferences
- A workshop has successfully been organized in Athens, 11-12 January 2016
- The existing mailing list of the project (http://mail.cosmo-model.org/mailman/listinfo/cosmo-calmo)

Task 1 Preliminary work

Computer resources are ensured by the end of September 2016 (e-mail of Maria-Grazia to be discussed)

Dear Antigoni,

I will extend the proposal until **September 30th, 2016.** This will be the final extension for this project. If you need to have additional resources you need to submit a new proposal by May (deadlines are already published on our webpage).
Please note that you can submit a multi-year project if you have a clear plan in your research. Please also note that we require to add information of past projects and usage of past projects in the proposal description, to have an idea of how well resources were used. Yours is a large proposal with over 1 Mio node hours granted over 1 year and this information will have an impact.

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Task 2: Adaptation of the method

2.1: Documentation of tuning parameters and choice of parameters subspace.
Main goal of the CALMO project is substituting expert tuning with objective calibration any time new unconfined parameters are induced in COSMO model. Thus this is considered an on-going task.

2.2: Selection of performance function(s)
Normalized RMSE and a COSI type score has also been tested. More details next talk of Pavel

2.3: Identification of key-variables for NWP
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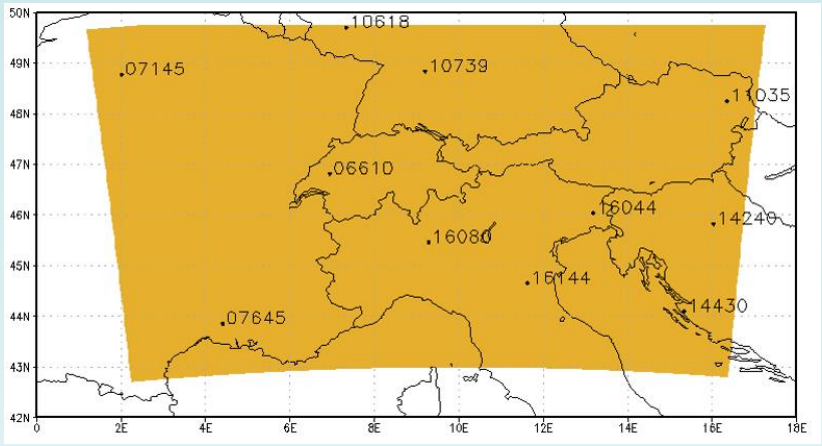
Steps from CALMO Stage 1 to Stage 2 (Task 2.3)
Added soundings profiles to include more variables



Stage-1

- Daily maximum 2m temperature
- Daily minimum 2m temperature
- 24h accumulated precipitation

Stage-2 (Stage-1 & New)

- Total column water vapor;
- Relative humidity, temperatures, East-West wind component and South-North wind component at 500mb ,700mb and 850mb;
- Vector wind shear between the levels of 1000mb-850mb, 850mb -700mb and 700mb- 500mb
- *Convective available potential energy* ; - *Convective inhibition* ;

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Experimental set-up (Task 2.4)

Steps from CALMO Stage 1 to Stage 2
Increased simulations period

Stage-1

- Two 3-weeks periods (from 40 days of 2008)
  - winter (3-20/1/2008) and
  - summer (2-20/6/2008)

Stage-2

- Entire year 2013

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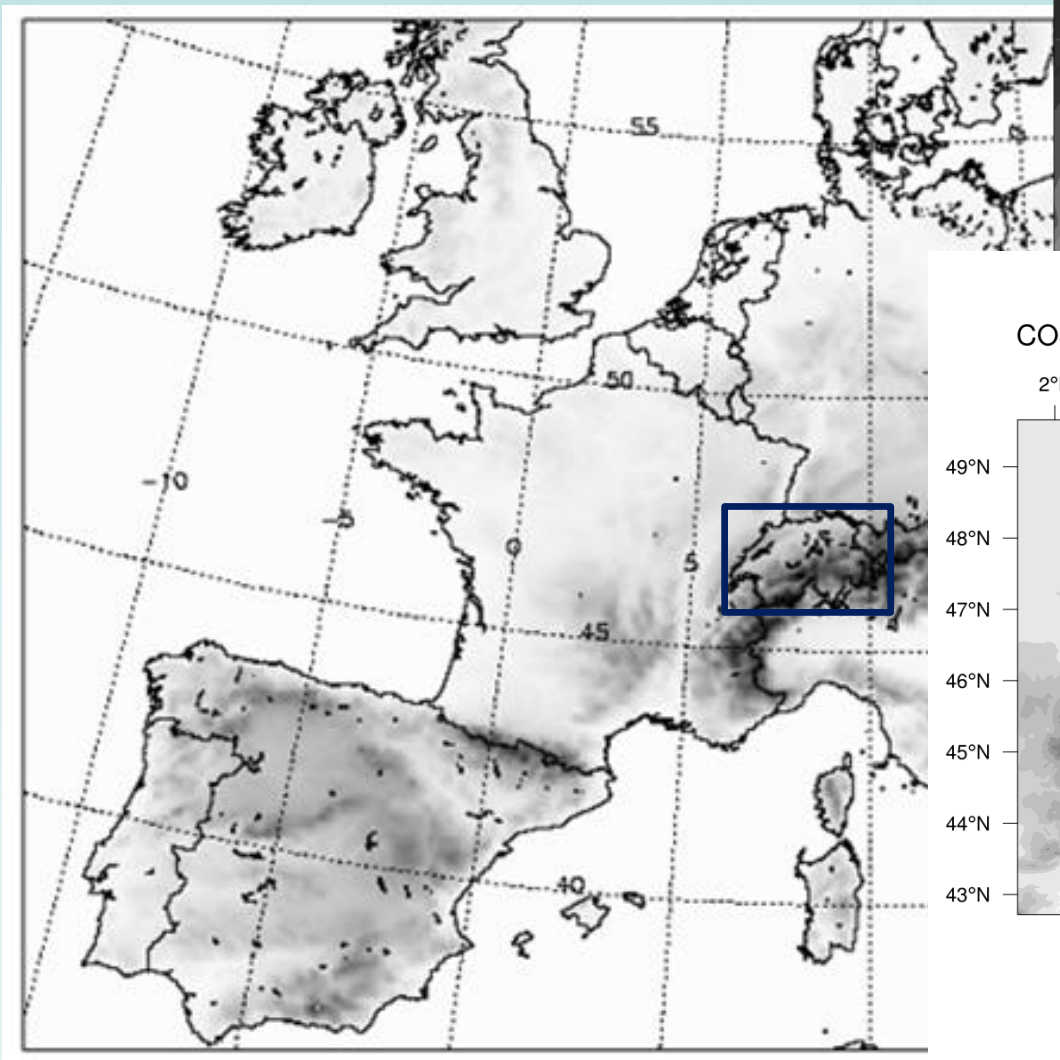
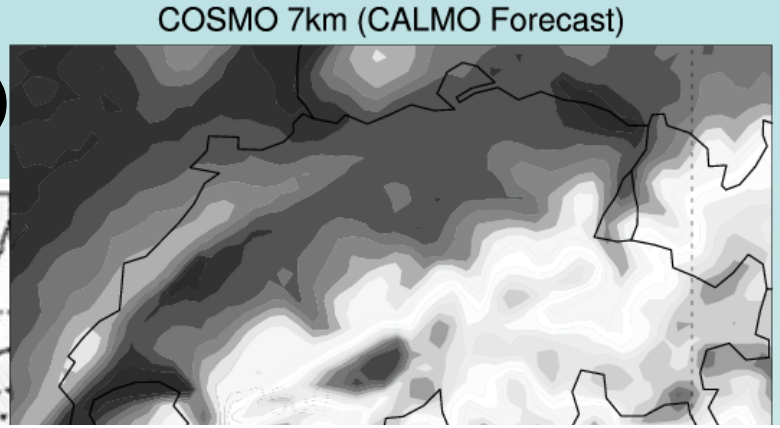
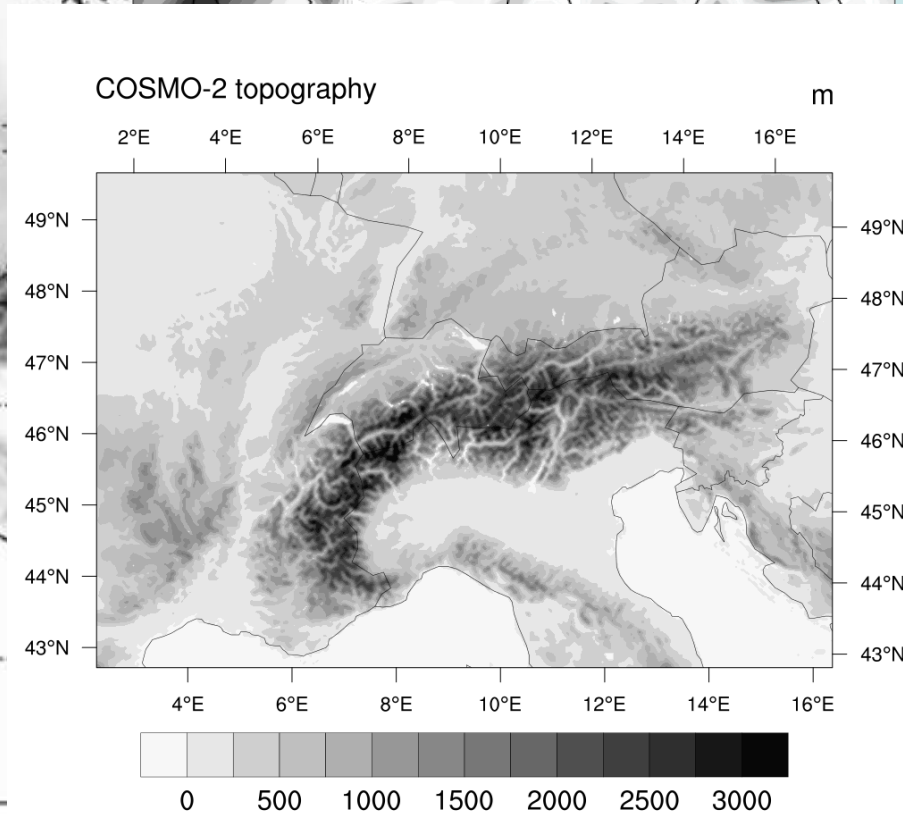
Steps from CALMO Stage 1 to Stage 2
Increased resolution from 7km (Task 2.4)







…..to 2.2km (Stage 2)

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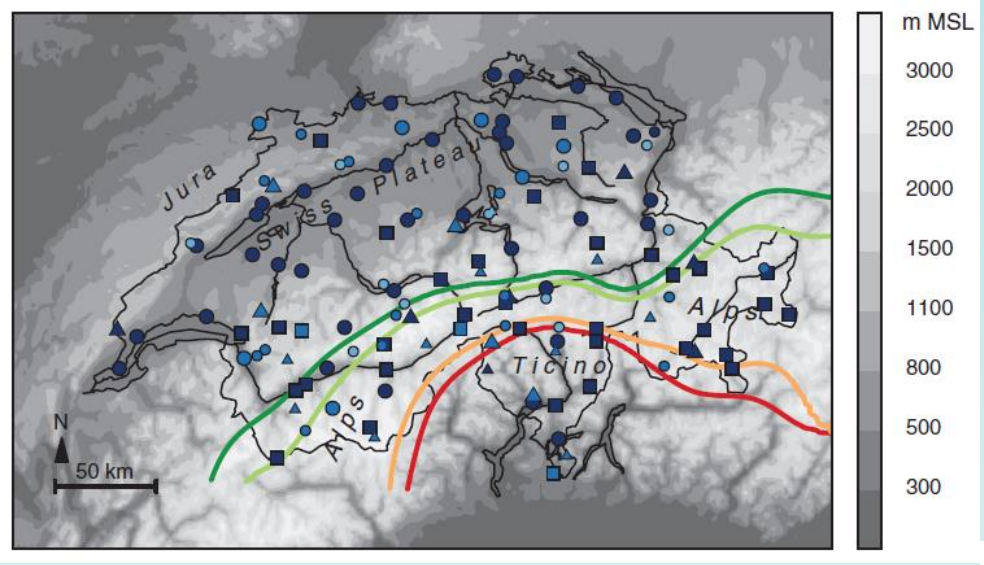
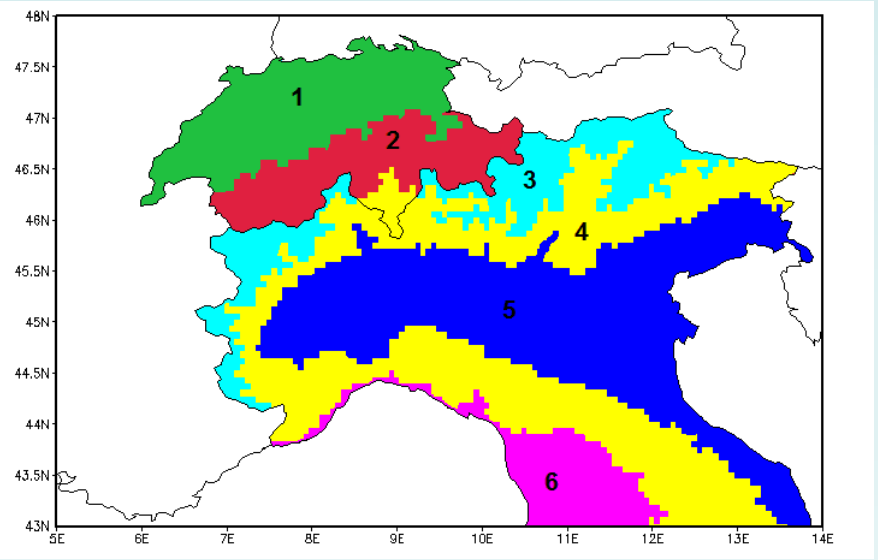
Steps from CALMO Stage 1 to Stage 2 (Task 2.5)
Increased verification area to include also north of Italy





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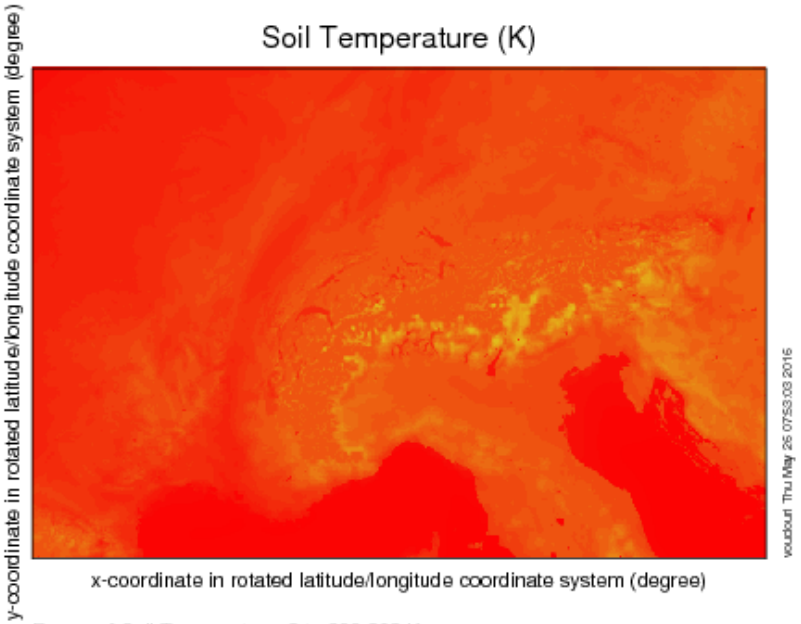
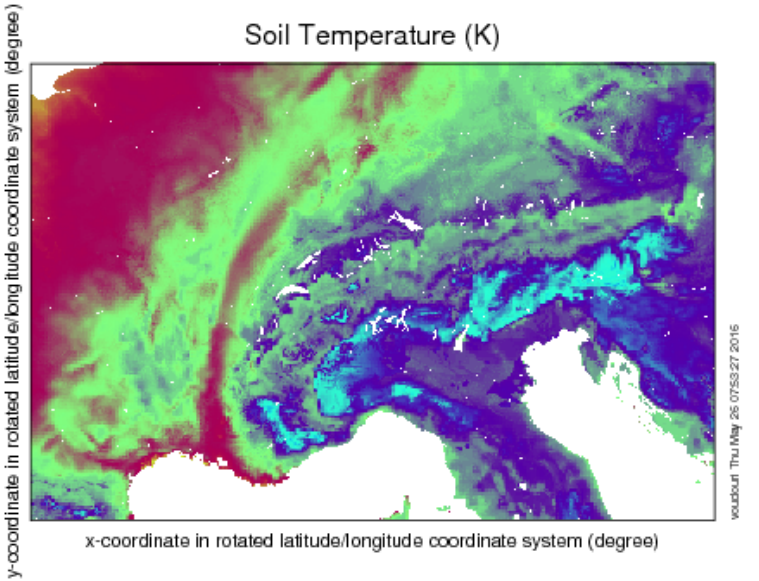
Initial data for soil temperature and soil water content extracted from the updated version of TERRA standalone (TSA) **Task 2.5**



Range of Soil Temperature: 0 to 290.039 K
Range of x-coordinate in rotated latitude/longitude coordinate system: -6.8 to 4.77 degree
Range of y-coordinate in rotated latitude/longitude coordinate system: -4.4 to 3.33 degree
Current time: 0 seconds since 2013-01-01 00:00:00
Current Depth below land surface: 0 cm
Frame 1 in File laf2013010100_noTSA.nc



Range of Soil Temperature: 258.867 to 289.714 K
Range of x-coordinate in rotated latitude/longitude coordinate system: -6.8 to 4.77 degre
Range of y-coordinate in rotated latitude/longitude coordinate system: -4.4 to 3.33 degre
Current time: 0 seconds since 2013-01-01 00:00:00
Current Depth below land surface: 0 cm
Frame 1 in File laf2013010100.nc

2.6: Modifications on the meta-model

(see next talk)

2.7: Compute experiments and analyse results

Used 6 parameters the minimum number of simulations required is 28. Some additional simulation have been also performed to constrain parameters (~50 in total) over entire 2013.

The final simulation is now running

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2.8 Data thinning policy and application

Answer to e-mail asking for storage capacity (to be discussed)

Every project has three months to remove the data from /project. That is by December 31st, 2016
all your data has to be moved elsewhere. Our policies are published on our webpage:
http://user.cscs.ch/storage/file_systems/project/index.html

If you need long-term storage you can only buy into it, we do not offer long-term storage for free.
If you are collaborating with MeteoSwiss you may ask Jean-Marie if you they can offer you to store
your data. http://user.cscs.ch/storage/file_systems/store/index.html

Best regards,
Maria Grazia

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Steps from CALMO Stage 1 to Stage 2
Increased number of free parameters tested for calibration

Surface layer		
Name	range	comment
rlam_heat (and rat_sea)	[0.1,1*,2] *([1,20*,100]*	*changes in rlam_heat must be compensated by an inverse change of rat_sea in order to maintain (at least approximately) rlam_heat*rat_sea. [0,20*, 200)* *This in principle also applies to COSMO model unless we intend to change the evaporation over water.*

turbulence		
Name	range	comment
tur_len	[100,150*, 1000]	L_scal=MIN(0.5*l_hori, tur_len
tkhmin (and tkmmin)	[0.1, 0.4*, 1]	*Should be equal!* *Increasing values does not keep low clouds, decreasing values better scores*

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Steps from CALMO Stage 1 to Stage 2
Increased number of free parameters tested for calibration

Surface layer		
Name	range	comment
c_soil	[0,1*, **0.5,** c_lnd]	c_lnd=2
rlam_heat (and rat_sea)	[0.1, **0.2**,1*,2] *([1,20*,100]*	*changes in rlam_heat must be compensated by an inverse change of rat_sea in order to maintain (at least approximately) rlam_heat*rat_sea. [0,20*, 200*) *This in principle also applies to COSMO model unless we intend to change the evaporation over water.*

Shallow convection		
Name	range	comment
entr_sc	[0.5 ,3*,**7.95,** 20]E-04	

turbulence		
Name	range	comment
tur_len	[100,150*, **316,** 1000]	L_scal=MIN(0.5*l_hori, tur_len
tkhmin (and tkmmin)	[0.1, 0.4*, **0.7,** 1]	*Should be equal!* *Increasing values does not keep low clouds, decreasing values better scores*

Grid scale precipitation		
Name	range	comment
v0snow	[10,**15,** 20*,30]	25 in COSMO-EU In (data_gscp.f90)

Vegetation and soil		
Name	range	comment
crsmin	[50,150*,200]	

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Work briefing

- More than 70 TB generated (additional 10TB given ☺)
- 7 parameters tested (rlam_heat, tkhmin, v0sn, csoil, crsmin, tur_len, entr_sc) 6 used (-crsmin)
- 1 additional simulation without observations for entire 2013
- Design of experiment (see talk of Euripides)

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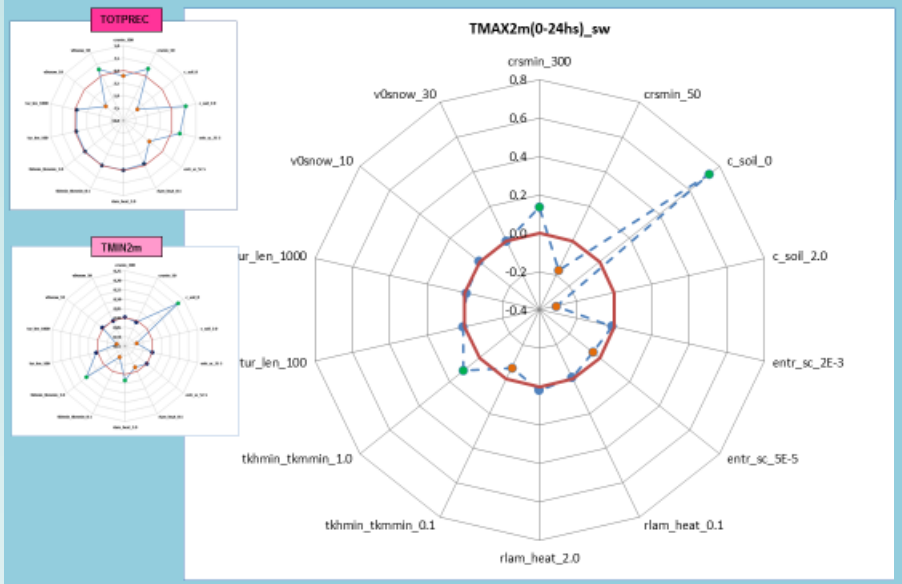
Steps from CALMO Stage 1 to Stage 2
Proposed a new methodology for the experiment design



TOTPREC class 1
TMIN2m class 2
TMAX2m class 3

	c_soil min	c_soil max	v0_sn min	v0_sn max	crsmin min	crsmin max	entr min	entr max	tkhm min	tkhm max	tur_l min	tur_l max	rlam_h min	rlam_h max
c_soil min			14	2	1	16	13	3	26	35		25	27	34
c_soil max			5	19	21	10	4	20	41	29		39	40	32
v0_sn min					6	18	15	7						
v0_sn max					22	11	8	23						
crsmin min							9	24	45	44				47
crsmin max							17	12	43	46				48
entr min														
entr max														
tkhm min												38	42	33
tkhm max												28	30	36
tur_l min														
tur_l max													37	31
rlam_h min														
rlam_h max														

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Steps from CALMO Stage 1 to Stage 2 Induced several modification to MM

- Tmax/Tmin are now optionally averaged over regions
- MM gives vertical profiles characteristics
- New regions for averaging the 24h accumulated precipitation (optional also for Tmax, Tmin) are defined
- Induced new performance score (from RMSE to COSI)
- Logarithmic transformation for some of the parameters
- Convergence to the optimal parameters combination

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Calibration results

- Calibration was performed using 4 different methods:
  - Averaging Tmax and Tmin over regions, using RMSE-type score;
  - Not averaging Tmax and Tmin over regions, using RMSE-type score;
  - Averaging Tmax and Tmin over regions, using or the COSI score;
  - Not averaging Tmax and Tmin over regions, using the COSI score.

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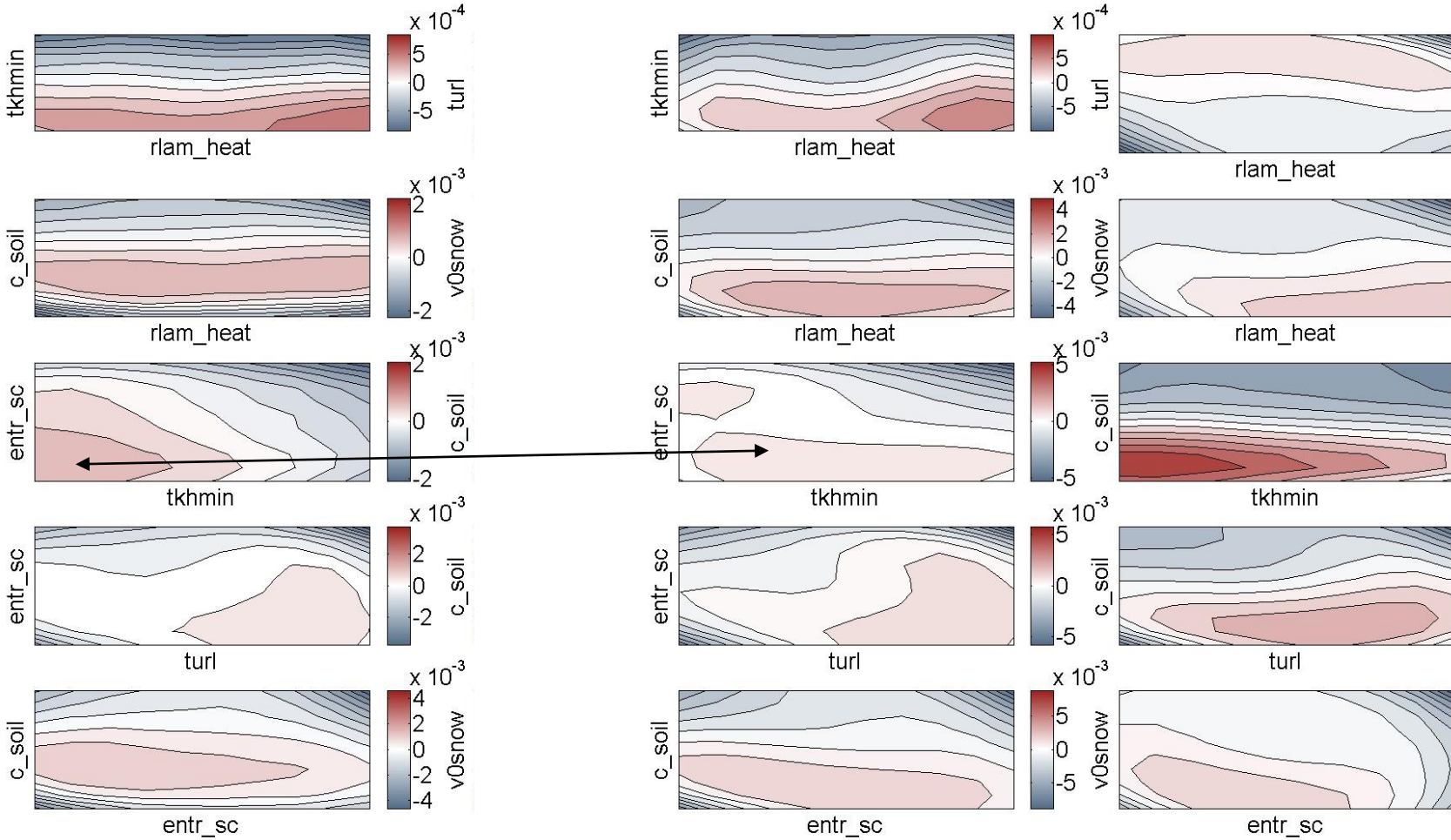
Method 3 :Averaging Tmax and Tmin over regions, using or the COSI score



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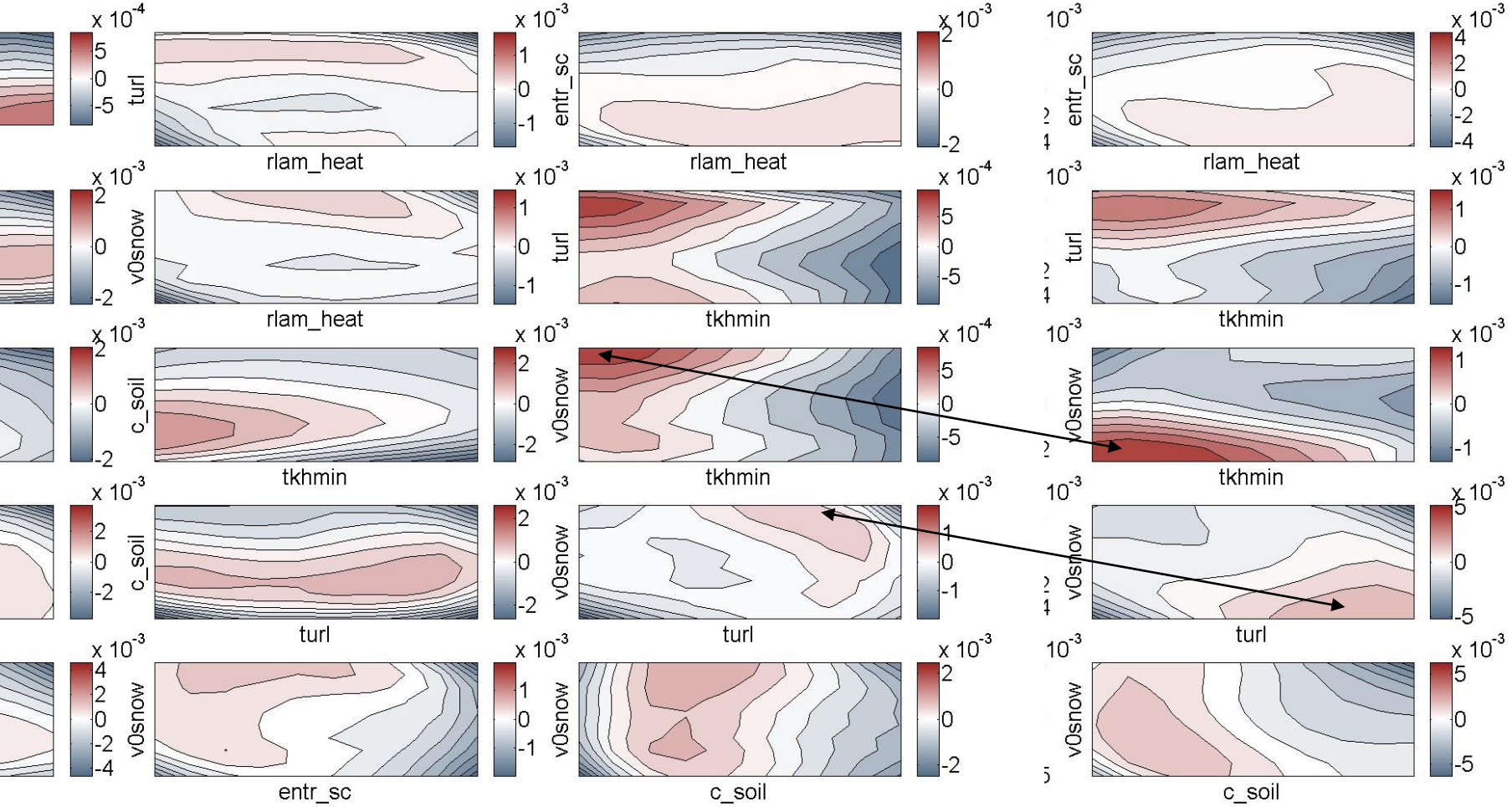
Method 4 : Not Averaging Tmax and Tmin over regions, using the COSI score



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Analyse results

- More discussion to follow ……

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COSMO-2 Simulations (no History, first guess of optimum values)

- &TUNING
- rlam_heat=0.266,
- rat_sea=75.188,
- c_soil=1.576,
- tur_len=169.107,
- tkhmin=0.385,
- tkmmin=0.385,
- v0snow=19.833,
- entr_sc=0.000942,
- /END

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Optimal parameters combinations according 4 different methods

	METHOD I	METHOD II	METHOD III	METHOD IV
	rlam_heat=0.763 tkhmin=0.209 tur_len=312.7 entr_sc=0.000101 csoil=0.626 v0snow=17.9	rlam_heat=1.105 tkhmin=0.390 tur_len=475.6 entr_sc=0.000077 csoil=0.761 v0snow=18.2	rlam_heat=0.740 tkhmin=0.176 tur_len=368.8 entr_sc=0.000114 csoil=0.663 v0snow=17.8	rlam_heat=1.240 tkhmin=0.233 tur_len=363.9 entr_sc=0.00026 7 csoil=0.492 v0snow=12.1
METHOD I	1.828 %	1.557 %	1.801 %	1.329 %
METHOD II	1.647 %	1.880 %	1.685 %	1.556 %
METHOD III	1.481 %	1.217 %	1.587 %	0.980 %
METHOD IV	2.980 %	2.966 %	2.916 %	3.951 %
Average score:	**1.984 %**	**1.905 %**	**1.997 %**	**1.954 %**

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Final optimum parameters set

Surface layer		
Name	range	comment
c_soil	[0,1*, **0.663,** c_lnd]	c_lnd=2
rlam_heat (and rat_sea)	[0.1, **0.74**,1*,2] *([1,20*,100]*	*changes in rlam_heat must be compensated by an inverse change of rat_sea in order to maintain (at least approximately) rlam_heat*rat_sea. [0,20*, 200)* *This in principle also applies to COSMO model unless we intend to change the evaporation over water.*

Shallow convection		
Name	range	comment
entr_sc	[0.5 , **1.14,**3*, 20]E-04	

turbulence		
Name	range	comment
tur_len	[100,150*, **368.8,** 1000]	L_scal=MIN(0.5*l_hori, tur_len
tkhmin (and tkmmin)	[0.1, **0.176,** 0.4*, 1]	*Should be equal!* *Increasing values does not keep low clouds, decreasing values better scores*

Grid scale precipitation		
Name	range	comment
v0snow	[10,**17.8**, 20*,30]	25 in COSMO-EU In (data_gscp.f90)

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Task 3: Assessing the usefulness of the calibration method

3.1: Application of the method using COSMO-1

3.2: Analyse results

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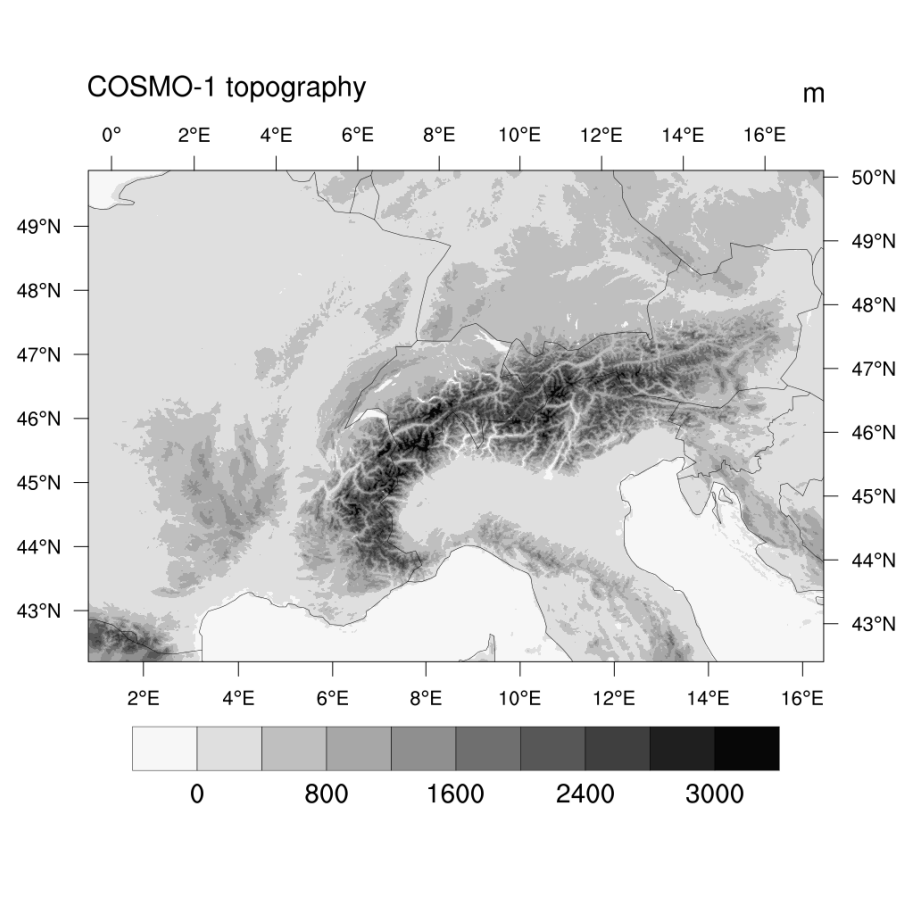
Status of COSMO-1 simulations

Exp. Name	STATUS	
DEF	up to 10.09	
HTKHM	up to 07.03	
LTKHM	up to 05.06	
HTUR	up to 04.04	
LTUR	up to 07.03	
HENTR	up to 19.02	running?
LENTR	up to 28.02	(05.03 withFieldextra)
HCSOI	up to14.02	running?
LCSOI	up to 05.04	
HCRSM	up to 05.02	running?
LCRSM	up to 04.03	
LTKHMLENT	up to 16.01	running?
LTKHLCSOI	up to 26.01	running?
LTKHHCSOI	up to 25.01	
LTKHLTUR	up to 19.01	running?
LTKHHTUR	up to 18.01	
LTURLENTR	up to 01.02	running?
LTURLCSOI	up to 18.01	running?
HTURLCSOI	up to 24.01	
LCSOILENTR	up to 22.01	running?
LCRSMLTKH	up to 12.02	running?
LCRSMHTKH	up to 27.01	
LCRSMLTUR	up to 24.01	running?
LCRSMHENTR	up to 18.02	
LCRSMLCSOI	up to 29.01	running?
VCRSM		
VTKHM	started	
VTUR	started	
VENTR	started	
VCSOI	started	

Steps from CALMO Stage 2 to Stage 3
Started COSMO-1 calibration Meteoswiss operational version of COSMO (v 5.0_2016.5, STELLA 1.04.12)



COSMO-1 simulations

- Without TSA files finished simulations:
- *tkhmin (16.01h-02,07l), tur_len (14.04), entr_sc (21.02h-12.03l), v0snow (06.02h-15.03l),c_soil (16.01h-11.05l)*

2 interaction ltkhmin-lentr 28.04, ltkh-lv0sn 13.01

- Minimum 2.5h delays due to queue time in Pilatus to start fieldextra

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Steps from CALMO Stage 2 to Stage 3
5 free parameters used for calibration

Surface layer		
Name	range	comment
c_soil	[0,1*, c_lnd]	c_lnd=2
rlam_heat (and rat_sea)	[0.1, 1*,2] *([1,20*,100]*	*changes in rlam_heat must be compensated by an inverse change of rat_sea in order to maintain (at least approximately) rlam_heat*rat_sea. [0,20*, 200)* *This in principle also applies to COSMO model unless we intend to change the evaporation over water.*

Shallow convection		
Name	range	comment
entr_sc	[0.5 ,3, 20]E-04	

turbulence		
Name	range	comment
tur_len	[100,150*, 1000]	L_scal=MIN(0.5*l_hori, tur_len
tkhmin (and tkmmin)	[0.1, 0.4*, 1]	*Should be equal!* *Increasing values does not keep low clouds, decreasing values better scores*

Vegetation and soil		
Name	range	comment
crsmin	[50,150*,200]	

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Delays on pending jobs

```
voudouri@daint102:/scratch/daint/voudouri/fine/wd> date
Wed Jul  6 05:19:36 CEST 2016
voudouri@daint102:/scratch/daint/voudouri/fine/wd> squeue -u voudouri --start
             JOBID PARTITION     NAME     USER ST       START_TIME  NODES SCHEDNODE
NODELIST(REASON)
            236323    normal  LM.lm_f voudouri PD      Tomorr 08:00     97 nid0[0137-0143,1278-
(Priority)
            236308    normal  LM.lm_f voudouri PD      Tomorr 05:30     97 nid0[0631-0701,0781-
(Priority)
            236301    normal  LM.lm_f voudouri PD      Tomorr 04:00     97 nid0[0615-0617,0631-
(Priority)
            236521    normal  LM.lm_f voudouri PD      Tomorr 08:00     97 nid0[0152-0158,2596-
(Priority)
            236523    normal  LM.lm_f voudouri PD      Tomorr 08:00     97 nid0[0409-0417,1029-
(Priority)
            236532    normal  LM.lm_f voudouri PD      Tomorr 08:00     97 nid0[0228-0234,2148-
(Priority)
            236615    normal  LM.lm_f voudouri PD      Tomorr 08:00     97 nid0[0485-0491,3709-
(Priority)
            236622    normal  LM.lm_f voudouri PD      Tomorr 08:00     97 nid0[1040-1047,1300-
(Priority)
            236876    normal  LM.lm_f voudouri PD      Tomorr 08:00     97 nid0[0013,1735-1742,
(Priority)
            237023    normal  LM.lm_f voudouri PD      Tomorr 08:00     97 nid0[0547-0553,0958-
(Priority)
voudouri@daint102:/scratch/daint/voudouri/fine/wd>
```

ΕΘΝΙΚΗ ΜΕΤΕΩΡΟΛΟΓΙΚΗ ΥΠΗΡΕΣΙΑ
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Task 4: Practicability of the method

Still an open question????

CALMO team (A. Voudouri, E. Avgoustoglou, I. Carmona, JM Bettems, ?????) intends to propose a new PP/PT to investigate the extent to which, data sets of full model runs can be reduced to still obtain robust and good quality calibration results. The implementation of this 'revised' methodology could be applied to the new set of parameters induced within ConSAT.

Thus a joint session with WG3a has already been scheduled for tomorrow

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Task 5: Documentation

- Avgoustoglou Euripides, Antigoni Voudouri, Pavel Khain, Federico Grazzini and Jean-Marie Bettems, 2016. Design and Evaluation of Sensitivity Tests of COSMO Model over the Mediterranean:13th International Conference on Meteorology, Climatology and Atmospheric Physics (COMECAP 2016),Thessaloniki, 19-21 September 2016. Springer International Publisher AG : “Perspectives on Atmospheric Sciences”
- Khain P., I. Carmona, A. Voudouri, E. Avgoustoglou, J.-M. Bettems, F. Grazzini (2016). Progress report on CALMO - stage 2
- Voudouri A., Khain P., Carmona I. Bellprar O., Grazzini F., Avgoustoglou E., Bettems J. M. and Kaufmann P. 2016: Objective calibration of numerical weather prediction models, Atm. Res. Under revision
- Voudouri Antigoni, Euripides Avgoustoglou and Pirmin Kaufmann, 2016. Impacts of observational data assimilation on operational forecasts. 13th International Conference on Meteorology, Climatology and Atmospheric Physics (COMECAP 2016),Thessaloniki, 19-21 September 2016. Springer International Publisher AG : “Perspectives on Atmospheric Sciences”

- Under preparation:
  - A second manuscript summarizing the work using COSMO 2km
  - Final project report

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Status of paper

Next steps

- Propose a new 1.5 year PP starting January 2017
- CALMO Methodology Applied on eXtremes (C-MAX), associated with calibration during extreme events, use of 'extremely' low resources as well 'extremely' new model parameterization
- Aim of the project to adjust CALMO methodology for operational use
- Start by using optimum set of parameters of CALMO.
- Limited computer resources are requested and human resources are partly available
- Contributing scientists: Voudouri, Avgoustoglou, Bettems, Carmona. Any other?