ICCARUS 2021 Pinboard

CALMO MAX
Final results from the Mediterranean domain

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outlet

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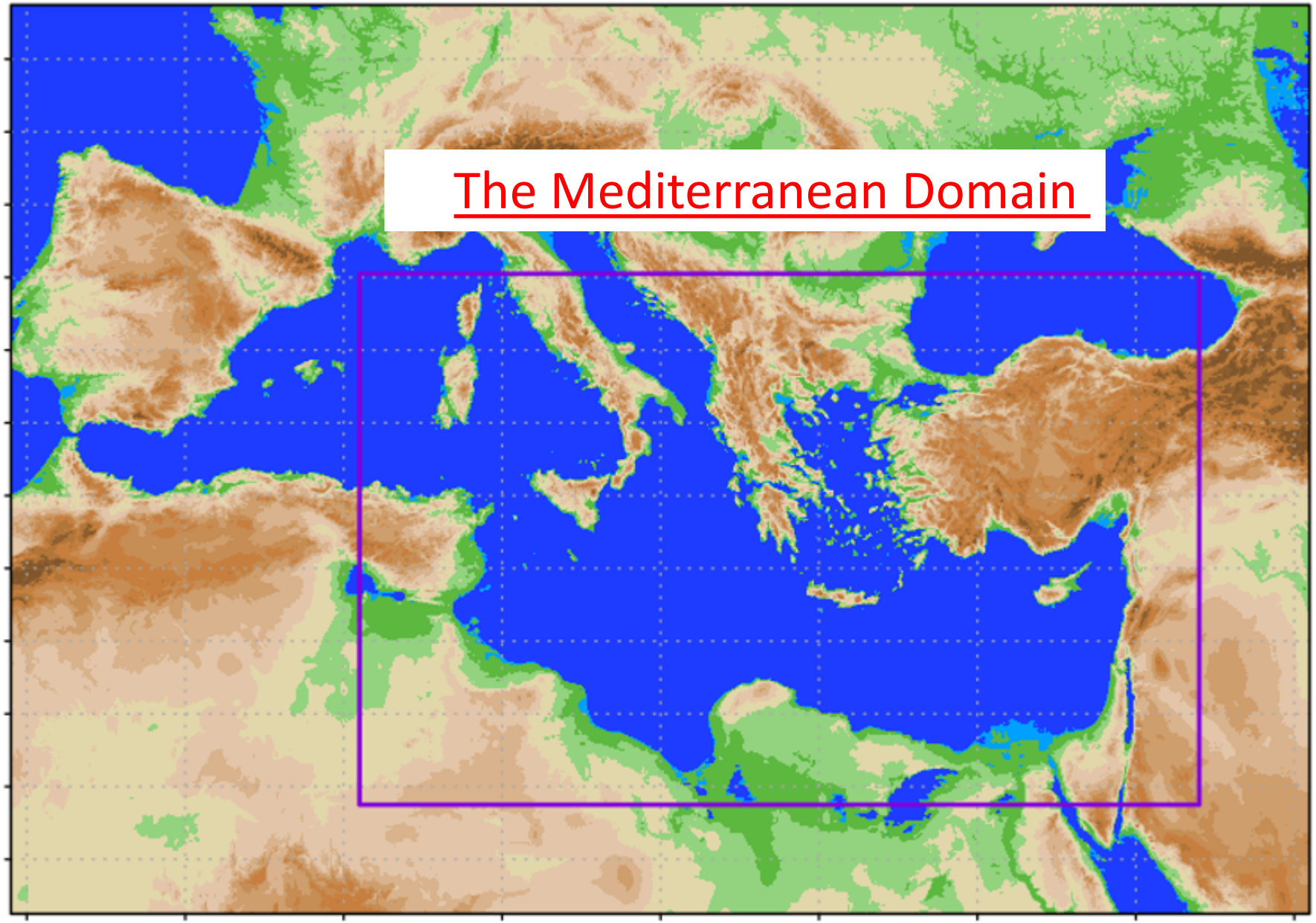
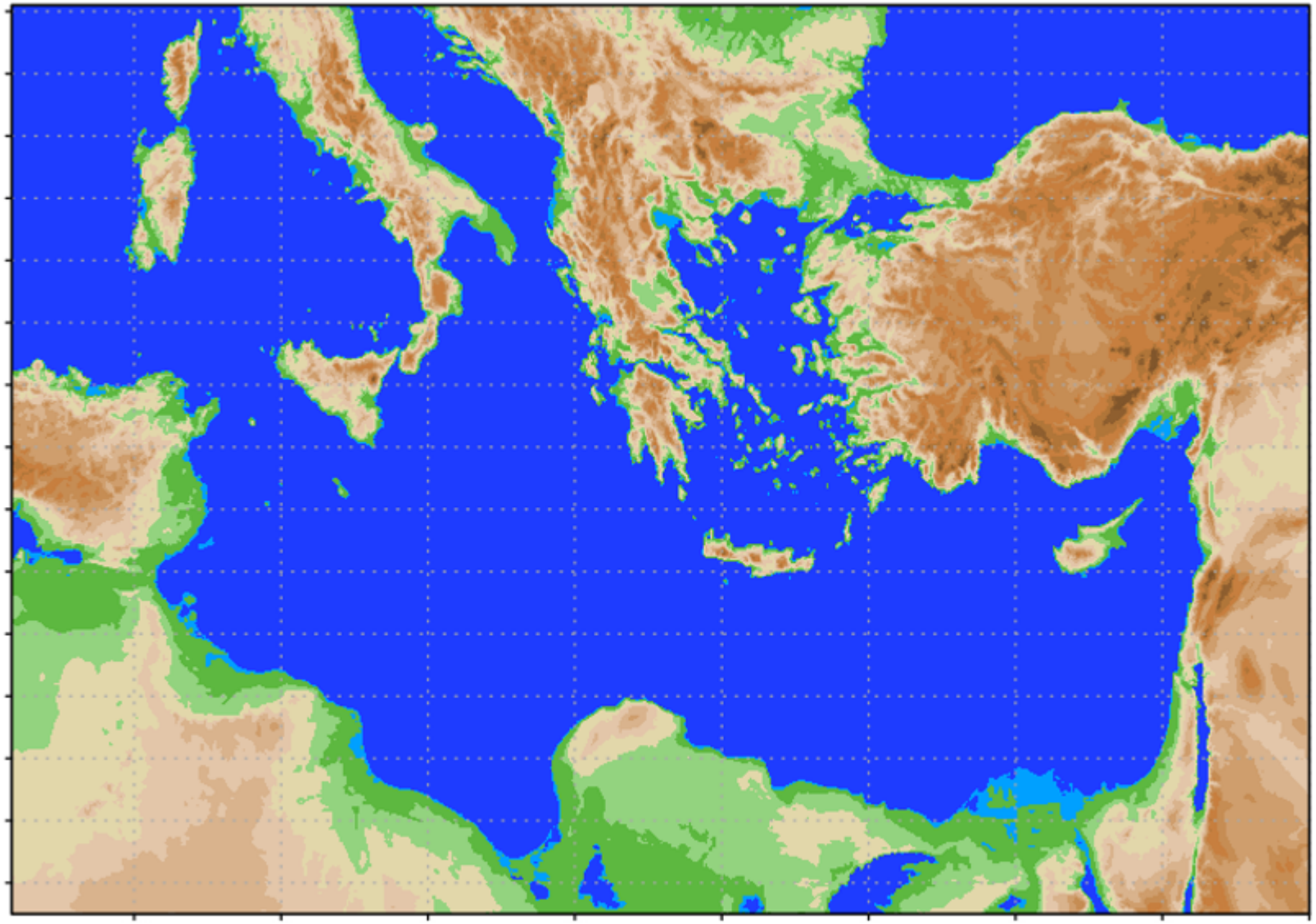

The Mediterranean Domain

The Mediterranean Domain (zoom)



Description of the 5 Meta Model tuning parameters

parameter	tkhmin	rlam	Tur_len	Rat_sea	C_soil
Optimal values	Minimal value of diffusion coefficient for heat	Scaling factor of the laminar boundary layer for heat .	Asymptotic maximal turbulent length scale [m]	Ratio of laminar scaling factor for heat over the sea .	Surface area density of the (evaporative) soil surface
Default	*0.4	1	150*	10	1
range	*0.1-2	0.1-2	*100-1000	1-50	0-2.0

* Notice that the calculations step of the MM and the iteration step contain values of “tkhmin” and “Tur_Len” in Log scale. This issue will be discussed before the results chapter (slides).

Surface fields

- Period: 60 days between JAN 2019 to DEC 2019.
- In Israel we relied on 62 stations and in Greece on 22 stations.
- Daily maximum and minimum T2m for 22 stations in Greece and 26 stations in Israel.
- Daily maximum and minimum Tdew (at 2m) for 22 stations in Greece and 62 stations in Israel.
- We used the same precipitation stations as in the Tdry case (same stations).
- No Radiosonde observations.

The 60 days in the MM

```
20190102  20190123  20190214  20190314  20190411  20190504  20190527  20190614  20190716  20190815  20190901  20190923  20191024  20191112  20191203
20190109  20190205  20190222  20190316  20190414  20190507  20190601  20190617  20190718  20190816  20190912  20191002  20191030  20191115  20191210
20190114  20190207  20190302  20190327  20190417  20190513  20190605  20190705  20190722  20190817  20190914  20191007  20191103  20191124  20191213
20190119  20190212  20190312  20190405  20190420  20190523  20190610  20190710  20190804  20190824  20190920  20191017  20191109  20191201  20191224
```

COSI-ETS SCORE: Daily rain thresholds

- Equitable Threat Score **(**ETS) average with 5 thresholds : 0.1 [mm/day], 1 [mm/day], 3 [mm/day], 7.5 [mm/day] and 10 [mm/day], all the same weight.

Results for the 60 representative days in 2019

COSI SCORE (Performance Score (PS))

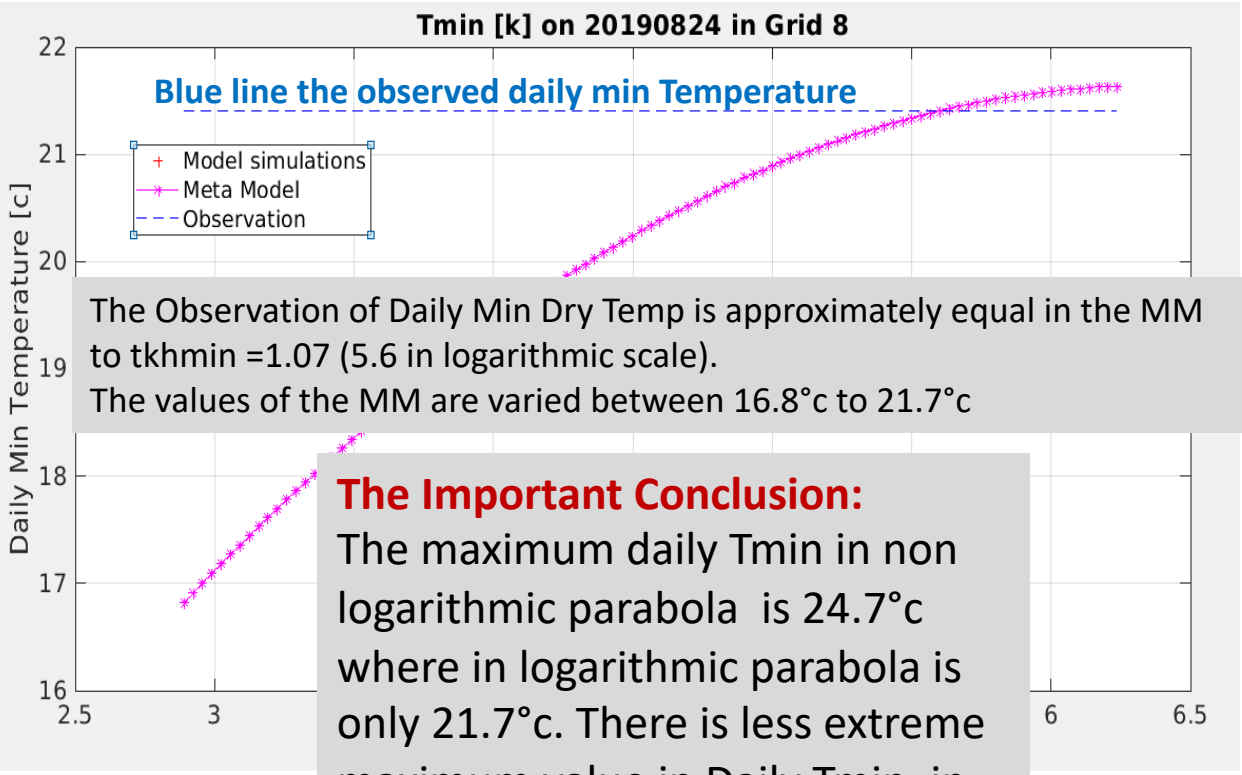
For all 5 Surface fields

Daily Tdry max, Tdry minimum, Tdew max, Tdew min and Rain. (temperature at 2m)

Tkhmin Meta Model, Parabolic, An example of Surface Daily Tmin

Surface Daily Tmin on 24/8/2019 in GRID 8 (In Southern Israel, Sede-Boqer 30.882°N,34.781°E)

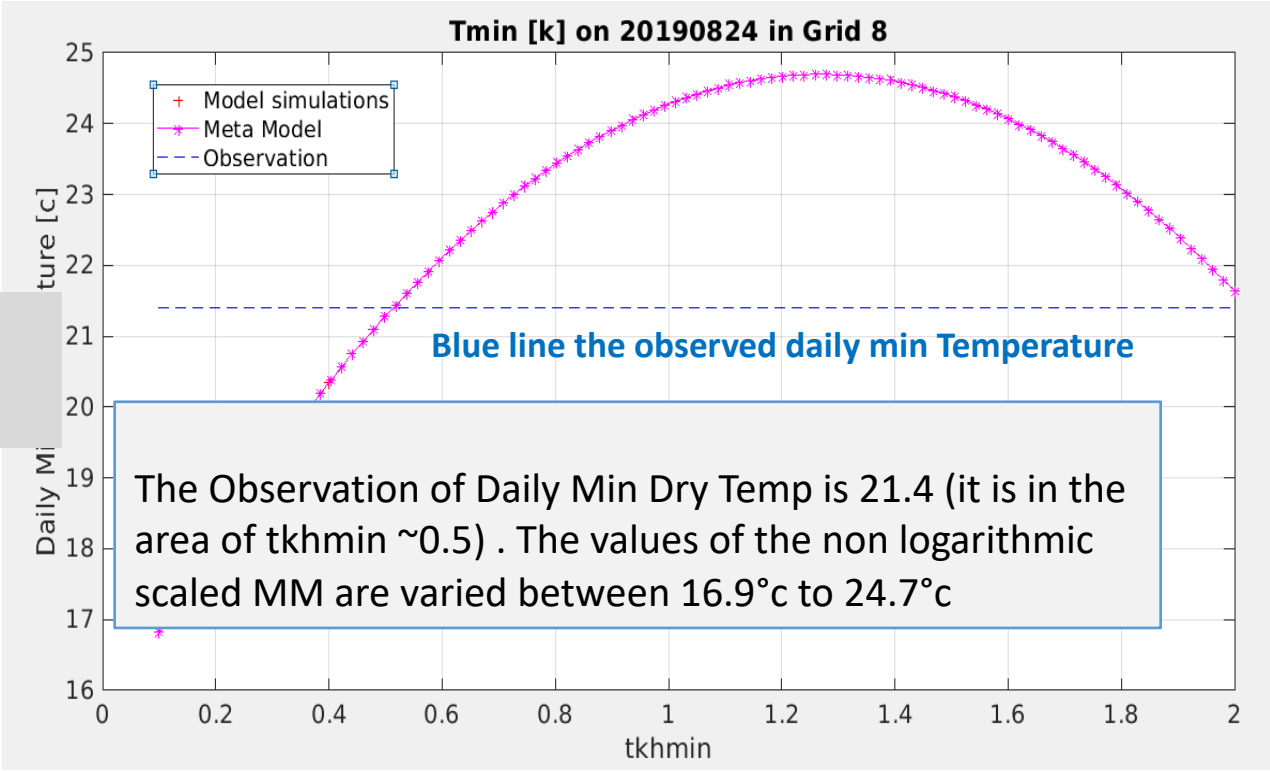
Log Scale



The Observation of Daily Min Dry Temp is approximately equal in the MM to tkhmin =1.07 (5.6 in logarithmic scale).
The values of the MM are varied between 16.8°c to 21.7°c

The Important Conclusion:
The maximum daily Tmin in non logarithmic parabola is 24.7°c where in logarithmic parabola is only 21.7°c. There is less extreme maximum value in Daily Tmin, in the logarithmic meta model than the non logarithmic **(in 3°c less)**, Therefore, it is better to use logarithmic scale in the MM in tkhmin parameter.

Non Log Scale



The Observation of Daily Min Dry Temp is 21.4 (it is in the area of tkhmin ~0.5) . The values of the non logarithmic scaled MM are varied between 16.9°c to 24.7°c

Parameters in Log Scale

- **“Tkhmin” and “Tur_Len” parameters were transferred to log Scale because the default was not close to the middle of the range between Maximum to minimum.**
- **In “Tkhmin” the values of minimum, default and maximum are 0.1 , 0.4 & 2 , respectively.**
- **In “Tur_Len” the values of minimum, default and maximum are 100 , 150 & 1000 , respectively.**
- **Hence, We dissuaded to calculate the meta model after doing transformation to log scale for the values of “Tkhmin” and “Tur_Len”.**
- **In “Tkhmin” the new values of minimum, default and maximum in Log scale is: 2.890371757896165, 4.564348191467836 & 6.238324625039508 , respectively.**
- **In “Tur_Len” the new values of minimum, default and maximum in Log scale is: -1.386294361119891, 1.446918982936325 & 4.280132326992542 , respectively.**
- **Notice that now the default in Log scale is exactly in the middle between minimum to maximum for “Tkhmin” and “Tur_Len”.**
- **The formula (equation) to transfer from normal space to log space (scale) is**

equation a.) xlog=ln(a*(x-minimum)/(maximum-minimum)+b)

1.) where x is not in log scale and xlog is in log scale.

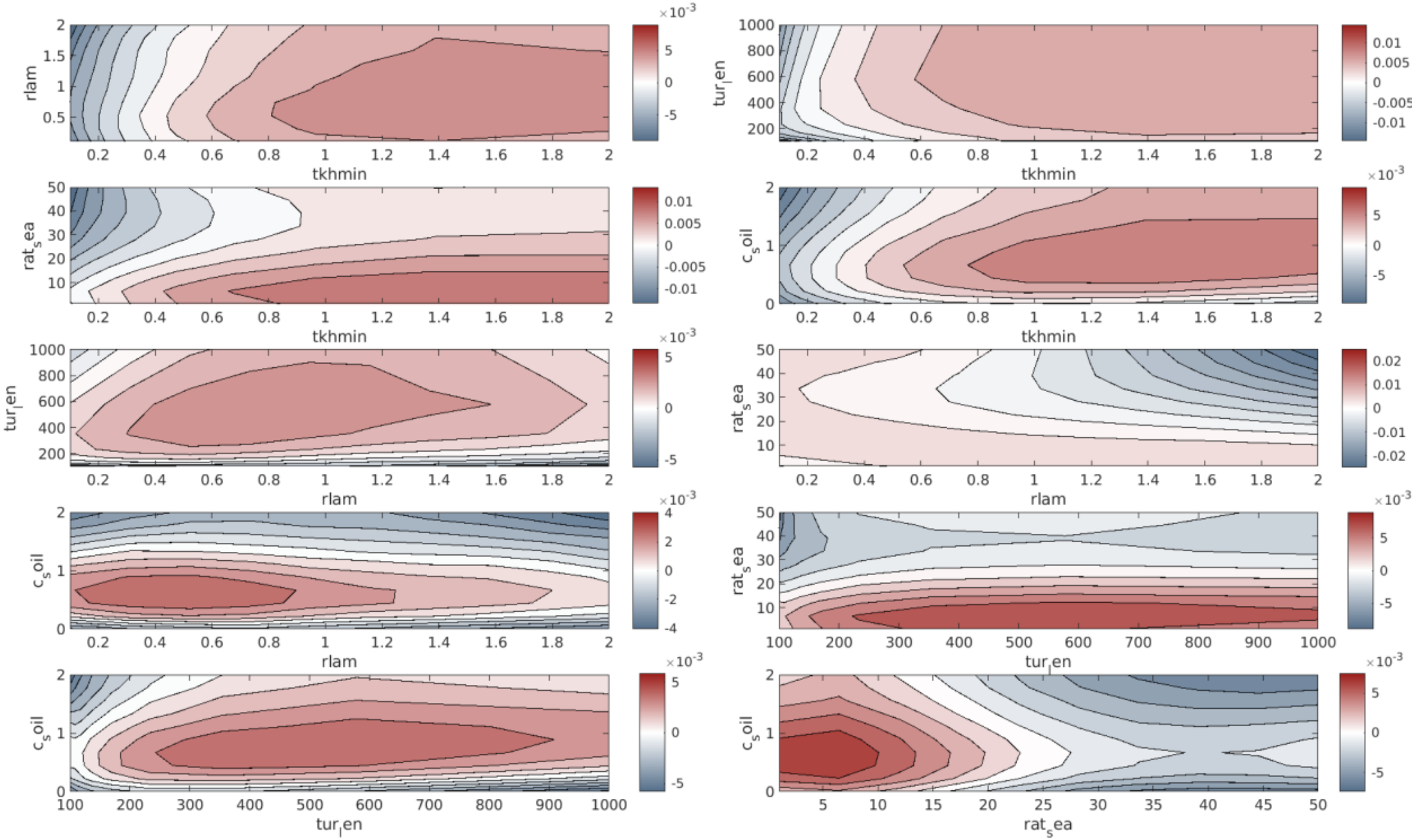
2.) maximum and minimum are the borders of the parameters and there values not in log scale (in normal (ordinary) scale).

3.) For “tur_len” a=72 , b=0.25 , minimum=100 & maximum= 1000

4.) For “Tkhmin” a=494 & b=18 , minimum=0.1 & maximum = 2

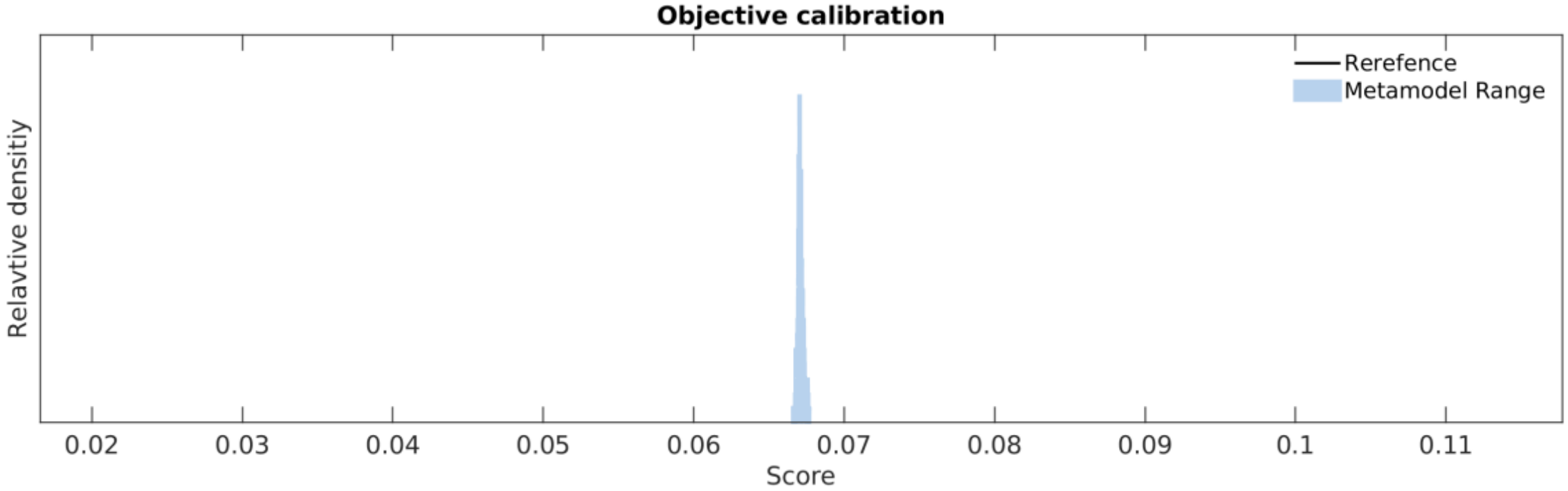
- **If we substitute in the above formula (equation a.) x=“tur_len default” or x=150 then the result (xlog) equal 1.4469 which is exactly in the middle between minimum to maximum in log scale.**
- **If we substitute in the above formula (equation a.) x=“tkhmin default” or x=0.4 then the result (xlog) equal 4.5643 which is exactly in the middle between minimum to maximum in log scale.**

Planes (COSI SCORE)



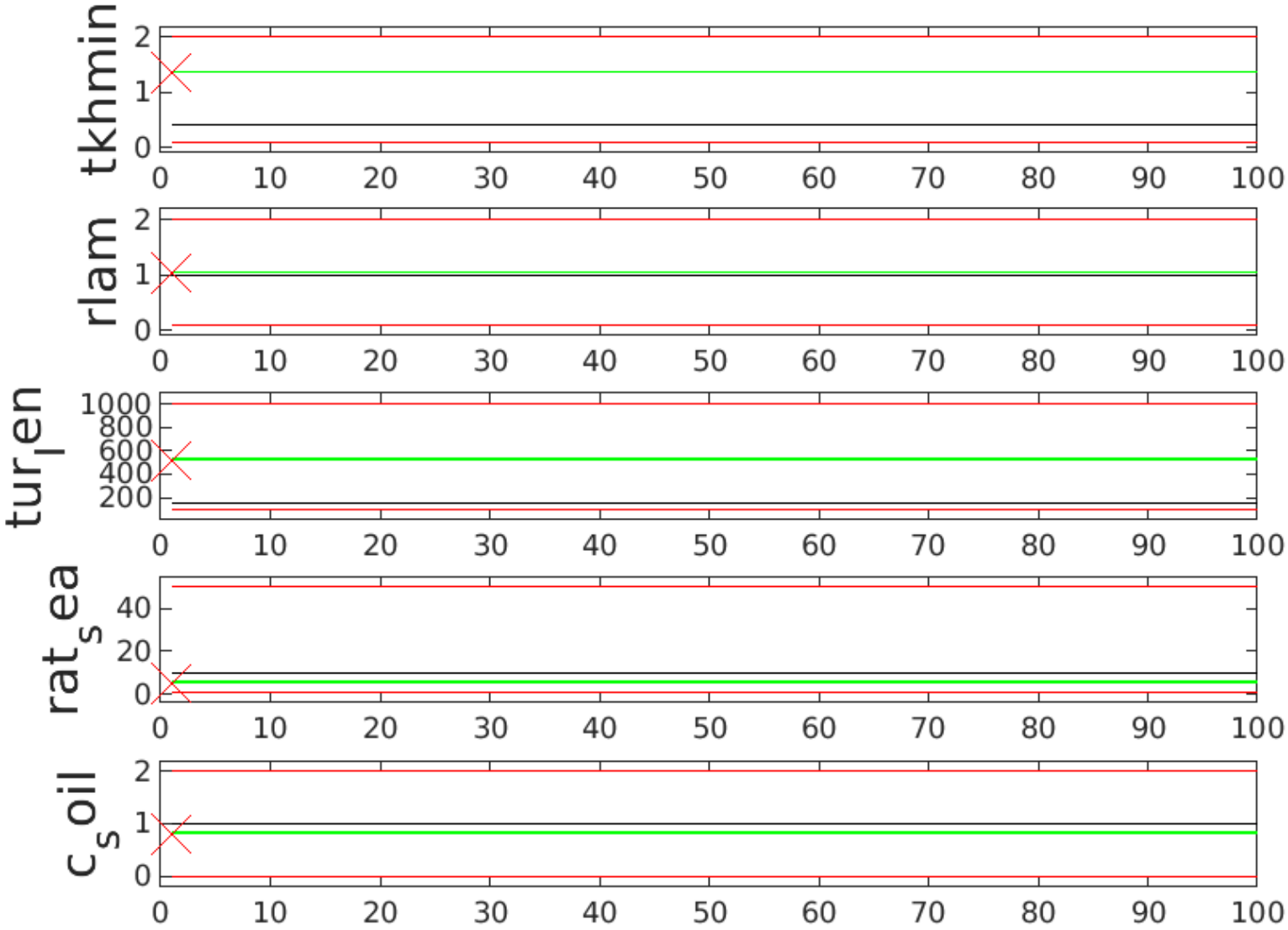
COSI Performance Score (for 5 surface fields, actually all surface fields

Iteration number 100: No convergence . (Psmax-Psmin)/Psmax>0.001



Iteration number 100: There is convergence in the parameters values although in Performance Score there is not convergence.

COSI SCORE



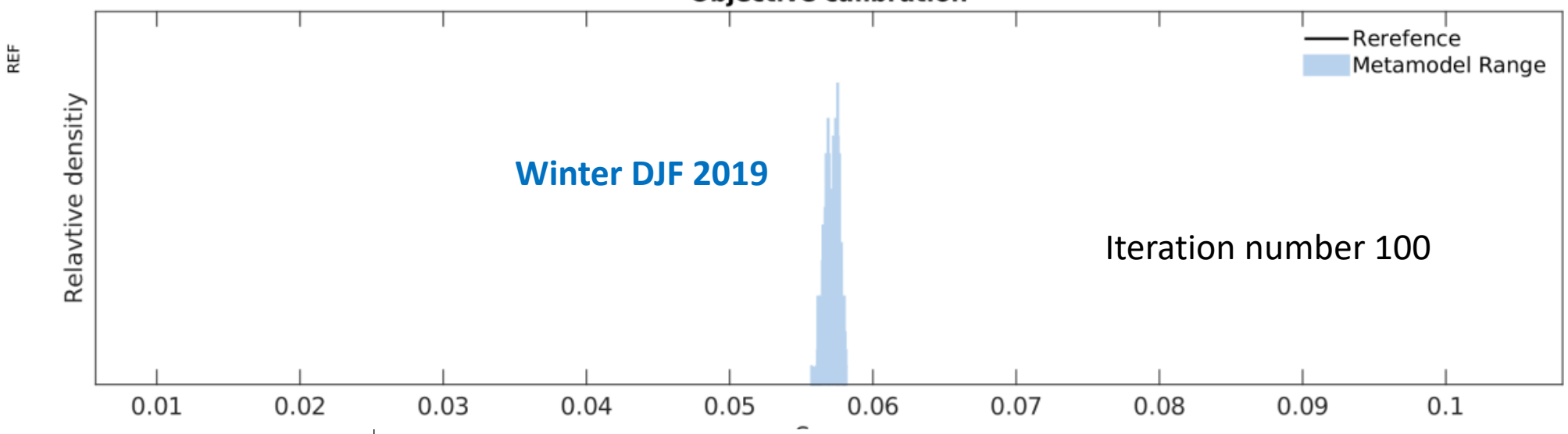
Optimal parameter values (iteration number 100)
Performance Score is for ALL 5 surface fields.

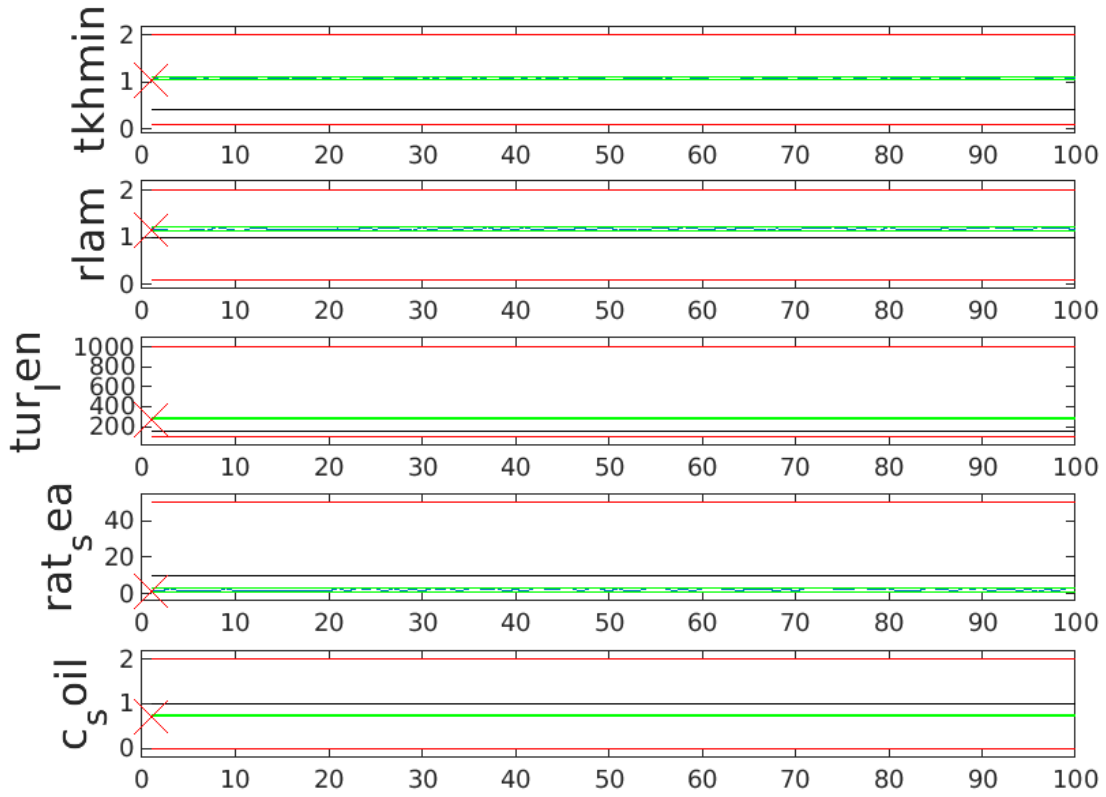
For 60 representative days in 2019)

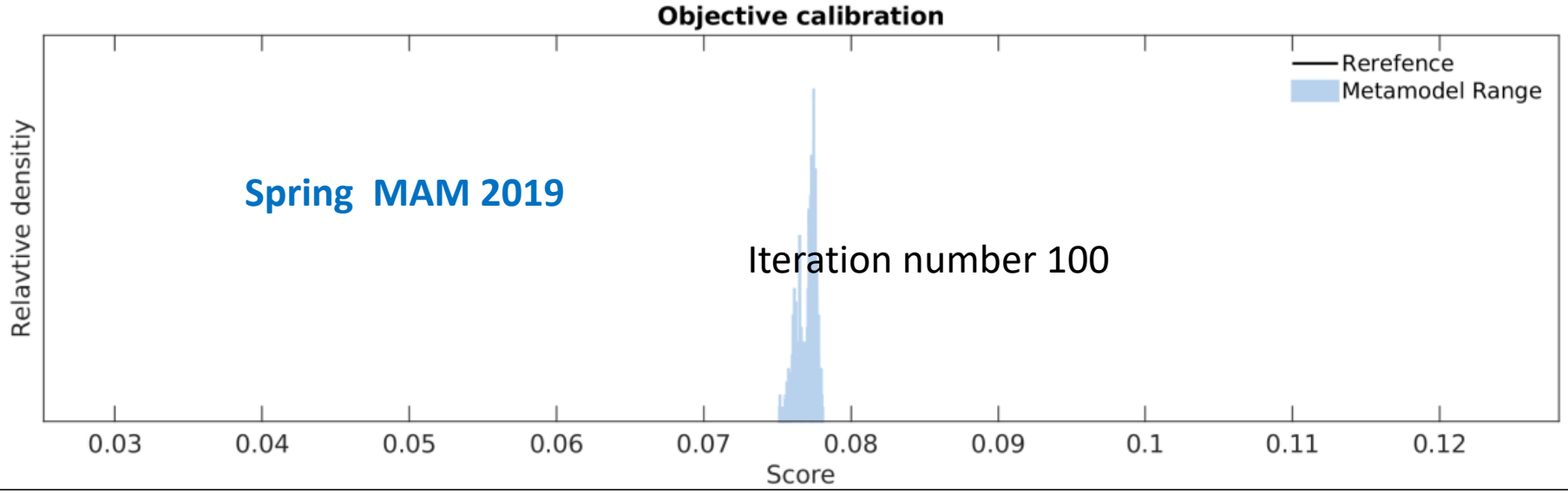
parameter	Tkhmin*	rlam	Tur_len*	Rat_sea	C_soil
Optimal values with height correction	1.3564	1.0489	524.66	5.2889	0.8252
Optimal values without height correction	1.3903	1.0737	568.35	4.7125	0.8408
Default	0.4	1	150	10	1
range	0.1-2	0.1-2	100-1000	1-50	0-2.0

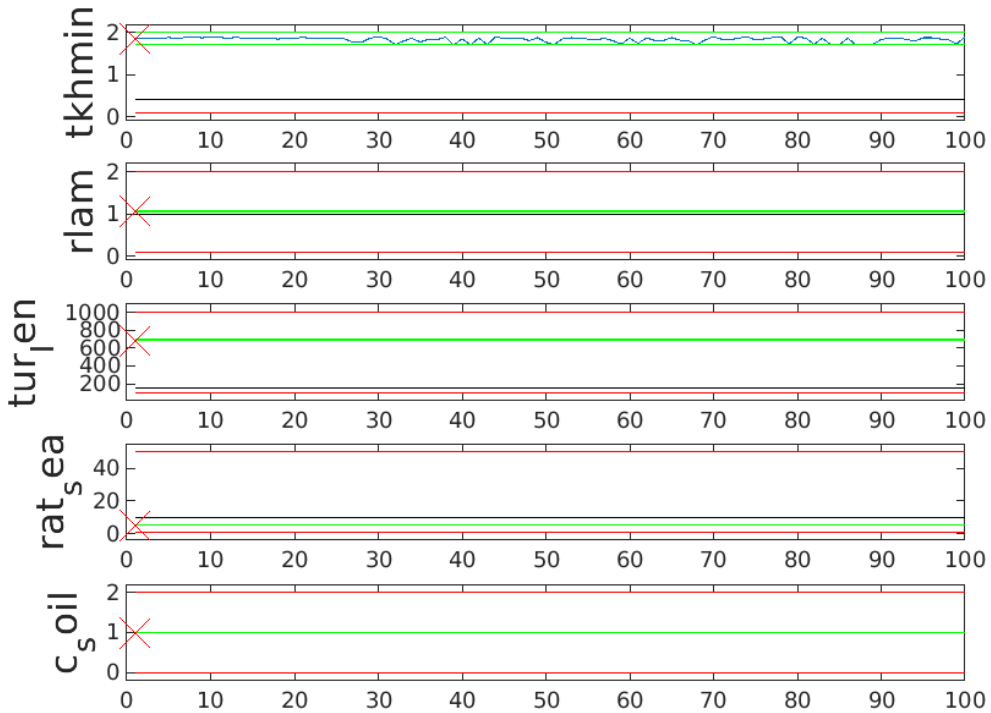
* Please notice that the whole MM model stage (building the MM step) and the iterations step where used the values of “tkhmin” and “tur_len” in log scale. But eventually in the end the logarithmic values were transformed back to normal scale in order to see the optimal values in regular (relvent) scale.

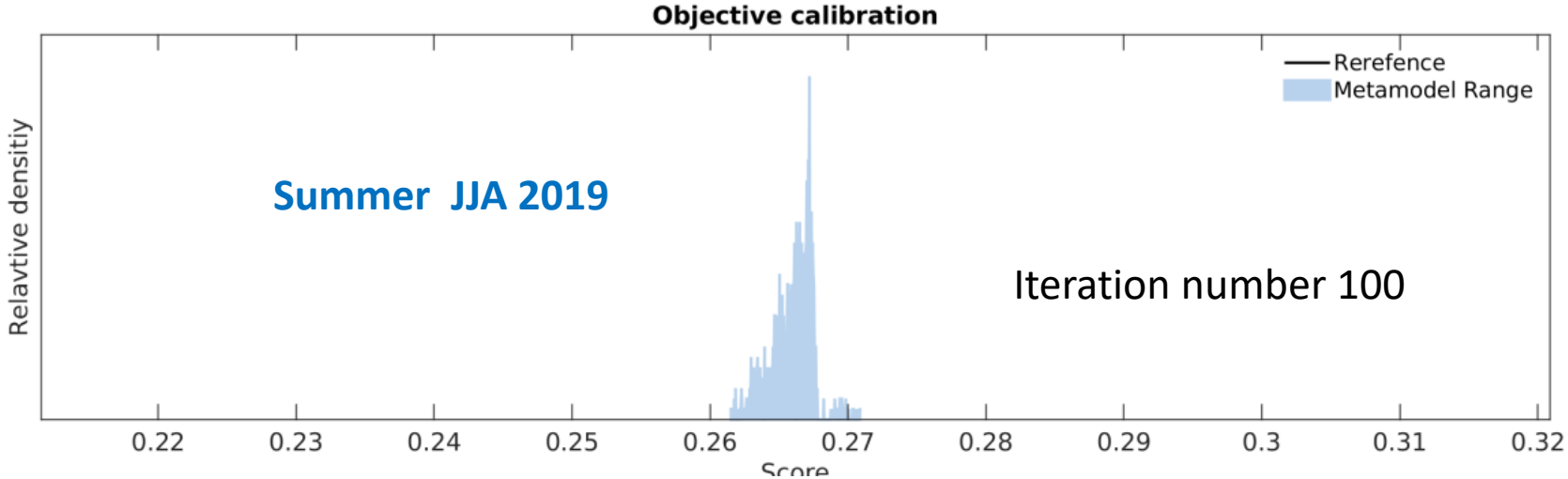
The results for the 4 seasons in 2019

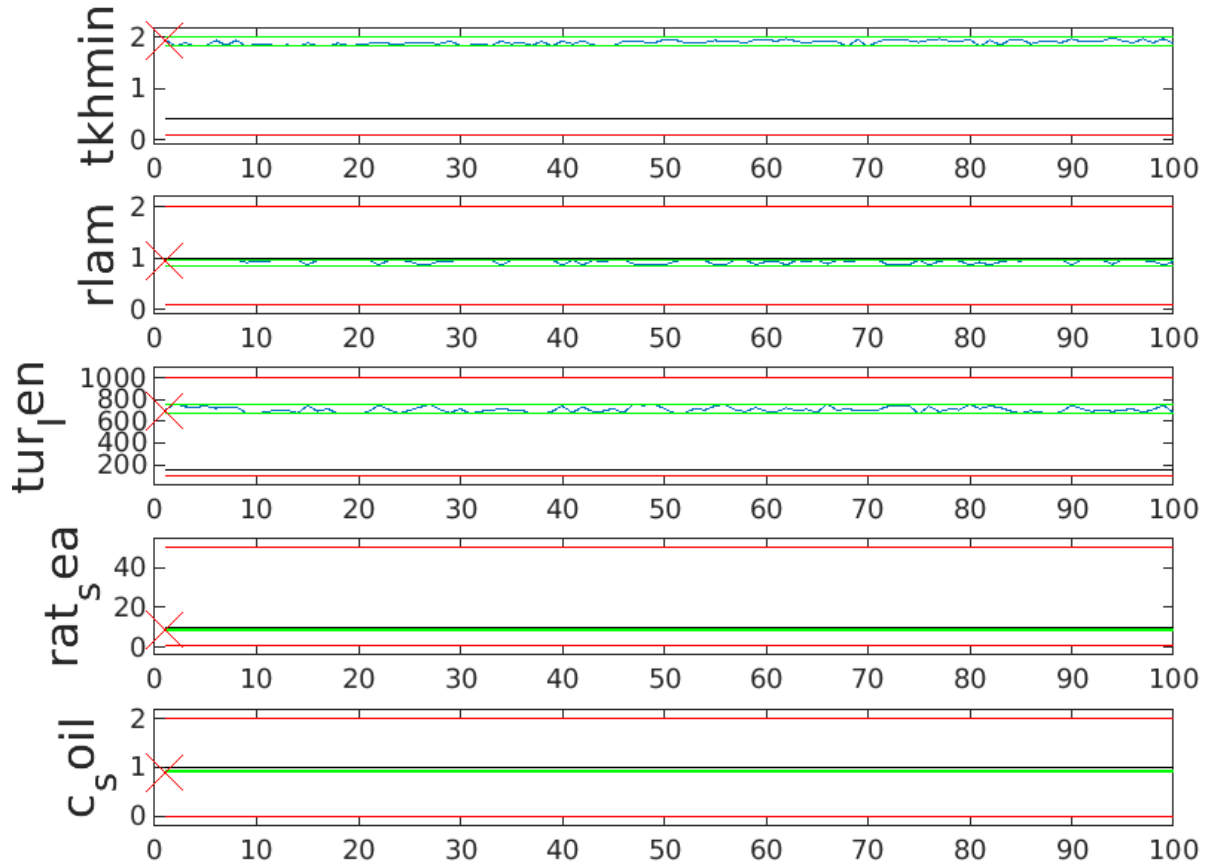

REF
Relavtive densitiy
Rerefence
Metamodel Range
Winter DJF 2019
Iteration number 100
0.01
0.02
0.03
0.04
0.05
0.06
0.07
0.08
0.09
0.1

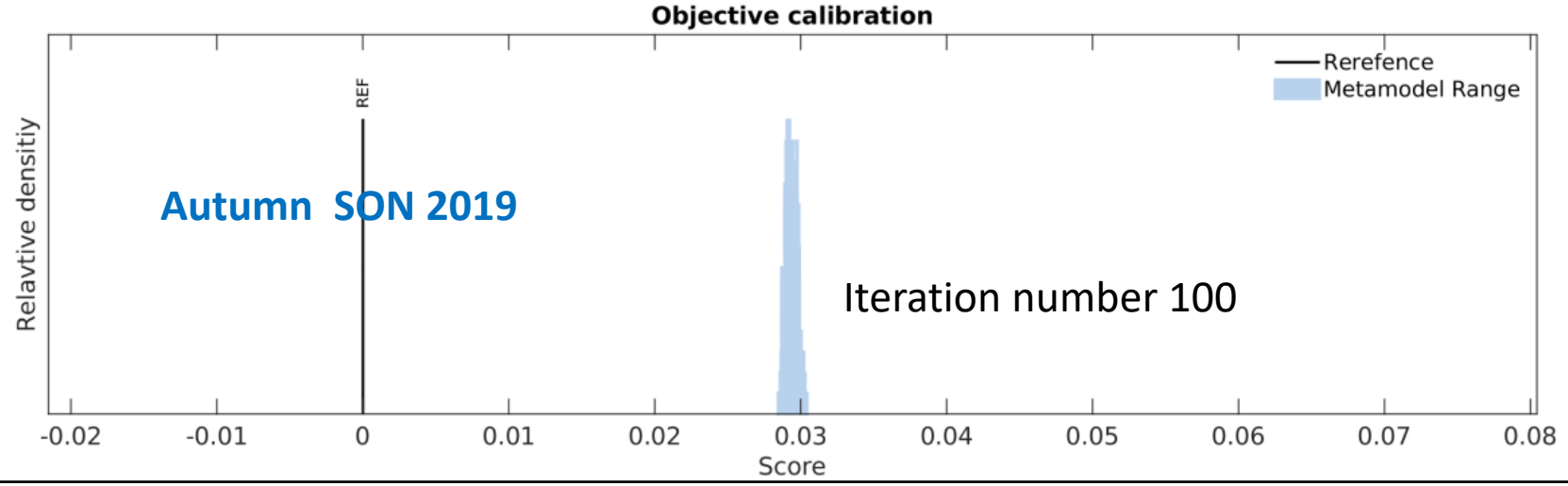

tkhmin
rlam
turlen
rats ea
cs oil

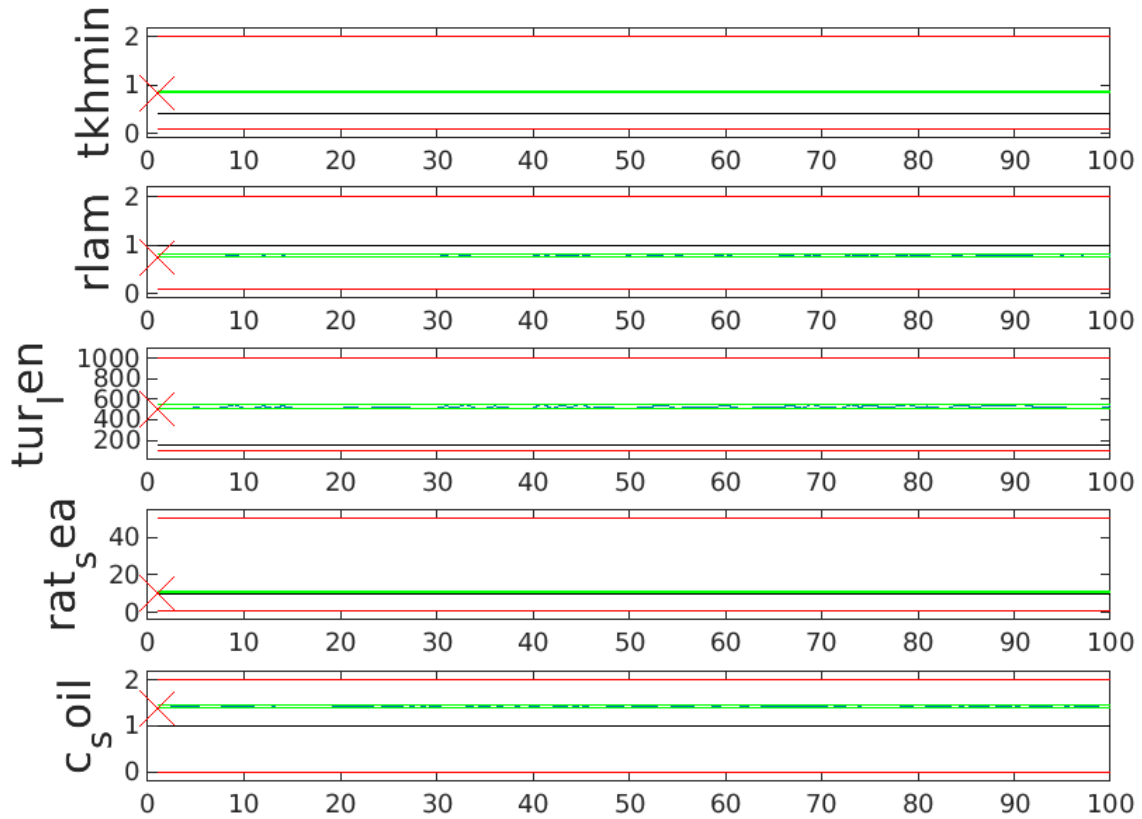

Objective calibration
Rerefence
Metamodel Range
Relavtive densitiy
Spring MAM 2019
Iteration number 100
0.03
0.04
0.05
0.06
0.07
0.08
0.09
0.1
0.11
0.12
Score


tkhmin
rlam
turb_en
rat_eas
c_soil
0
10
20
30
40
50
60
70
80
90
100


Objective calibration
Rerefence
Metamodel Range
Relavtive densitiy
Summer JJA 2019
Iteration number 100
0.22
0.23
0.24
0.25
0.26
0.27
0.28
0.29
0.3
0.31
0.32
Score


tkhmin
rlam
turlen
ratsea
csoil
0
10
20
30
40
50
60
70
80
90
100


Objective calibration
Rerefence
Metamodel Range
REF
Relavtive densitiy
Autumn SON 2019
Iteration number 100
-0.02
-0.01
0
0.01
0.02
0.03
0.04
0.05
0.06
0.07
0.08
Score


tkhmin
rlam
turlen
ratsea
csoil
0
10
20
30
40
50
60
70
80
90
100

Optimal parameter values (iteration number 100)
Performance Score is for ALL 5 surface fields.

4 season 15 representative days for every season in 2019

parameter	tkhmin	rlam	Tur_len	Rat_sea	C_soil
Optimal values for **winter** (DJF months, 15 days)	1.0551	1.1796	274.658	1.3873	0.7346
Optimal values for **spring** (MAM months, 15 days)	1.8574	1.0677	688.76	5.3174	1.0004
Optimal values for **summer** (JJA months, 15 days)	1.8626	0.9510	711.41	8.9973	0.9184
Optimal values for **autumn** (SON months, 15 days)	0.8552	0.7681	508.81	10.7768	1.3921
Optimal values for all 2019 (60 representative days)	1.3564	1.0489	524.66	5.2889	0.8252
Default	*1*	*1*	*500*	*10*	*1*
range	*0.1-2*	*0.1-2*	*100-1000*	*1-50*	*0-2.0*

Summary and conclusions

- There are quite differences in the optimal values of the 5 parameters, among the 4 different seasons in 2019.
- Tkhmin is 1.36 for the 60 representative days of 2019.
- In **winter** Rat_sea has the lowest optimal value than the other 3 seasons (Rat_sea=1.39).
- In **winter** Tur_Len has the lowest optimal value than the other 3 seasons (Tur_Len=274.7).
- In **winter** Tkhmin has the value of 1.06.
- In **spring** and **summer** Tkhmin has higher value compare to winter and autumn (tkhmin=1.86 in **summer** and **spring**).
- In **summer** Tur_Len has the highest value among the 4 seasons (tur_len=711).
- Also, in **autumn** Tkhmin has the lowest value among the 4 seasons, its value in **autumn** is 0.86.

Thanks for your attention