CANARI “summer problem”

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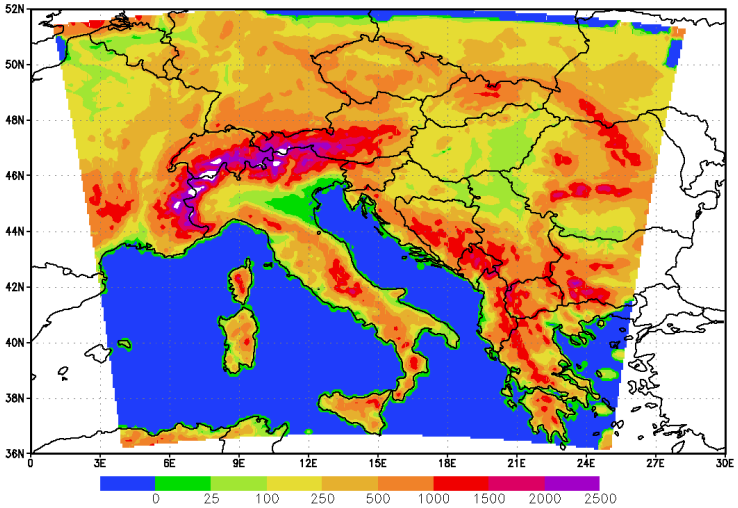
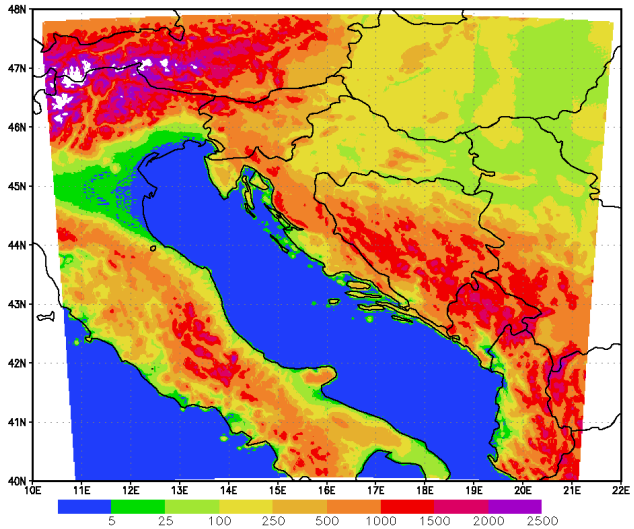
Introduction

- Description of “problem”
- Tests
- Results
- Summary & Questions

Model setup





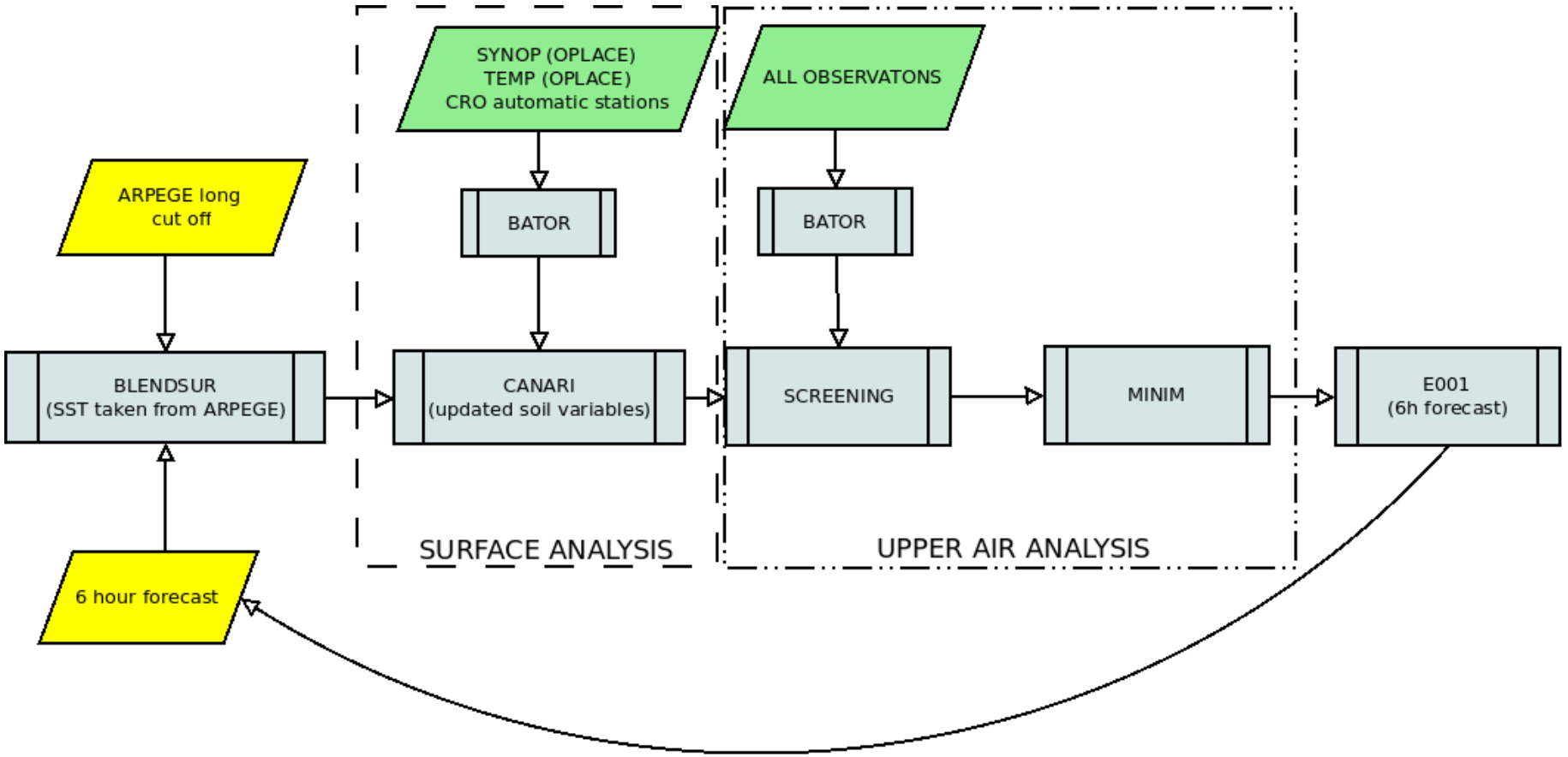
ALADIN HR domain

- 8 km horizontal resolution
- 37 levels, 229x205 (240x216) grid points
- 32T3: ALARO0-3MT, old radiation scheme, DFI
- 72 hours forecast, 1-3 hourly output

ALADIN HR22 domain

- 2 km horizontal resolution: 439x439 (450x450) grid points
- hourly 2 km dynamical adaptation up to 72 hrs @ 15 levels for 10 m wind forecast, model version AL29T2-mxl
- 24 hrs **2 km full NH** model run @ 37 levels, started from 00UTC 6h forecast, model version AL36T1, ALARO0 set-up (operational since July 2011.)

Assimilation cycle



- Cy35t1: CANARI, BATOR, screening, minimization
- Cy32t3: e001, e927
- Observations: OPLACE, Slovenian and Croatian automatic stations

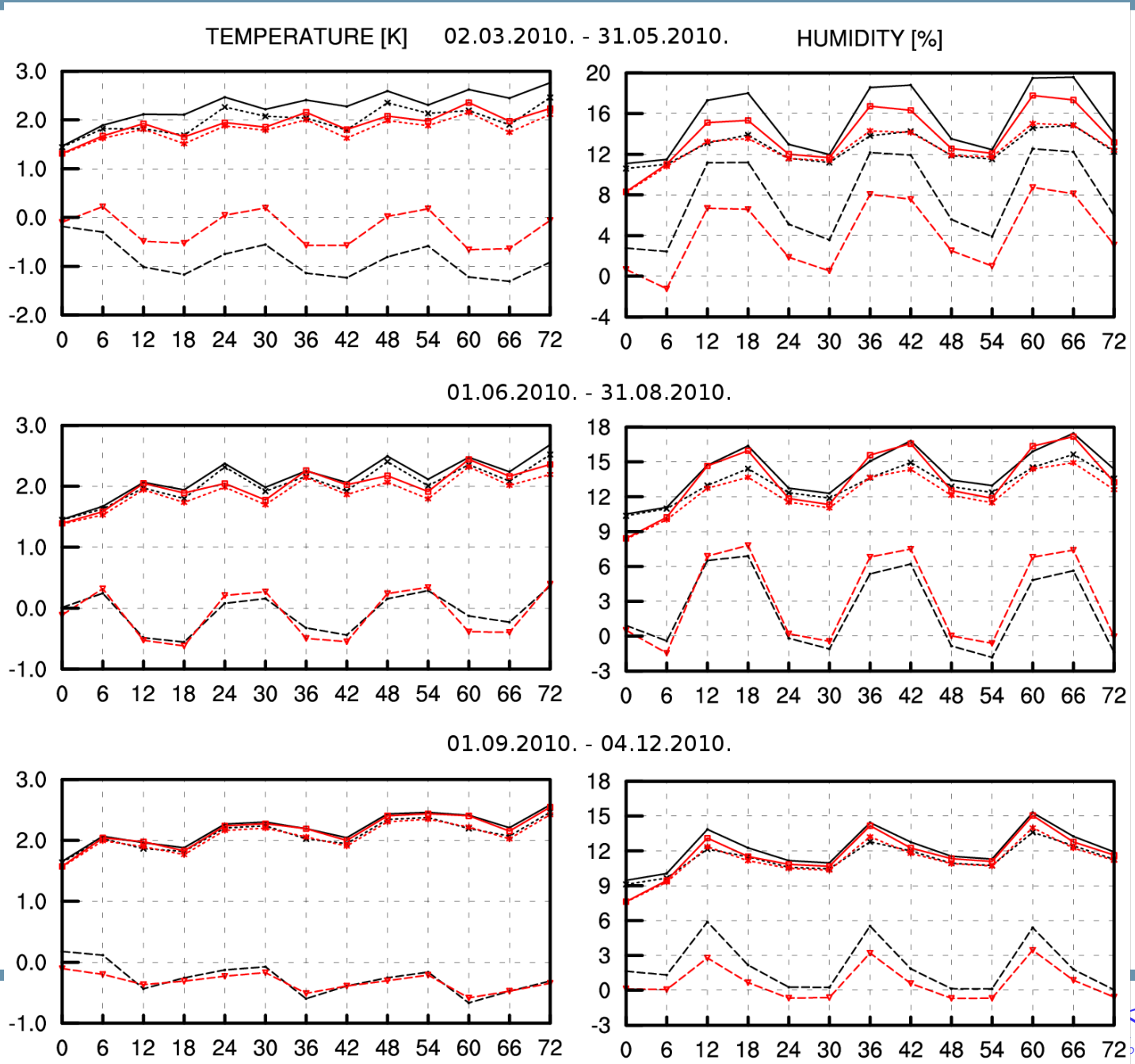
Verification

Experiments:

- **Alar** - dynamical adaptation => no assimilation, surface and upper air fields obtained by interpolation from ARPEGE short cut off analysis and forecast;
- **CV00** – assimilation; CANARI for surface, 3DVar for upper-air

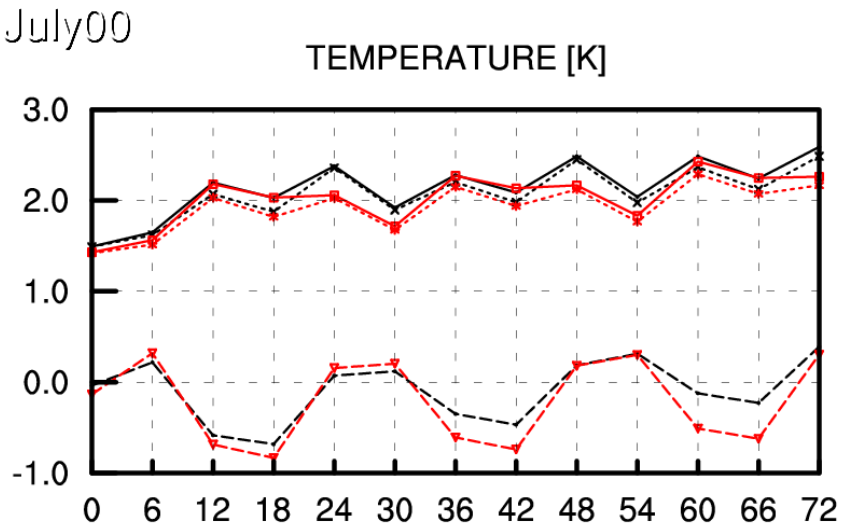
Verification – 00 UTC run

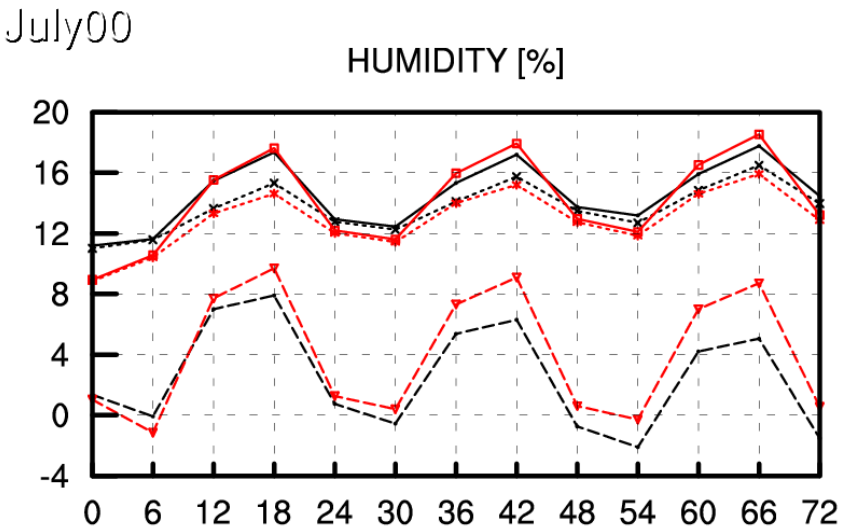
- BIAS: dashed
- RMSE: full line
- STD: dotted
- EXP: **Alar**, **CV00**



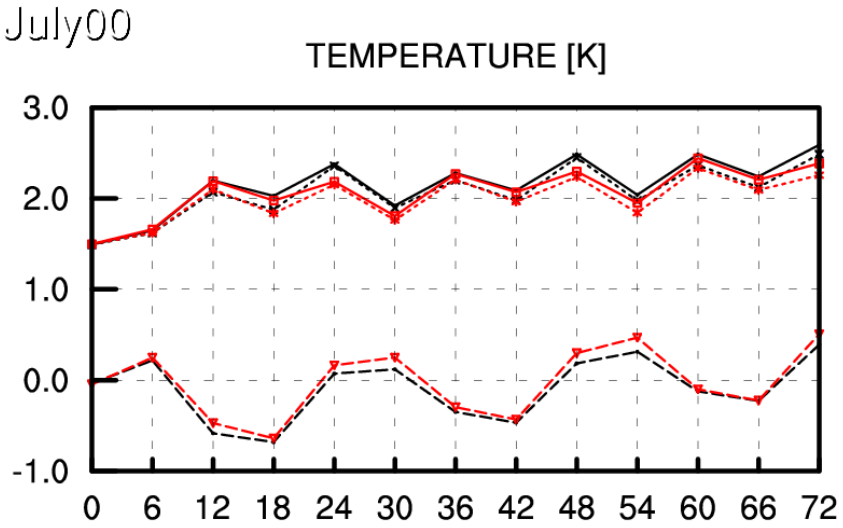
Verification – 00 UTC run

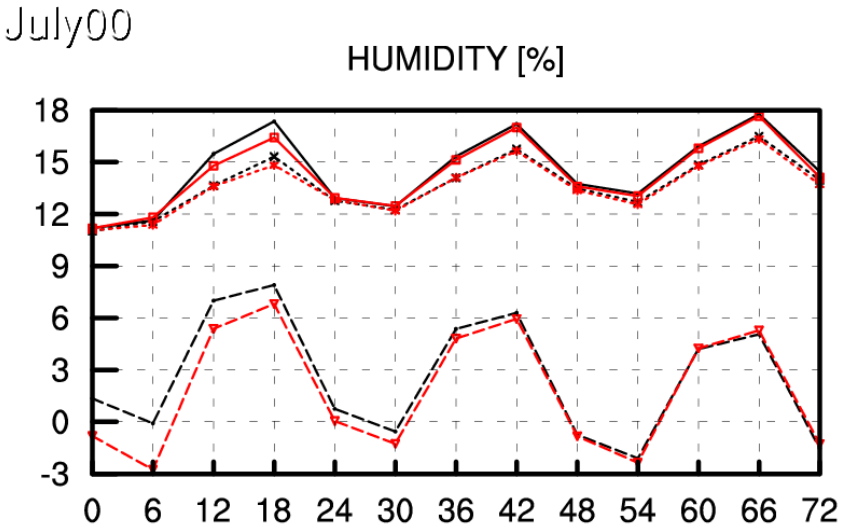
July 2011





CV00 vs. Alar





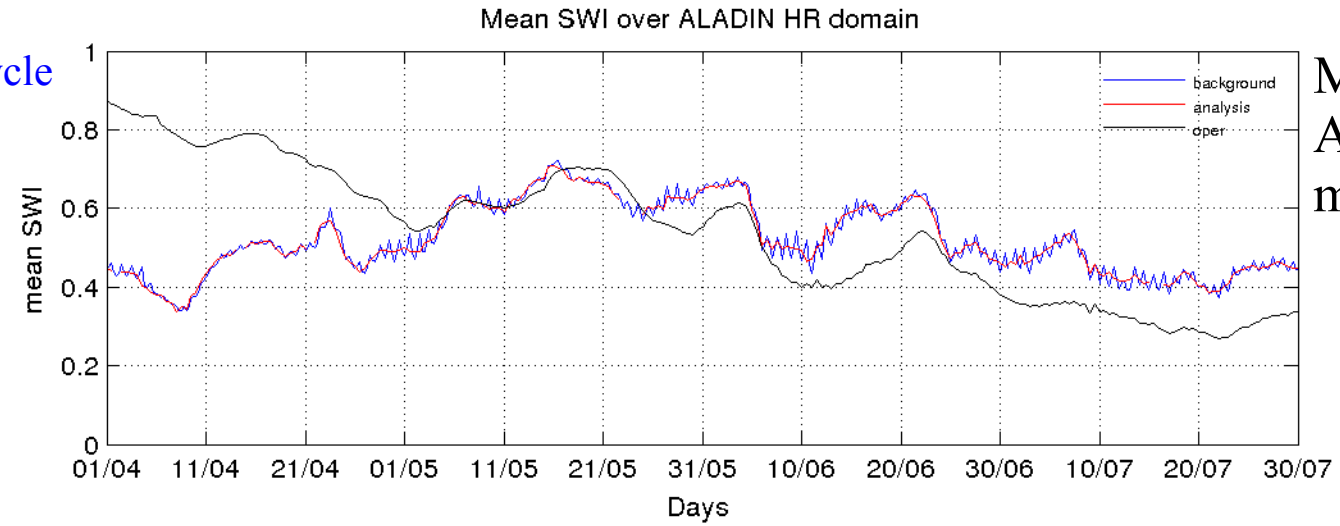
CV01 vs. Alar

CV01 – in production surface fields cp from ARPEGE

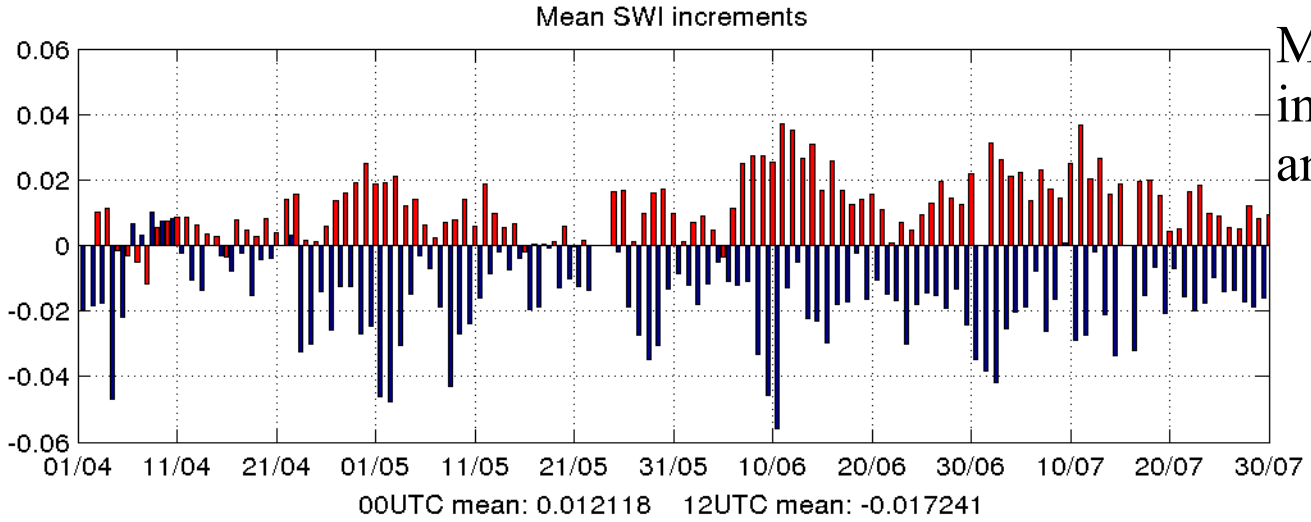
SWI evolution

April-July 2011

6h fcs from assim. cycle
Alar "analysis"
CV00 analysis



Mean SWI over ALADIN HR domain

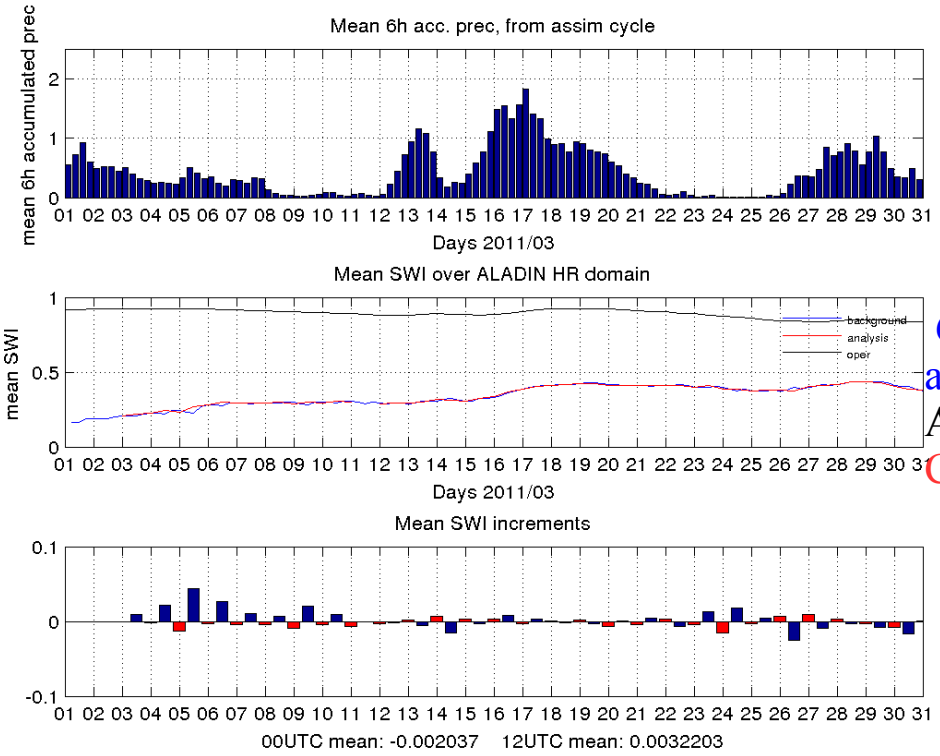


Mean SWI analysis increments at 00 and 12 UTC

SWI evolution

April-July 2011

March 2011

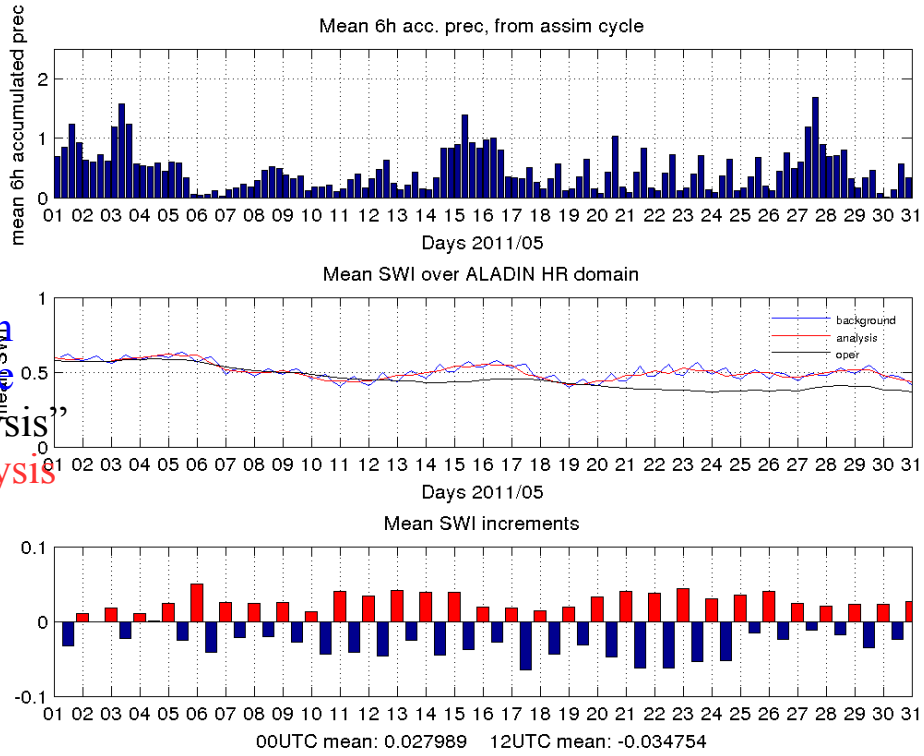


6h fcs from assim. cycle

Alar "analysis"

CV00 analysis

May 2011



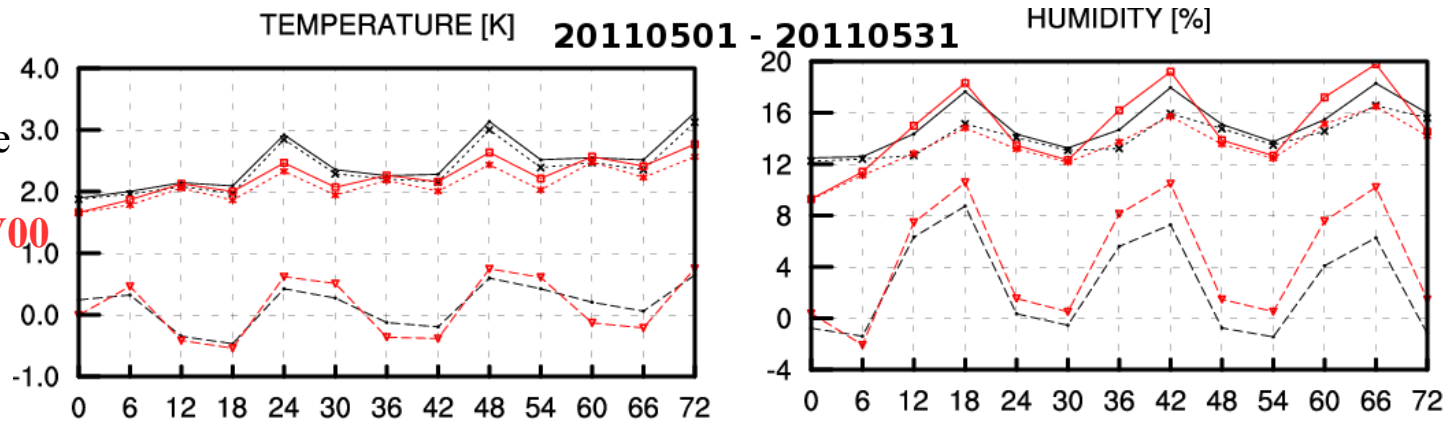
Mean SWI analysis increments at 00 and 12 UTC

SWI evolution

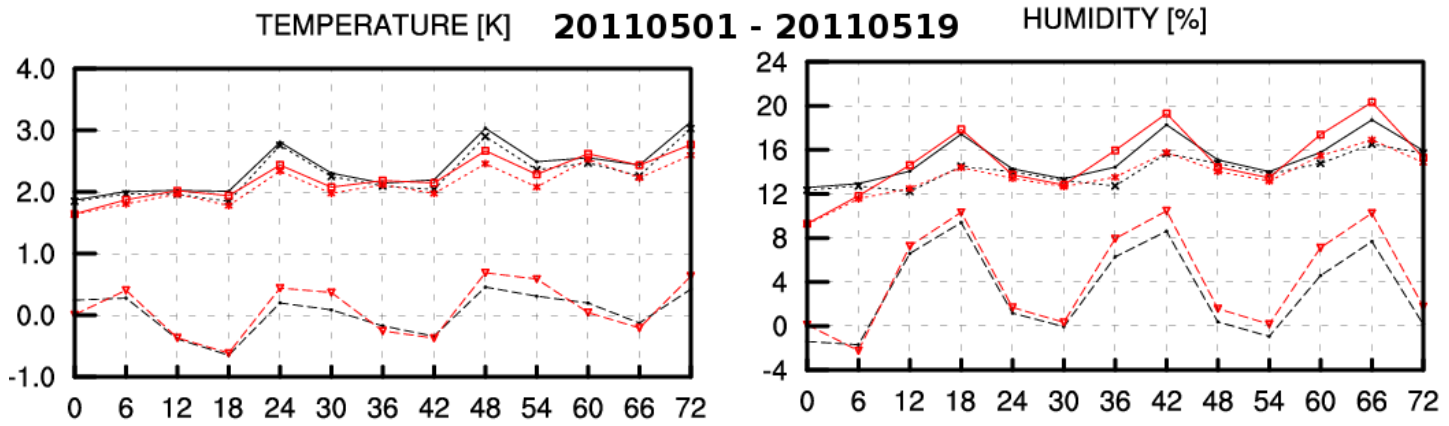
- CV00 – dryer than Alar in “winter period” (SWI domain average)
  - Beneficial for 2m scores
- CV00 – bigger SWI than Alar in “summer period” (SWI domain average)
  - 2m scores show degradation in BIAS when compared with Alar
- SWI increments in March smaller than increments in May and in both ways at 00 and 12 UTC compared to one-way increments in May

Testing period – May 2011

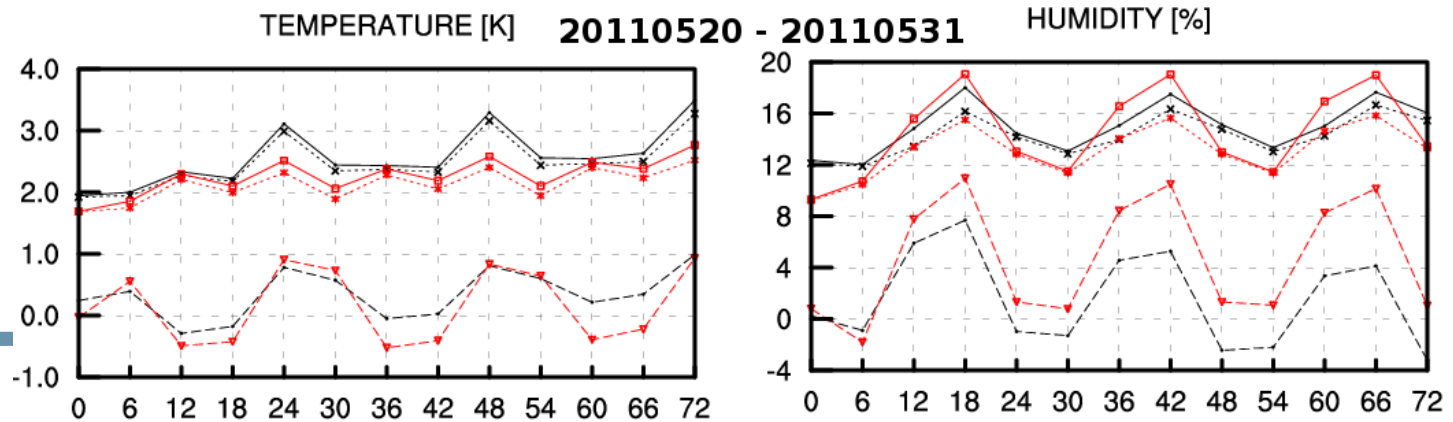
BIAS: dashed
RMSE: full line
STD: dotted
EXP: **Alar**, **CV00**



T2m and RH2m bias of CV00 bigger than Alar for afternoon hours

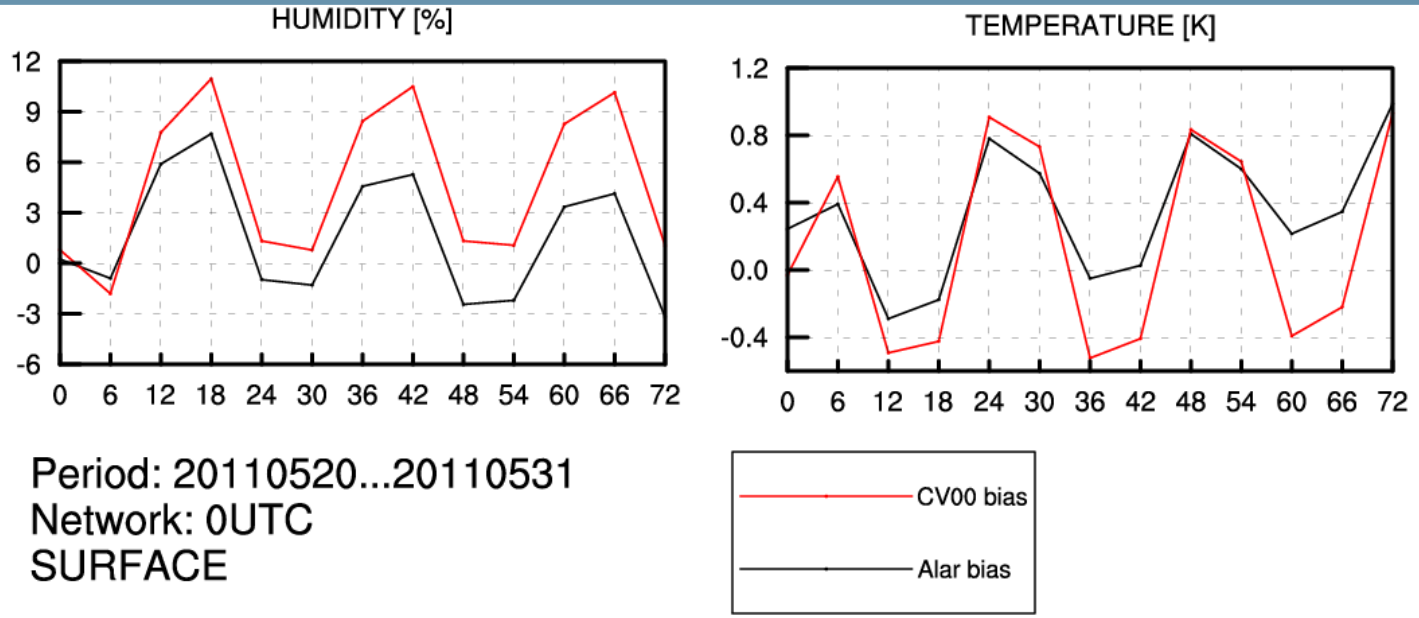


warm-up period

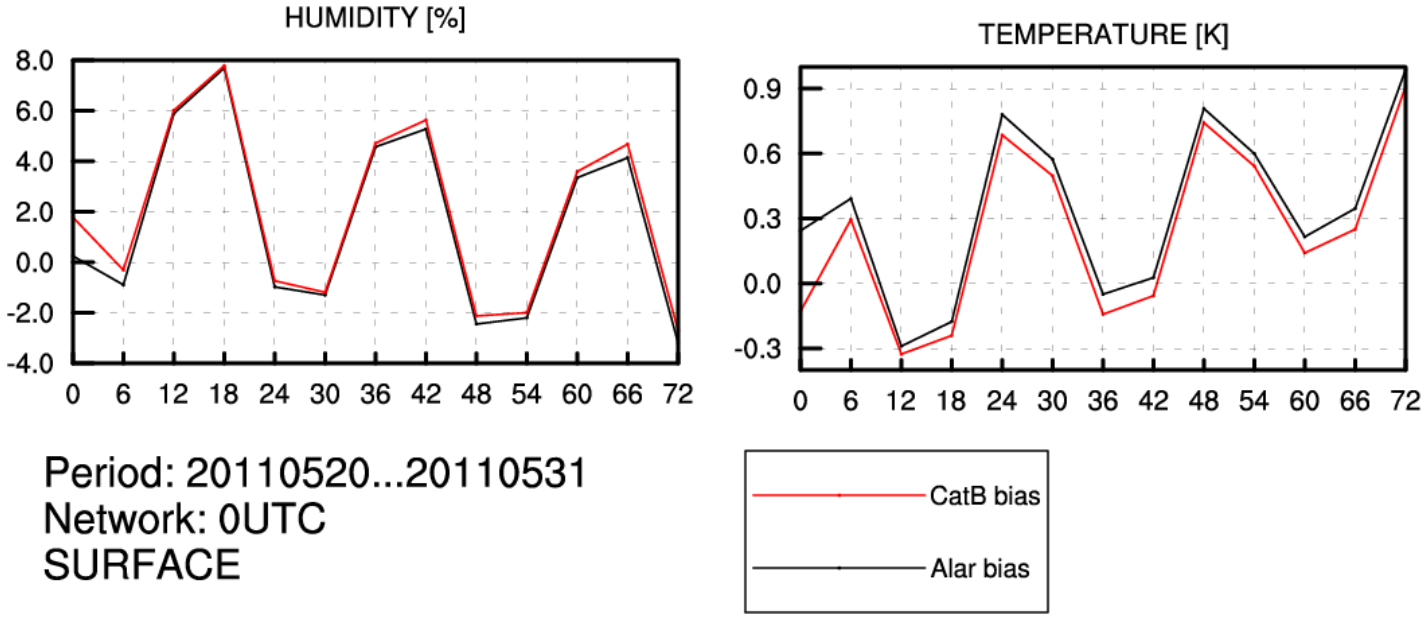


verification period

Testing period – May 2011



In production cp soil from ARPEGE short cut off analysis



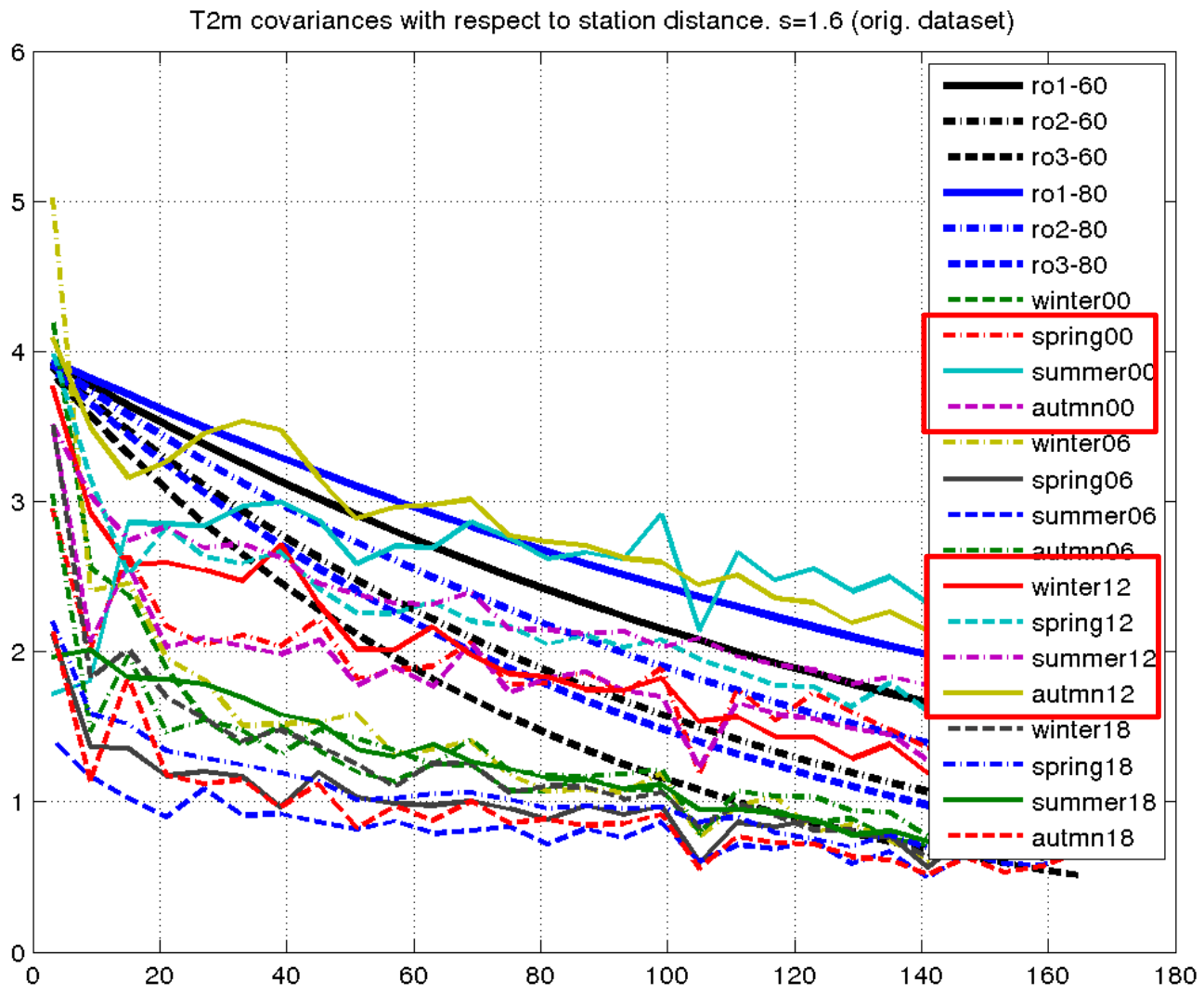
CANARI

Changing settings in CANARI analysis:

- reference horizontal length scale for T2m and RH2m (REF_A_H2, REF_A_T2)
- model error standard deviation for T2m and RH2m (REF_S_H2, REF_S_T2)
- maximum distance for horizontal selection (QDSTRA)
- maximum number of observations per quadrant (NMXGQA)
- smoothing radius (RA_SM_WP)
- maximum obs altitude for SYNOP use (OROLIM)
- maximum difference allowed between SYNOP altitude and corresponding model orography (ORODIF)
- blacklisting suspicious observations

RESULTS

Changing horizontal length scale & model standard deviation

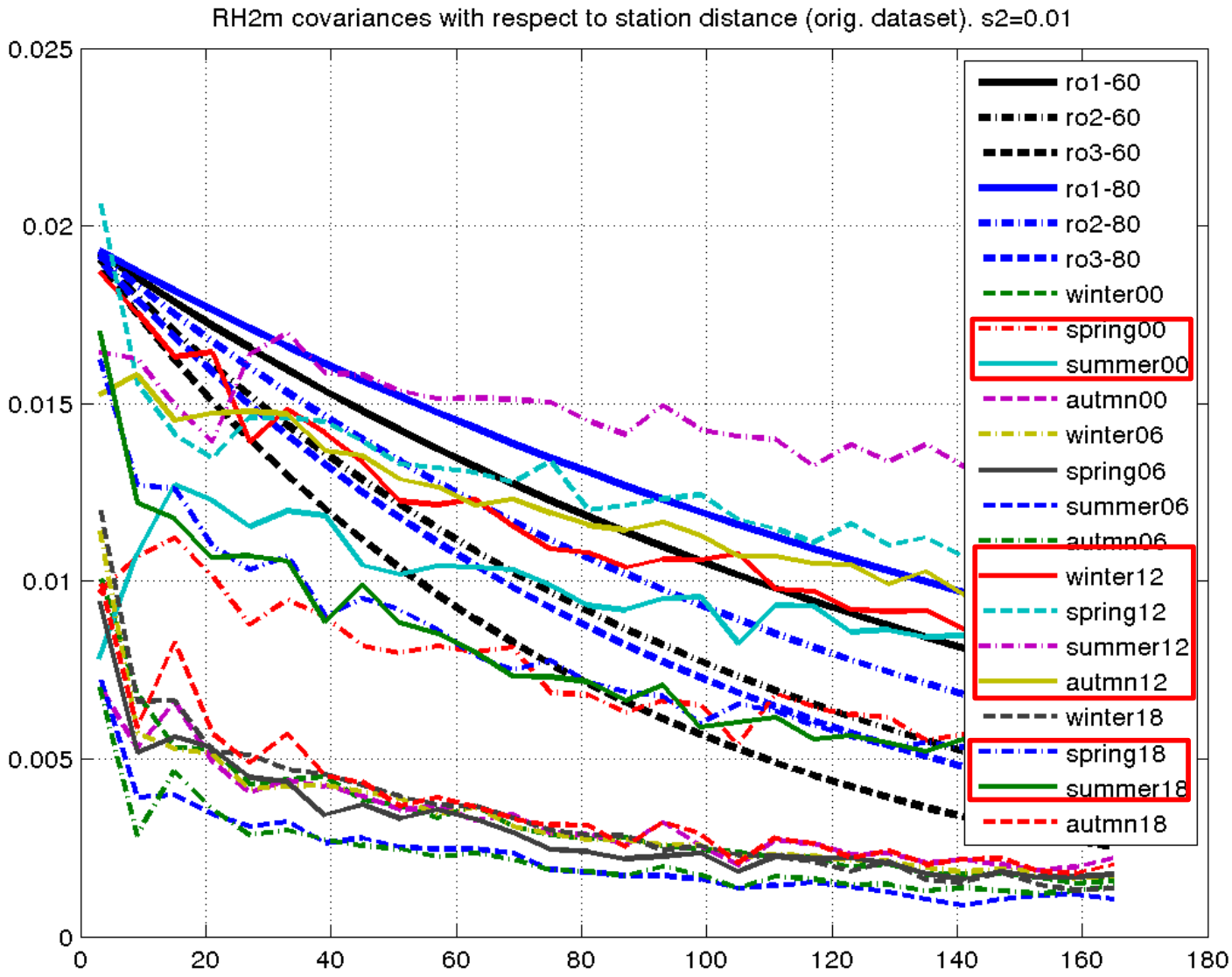


Long horoz. length scale & larger stdev

~1 year of data

RESULTS

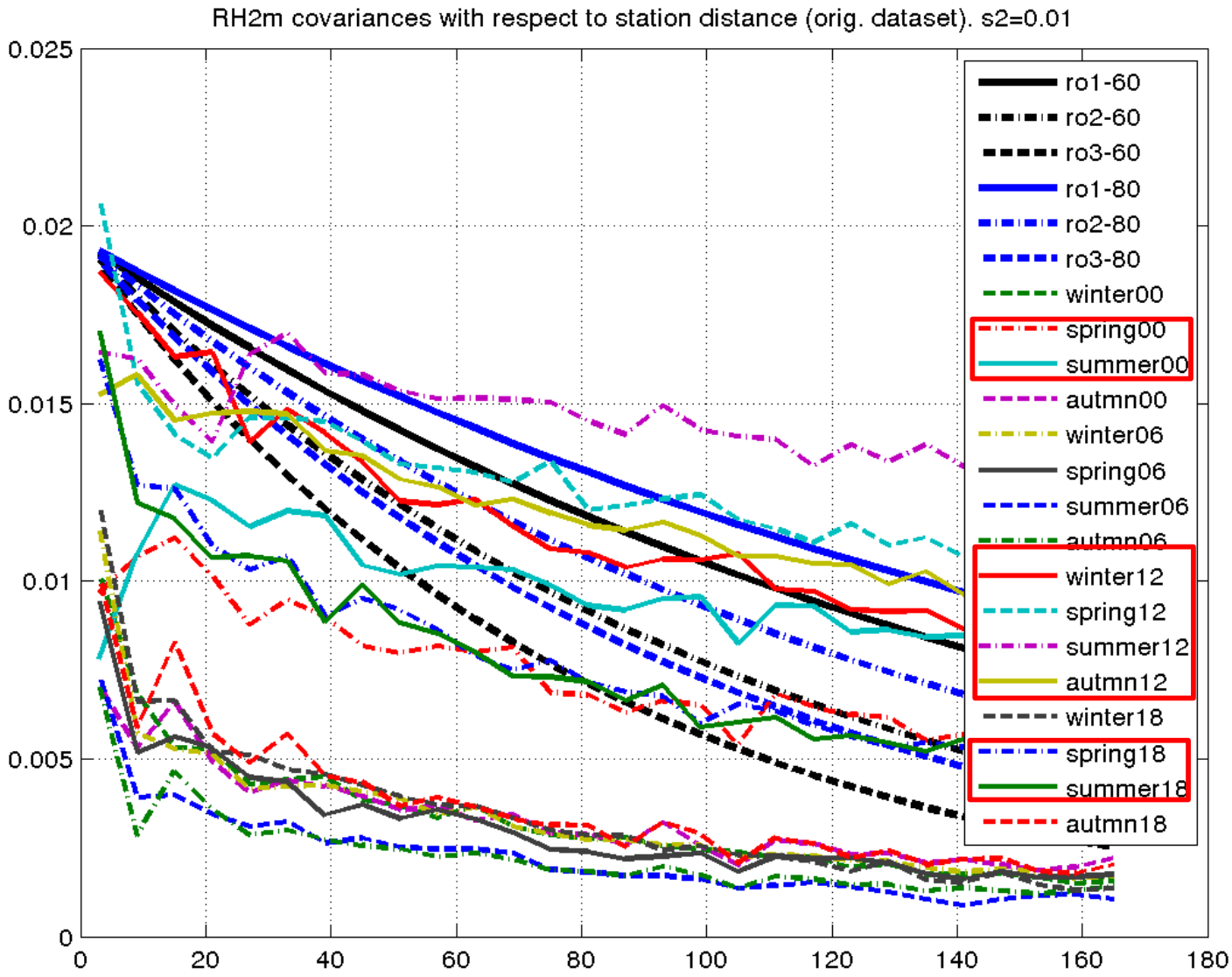
Changing horizontal length scale & model standard deviation



Long horoz. length scale & larger stdev

RESULTS

Changing horizontal length scale & model standard deviation



Long horoz. length scale & larger stdev

RESULTS

Changing horizontal length scale & model standard deviation

Time	**00**		**12**		**06 and 18**	
Variable	T2m	RH2m	T2m	RH2m	T2m	RH2m
D [km]	90	90	120	120	60	60
Standard deviation	1.7	0.1	1.8	0.135	1.6	0.09

Original settings: REF_A_H2=55000., REF_A_T2=50000., REF_S_H2=0.18, REF_S_T2=1.6

RESULTS

- Cat 1:
  - reference horizontal length scale for T2m and RH2m (REF_A_H2, REF_A_T2) according to previous Table
  - model error standard deviation for T2m and RH2m (REF_S_H2, REF_S_T2) according to previous Table
  - maximum distance for horizontal selection (QDSTRA) was changed from original settings of 1000km to 150km
  - maximum number of observations per quadrant (NMXGQA) was reduced from 50 to 7
  - smoothing radius (RA_SM_WP) was changed from 5km to 8km
  - Same in production

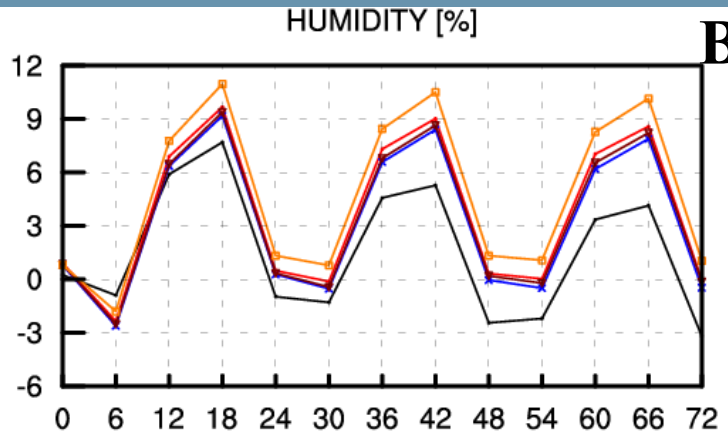
- **NO impact on verification scores**

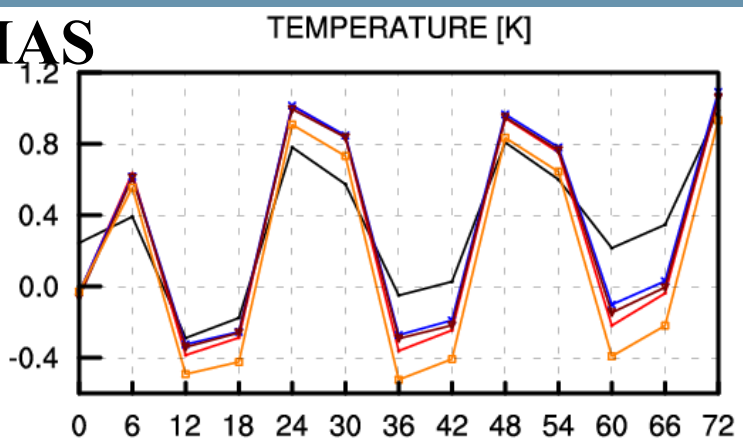
RESULTS

- Cat 4: same as Cat1 but at 00 no RH2m analysis. Same in production.
- Cat5: same as Cat1 but at 00 no RH2m analysis. At the beginning of May soil was taken from OPER (restart); normal cycling afterwards. Same in production.
- Cat6: No RH2m analysis at 00UTC; horizontal length scale and standard deviation from Table 3 but doubled. At the beginning of May soil was taken from OPER (restart); normal cycling afterwards. Same in production.

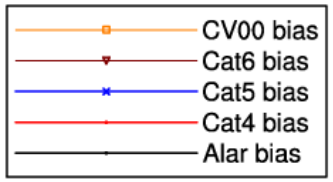
RESULTS

BIAS

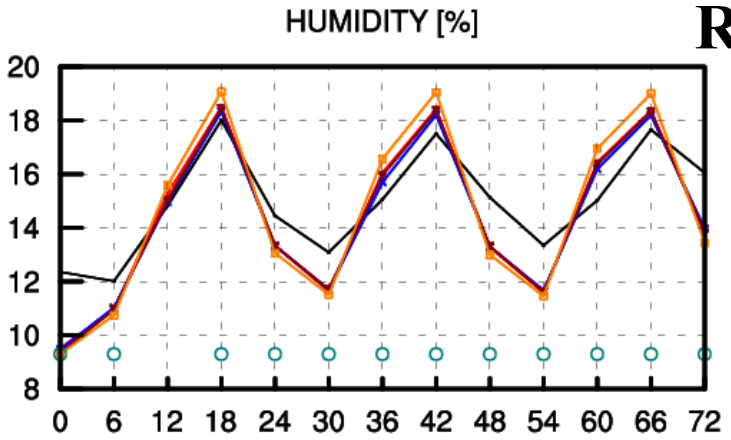


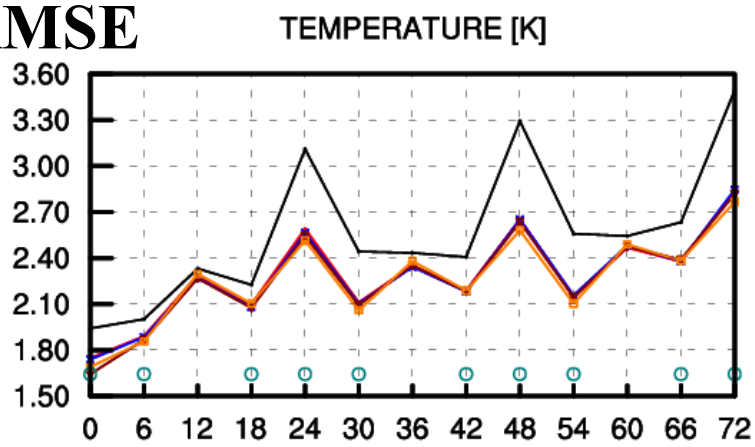


Period: 20110520...20110531
Network: 0UTC
SURFACE

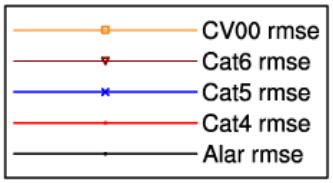


RMSE





Period: 20110520...20110531
Network: 0UTC
SURFACE



RESULTS

- Switching off RH2m analysis at 00 UTC brings improvement in BIAS verification scores for T2m and RH2m in afternoon hours, degradation in night hours
- Increasing horizontal length scale and model standard deviation - small impact on verification scores
- Soil characteristics that are responsible for bad verification scores are not accumulated during winter months – 20 days period is enough for soil analysis to change soil in “bad” way
- Cat7 and Cat8 – same as Cat5 and Cat6 respectively but they started for regular assimilation cycle (not restart) and ISBA polynomes version 3 used - almost identical results as Cat5 and Cat6

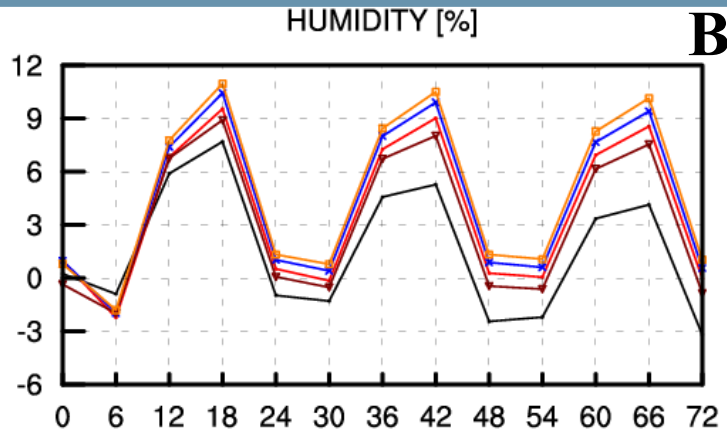
RESULTS

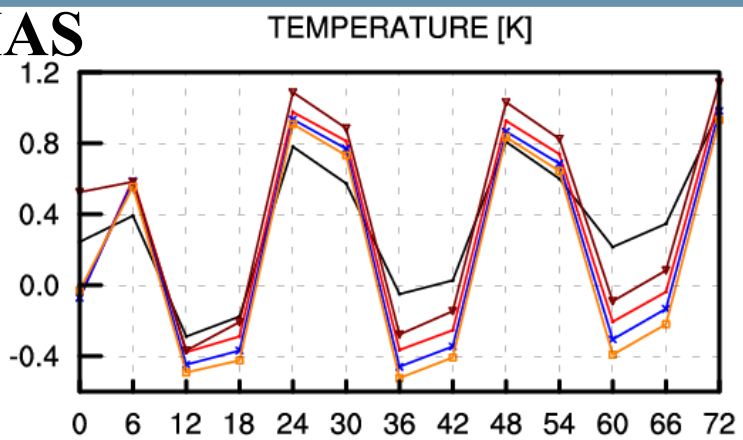
- Test impact analysis at initialization time
  - experiments where CANARI settings only in production were changed
  - Build on top of Cat7 cycle

- Cat7: **no** RH2m, **yes** T2m analysis at 00UTC
- Cat9: **yes** RH2m**, yes** T2m analysis at 00UTC
- CatA: **no** RH2m, **no**T2m analysis at 00UTC

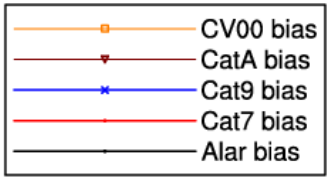
RESULTS

BIAS

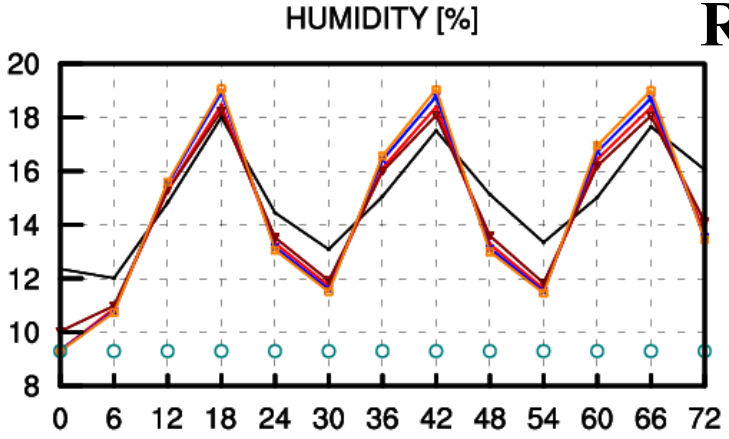


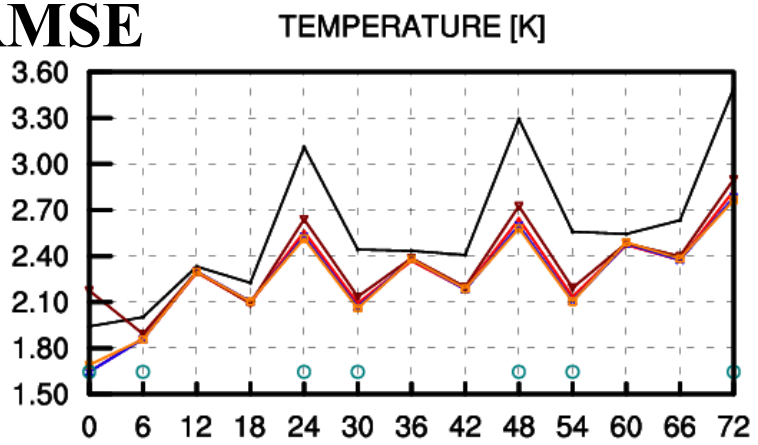


Period: 20110520...20110531
Network: 0UTC
SURFACE

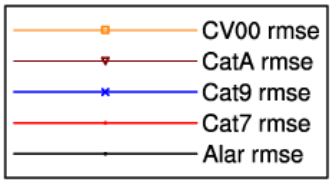


RMSE





Period: 20110520...20110531
Network: 0UTC
SURFACE



RESULTS

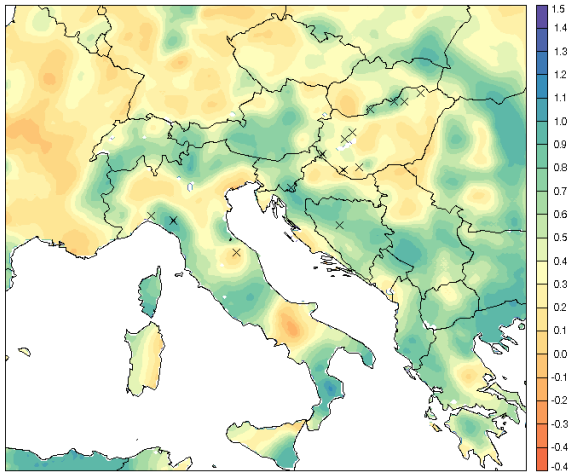
- analysis at the time of initialization of model forecast has big influence on verification scores
- run without T2m and RH2m assimilation brings most of improvement in verification scores but also at some forecast hours it deteriorates forecast more then others setups
- compromising solution is performing CANARI analysis for 00UTC with RH2m switched off and T2m switched on (Cat7).

RESULTS

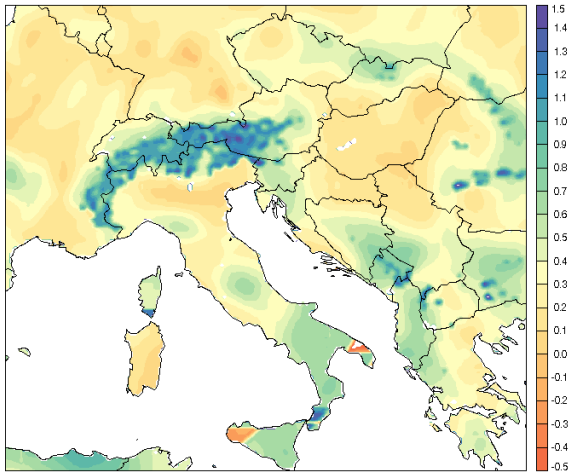
- CatC: same as Cat4; some stations blacklisted, OROLIM=800m, ORODIF=200m. Same in production.
- CatD: same as CatC but also RH2m analysis turned of at 06 UTC

RESULTS

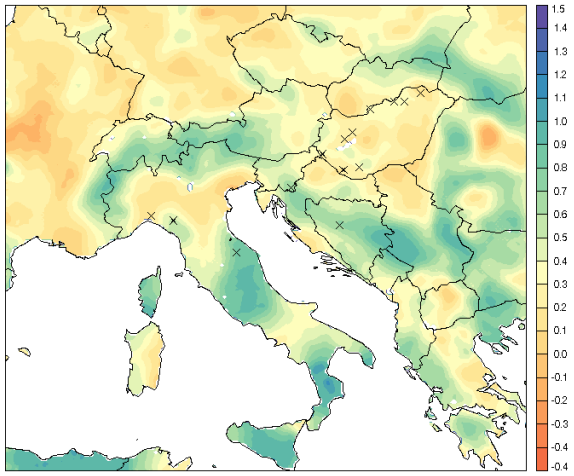
CYCLE 20110531 12UTC



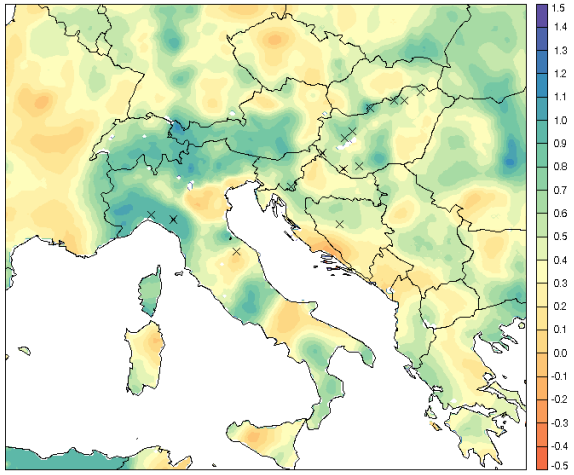
OPER 20110531 12UTC



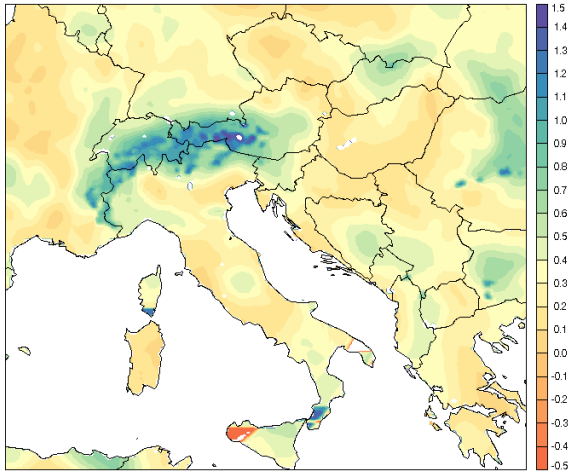
NEW 20110531 12UTC



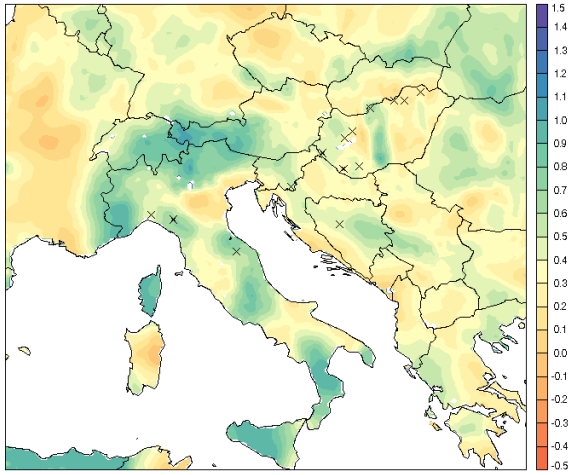
CYCLE 20110630 12UTC



OPER 20110630 12UTC

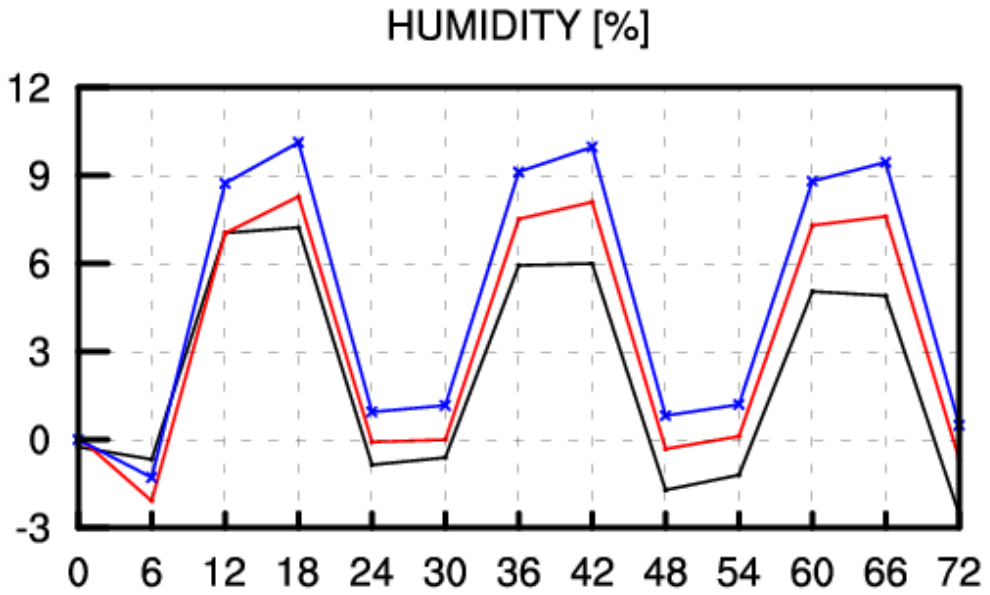


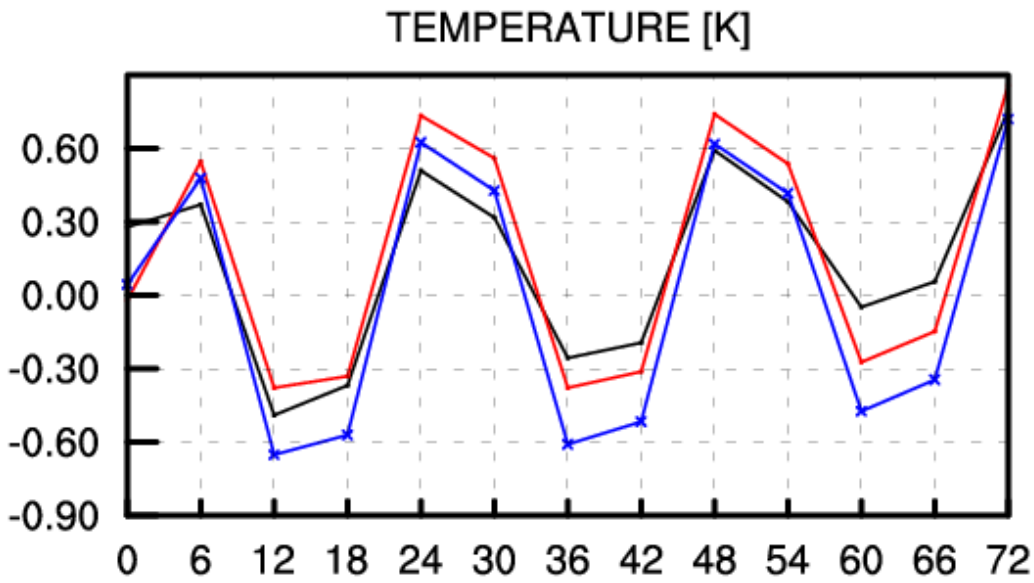
NEW 20110630 12UTC



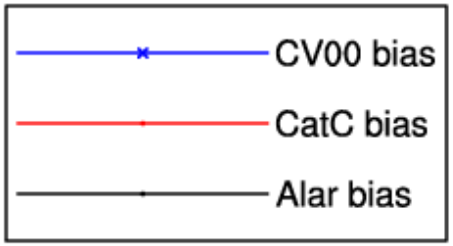
RESULTS

BIAS



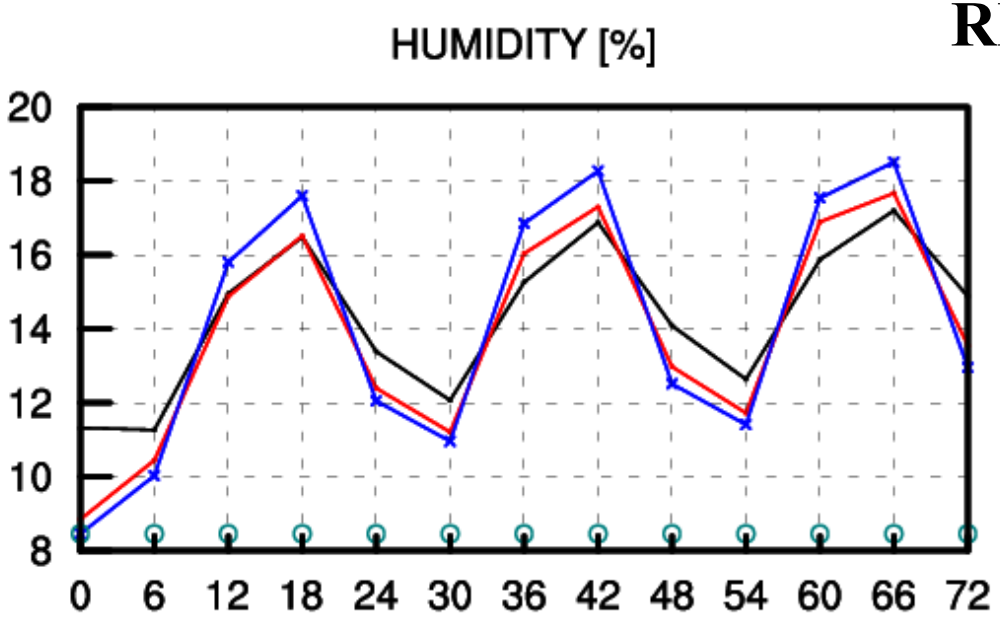


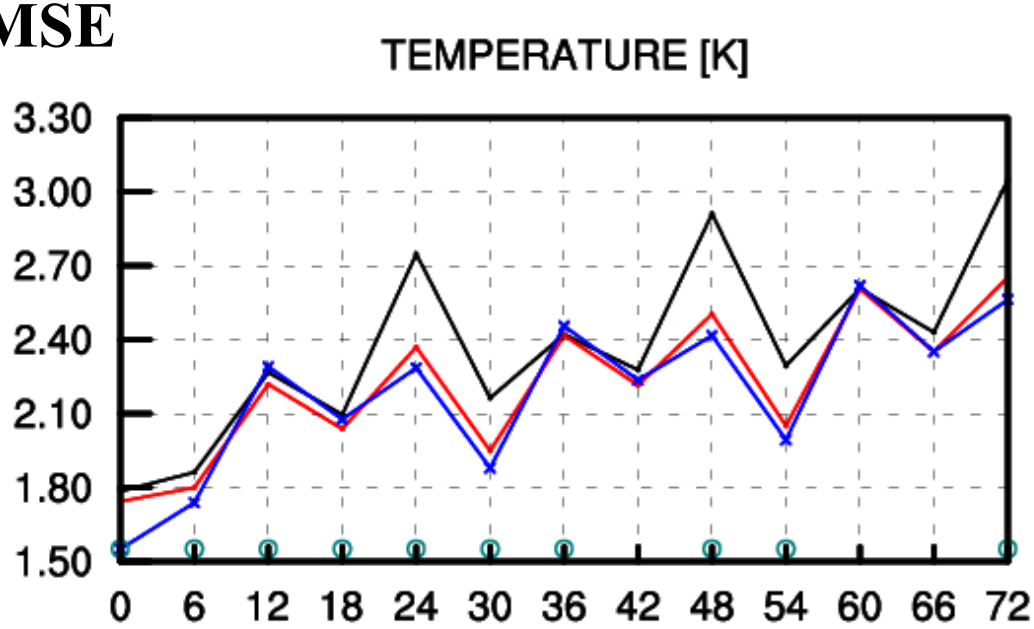
Period: 20110520...20110630
Network: 0UTC
SURFACE



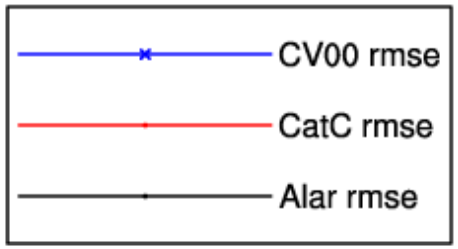
RESULTS

RMSE





Period: 20110520...20110630
Network: 0UTC
SURFACE

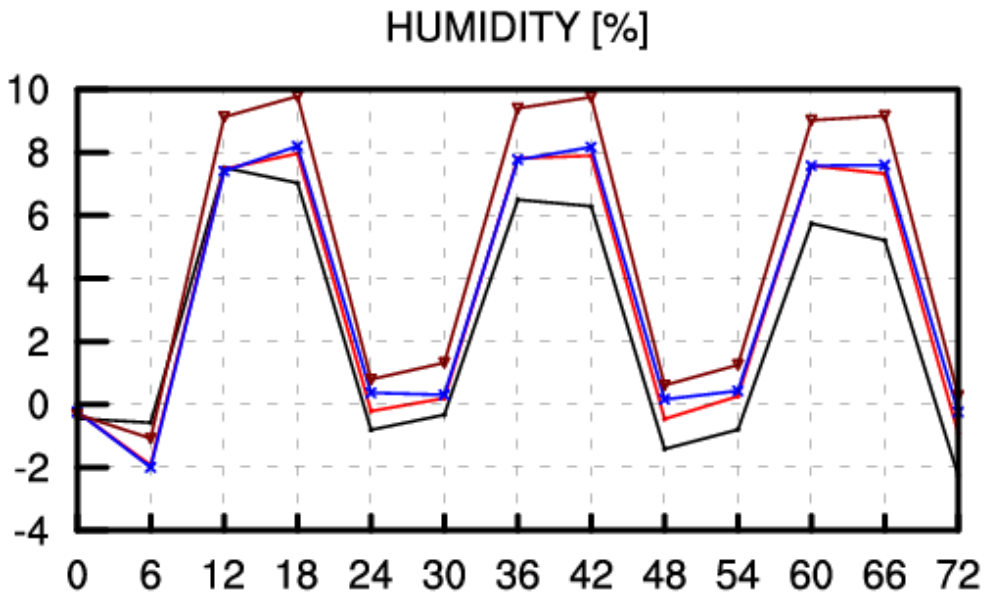


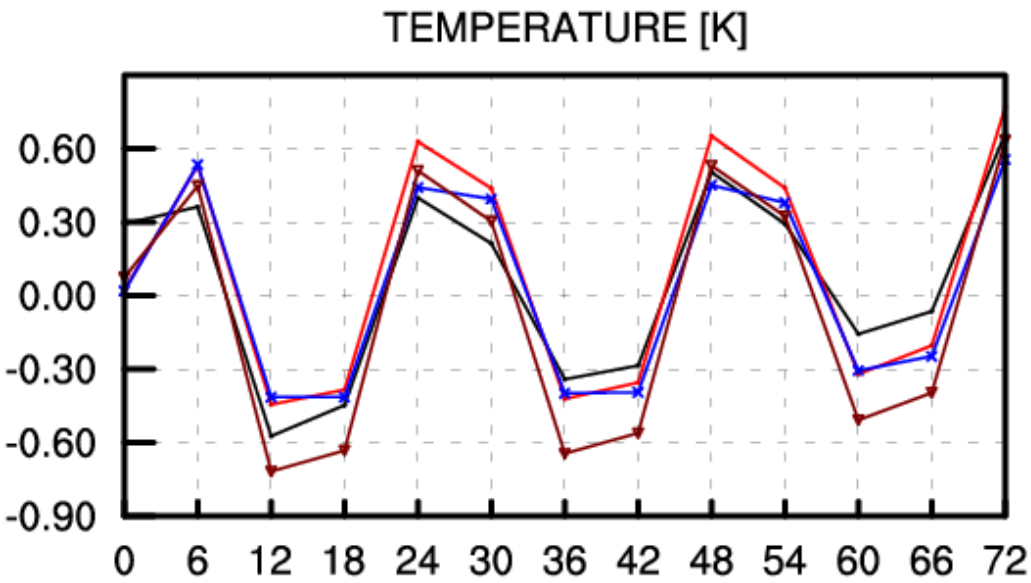
RESULTS

- tuning of thermal inertia coefficient
- RCTVEG(3)=RCTVEG(4)=0.8 E-5 changed to 0.9 E-5

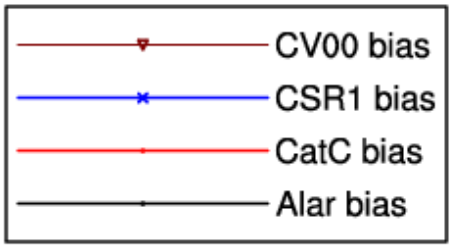
RESULTS

BIAS



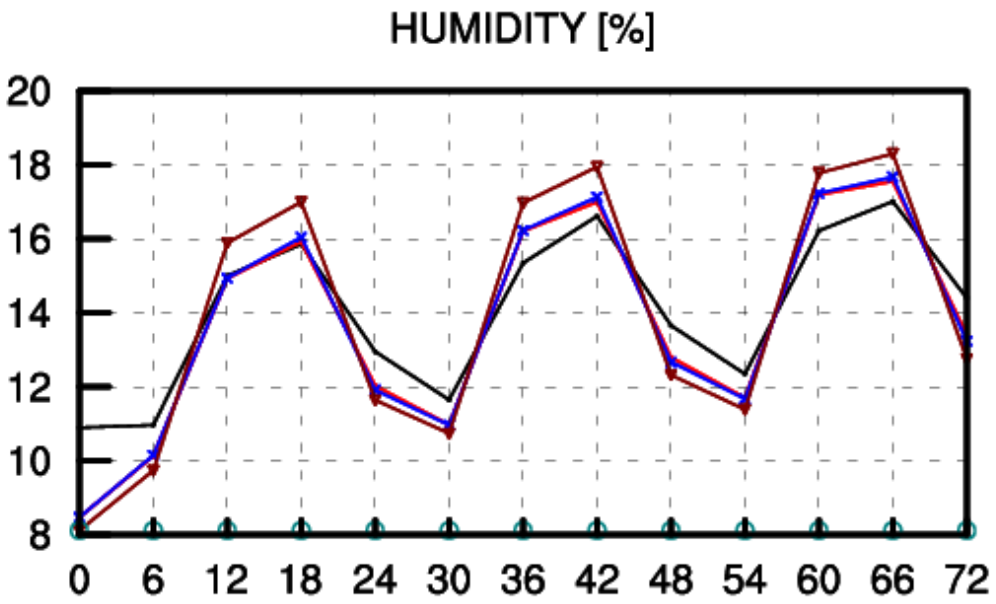


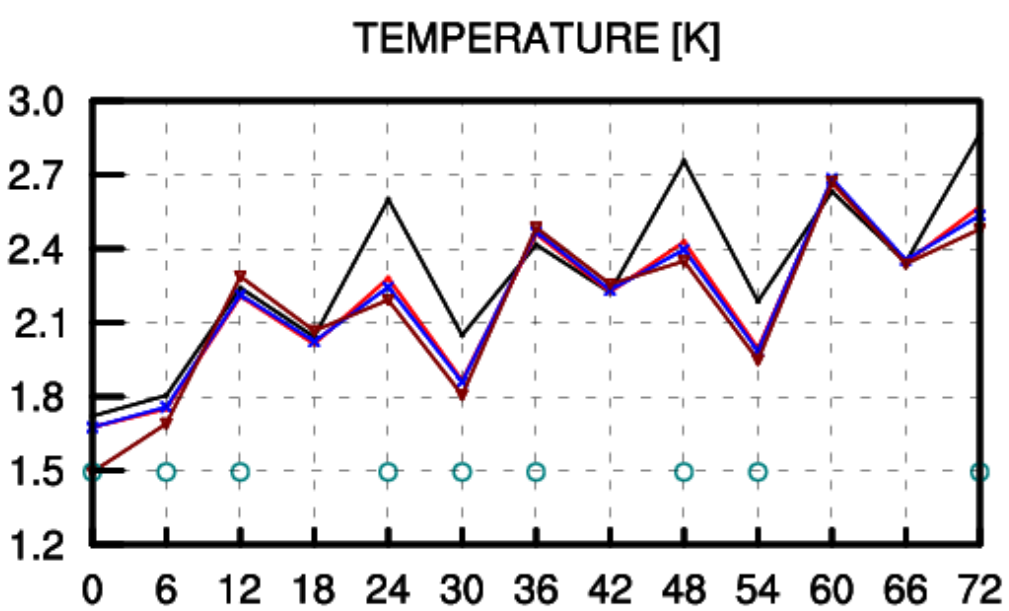
Period: 20110601...20110630
Network: 0UTC
SURFACE



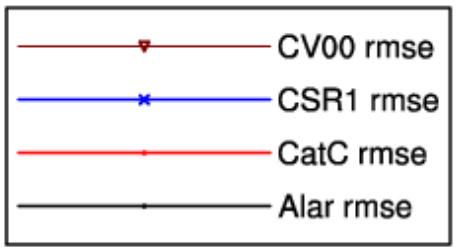
RESULTS

RMSE





Period: 20110601...20110630
Network: 0UTC
SURFACE



Summary & Questions

- changing reference horizontal length scale for T2m and RH2m and model error standard deviation for T2m and RH2m both in cycling and production had little influence on verification scores
  - one possible reason could for that be to short time of cycling (~20 days)
  - other may be that parameters like standard deviation of model error was not changed too much
- biggest influence on SWI evolution and verification scores had shutting off RH2m analysis (at 00UTC)
  - when RH2m analysis was turned also at 06 UTC better verification scores were obtained for afternoon hours but results deteriorates for morning/night hours

Summary & Questions

- turning on and off analysis just in production has big impact on verification scores
  - magnitude of influence is comparable to changing settings in assimilation cycle => assimilation in production very important
- some stations can be unrepresentative, even if because they are badly positioned or model forecast is unrepresentative for that area
  - how to handle those stations ?
- stations are present only few times at day (e.g. one or two times) and if this is at 00 and 06 UTC than increments at those stations can always go in same direction (because of model bias)

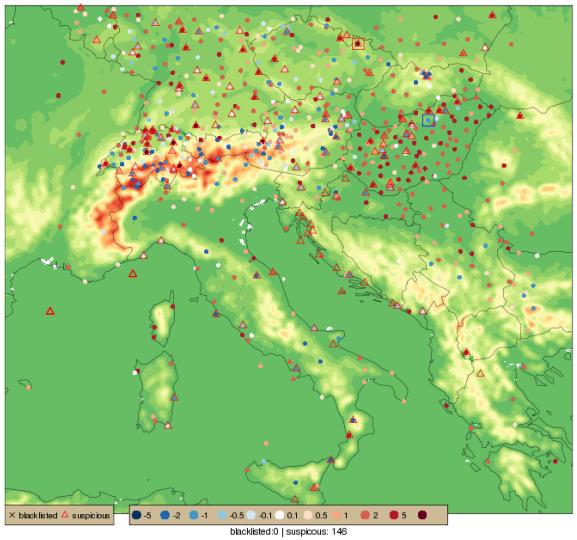
Questions

Model bias

Razdoblje: 20110501 - 20110531

CYT8 0 UTC: t2m bias (model-obs)

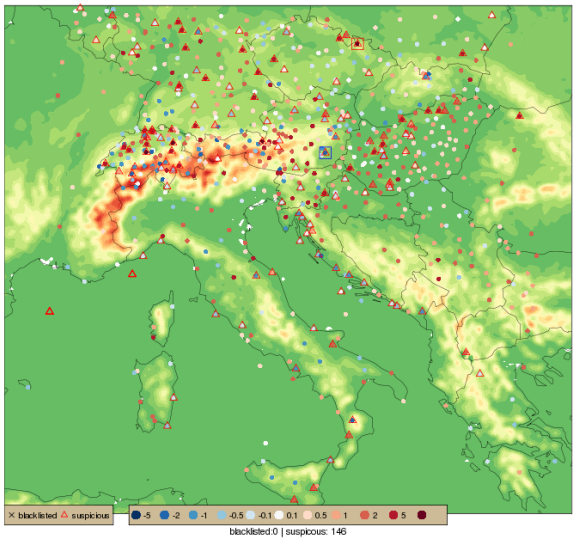
mean: 0.7153 | min: -3.793 | max: 6.59



Razdoblje: 20110501 - 20110531

CYT8 6 UTC: t2m bias (model-obs)

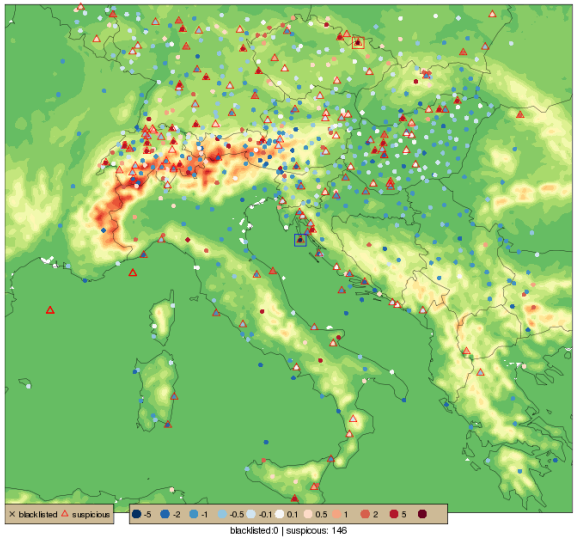
mean: 0.5014 | min: -2.369 | max: 7.503



Razdoblje: 20110501 - 20110531

CYT8 12 UTC: t2m bias (model-obs)

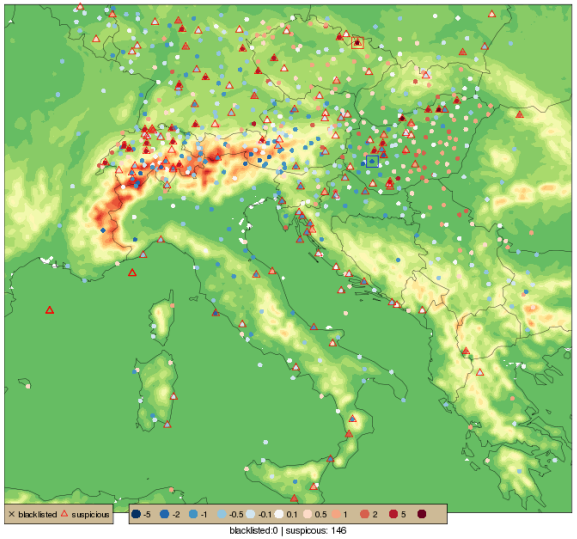
mean: -0.4435 | min: -5.382 | max: 9.252



Razdoblje: 20110501 - 20110531

CYT8 18 UTC: t2m bias (model-obs)

mean: -0.06291 | min: -7.666 | max: 9.352

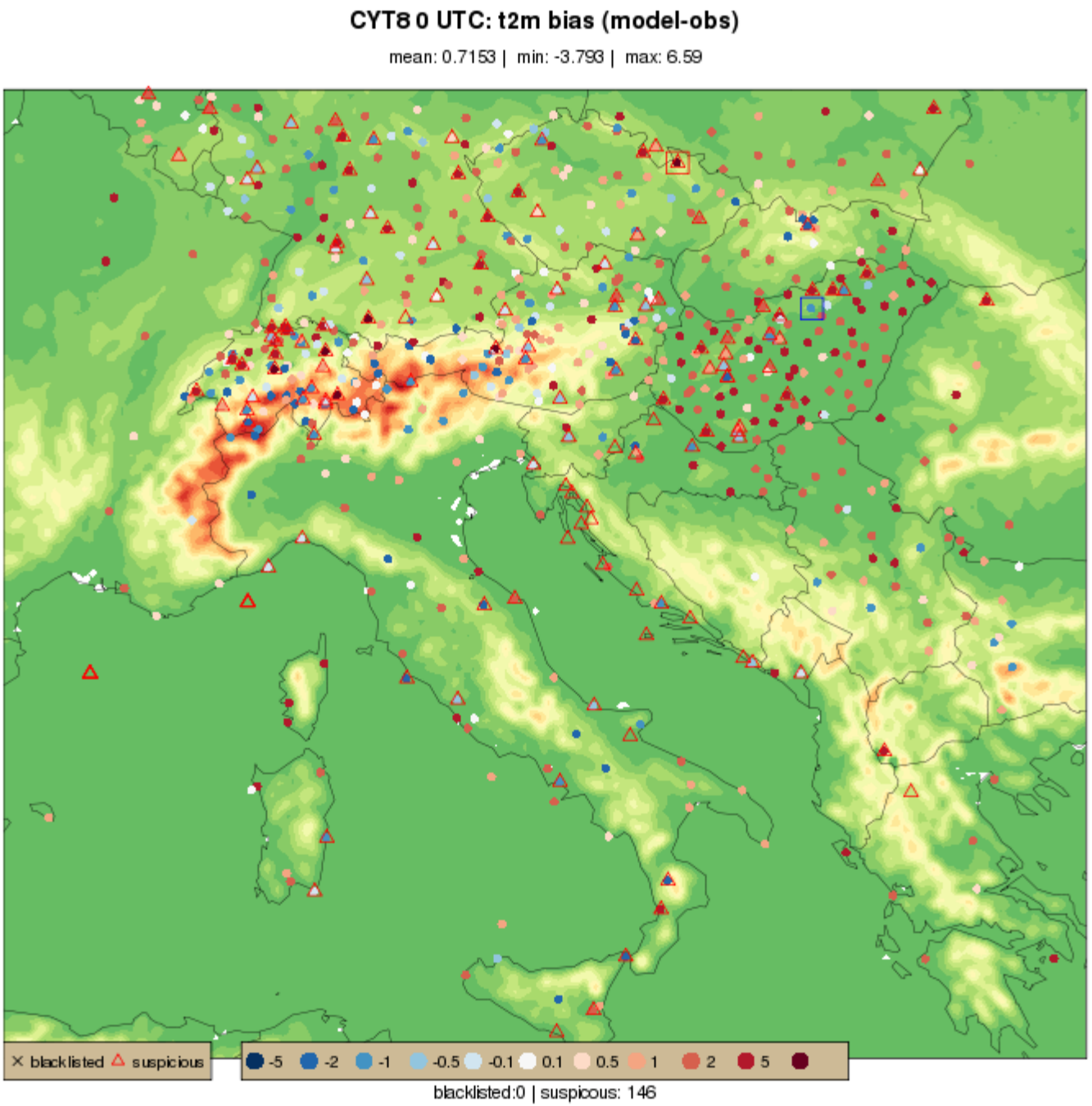


DHMZ

LACE
nwp central europe

RESULTS

Stations with bias in same direction on average (threshold 3 times)



Questions

- When to turn on/off RH2m or T2m analysis?
- How to handle unrepresentative stations or stations that point in same direction (on average) in all analysis times?
- What to do with stations that are present only few times a day (taking into account model bias)?
- Should we use same blacklist for CANARI and 3DVar?
- Include modifications of thermal coefficient in cycling?