GLAMEPS and HarmonEPS

GLAMEPS is a common project for operational EPS in the short-range in the HIRLAM and ALADIN SRNWP consortia

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Antalya October 2013

GLAMEPS_v1 for the "synoptic" scales:

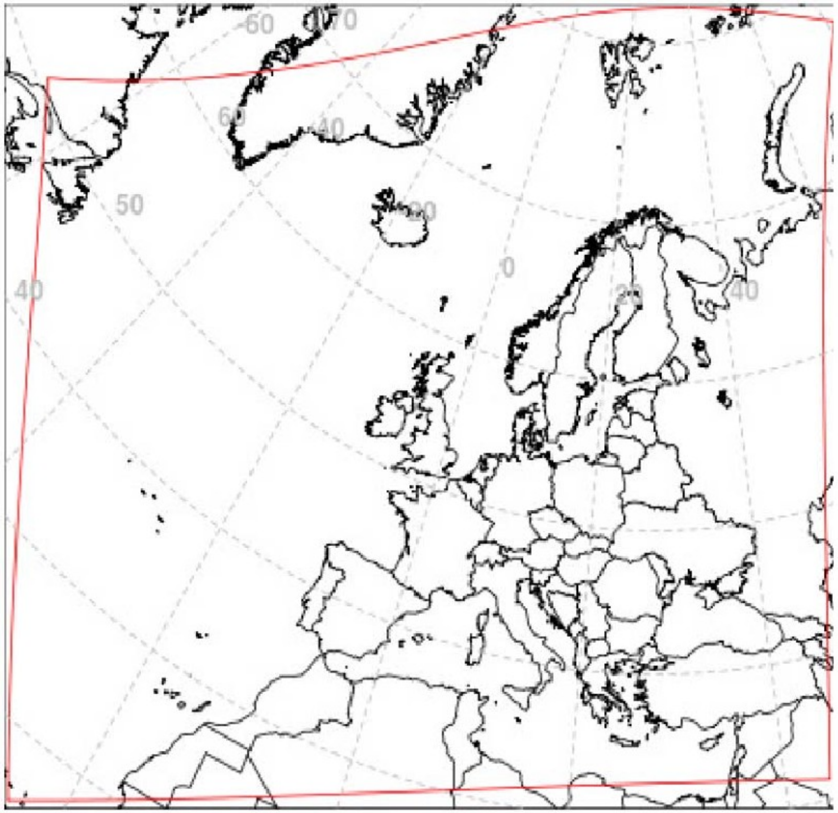
54 ensemble members:
- EC DET (1) +
- HirEPS_S (12+1) +
- HirEPS_K (12+1) +
- AladEPS (13) +
- EC EPS (14) = 54

Forecast range: 54h

- 06 and 18 UTC (EC 00 and 12 UTC)

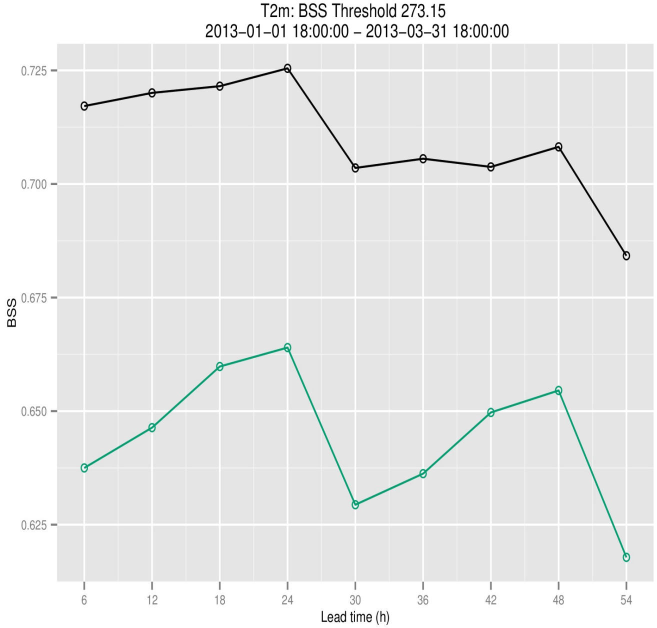
~11 km resolution
Aladin: 629x529, 11.8 km, L37
Hirlam: 646x492, 0.10° (11,1 km), L40

Runs as Time-Critical Facility at ECMWF

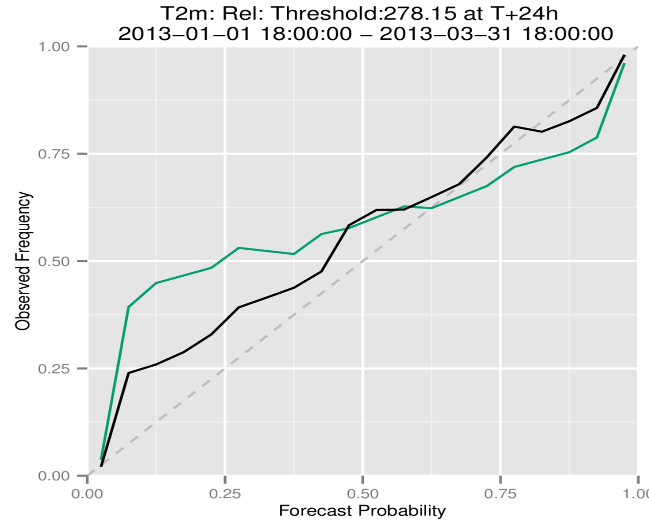


Black frame: Aladin domain
Red domain: Hirlam domain and common output domain

GLAMEPS_v1 performance



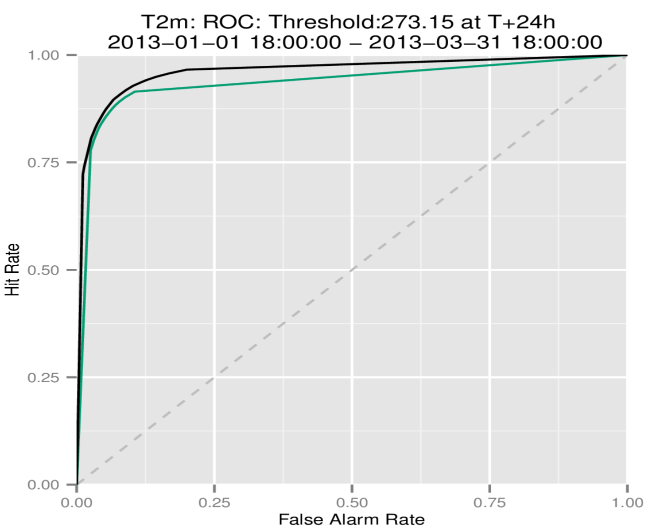
BSS
THR 0



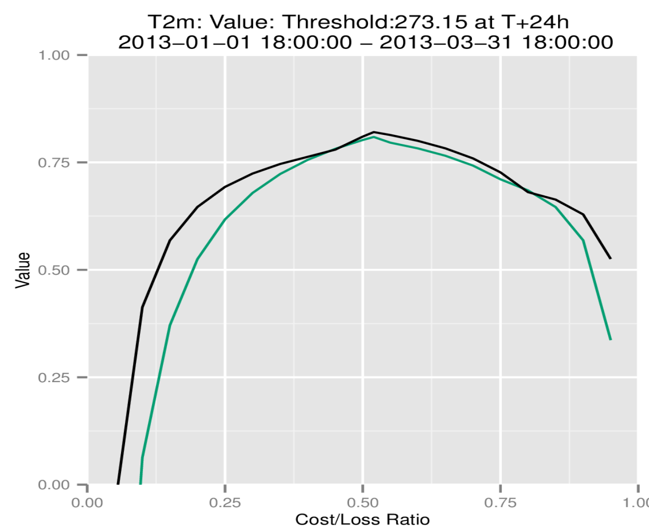
Rel.
THR 5
+24h

T2m

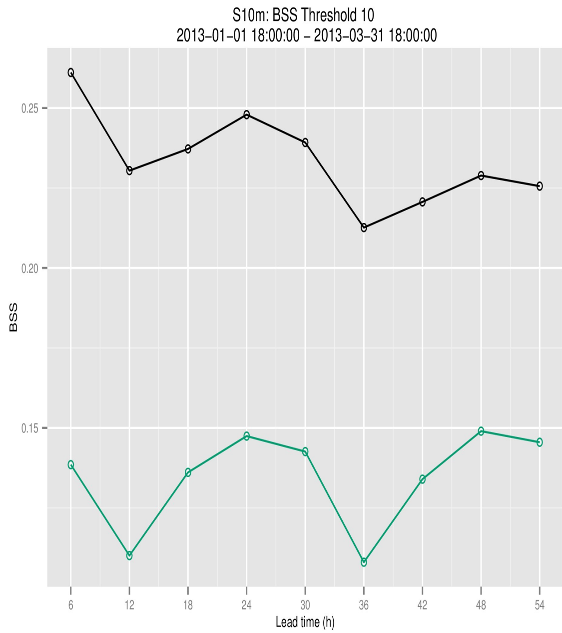
GLAMEPS
EC EPS



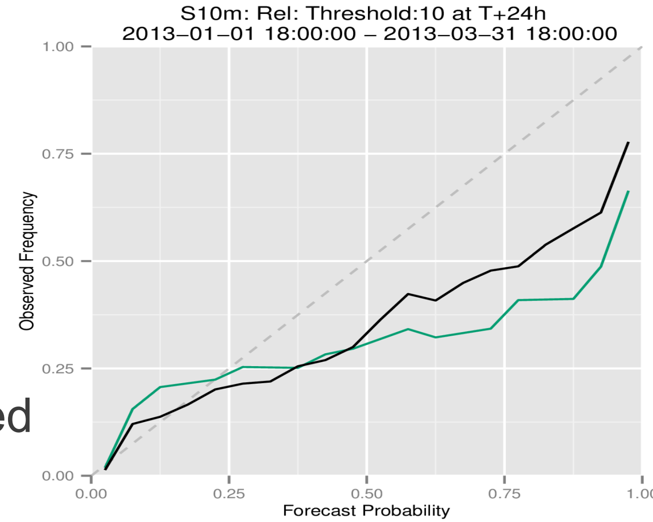
ROC
THR 0
+24h



Value
THR 0
+24h



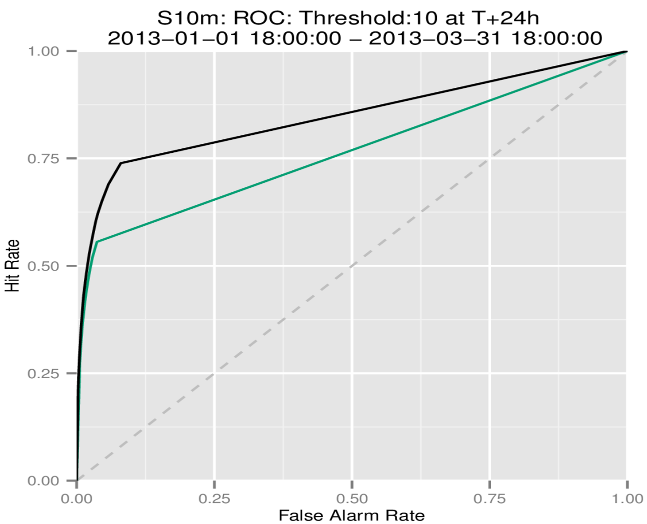
BSS
THR 10



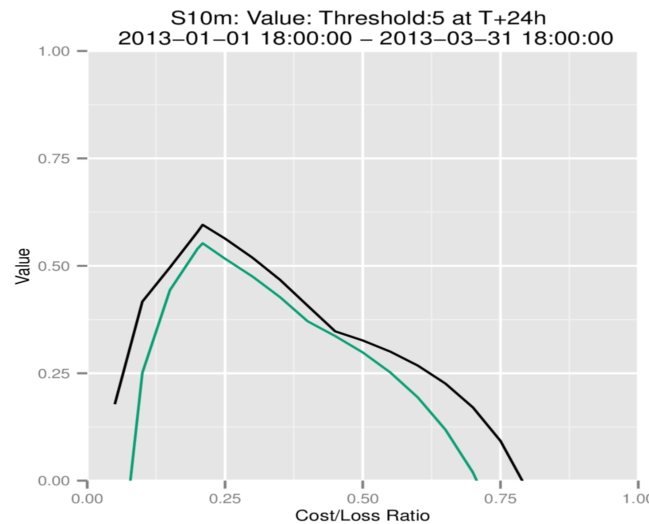
Rel.
THR 10
+24h

10m wind speed

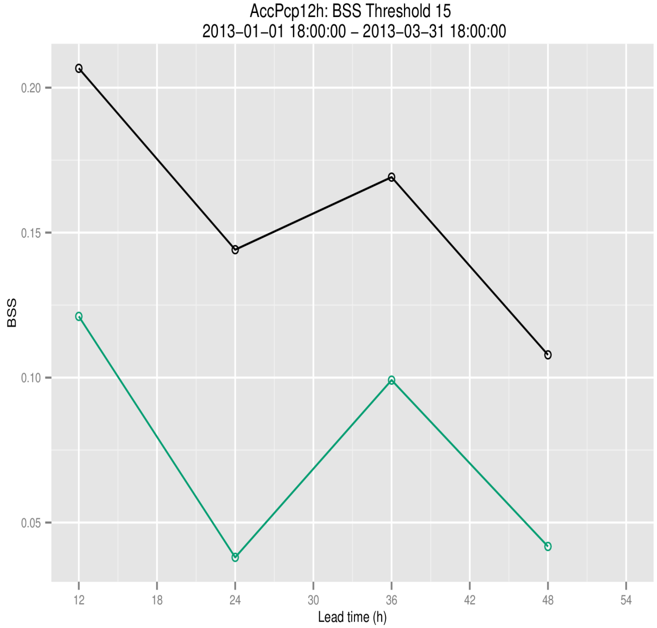
GLAMEPS
EC EPS



ROC
THR 10
+24h



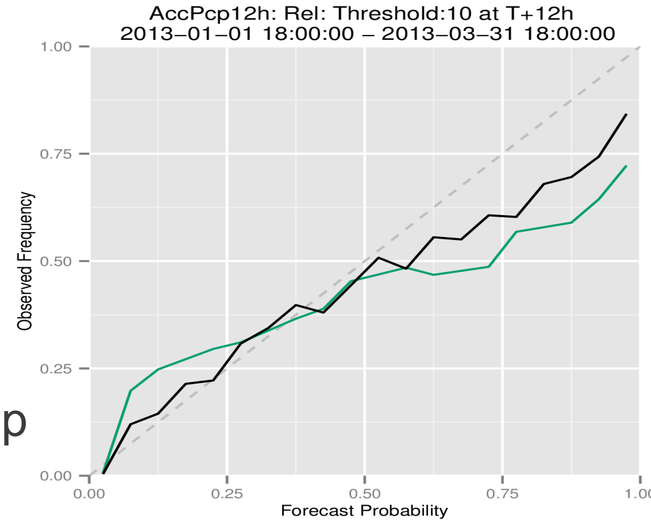
Value
THR 5
+24h



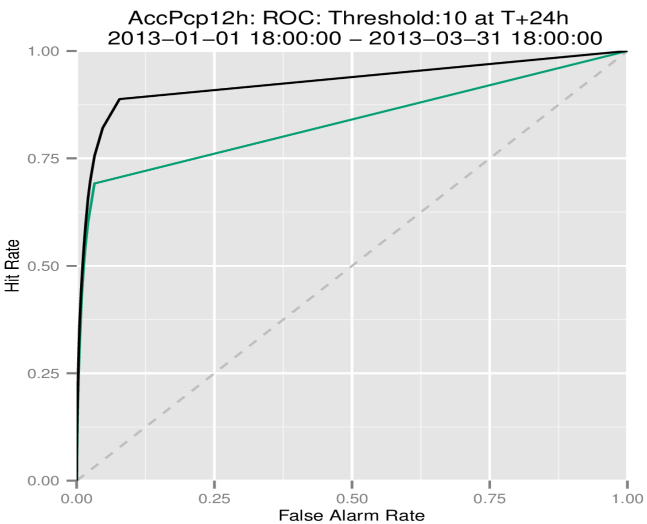
BSS
THR 15

12h acc. precip

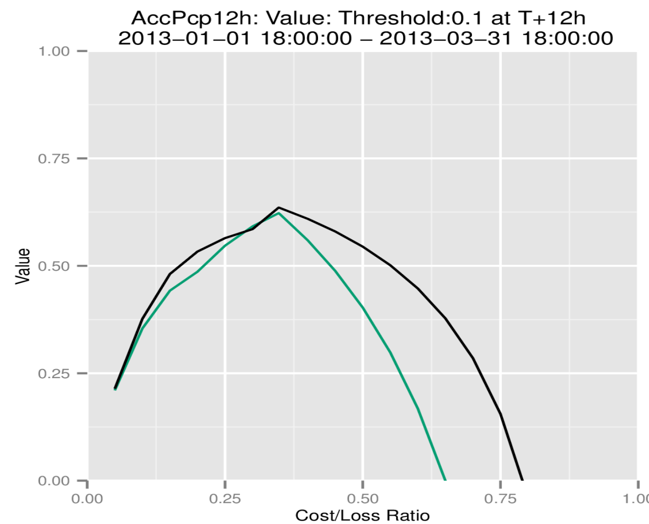
GLAMEPS
EC EPS



Rel.
THR 10
+12h



ROC
THR 10
+24h



Value
THR 0.1
+12h

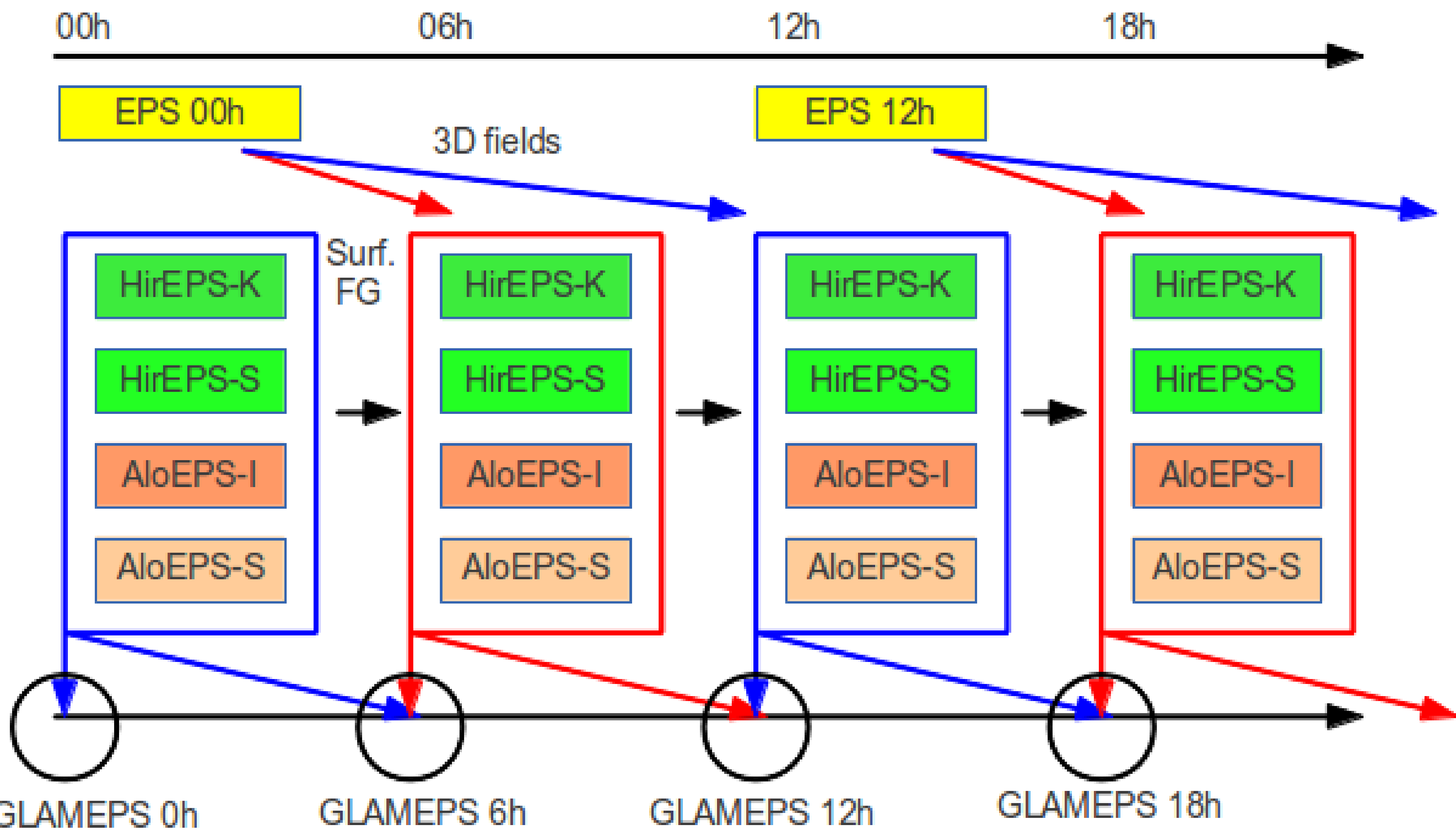
R&D for further improvements for a version 2 (2014)

- Increase the number of Alaro ensemble members (new with Surfex) at expense of the EC EPS members

- GLAMEPS 4 times per day (lagged ensembles, 25 new every six hours and 25 from six hours earlier)

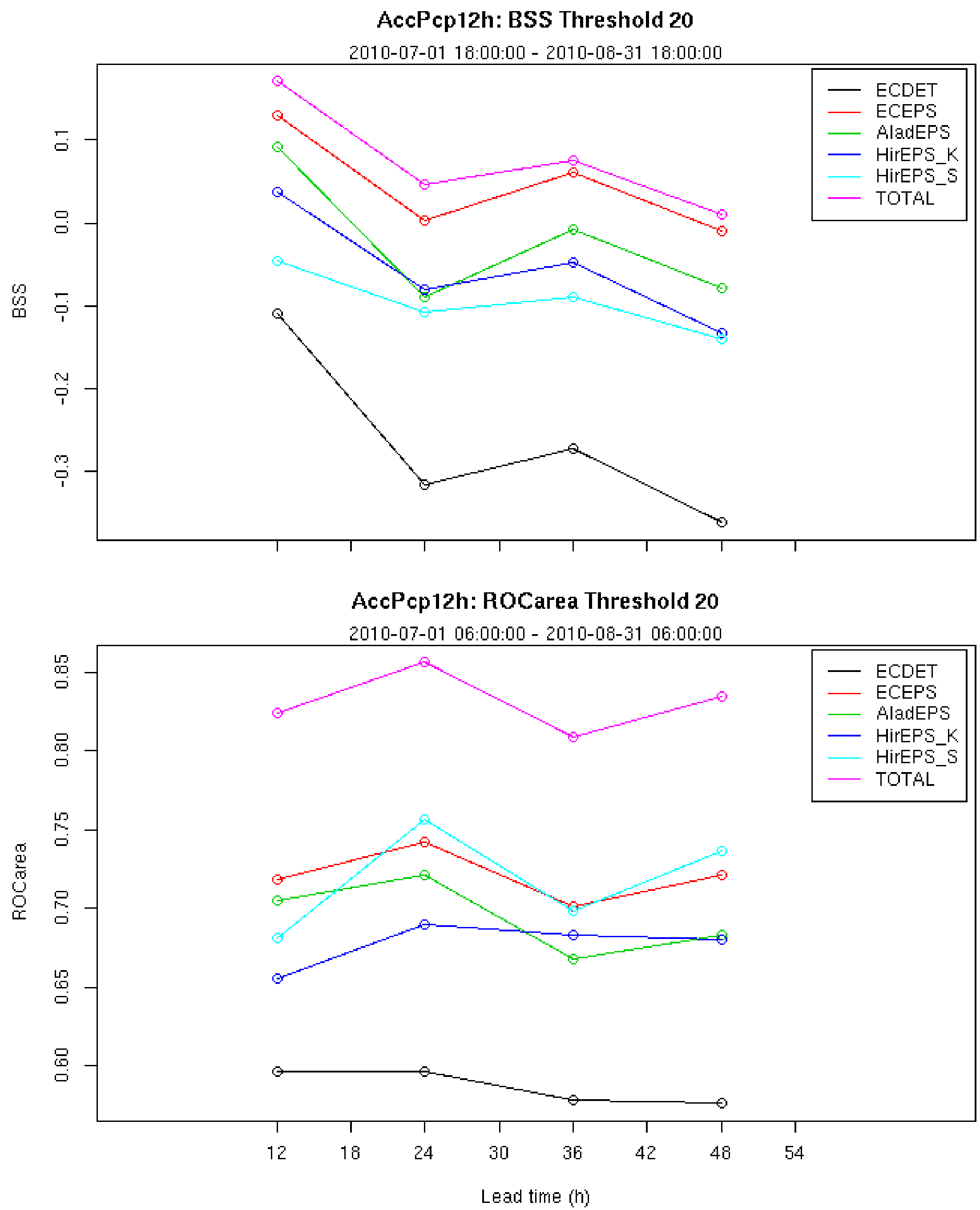
- Increased resolution (~8 km).

- Updated model versions.

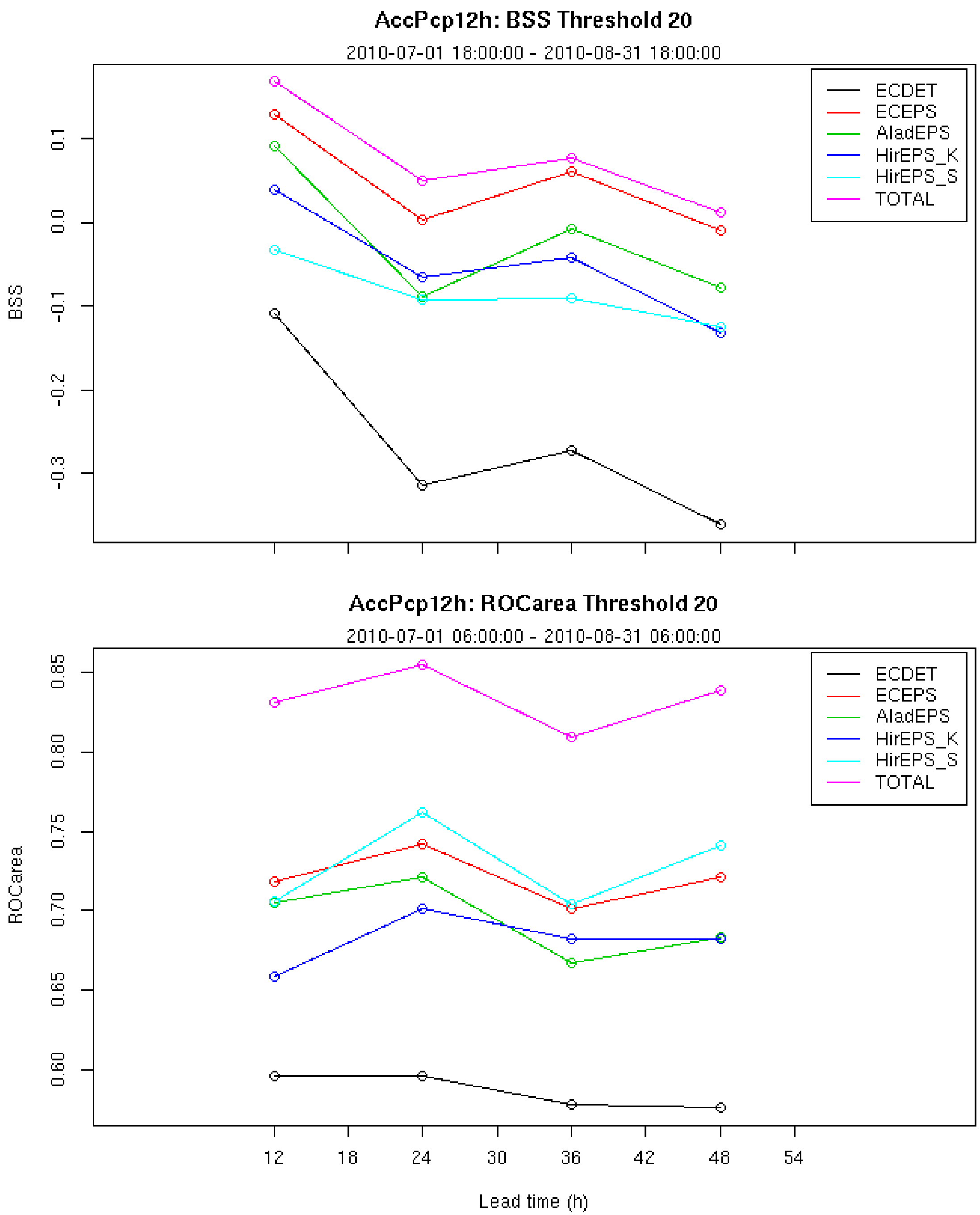


00h
06h
12h
18h
EPS 00h
EPS 12h
3D fields
Surf. FG
HirEPS-K
HirEPS-S
AloEPS-I
AloEPS-S
HirEPS-K
HirEPS-S
AloEPS-I
AloEPS-S
HirEPS-K
HirEPS-S
AloEPS-I
AloEPS-S
HirEPS-K
HirEPS-S
AloEPS-I
AloEPS-S
GLAMEPS 0h
GLAMEPS 6h
GLAMEPS 12h
GLAMEPS 18h

Including CAPE SV perturbations in GLAMEPSv2



AccPcp12h: BSS Threshold 20
2010-07-01 18:00:00 - 2010-08-31 18:00:00
BSS
ECDET
ECEPS
AladEPS
HirEPS_K
HirEPS_S
TOTAL
AccPcp12h: ROCarea Threshold 20
2010-07-01 06:00:00 - 2010-08-31 06:00:00
ROCarea
Lead time (h)


AccPcp12h: BSS Threshold 20
2010-07-01 18:00:00 - 2010-08-31 18:00:00
BSS
0.1
0.0
-0.1
-0.2
-0.3
ECDET
ECEPS
AladEPS
HirEPS_K
HirEPS_S
TOTAL
AccPcp12h: ROCarea Threshold 20
2010-07-01 06:00:00 - 2010-08-31 06:00:00
ROCarea
0.85
0.80
0.75
0.70
0.65
0.60
ECDET
ECEPS
AladEPS
HirEPS_K
HirEPS_S
TOTAL
12
18
24
30
36
42
48
54
Lead time (h)

Calibration of GLAMEPS for 10m wind

Can GLAMEPS wind speed forecasts be improved by Statistical postprocessing?

Method: Logistic regression and Extended Logistic regression

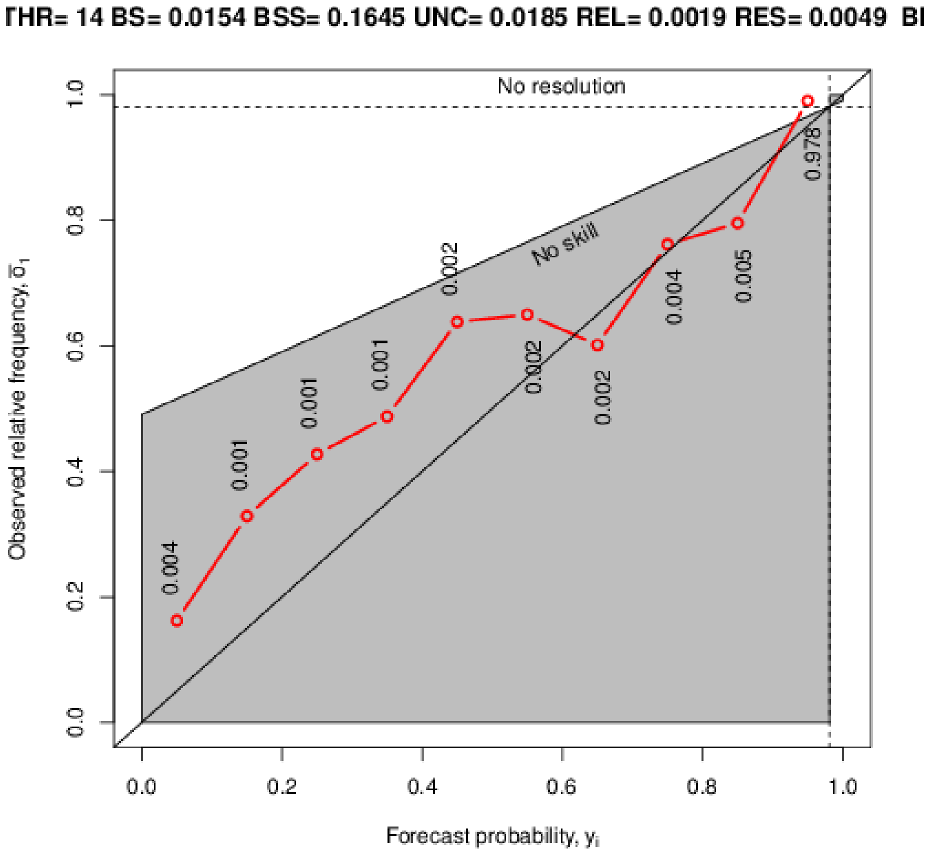
Training month: Nov 2011, verification month: Dec 2011

European stations

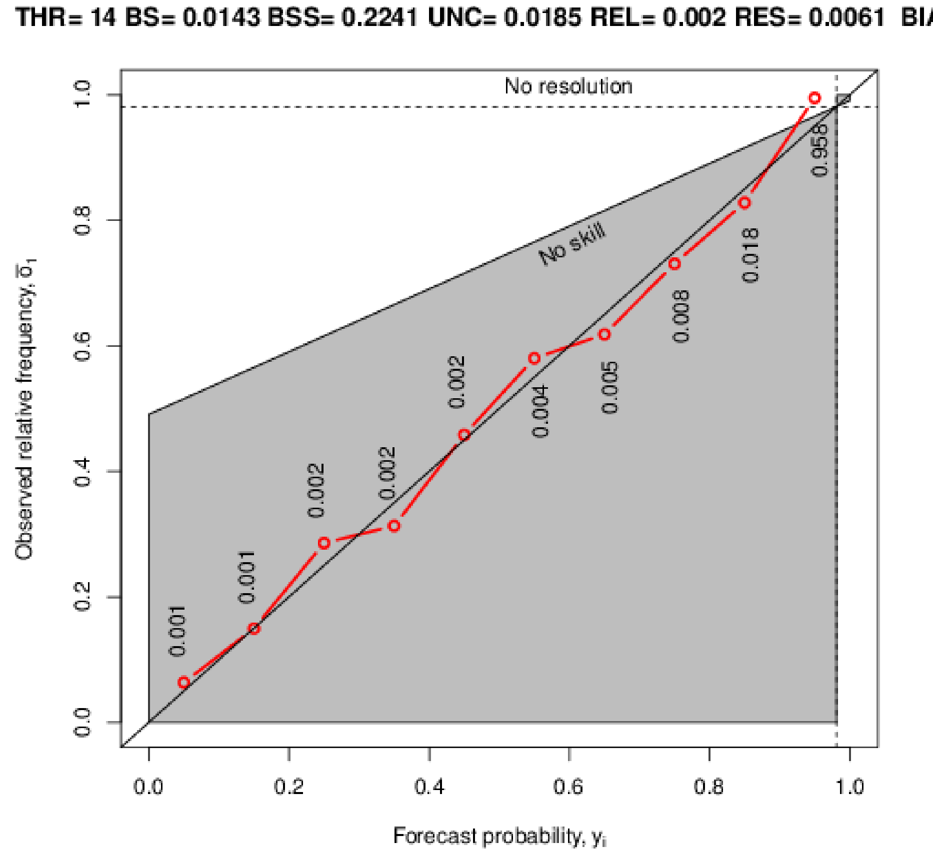
+18 h

Predictors: GLAMEPS wind speed, latitude, longitude, altitude of stations

Reliability Diagram (≤ 14 m/s)

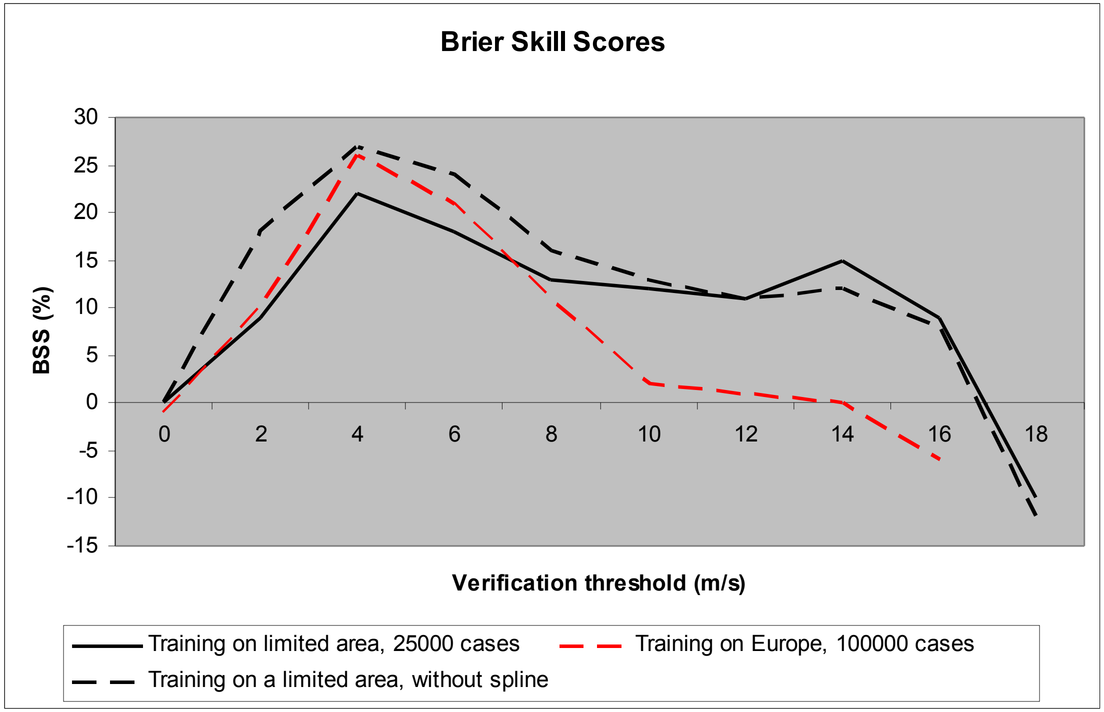


Raw GLAMEPS



After postprocessing

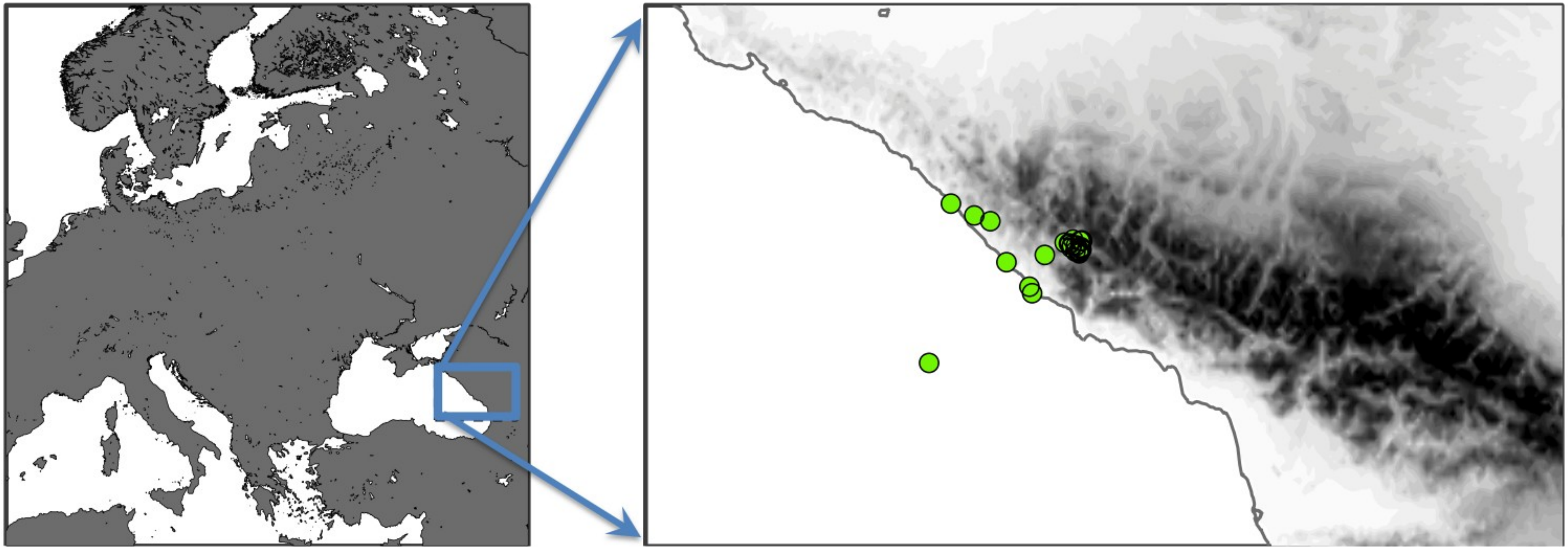
Training on a limited area



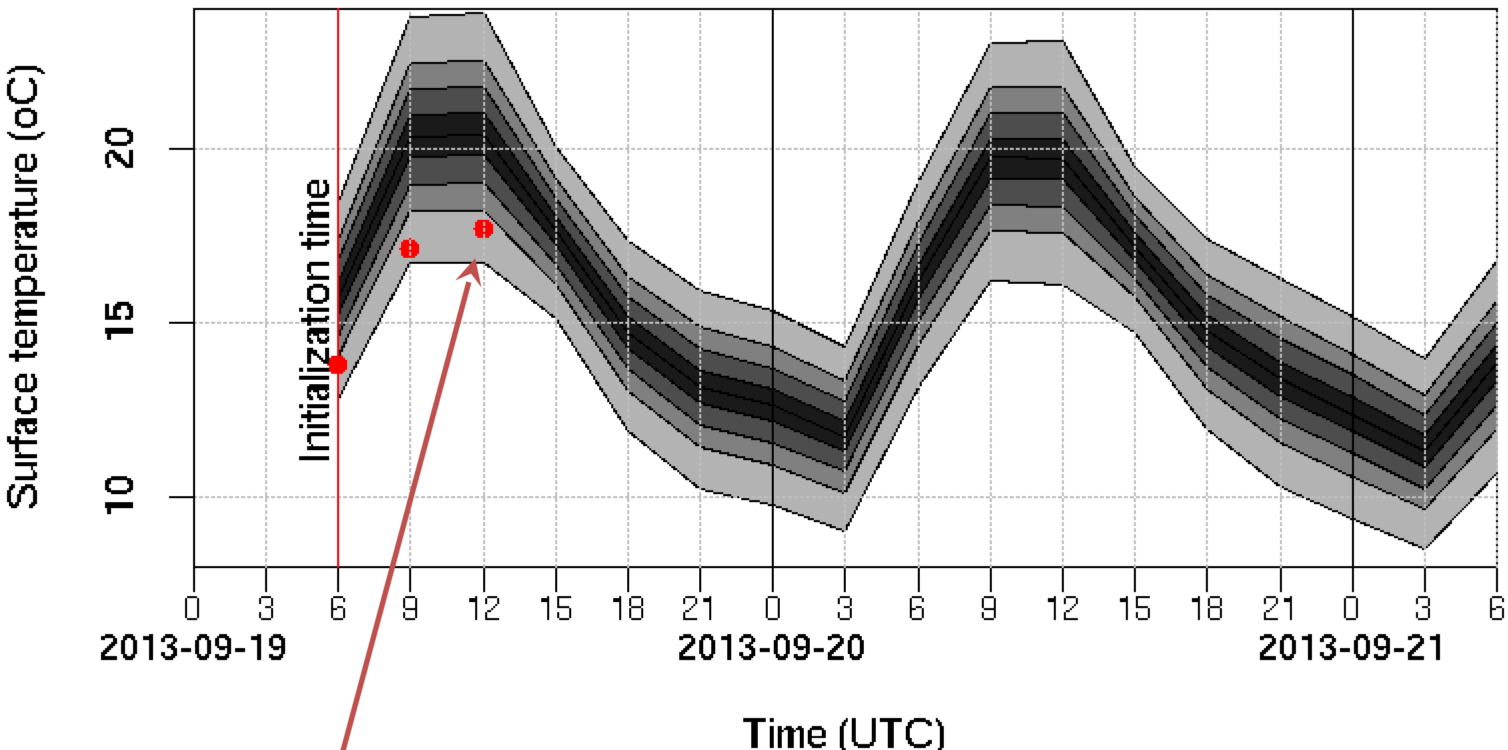
Conclusions:
* Significant improvements of both reliability and resolution can be obtained by postprocessing.
* The ensemble mean and s(lon,lat,h) are good predictors.
* Better results can be obtained for higher thresholds by training on a limited area.

Using GLAMEPS for Sochi Olympics Calibration of temperature

- Probabilistic forecasts for 30 locations
  - **Temperature**, winds, precipitation
  - Goal: Frequently updated forecasts

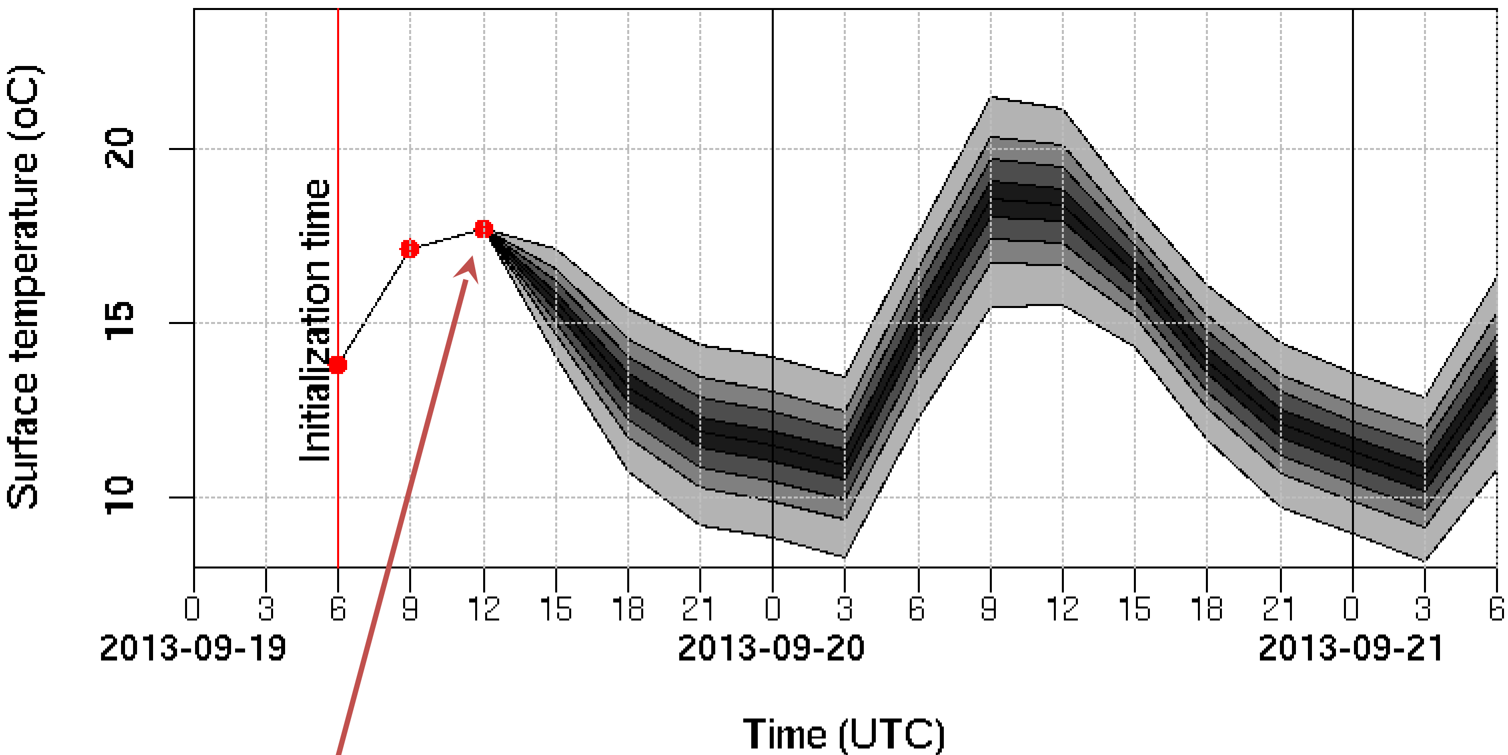


Temperature forecasts



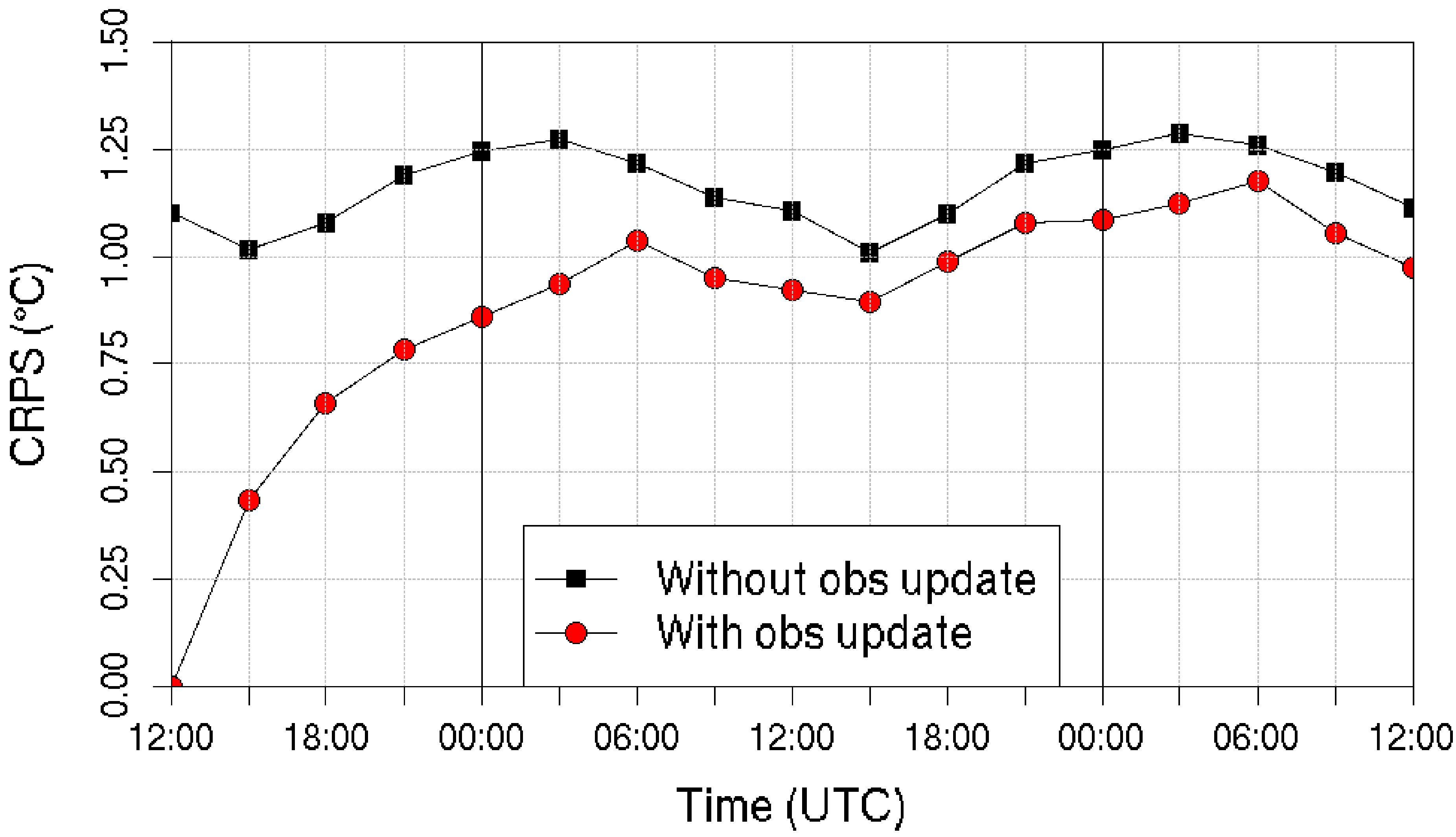
Most recent observation

Updated temperature forecasts



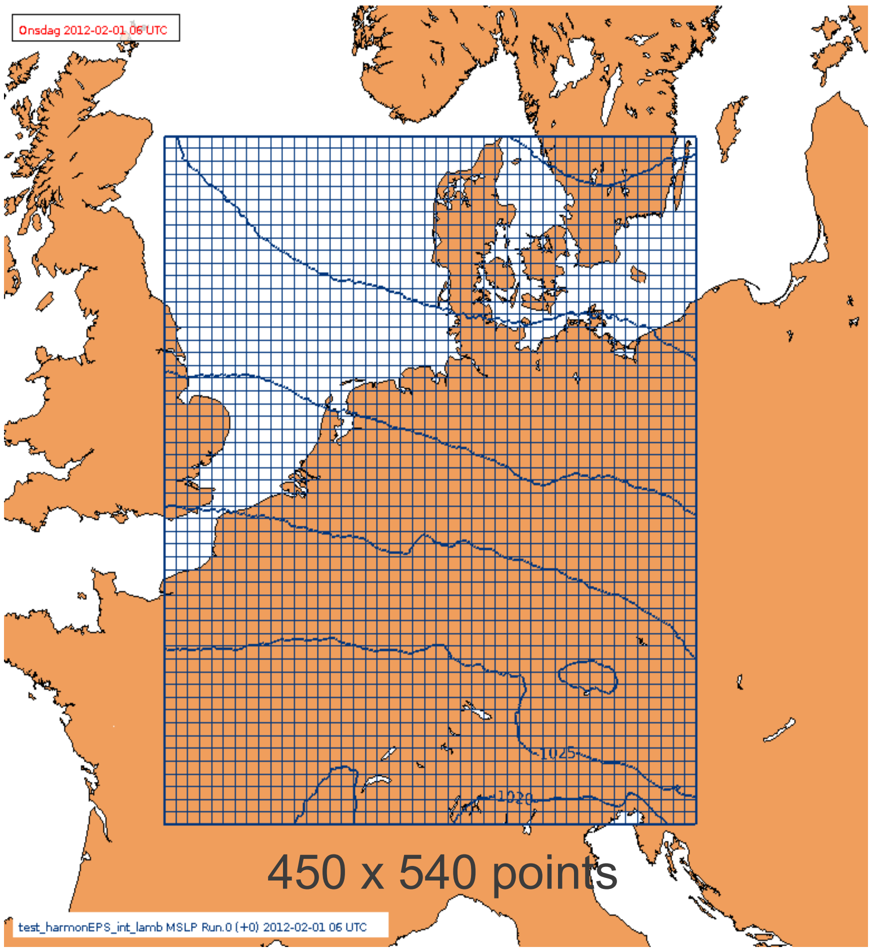
Most recent observation

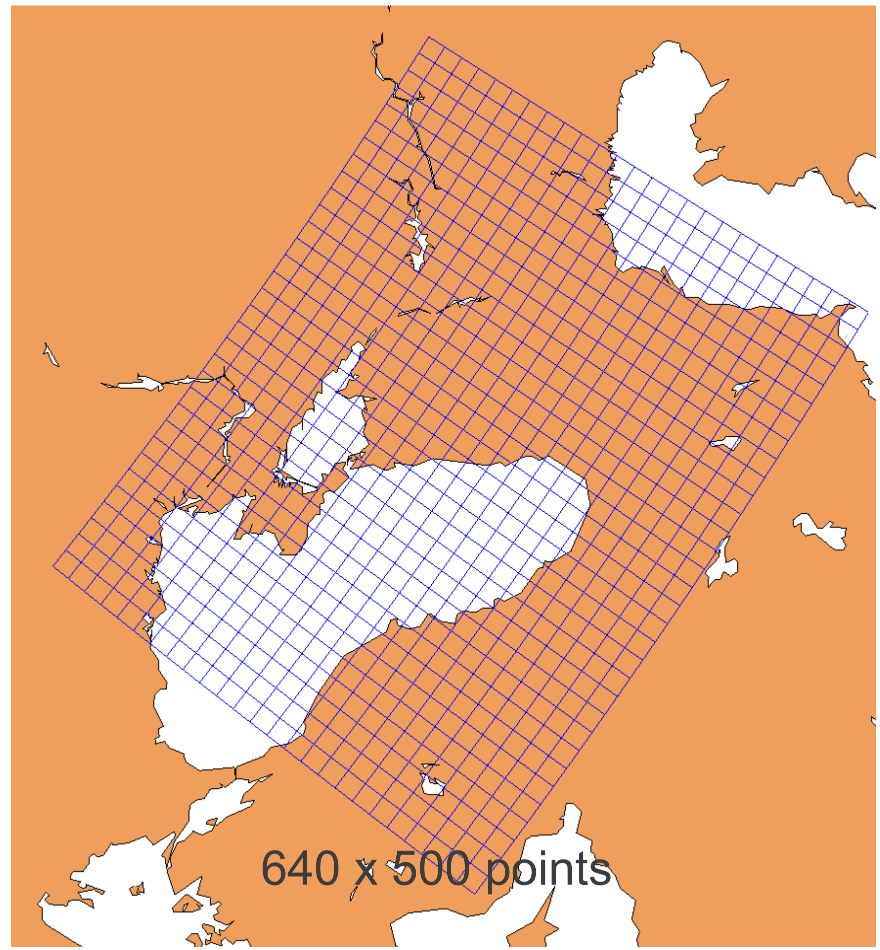
Verification (temperature)



HarmonEPS

First areas for experimentation





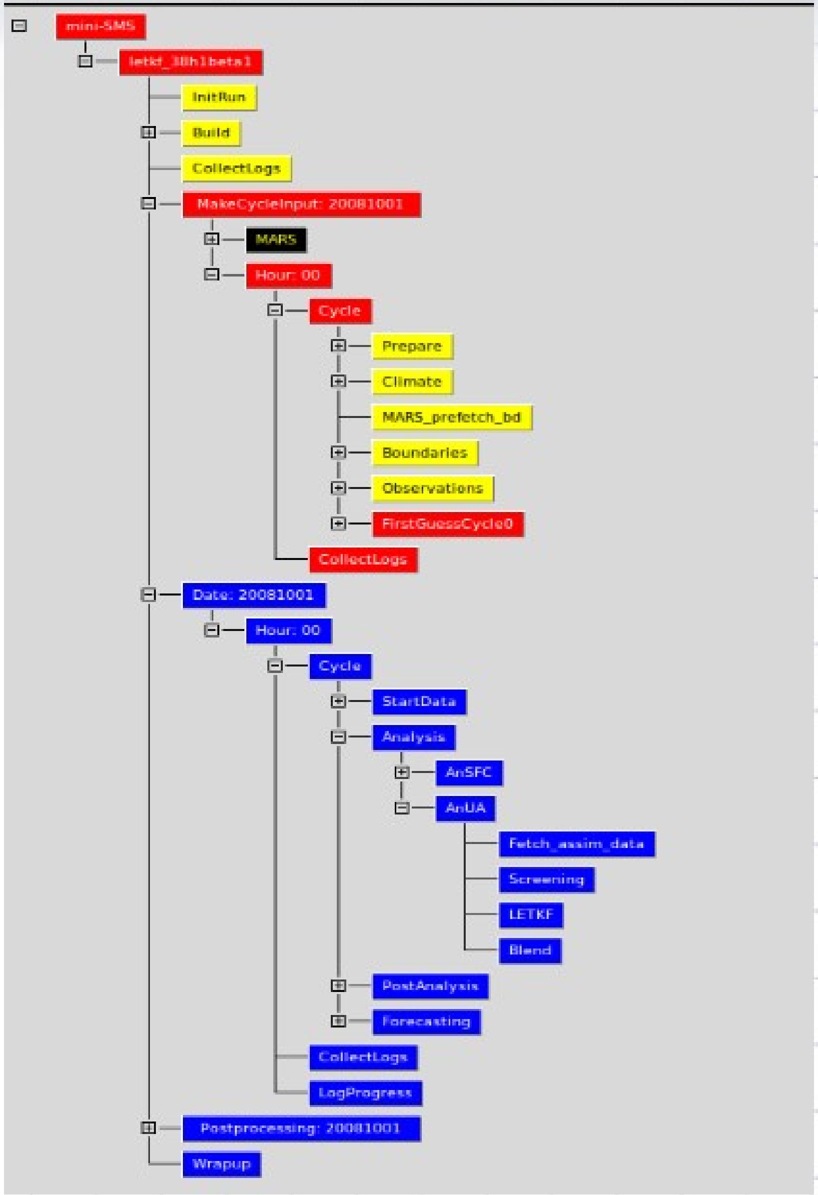
HarmonEPS: set-up first experiments

- A convection-permitting EPS, ~2.5 km, sub-European and Sochi-area
- 2.5 km resolution
- +36 h lead time.
- Full DA and 6 h cycling for the control,
- HarmonEPS to be run every 12 h
- Surface assimilation included for every member.
- 20 members, 10 members with AROME and 10 with ALARO . -> continue the multi-model approach

HarmonEPS: status of some experiments/ developments

Harmonie LETKF:

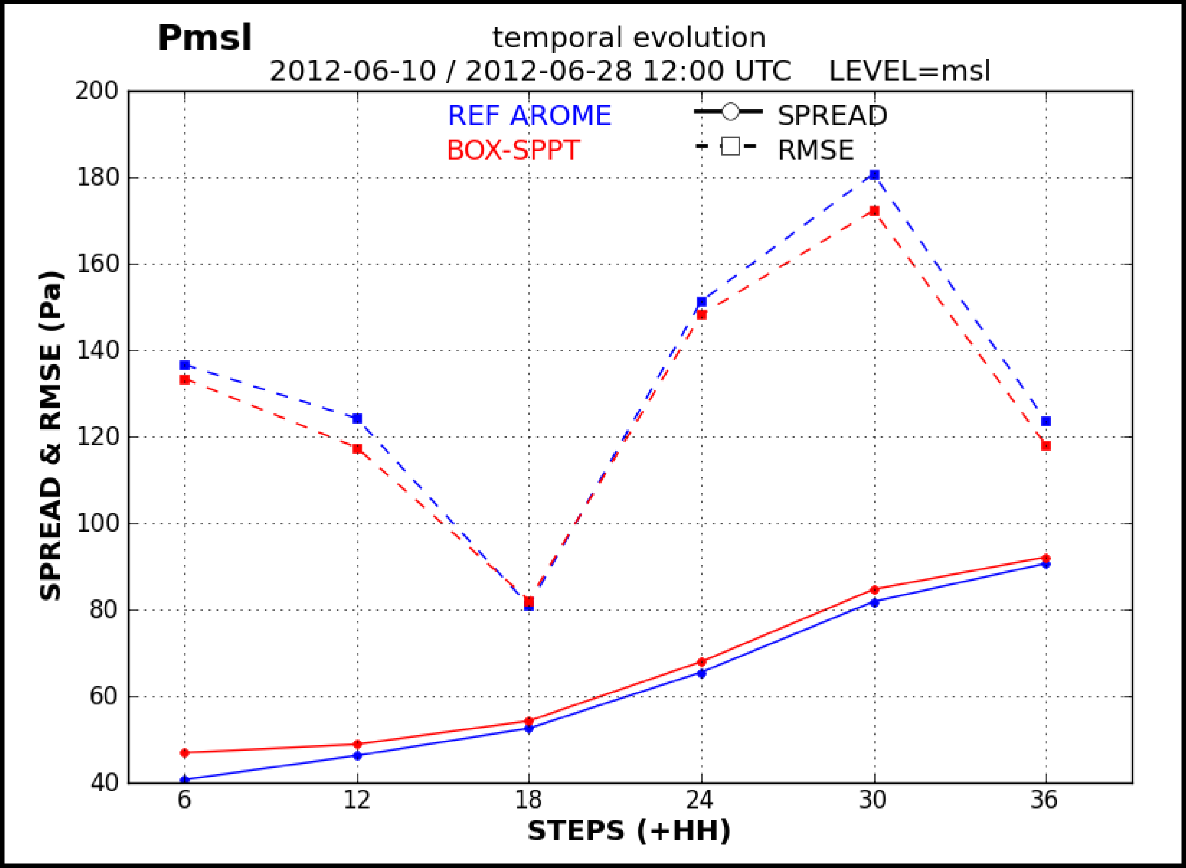
- At the moment in phase of development
- In 2014 migration finished and comparison with other algorithms available in Harmonie (3DVAR, SVs, EPS-ECMWF downscaling,...)



Model error in HarmonEPS

SPPT (Stochastic Perturbed Parameterisation Tendencies)

- **SPPT is currently developed in HARMONIE**
- **BOX-SPPT outperforms AROME physics without stochastic parameterizations:**
  - **More spread**
  - **Less error**
  - **More skill !!!**

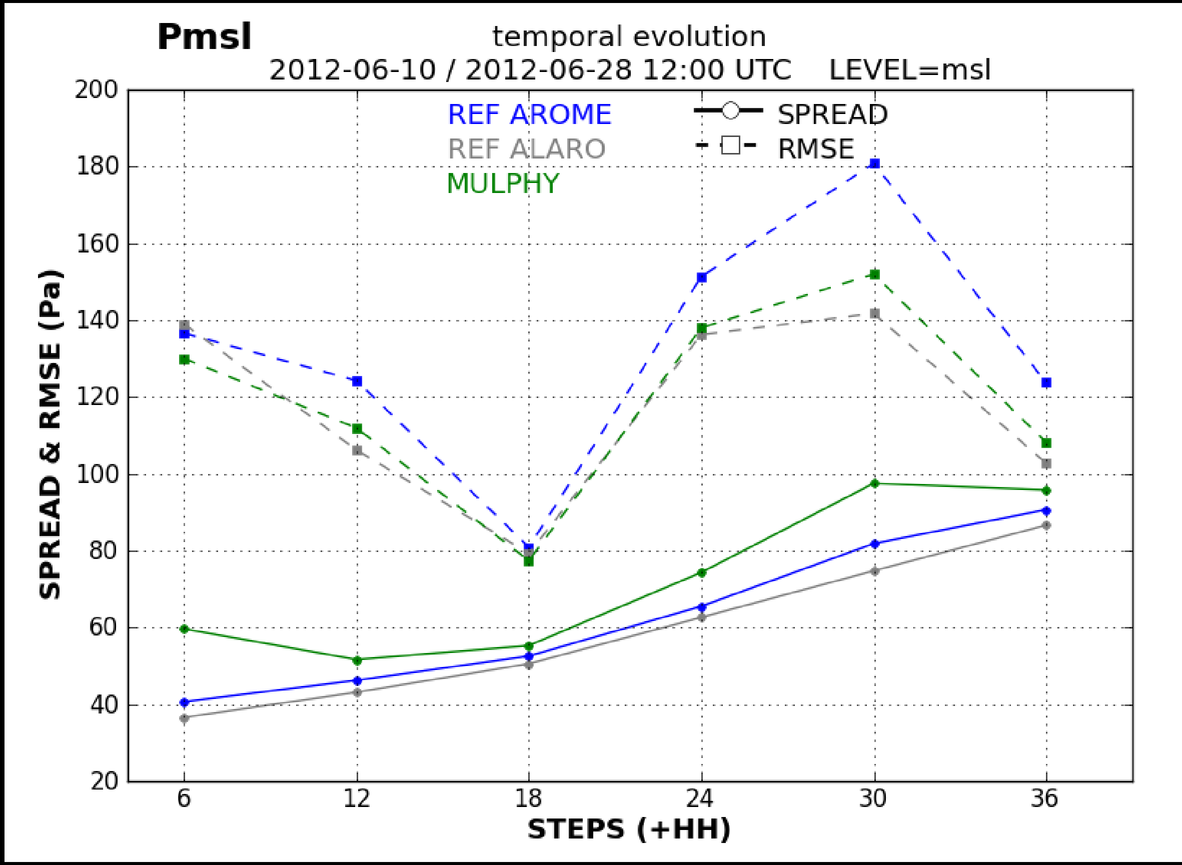


SPPT could be a good way to take into account parameterization uncertainties

Model error in HarmonEPS

Multiphysics (AROME and ALARO parameterisations)

- **Multiphysics** is better than **AROME** and **ALARO** single physics:
  - Quite good increasing spread
  - Not significant error increase
  - More skill !!!

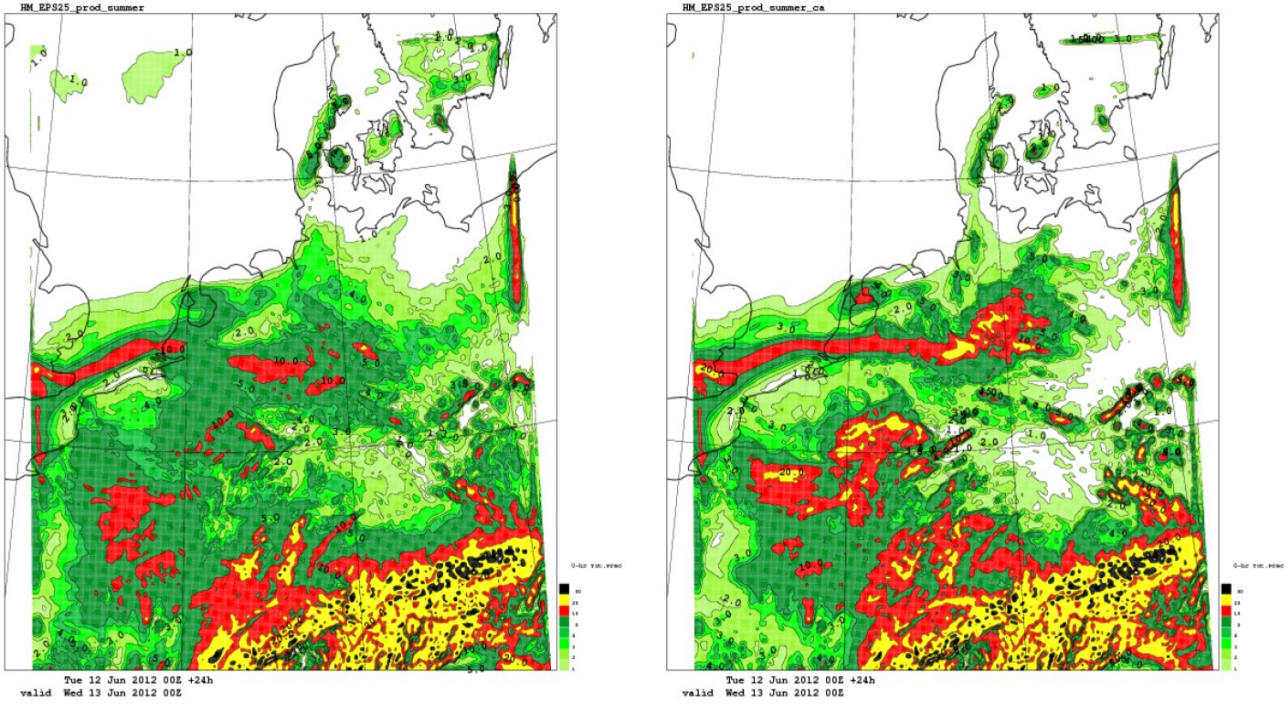


Multiphysics seems to be valuable approach to deal with parameterization uncertainties in HarmonEPS

CA in HarmonEPS
A stochastic parameterization for deep convection organization using cellular automata

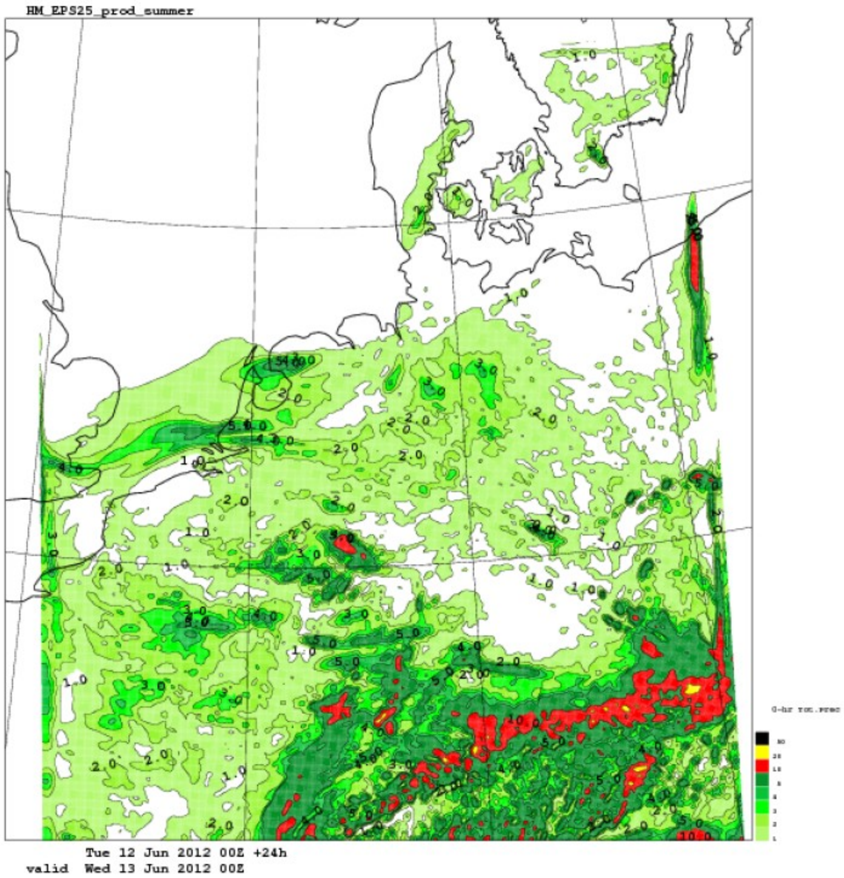
MEAN 24 h acc. precip

Reference | With CA scheme

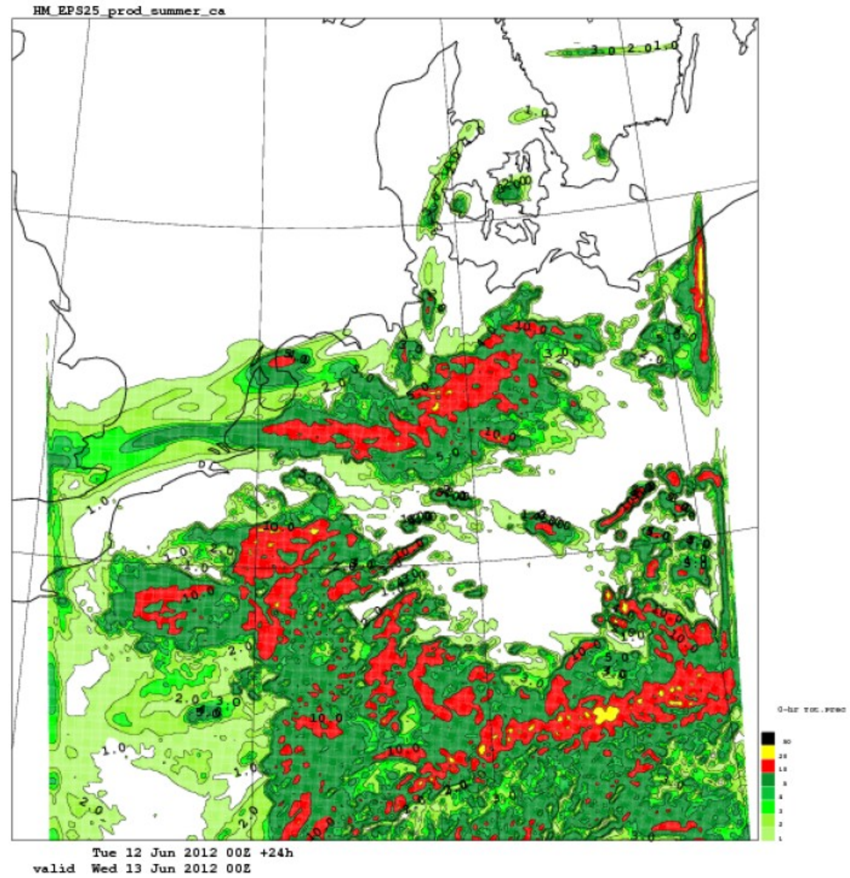


SPREAD 24 h acc. precip

Reference



With CA scheme



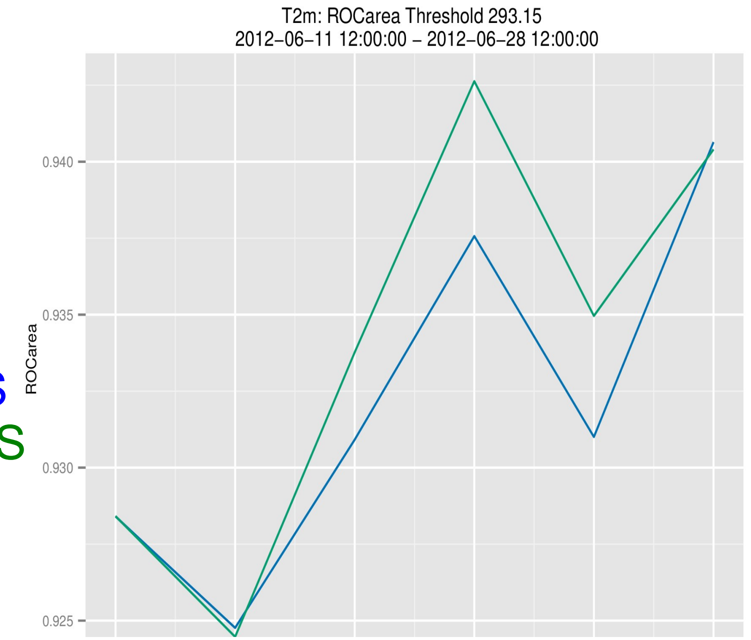
CA seems to be too active at 2.5 km, needs tuning of time/space scales and CAPE threshold

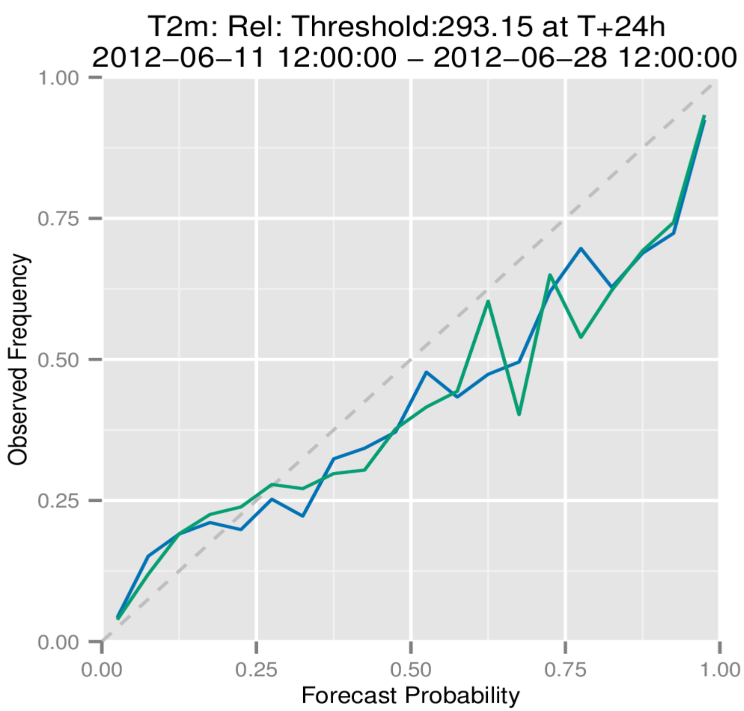
Preliminary results nesting HarmonEPS in IFS ENS at T639 IFS ENS at T1279

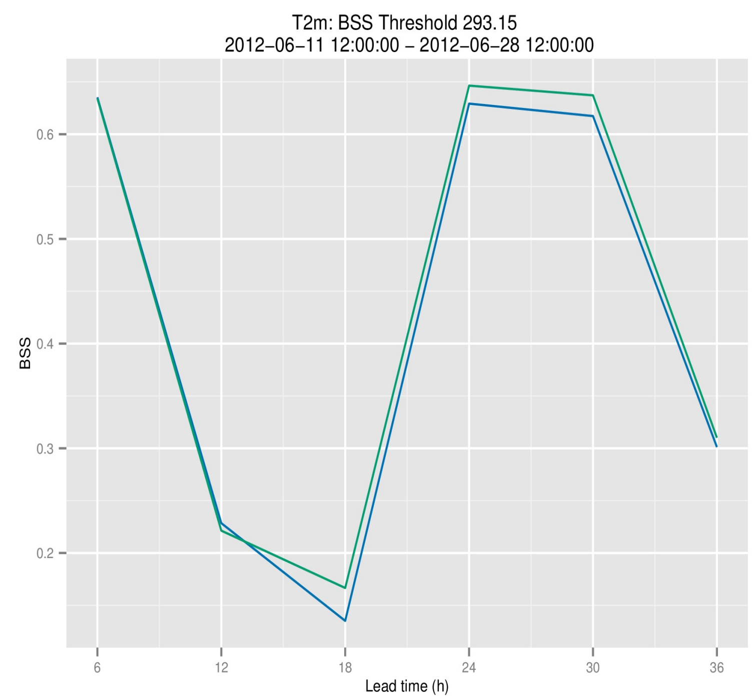
Examples of verification T2m 18 days in June 2012

Opr res EPS

High res EPS

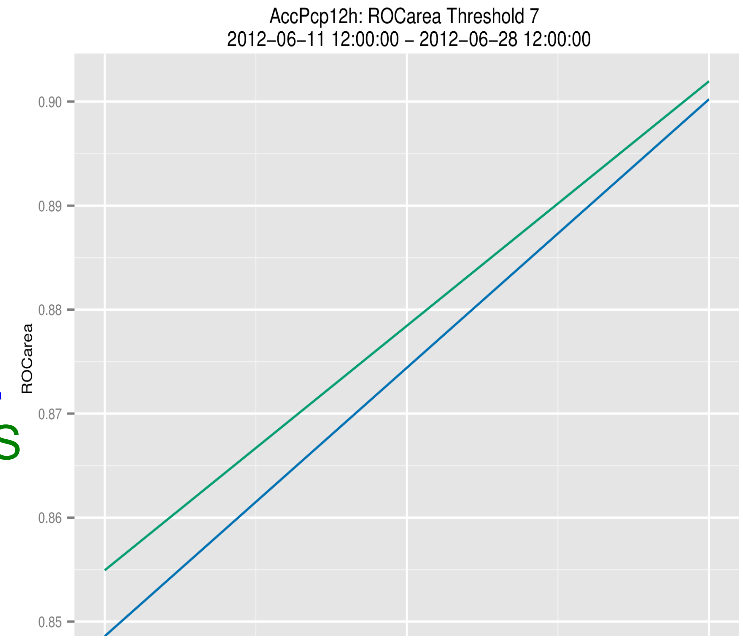


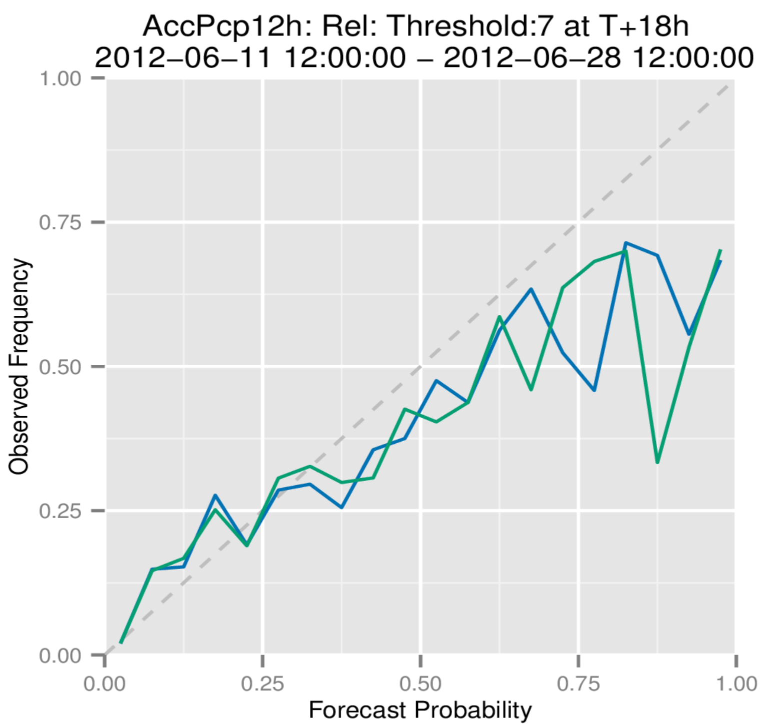


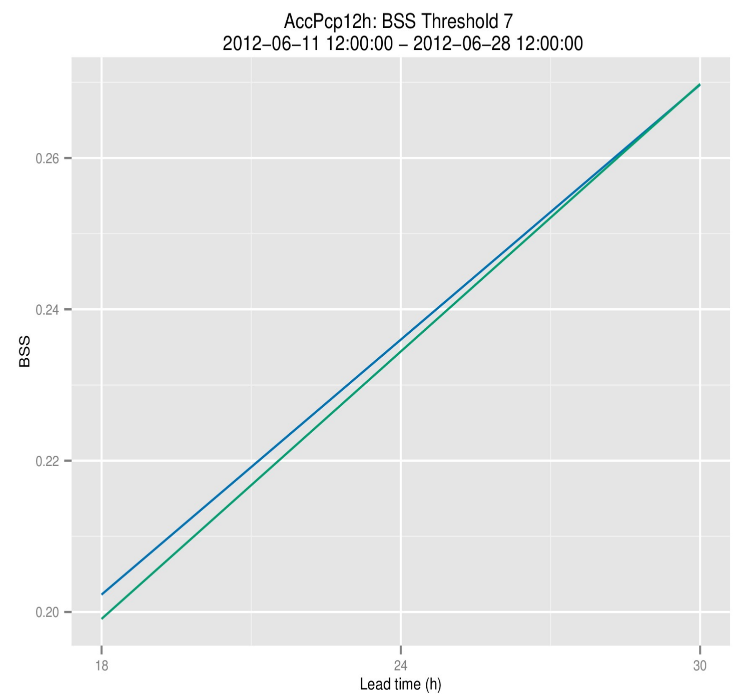


Examples of verification
12 h acc precip
18 days in June 2012

Opr res EPS
High res EPS







HIRLAM (EPS) contribution to FROST

2011:

•GLAMEPS semi operational (FDP). Technical work in setting up Harmonie to run in ensemble mode (RDP)

2012:

•Providing GLAMEPS results routinely (FDP) – Delivery of GLAMEPS to FROST from September 2012.

•Run HarmonEPS experiments for the area of Sochi.

•Calibration of EPS forecasts (RDP).

2013:

•Run HarmonEPS for the area of Sochi and provide output

•Calibrated forecasts for venues

Thank you

HarmonEPS: Uncertainty strategies

Initial condition perturbations:

- Perturbations from EC EPS
- Humidity perturbations: humidity in SVs, use of MSG cloud mask
- Later LETKF/EnVAR/4DEnVAR

Lateral boundary perturbations:

- Tested EPS (T639) vs EPS (T1279)
- Difference between deterministic runs / SLAF

Model error

- Multi-model
- SPPT
- physics parameter perturbations
- Introduce "stochastic physics" on process level, rather than multiplying the total physical tendencies
- Use Cellular Automata (CA)

Ground surface uncertainties