Experimentations with the COSMO-based ensemble systems in the framework of C-SRNWP collaboration

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BCs for LAMEPS

Under the coordination of the Expert Team on Predictability and EPS of the C-SRNWP Programme, a cooperation is ongoing between ECMWF and several European Weather Services.

ECMWF provided the LAMEPS community data from different ensemble configurations to foster research with convection-permitting ensembles.

Initial and boundary conditions from ECMWF ENS were provided from two experimental ENS datasets:

- Experiment R (operational resolution): TL639 (32 km)
- Experiment H (higher resolution): T_L1279 (16 km)

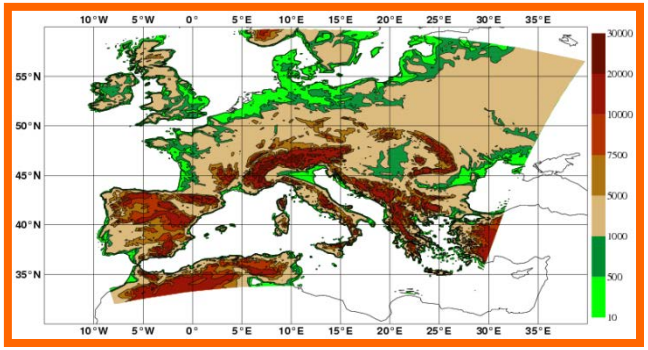
20+1 forecasts twice daily at 00 and 12 UTC, 7-day forecast range

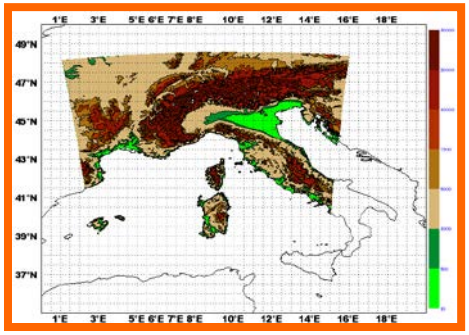
Model physics and perturbation methodologies as in 38r1 ope ENS

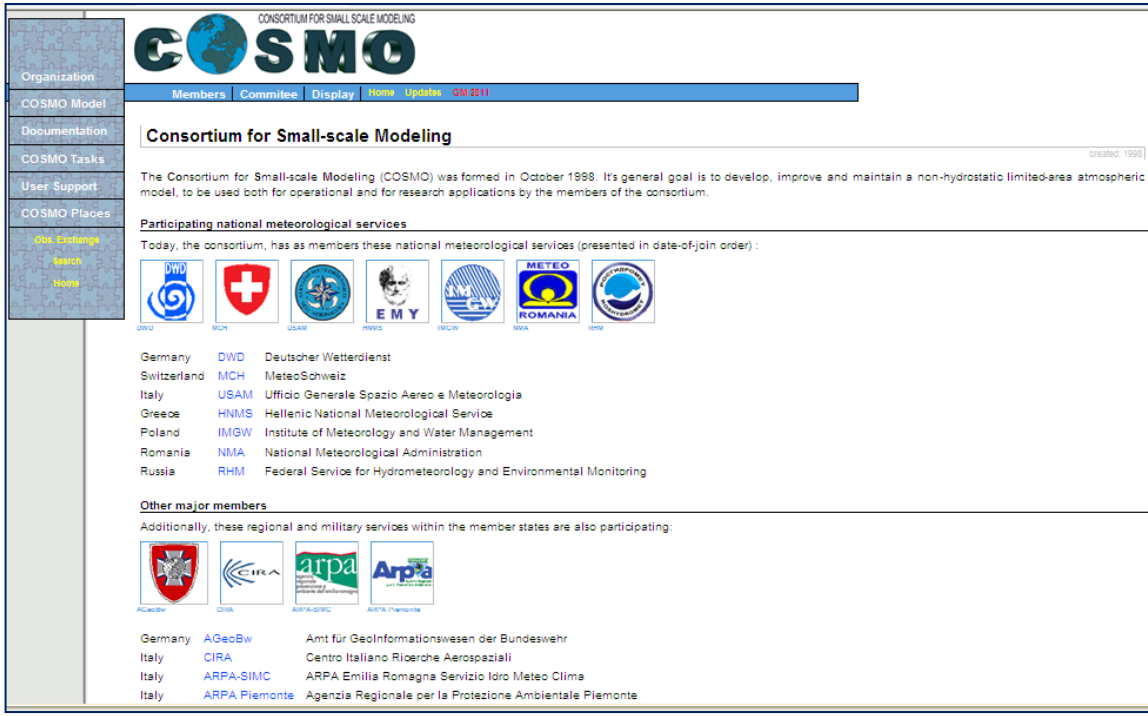
ARPA-SIMC contribution

ARPA is participating with two LAM EPS both based on the COSMO model :

- COSMO-LEPS – the COSMO Consortium LAM EPS – 7 km H.R.
- COSMO-H2-EPS – ARPA 2.8 km ensemble – Prototype for HYMEX Project







COSMO-H2-EPS

ARPA SIMC 2.8 km ensemble – Prototype for the HYMEX Project

- **run for the period: 23 Oct – 7 Nov 2011** (floods over Italy and France)

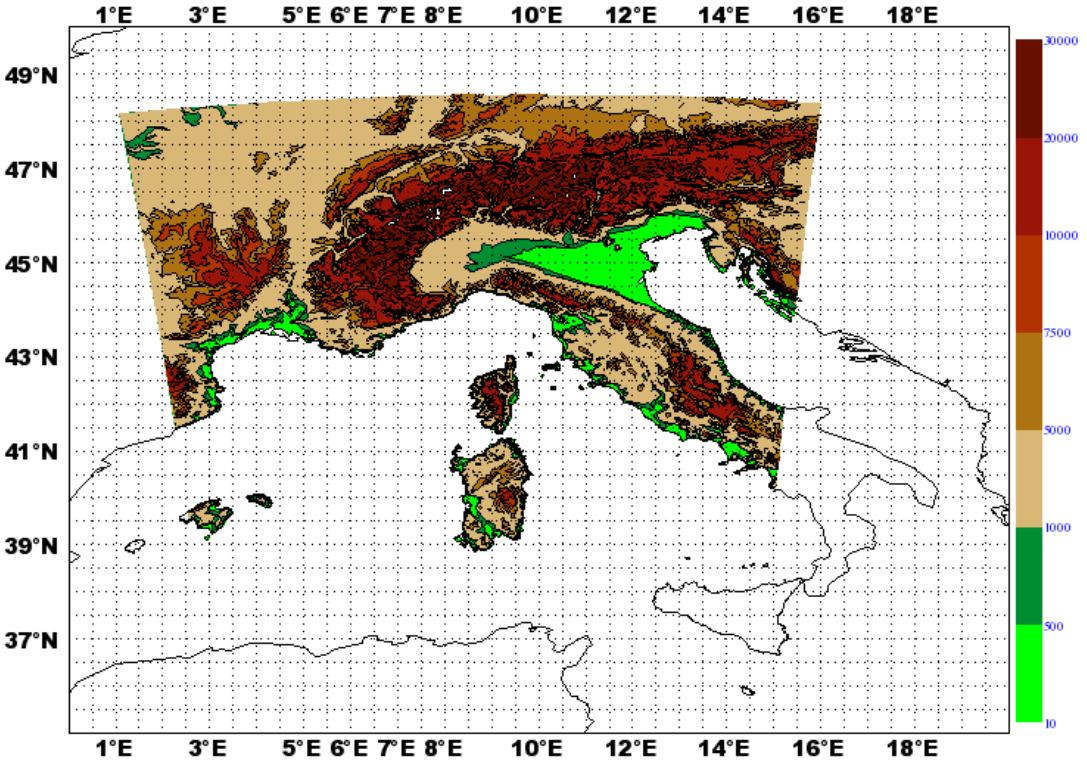
- **Verification against Synop observations > 36 hours**
- Nearest point
- 12 hours accumulated precipitation : 6-18 h;18-30 h
- 2 meter temperature
- 2 meter dew-point temperature

- **Verification against Northern Italy high density network**
- average over boxes 0.2 x 0.2 degrees
- 6 hours accumulated precipitation

COSMO-H2-EPS

- ensemble set-up:
  - IC and BCs from ECMWF ENS, R (T639) or H (T1279)
  - hourly BCs
  - no parameter perturbations
  - no data assimilation
  - 2.8 km, 50 levels
  - 20+1 members
  - starting at 12 UTC
  - 36h forecast range

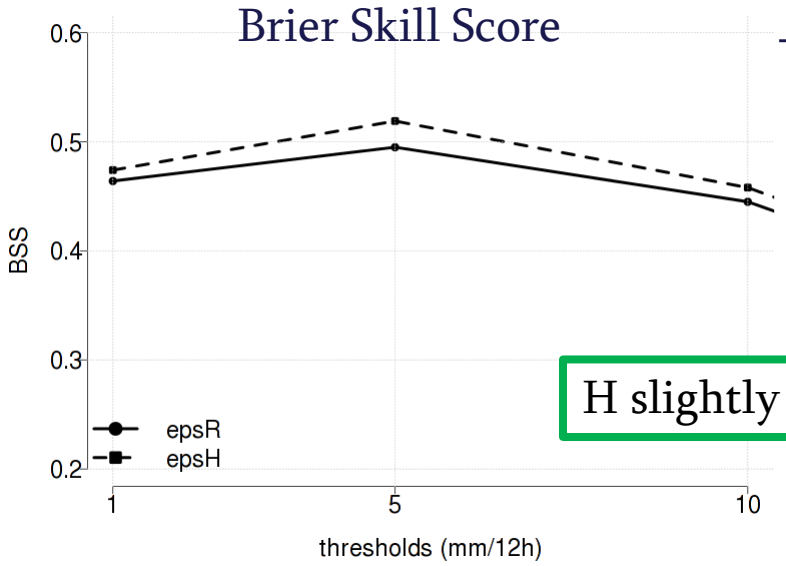
  - Autumn period: 23/10 - 7/11 2011

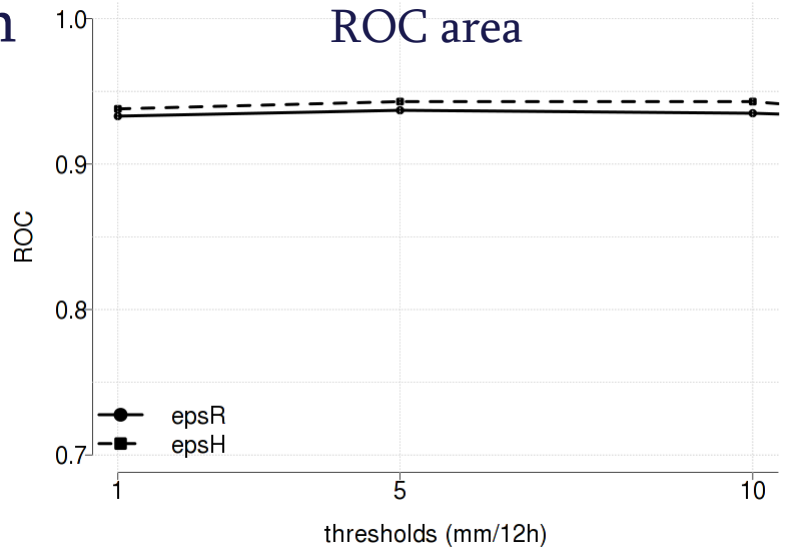


BSS	higher is better
ROC area	higher is better

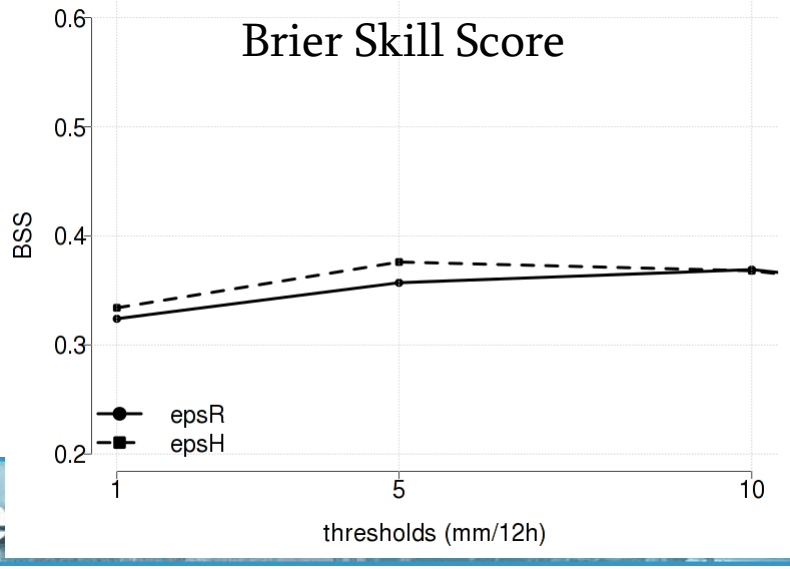
total precipitation over 12h

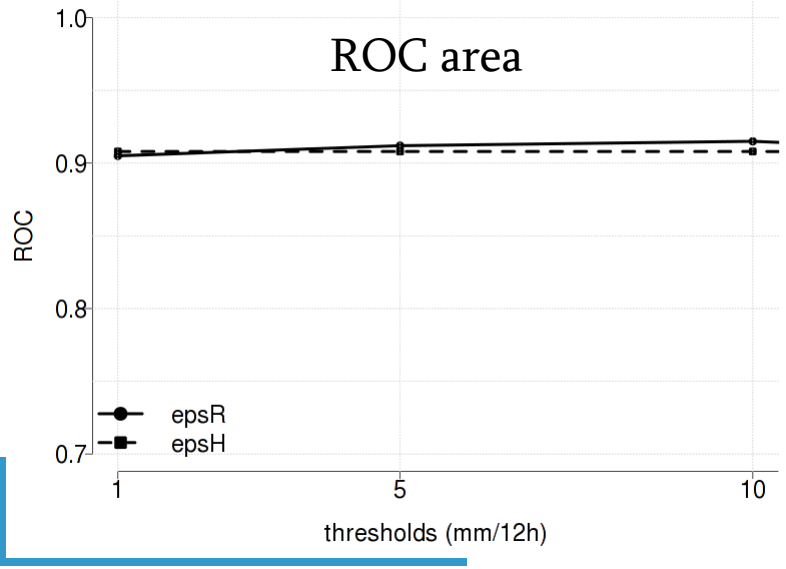
whole domain – synop data – nearest point





H slightly better





RPS	lower is better
RPSS	higher is better
Outliers	lower is better

total precipitation over 12h

whole domain – synop data – nearest point

+ 6-18h	RPS	RPSS	Outliers
epsR	0.157	0.449	14%
epsH	0.153	0.463	13%

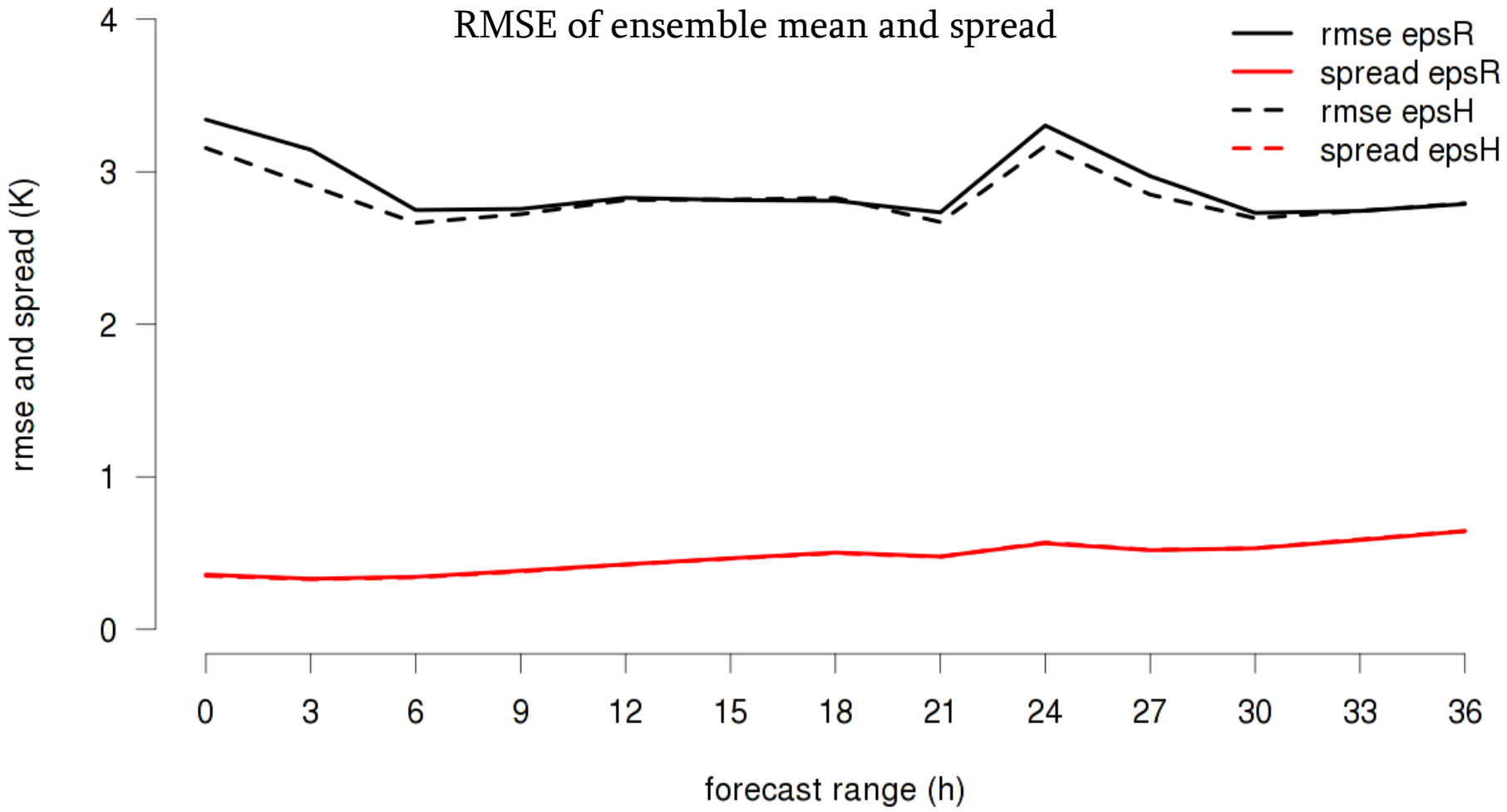
H slightly better

+ 18-30h	RPS	RPSS	Outliers
epsR	0.183	0.339	10%
epsH	0.181	0.348	10%

H slightly better

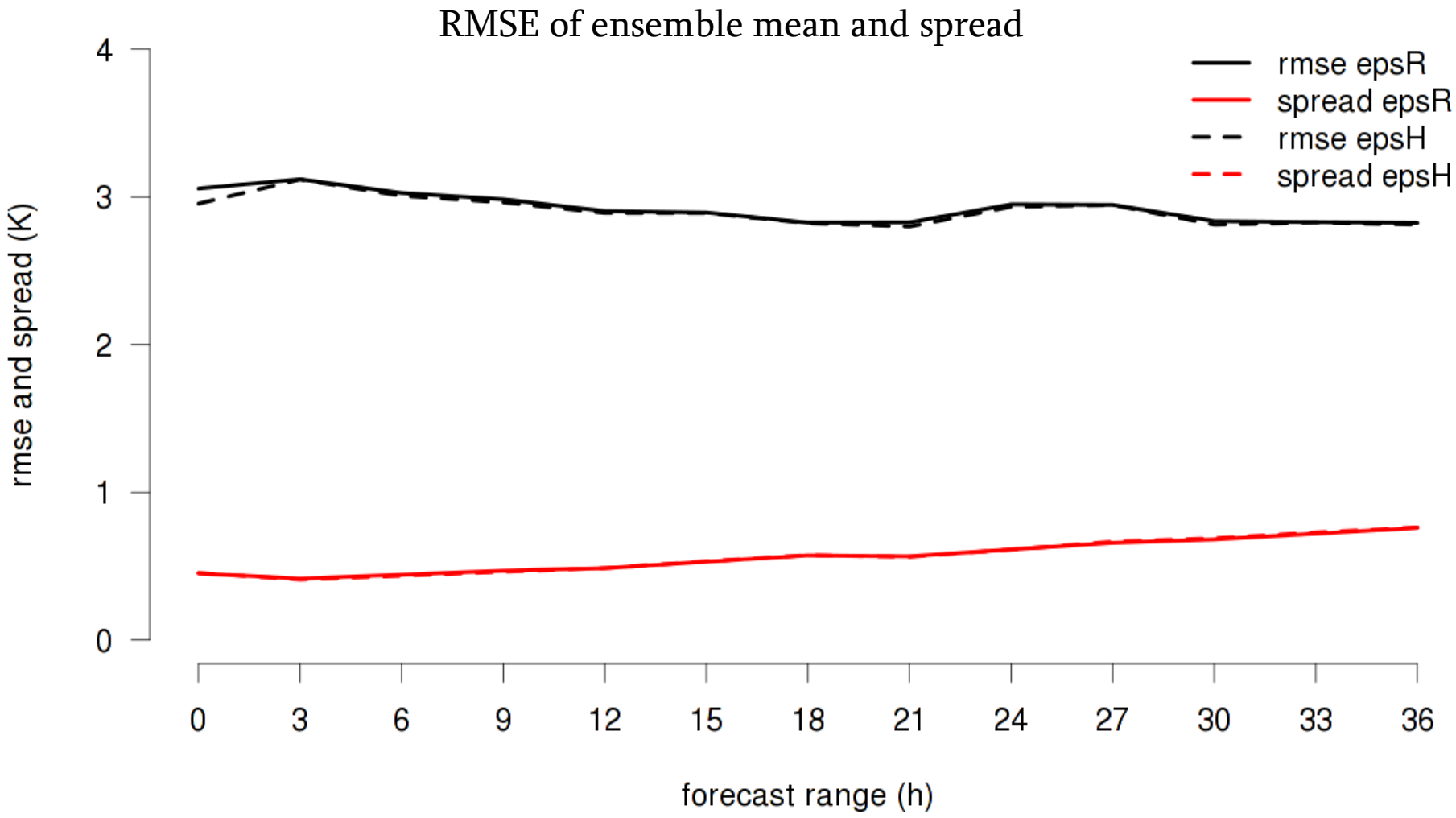
2m temperature

whole domain – synop data – nearest point



2m dew-point temperature

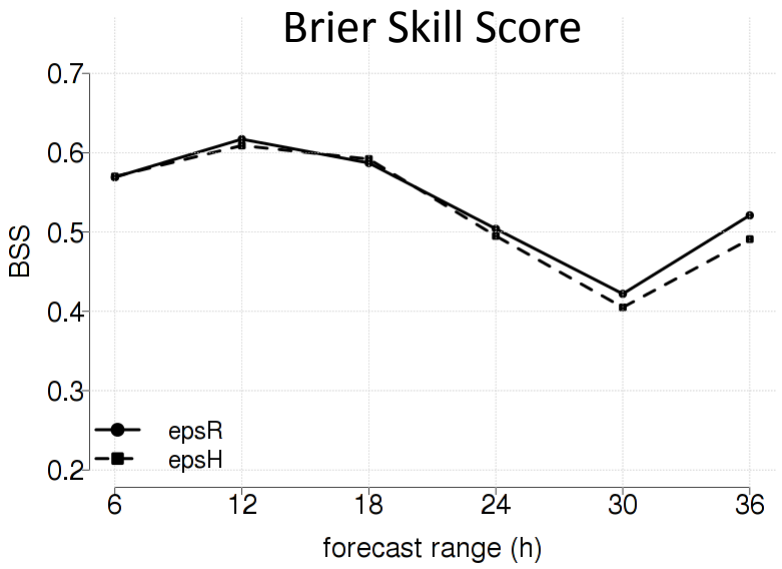
whole domain – synop data –nearest point

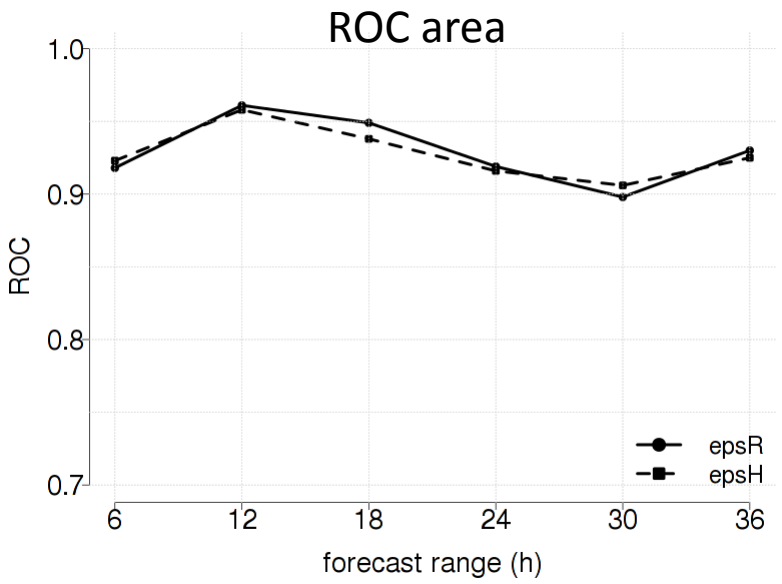


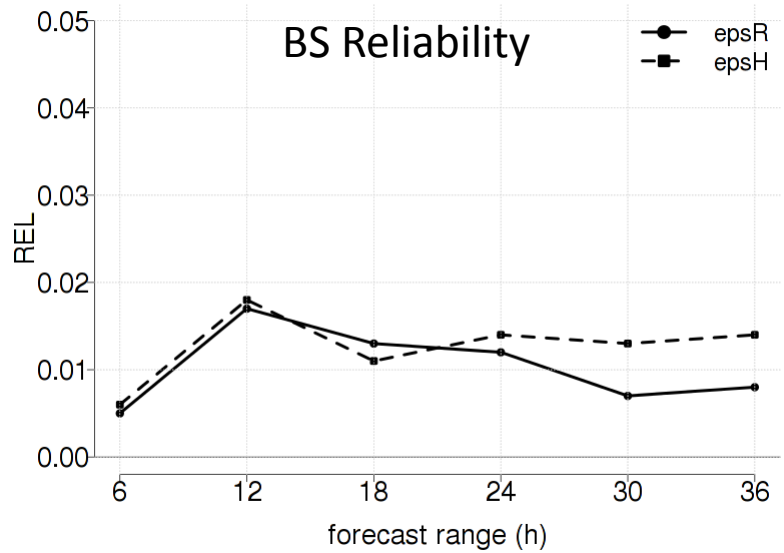
BS reliability lower is better
BS resolution higher is better

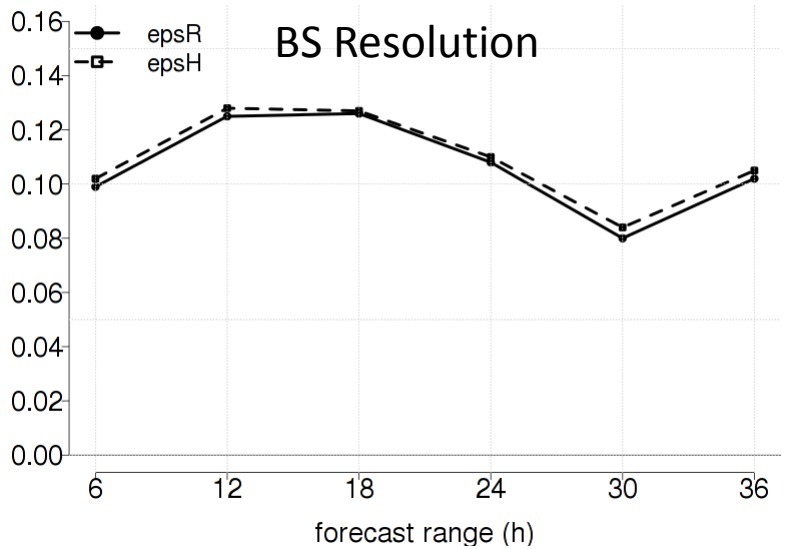
total precipitation over 6h

Northern Italy high-res – average over 0.2x0.2 deg boxes > 1mm





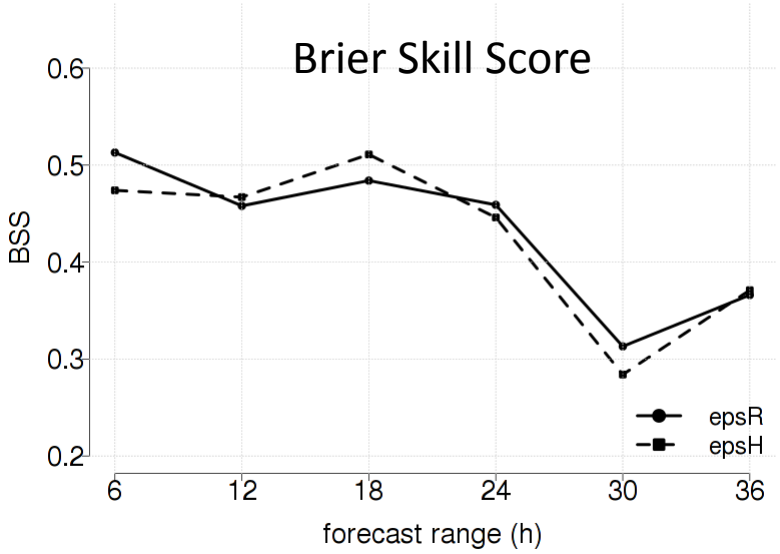


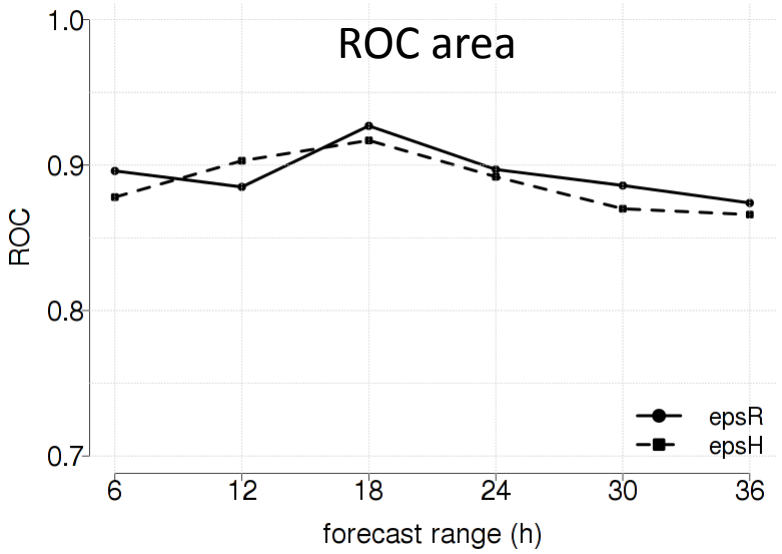


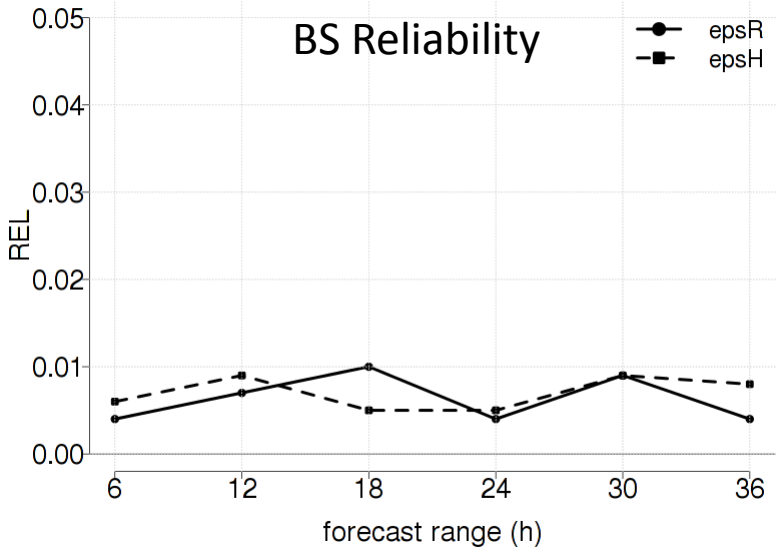
BS reliability lower is better
BS resolution higher is better

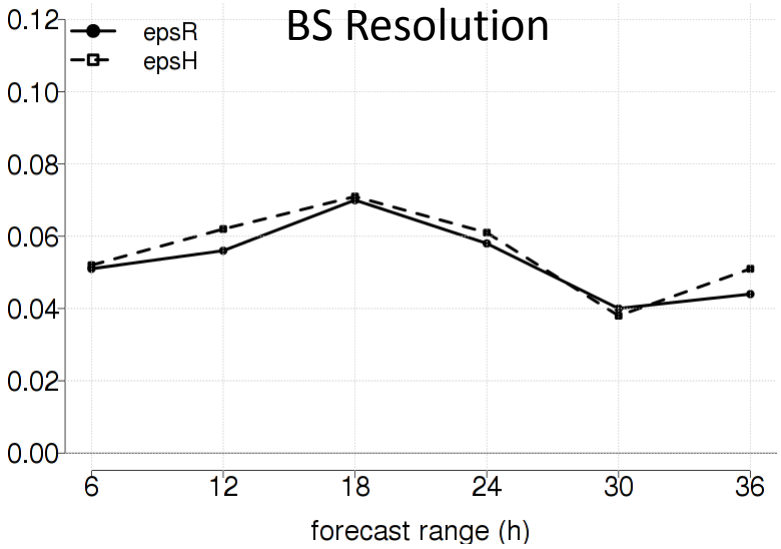
total precipitation over 6h

Northern Italy high-res – average over 0.2x0.2 deg boxes > 5mm





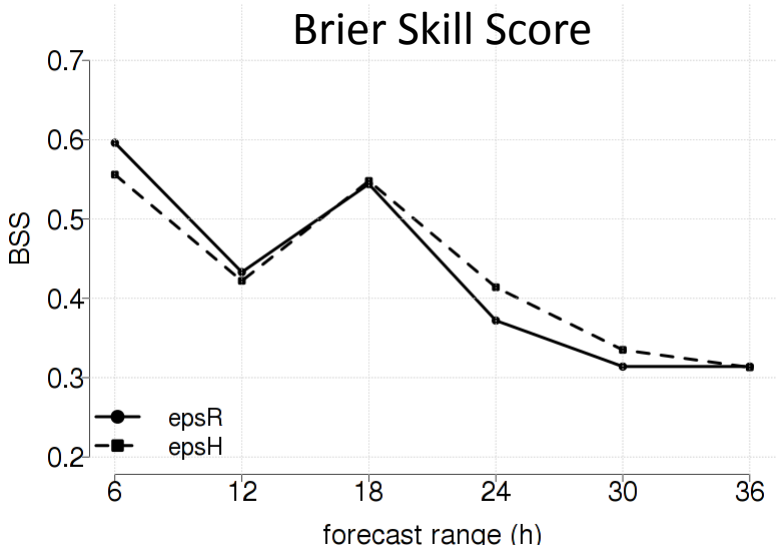


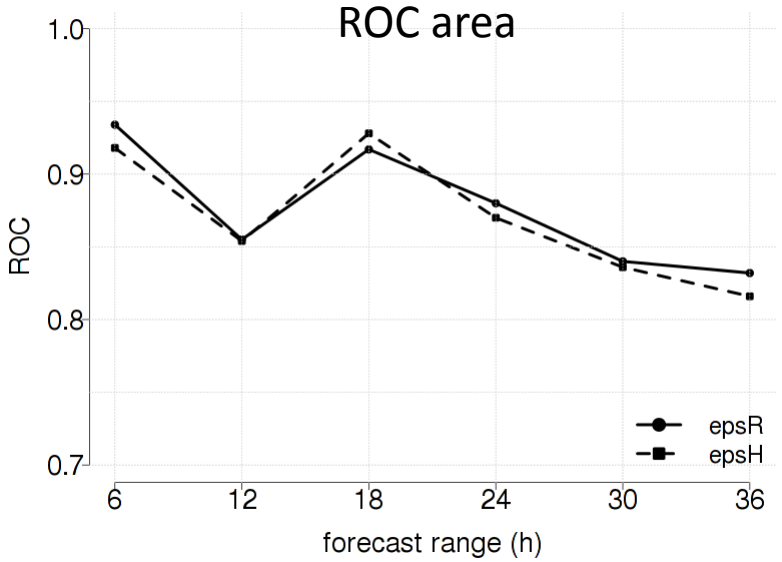


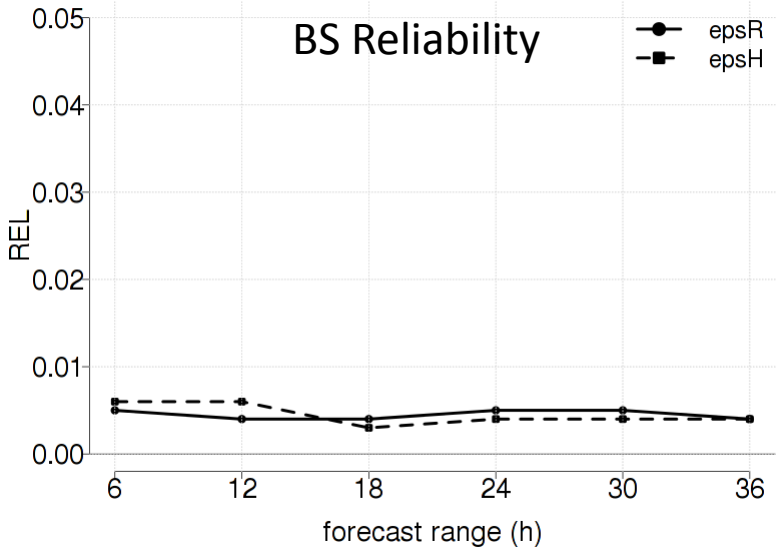
BS reliability lower is better
BS resolution higher is better

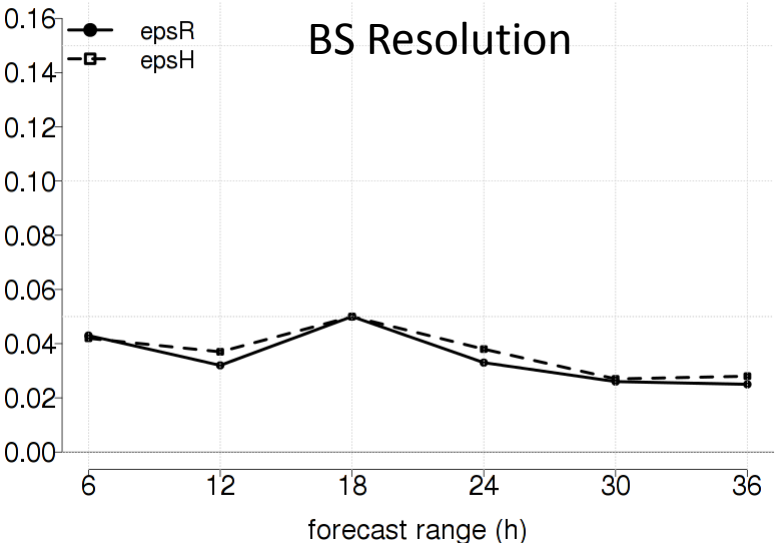
total precipitation over 6h

Northern Italy high-res – average over 0.2x0.2 deg boxes > 10mm





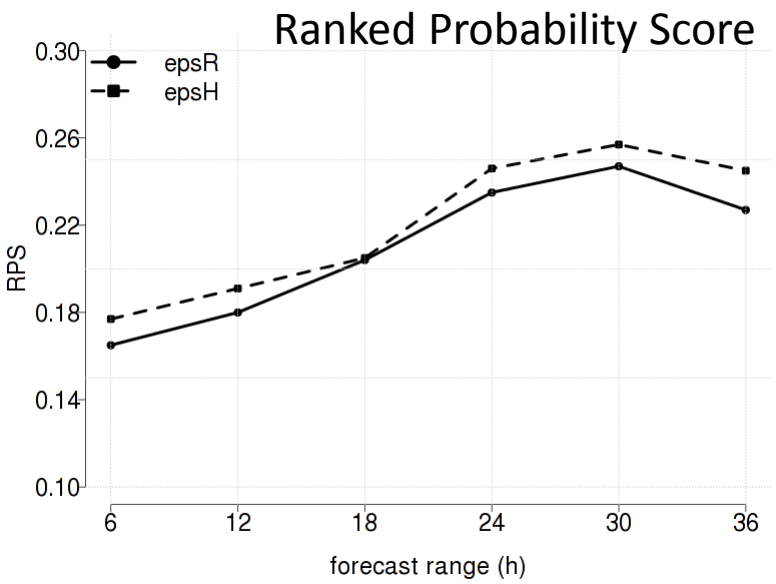


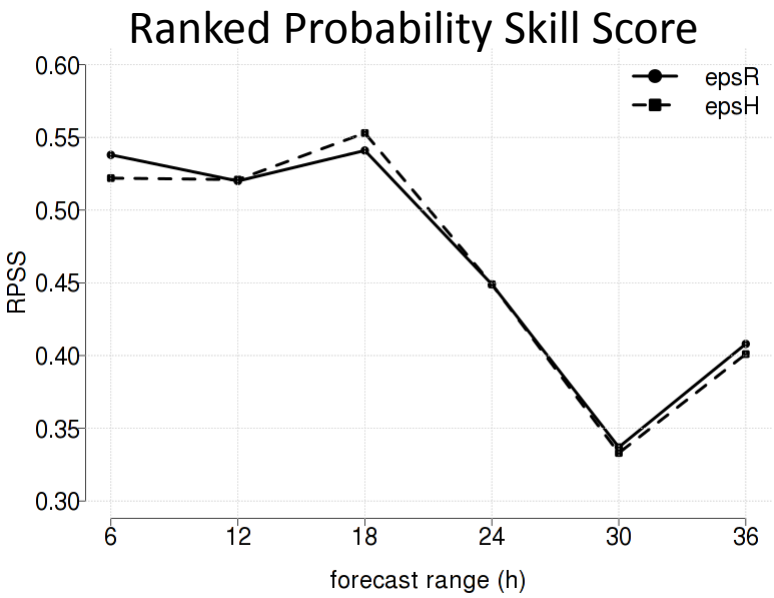


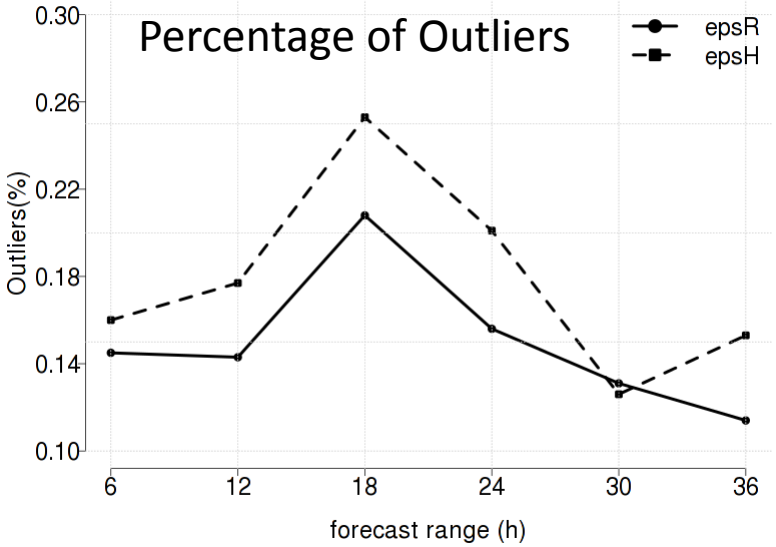
RPS	lower is better
RPSS	higher is better
Outliers	lower is better

total precipitation over 6h

Northern Italy high-res – average over 0.2x0.2 deg boxes



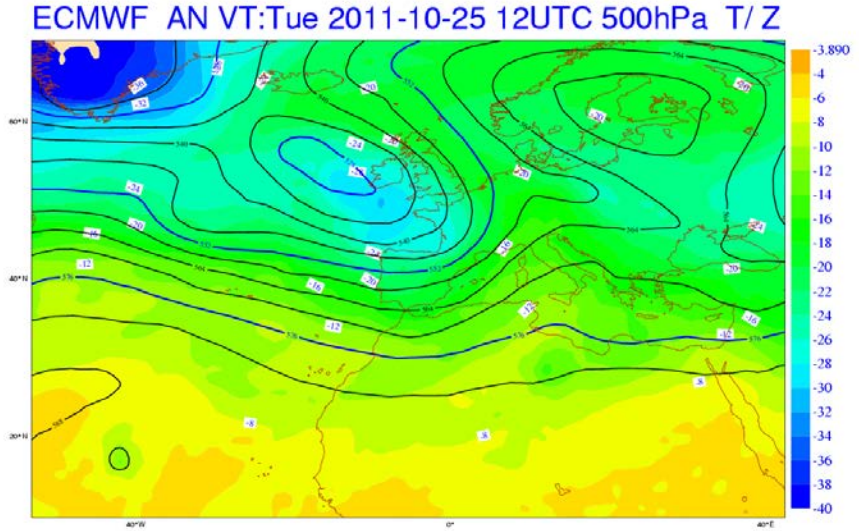




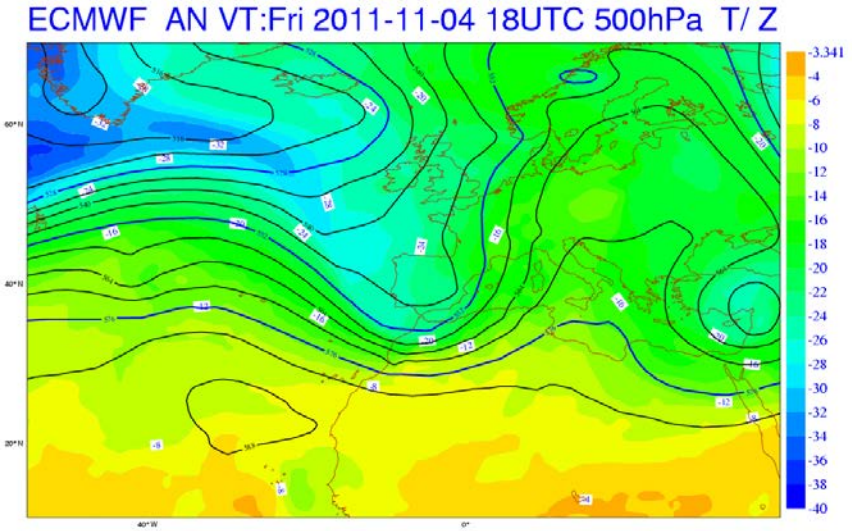
R slightly better

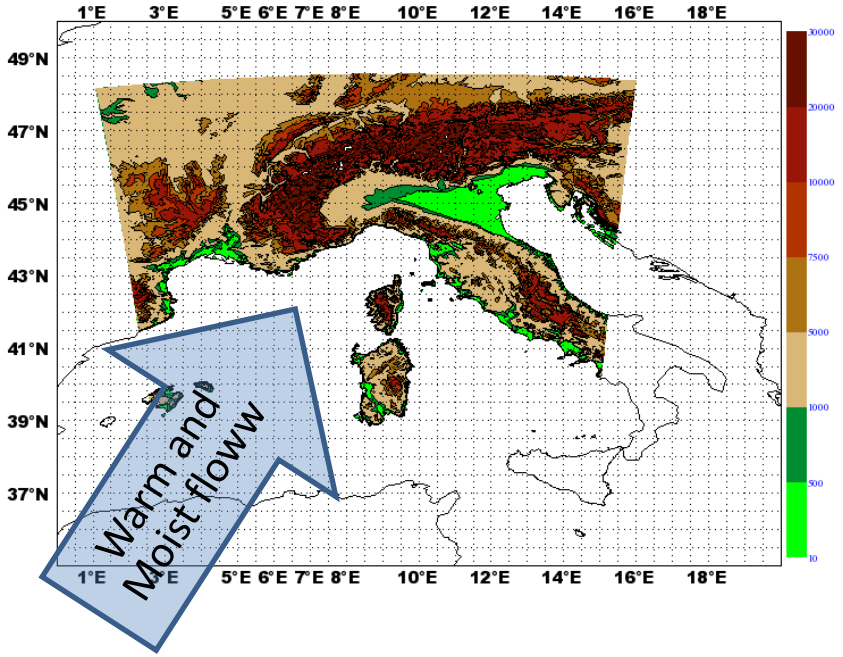
Two flood events

Liguria Cinque Terre - 25/10/2011



Genova – 04/11/2011

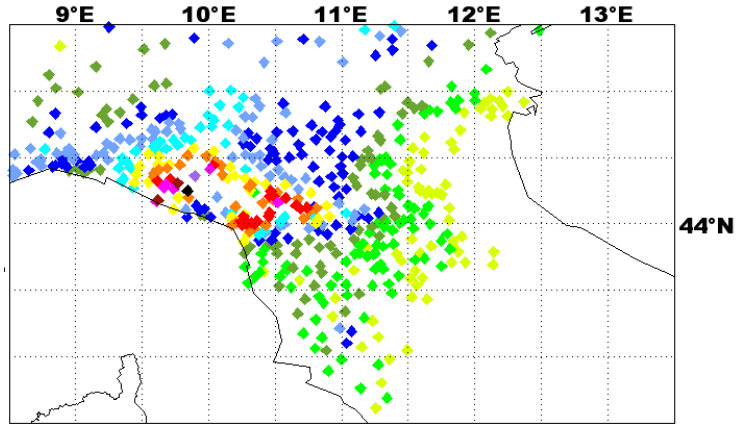


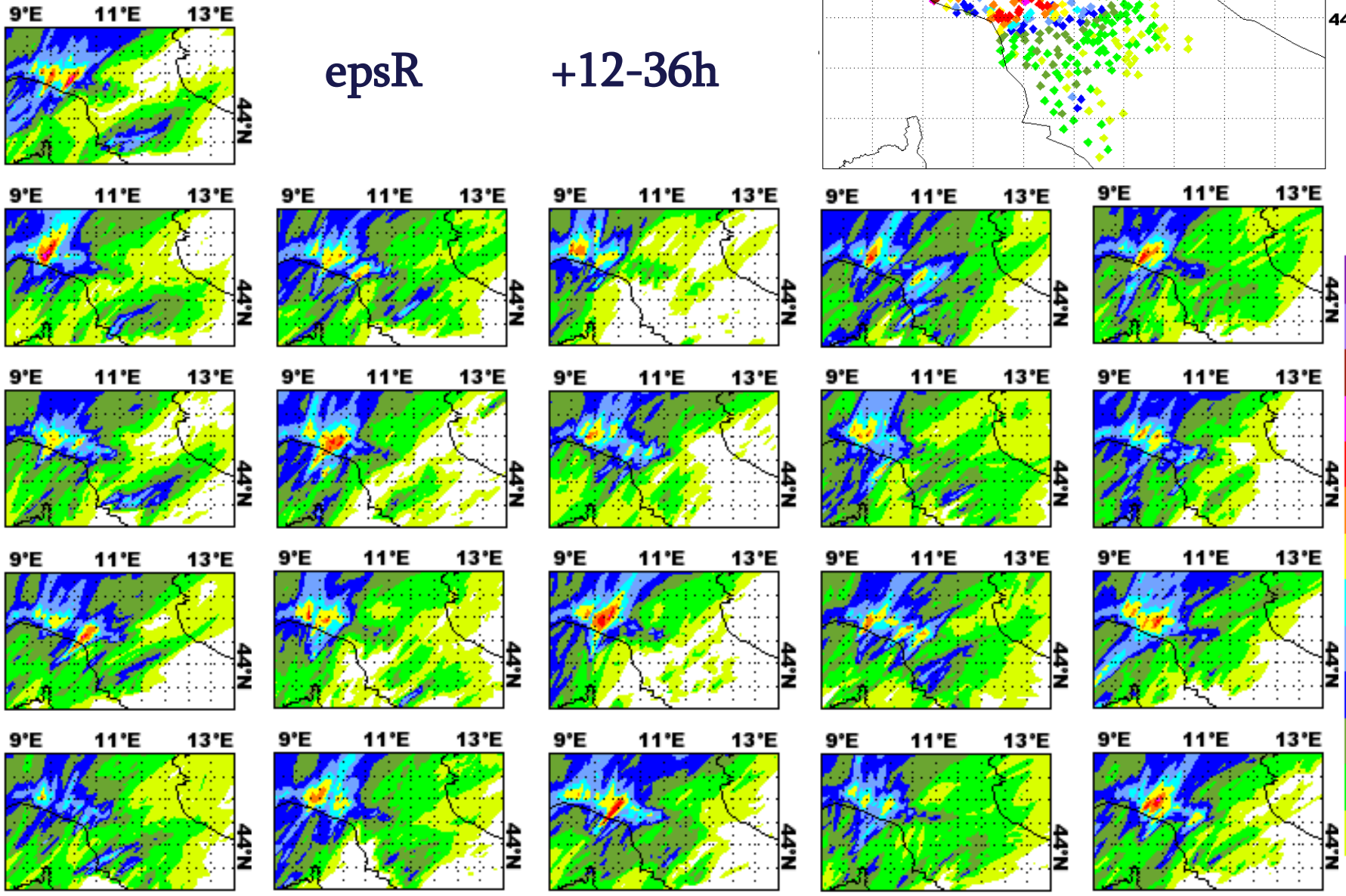


25 October 2011

5 Terre flood

epsR +12-36h

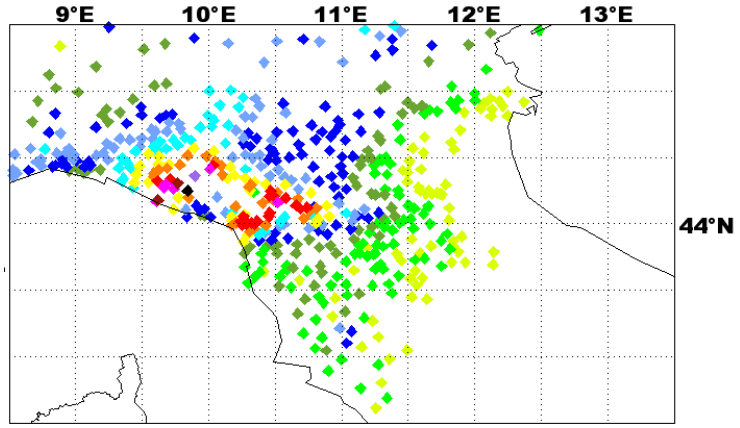


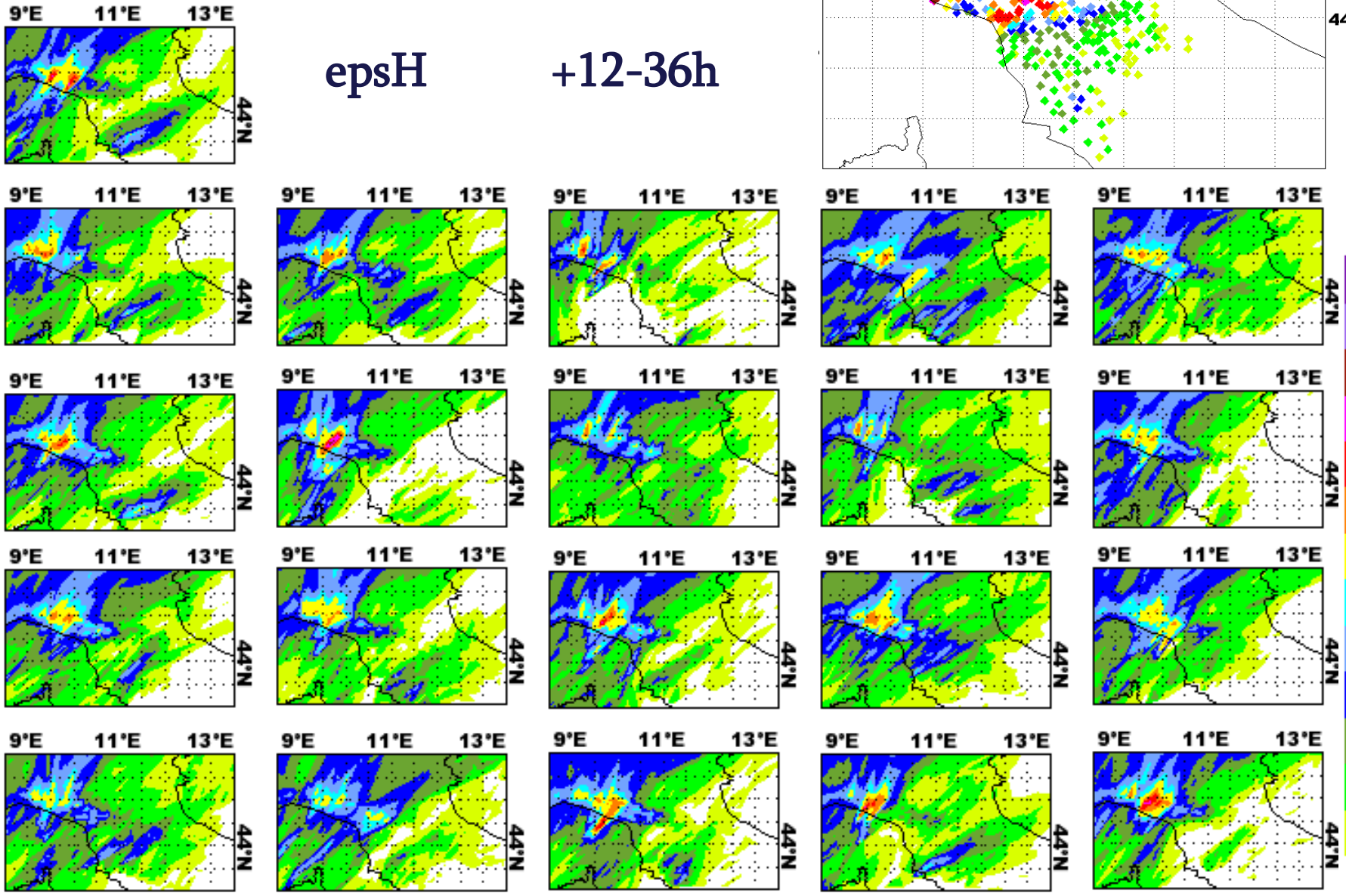


25 October 2011

5 Terre flood

epsH +12-36h

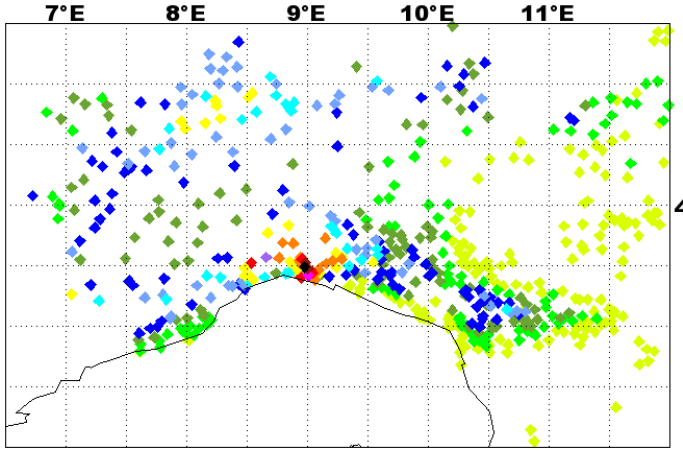


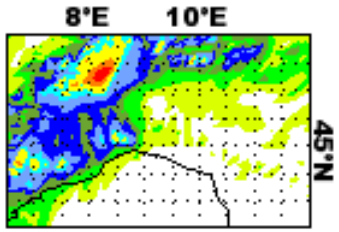


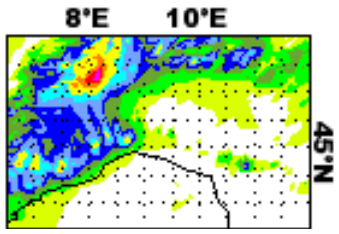
4 November 2011

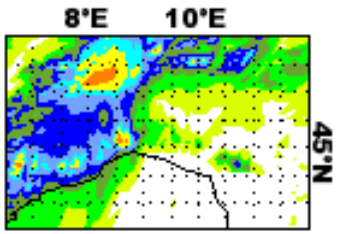
Genova flood

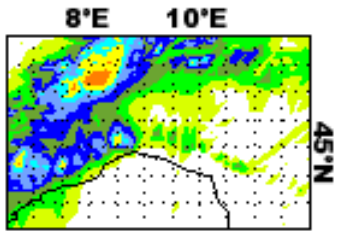
epsR +12-36h

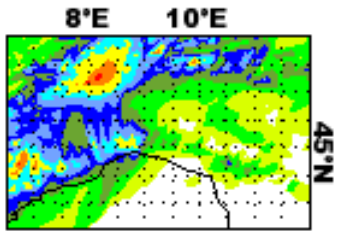


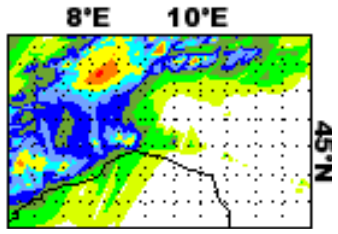


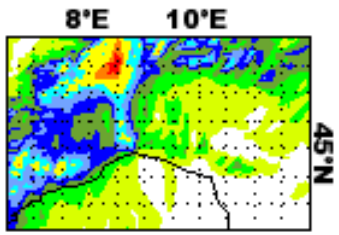


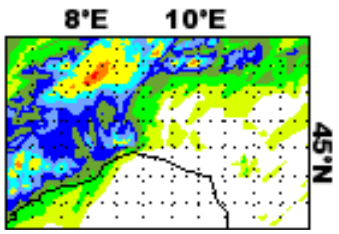


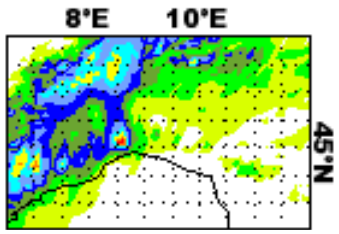


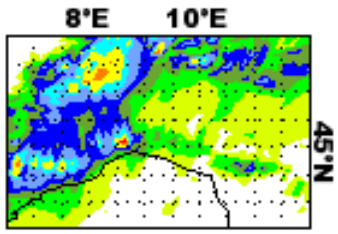


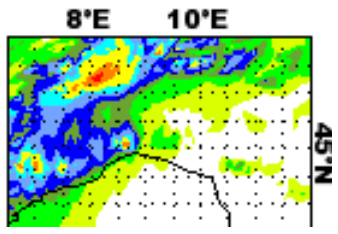


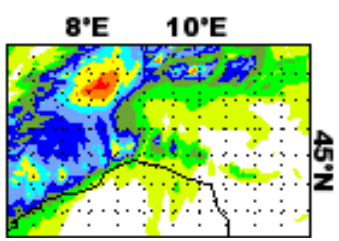


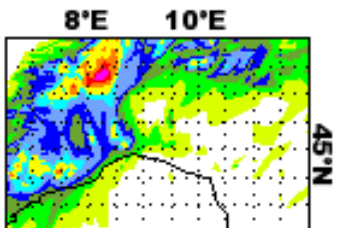


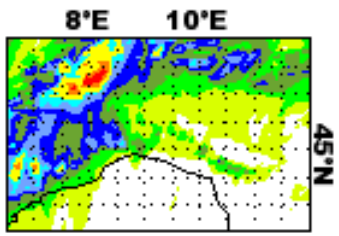


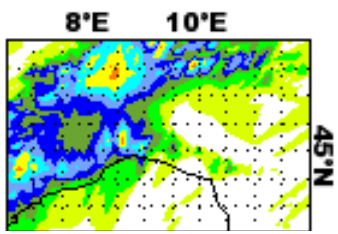


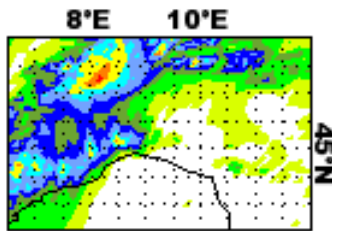


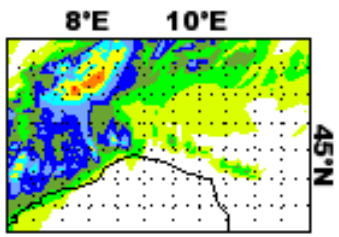


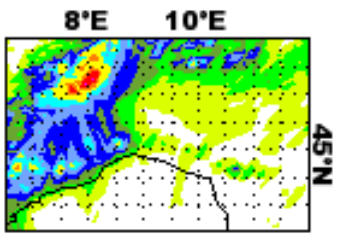


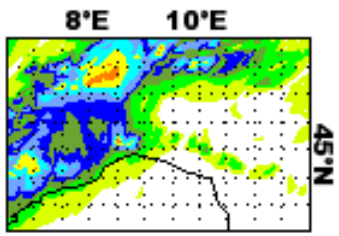


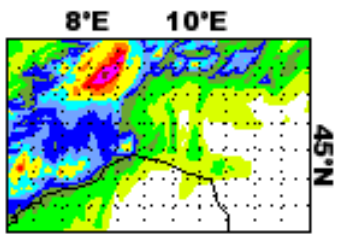


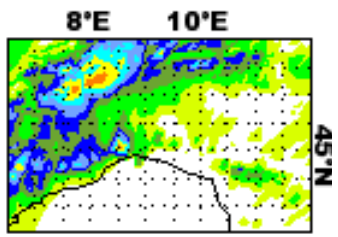








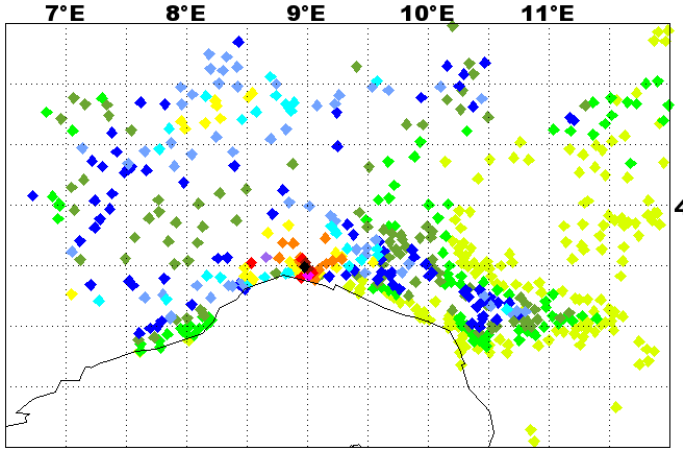


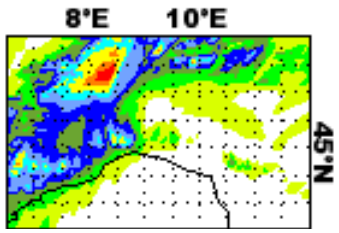


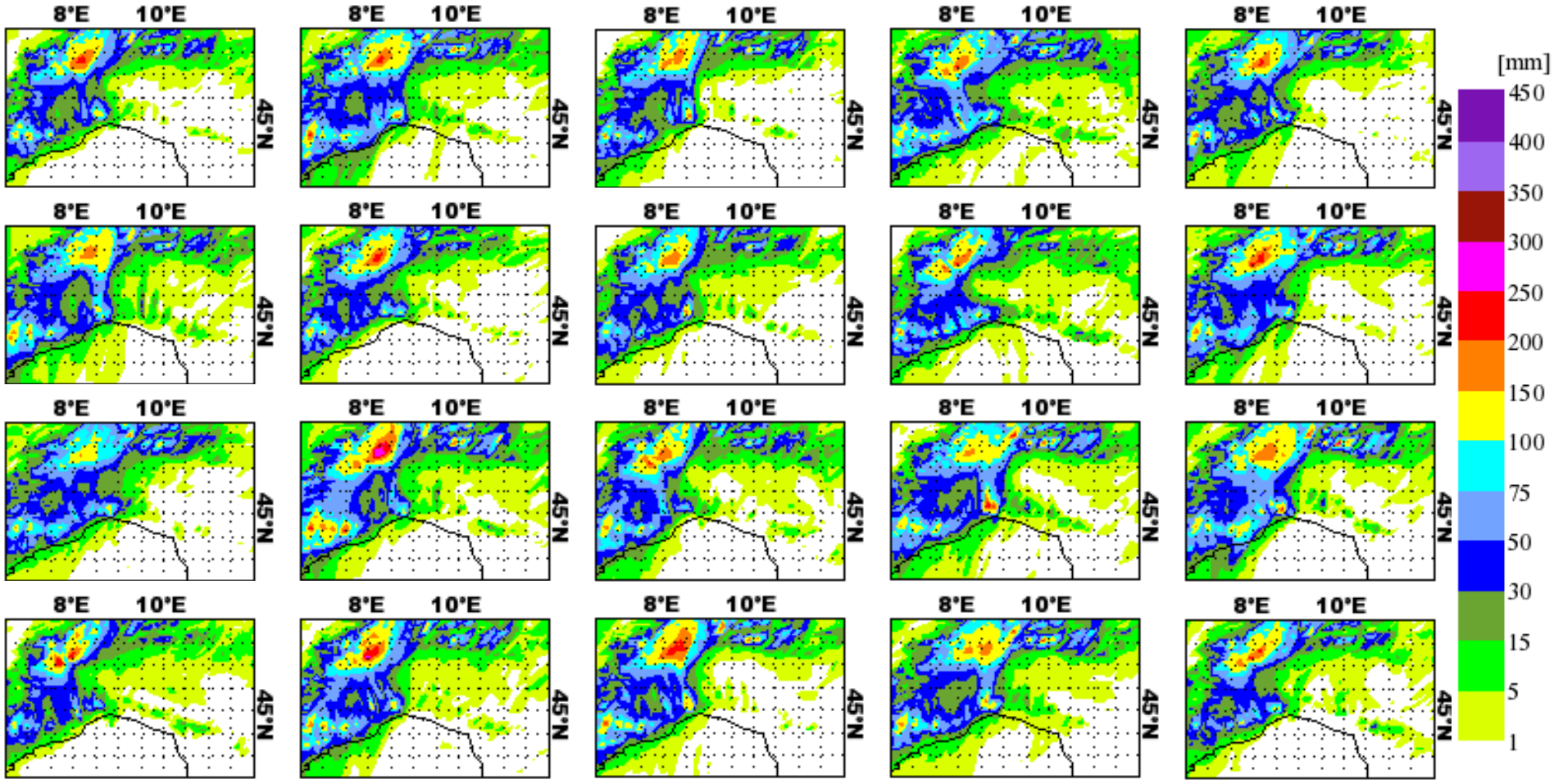
4 November 2011

Genova flood

epsH +12-36h

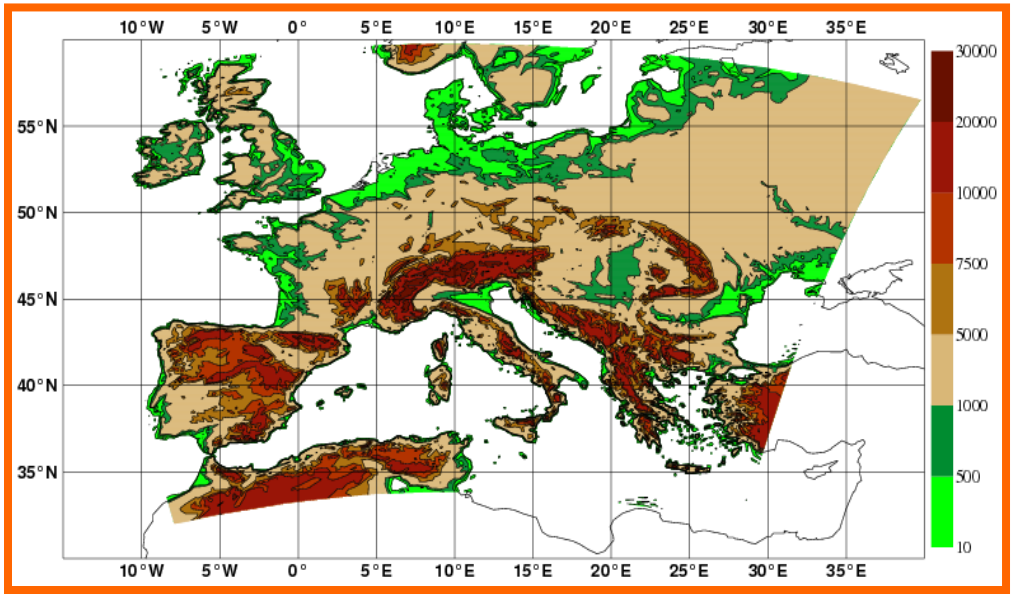






COSMO-LEPS

- COSMO Consortium ensemble, 7 km, 40 levels
- ICs and BCs from 16 members out of two (51+51) ECMWF ENSs
- The 16 member selection is made by:
  - Cluster Analysis (16 clusters) of the 102 EPS members
  - Selection of 16 members as representative of their own cluster
- Perturbations of the model physics parameters are applied to the 16 COSMO runs
- Run daily at 00 and 12 UTC
- 132 h forecast range

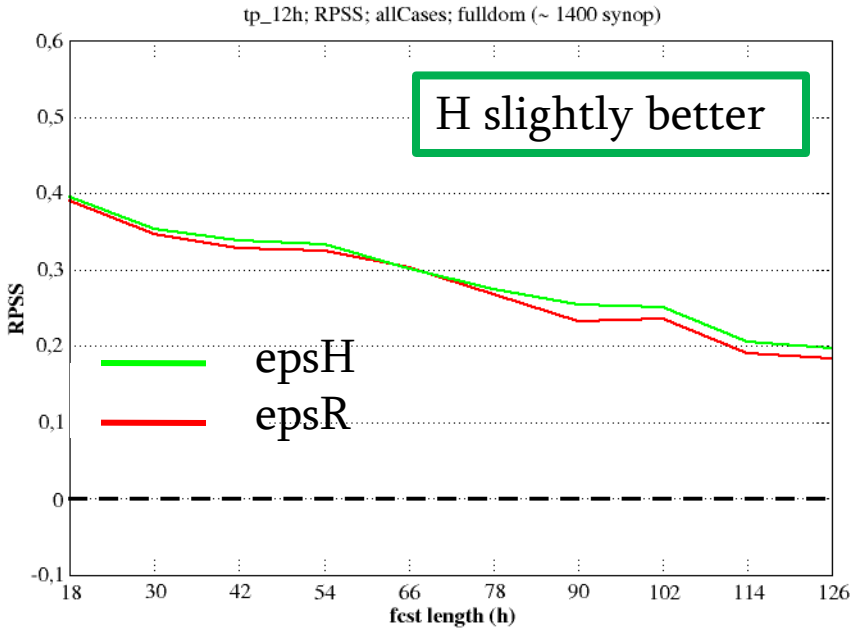


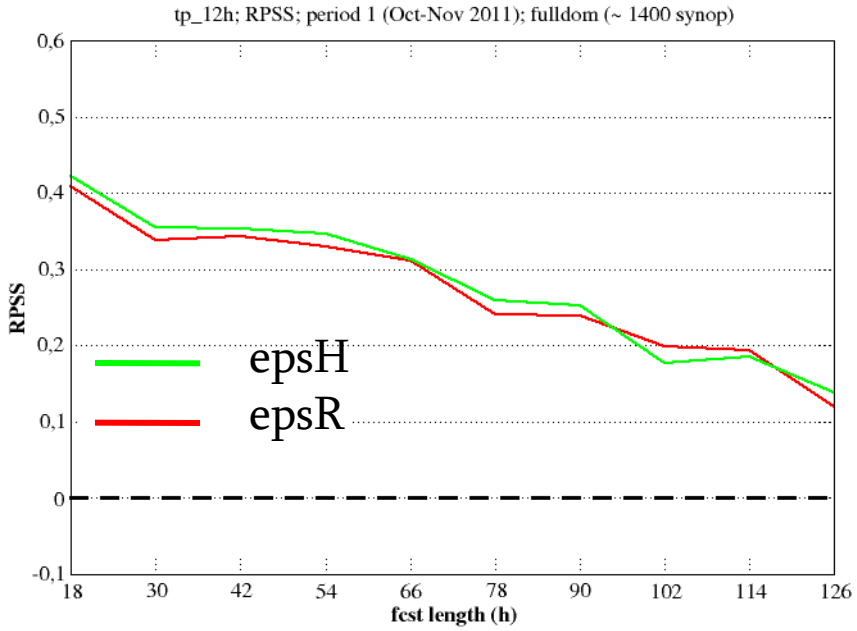
COSMO-LEPS

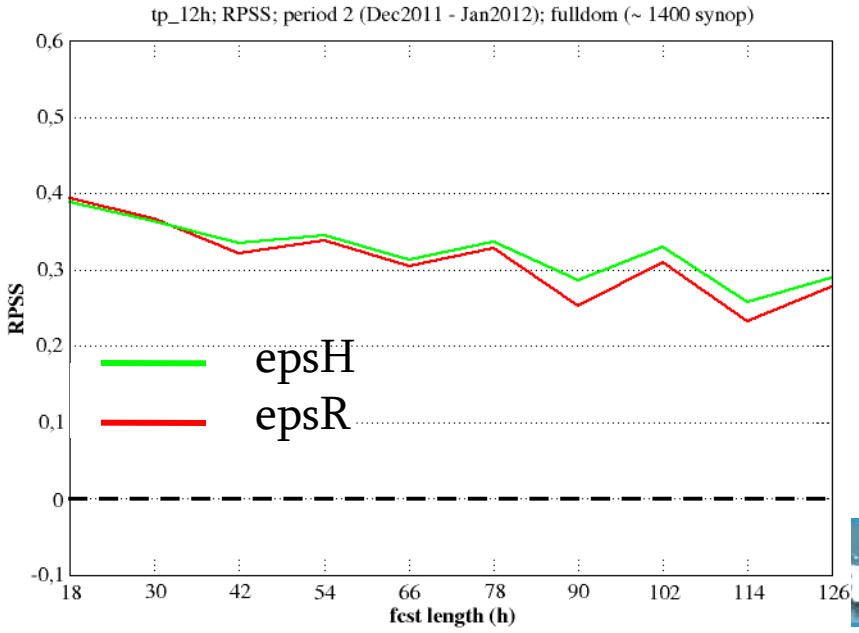
- All periods:
  - Period 1: 24/10/2011 -> 7/11/2011 15 cases
  - Period 2: 27/12/2011 -> 8/1/2012 13 cases
  - Period 3: 11/6/2012 -> 28/6/2012 18 cases
  - **allCases** **46 cases**
- **Verification against Synop observations** (only 12UTC runs are shown)
- variables: 12h cumulated precip (18-06, 06-18 UTC), *2-metre temperature*
- region:
  - 43-50N, 2-18E (**mapdom**)
  - 35-58N, 10W-30E (**fulldom**)
- method: nearest grid point; no-weighted fcst
- fcst ranges: 6-18h, 18-30h, …, 102-114h, 114-126h
- thresholds: **1, 5, 10, 15, 25, 50 mm/12h**

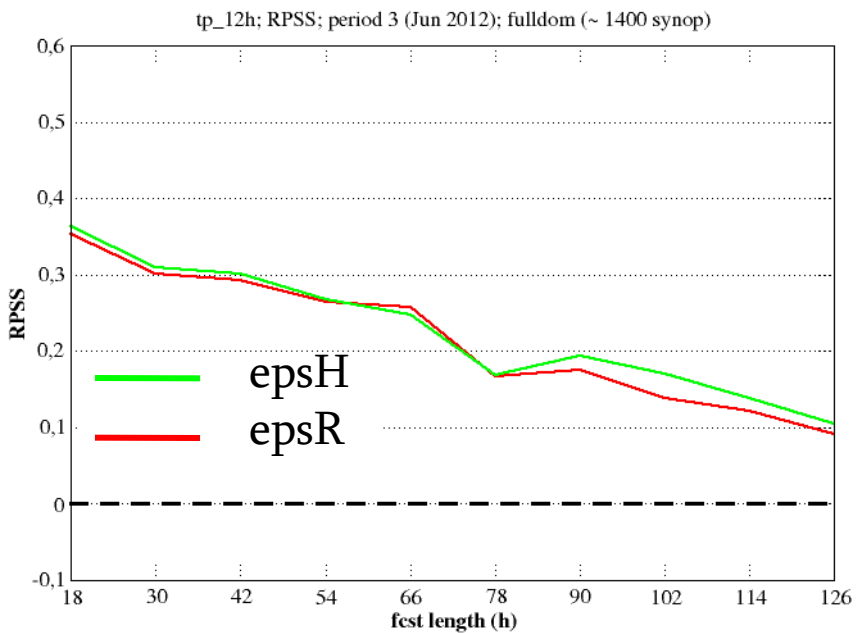
RPSS higher is better

total precipitation over 12h









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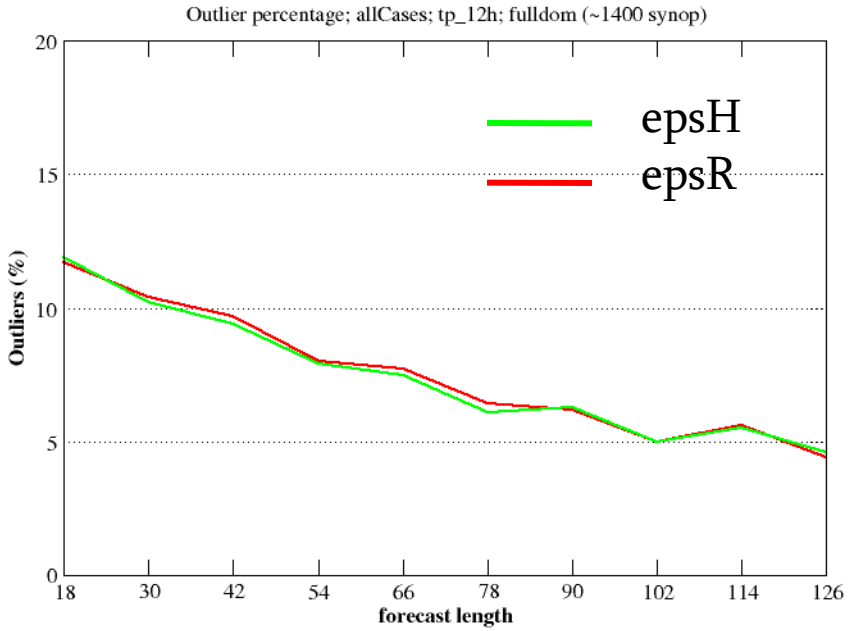
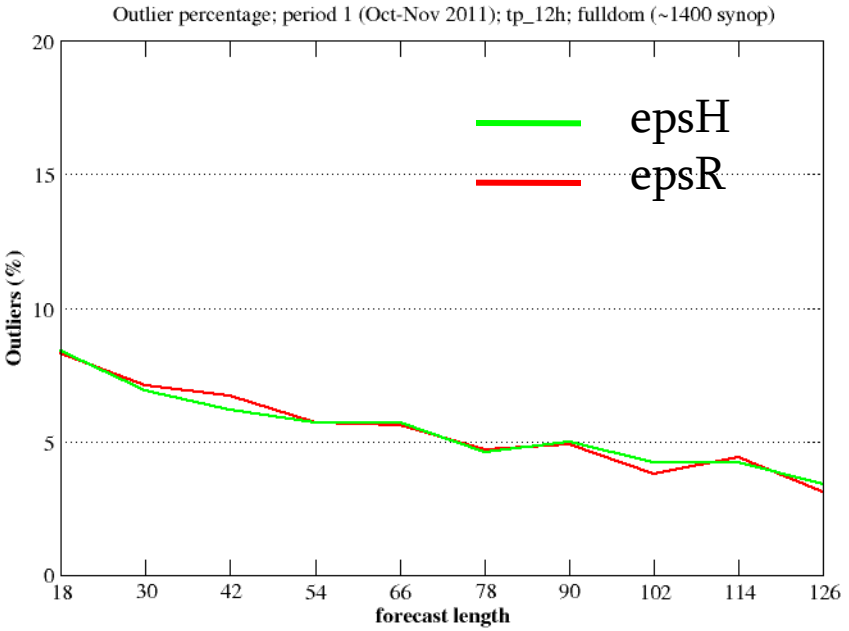
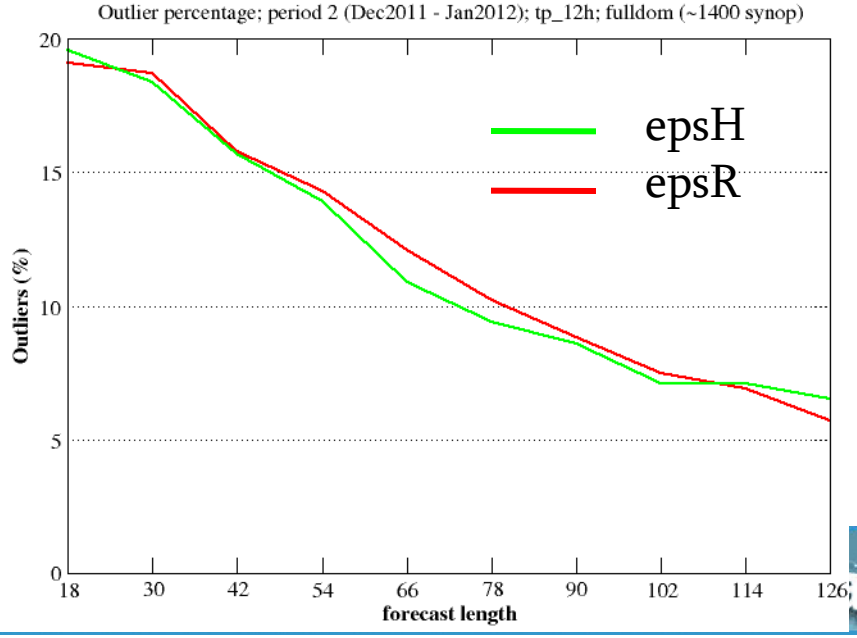
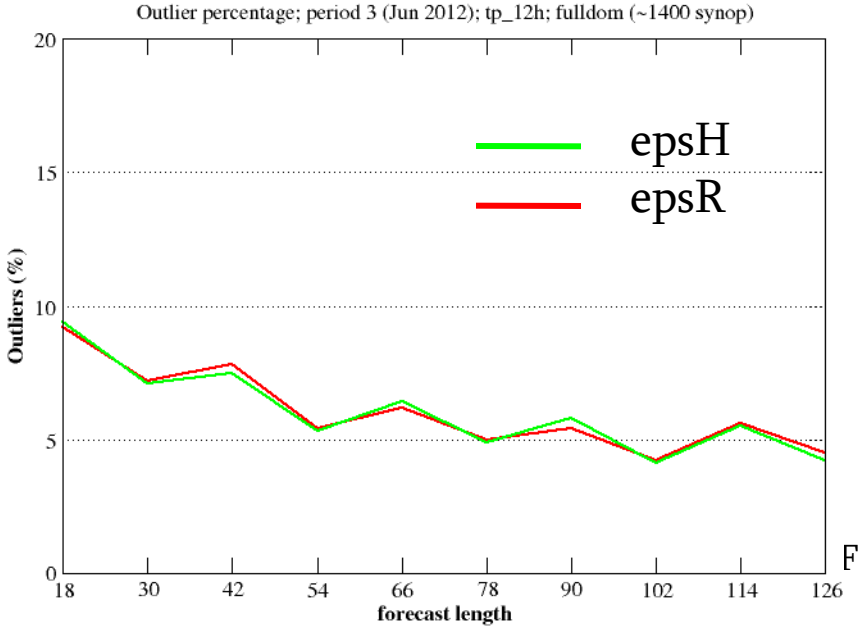
Outliers lower is better

total precipitation over 12h



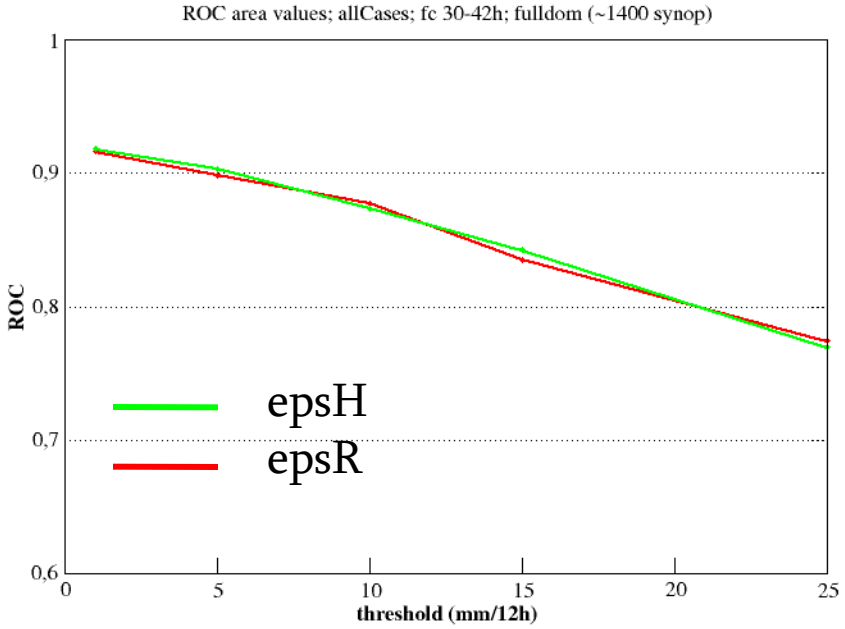


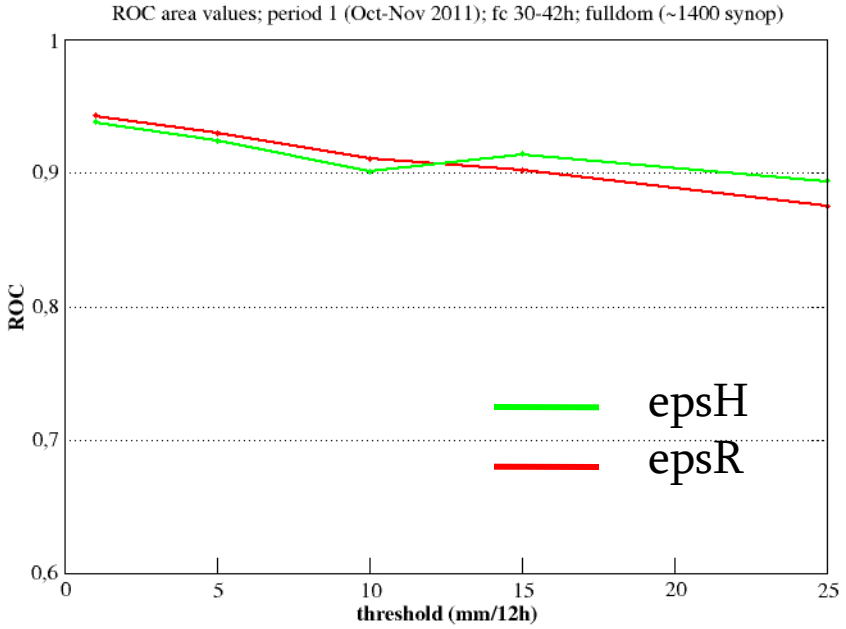


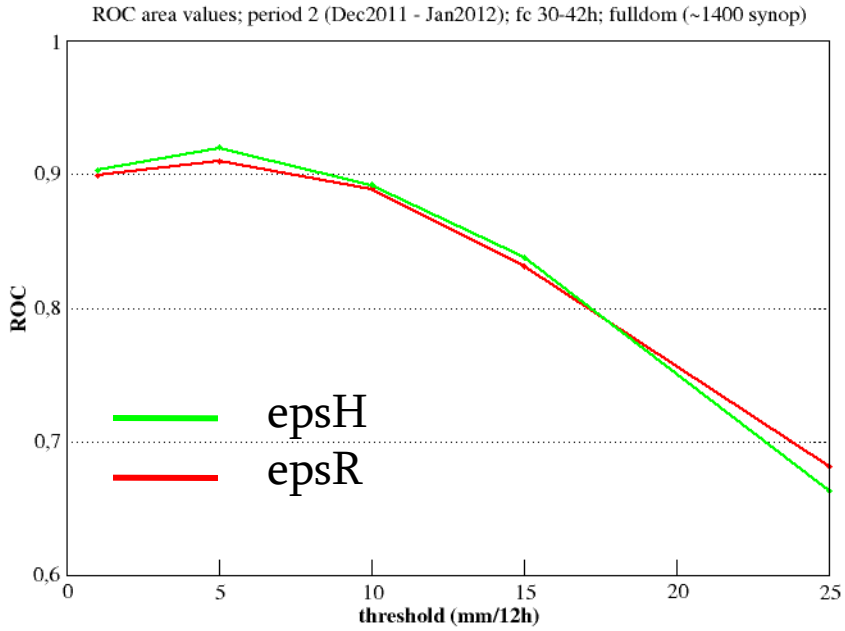


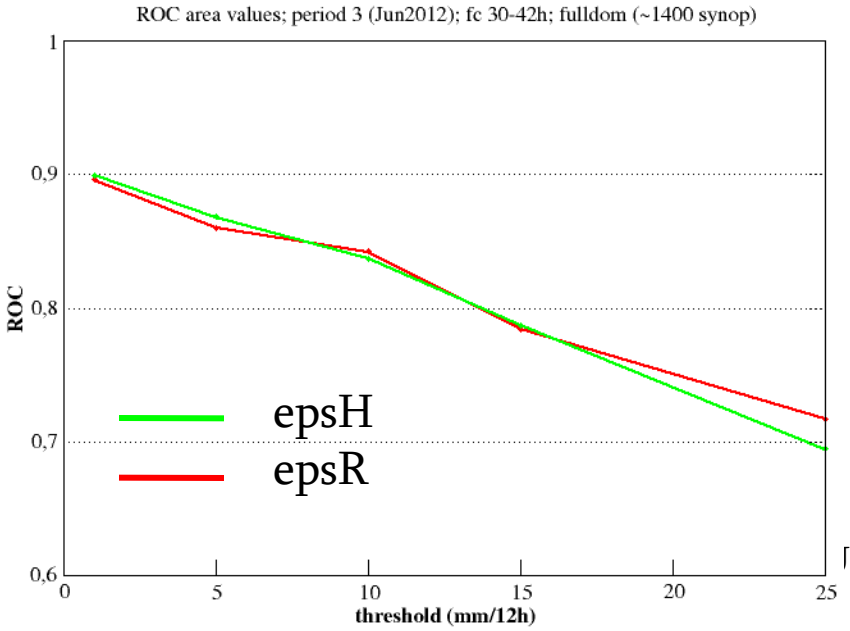
ROC area higher is better

total precipitation over 12h (fulldom)









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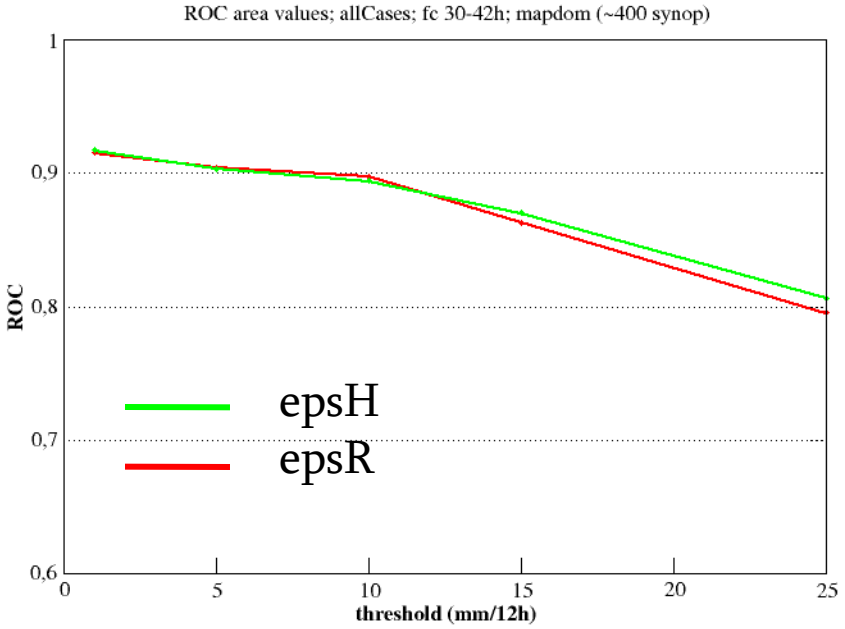
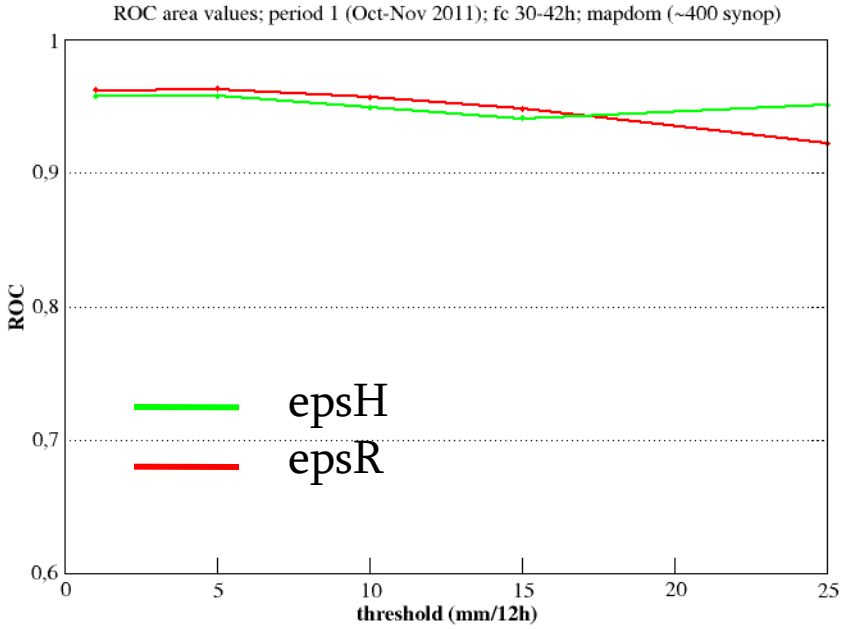
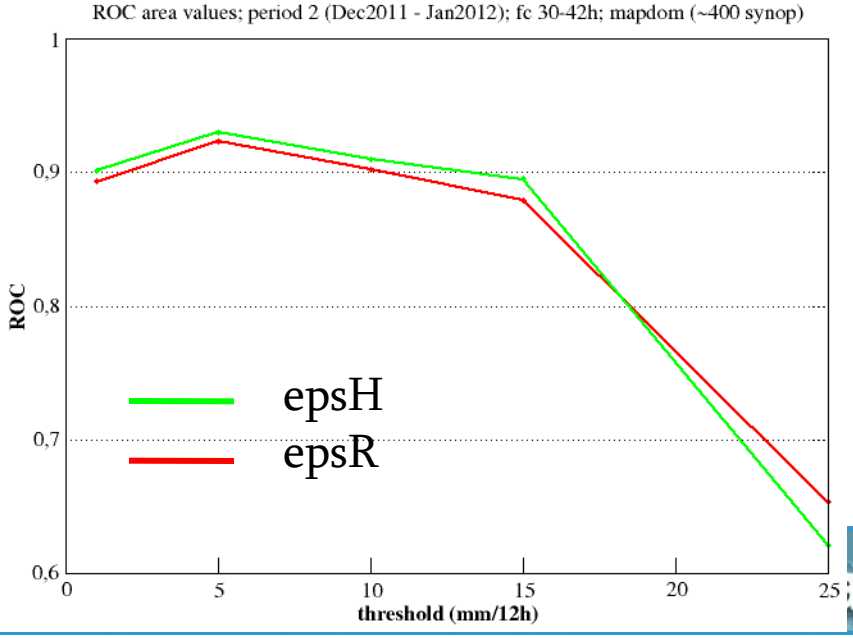
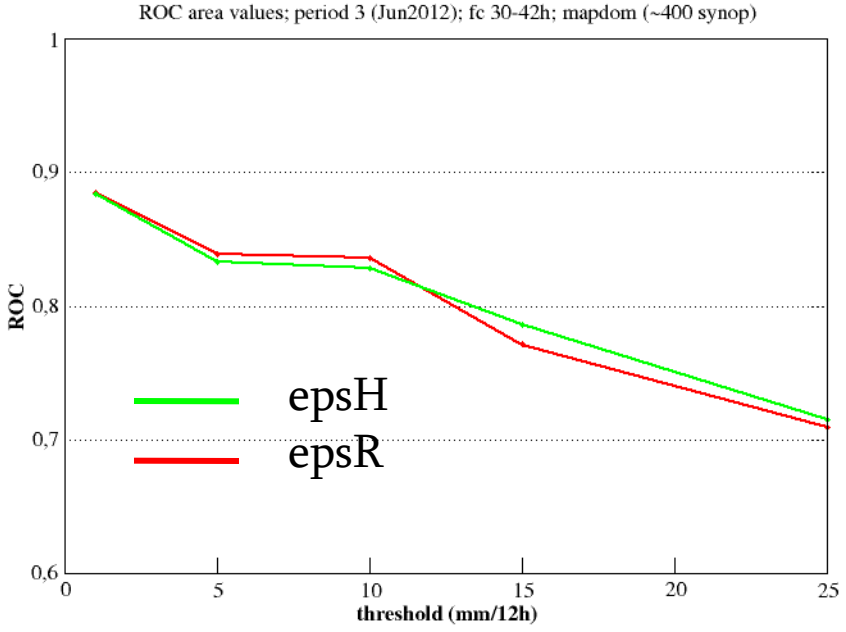
ROC area higher is better

total precipitation over 12h (mapdom)









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EF

Concluding remarks

- Under the C-SRNWP coordination, an action to evaluate the impact of using higher resolution BCs from ECMWF EPS has been carried out
- Martin Leutbecher from ECMWF (thank you!) run two experimental ENS sets, providing initial and boundary conditions for convection-permitting ensembles:
  - Experiment R: TL639 (32 km)
  - Experiment H: TL1279 (16 km)
- ARPA-SIMC contributed to this project by running two LAM EPS systems based on the COSMO model:
  - COSMO 2.8km, Italian domain, autumn period only
    - Verification has been carried on by using synop data and also high res. precipitation data over northern Italy
  - COSMO-LEPS, 7km, European domain, three periods
    - Verification has been carried on by using synop data

Concluding remarks

Outcome:

- a small but detectable improvement has been found, confirmed by different scores and for different periods
- there seems to be little dependence on this increase of IC/BC resolution
- significance tests were not performed considering the very small differences
- some confidence on theses conclusions comes from the similar results obtained by the other groups (5 other European LAM EPS groups)
- results have been presented and discussed during the a meeting of the C-SRNWP LAM EPS groups hosted by ECMWF in December 2013. It was found that this increase of horizontal resolution of the ENS is only slightly beneficial in most of the implementations

This cooperation is still ongoing with experiments to test the impact of more frequent BCs

Thanks for your attention !