

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

Chiara Marsigli, Andrea Montani, Tiziana
Paccagnella

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)

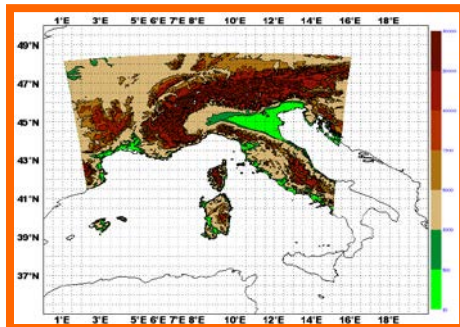
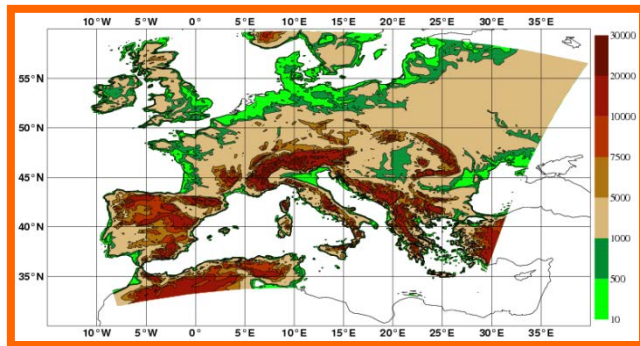
20+1 forecasts twice daily at 00 and 12 UTC, 7-day forecast range

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



CONSORTIUM FOR SMALL SCALE MODELING

COSMO

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Consortium for Small-scale Modeling

The Consortium for Small-scale Modeling (COSMO) was formed in October 1998. Its general goal is to develop, improve and maintain a non-hydrostatic limited-area atmospheric model, to be used both for operational and for research applications by the members of the consortium.

Participating national meteorological services

Today, the consortium, has as members these national meteorological services (presented in date-of-join order):

Germany	Switzerland	Italy	Greece	Poland	Romania	Russia
DWD Deutscher Wetterdienst	MCH MeteSchweiz	USAM Ufficio Generale Spazio Aereo e Meteorologia	HNMS Hellenic National Meteorological Service	IMGW Institute of Meteorology and Water Management	NMA National Meteorological Administration	RHM Federal Service for Hydrometeorology and Environmental Monitoring

Other major members

Additionally, these regional and military services within the member states are also participating:

Germany	Italy	Italy	Italy
AGeobw Amt für GeoInformationswesen der Bundeswehr	CIRA Centro Italiano Ricerche Aerospaziali	ARPA-SIMC ARPA Emilia Romagna Servizio Idro Meteo Clima	ARPA Piemonte Agenzia Regionale per la Protezione Ambientale Piemonte

COSMO-H2-EPS

ARPA SIMC 2.8 km ensemble – Prototype for the HYMEX Project

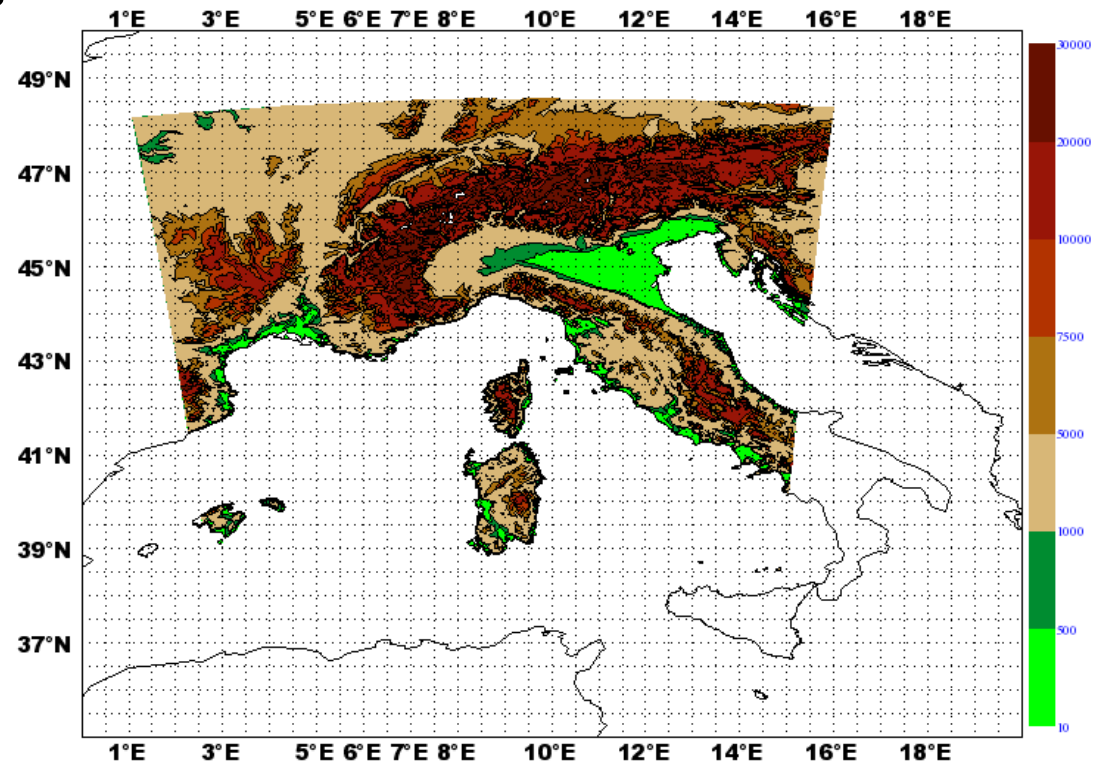
- **run for the period: 23 Oct – 7 Nov 2011** (floods over Italy and France)

- **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

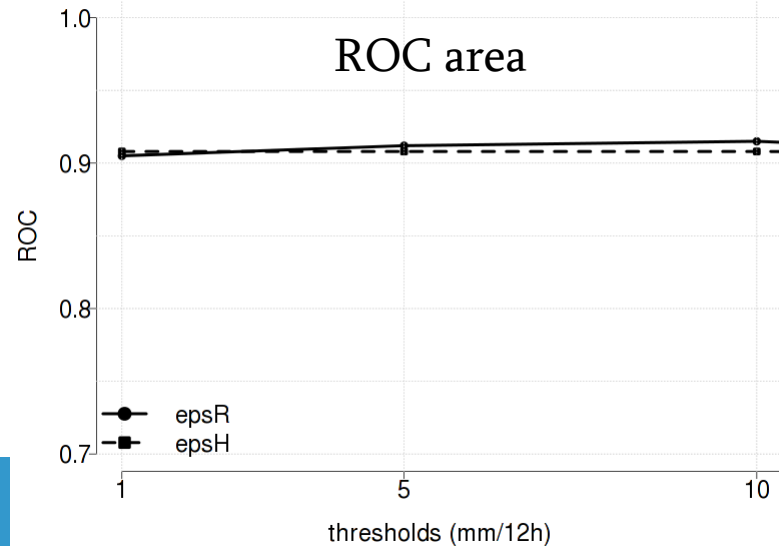
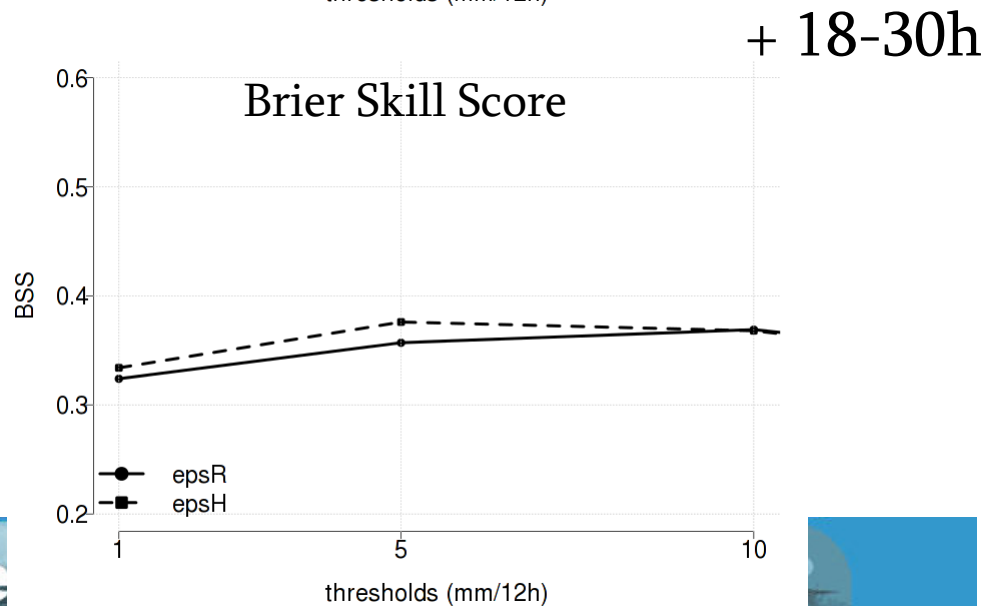
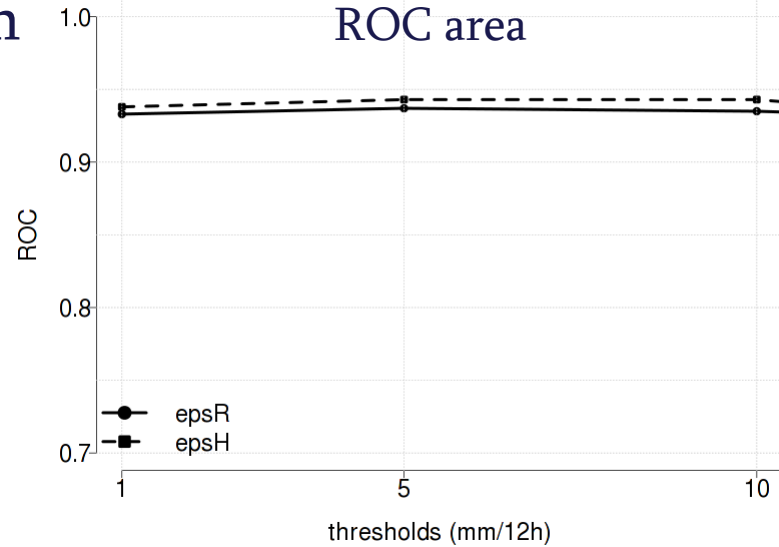
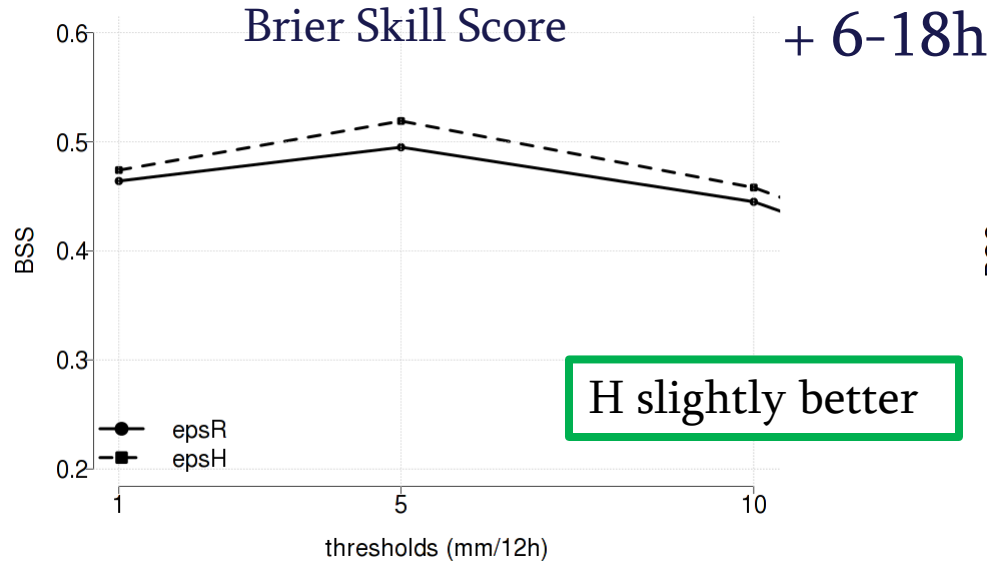
- ensemble set-up:
 - IC and BCs from ECMWF ENS, R (T639) or H (T1279)
 - hourly BCs
 - no parameter perturbations
 - no data assimilation
 - 2.8 km, 50 levels
 - 20+1 members
 - starting at 12 UTC
 - 36h forecast range
- Autumn period:
23/10 - 7/11 2011



BSS higher is better
ROC area higher is better

total precipitation over 12h

whole domain – synop data – nearest point



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%

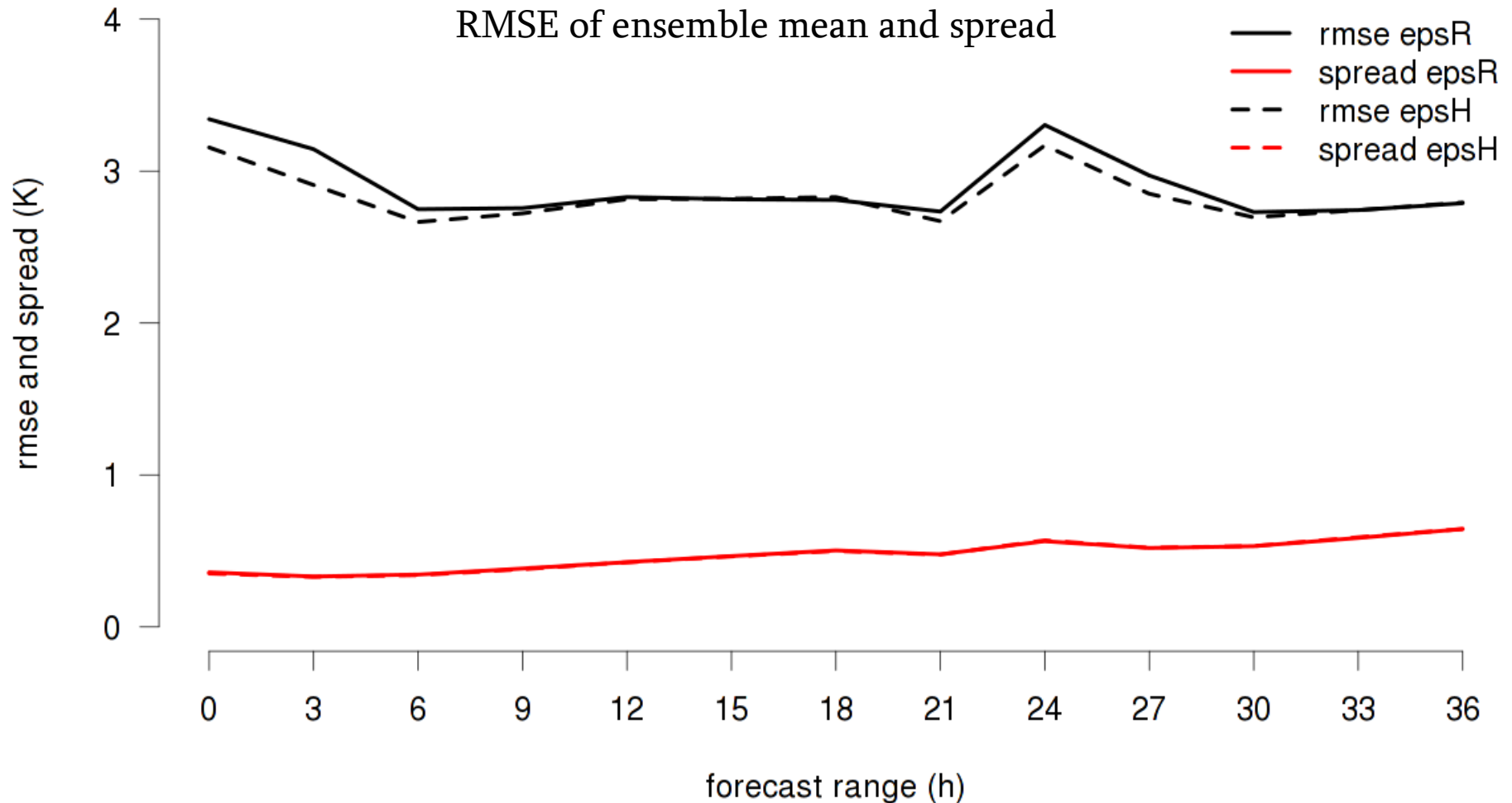
H slightly better

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

H slightly better

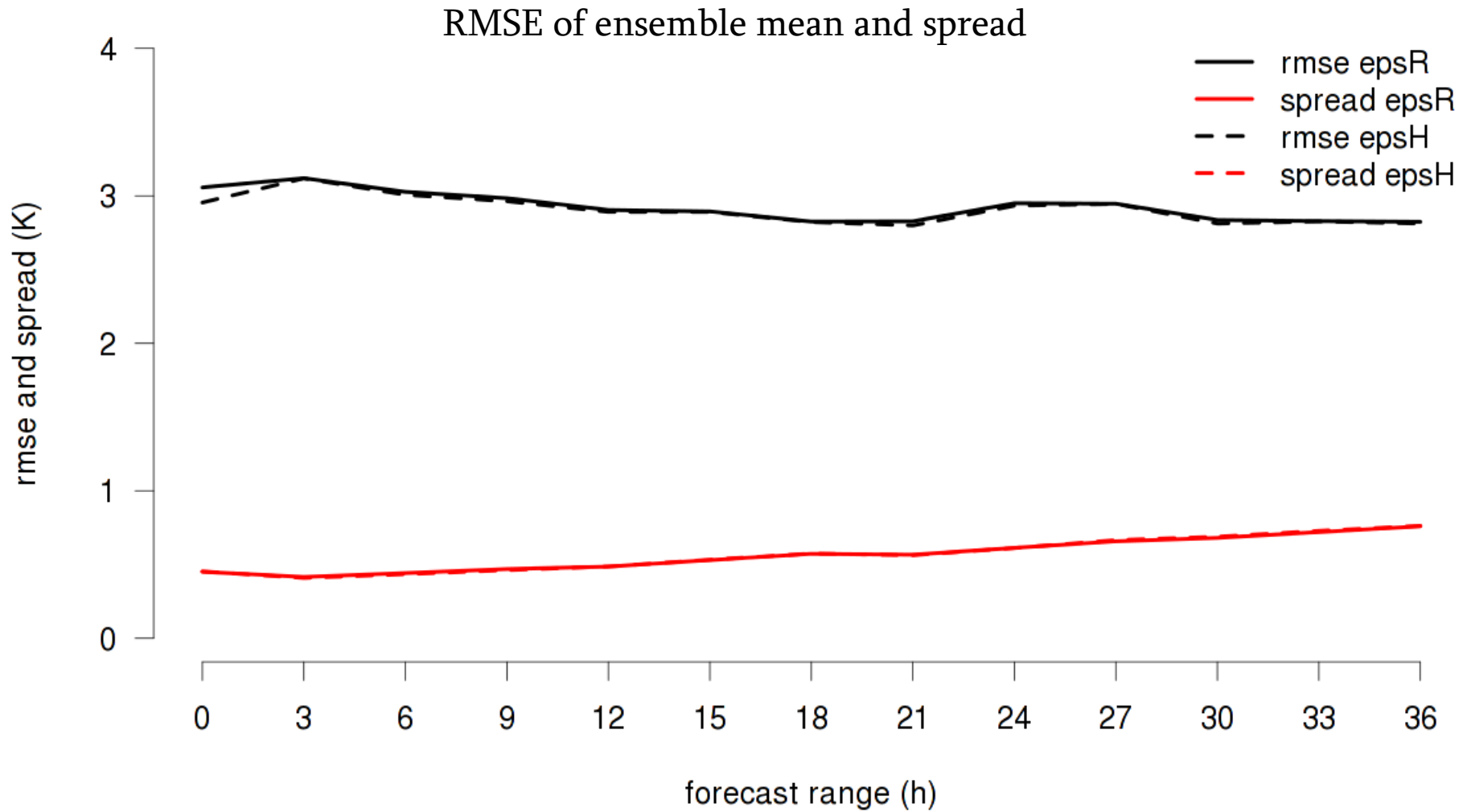
2m temperature

whole domain – synop data – nearest point



2m dew-point temperature

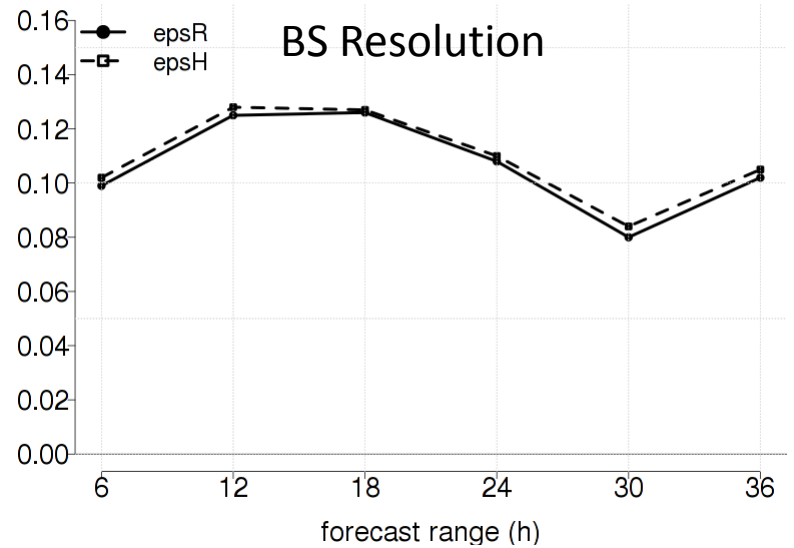
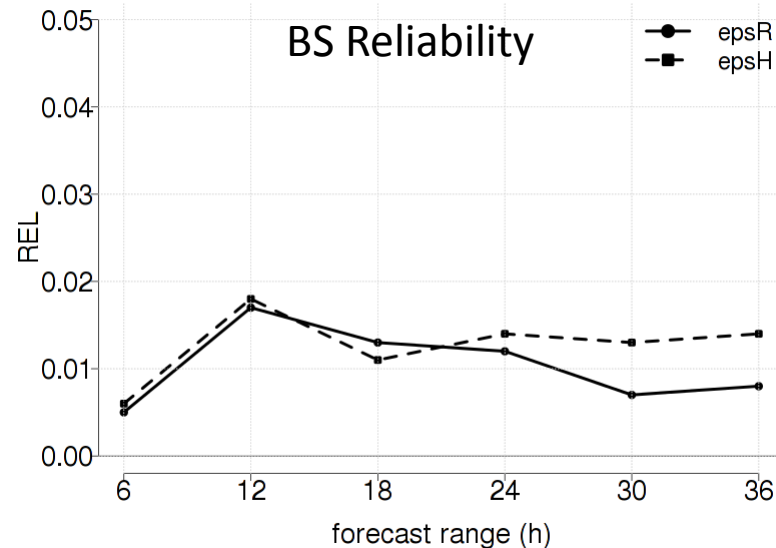
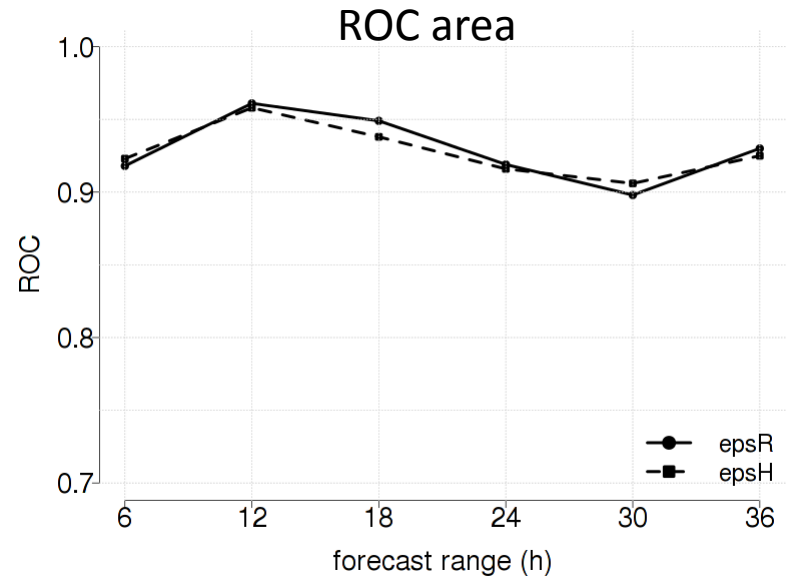
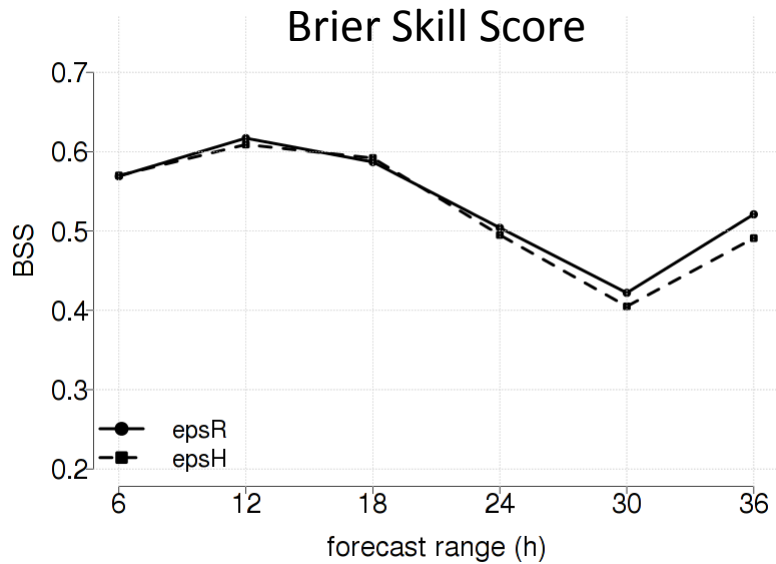
whole domain – synop data – nearest point



BS reliability lower is better
BS resolution higher is better

total precipitation over 6h

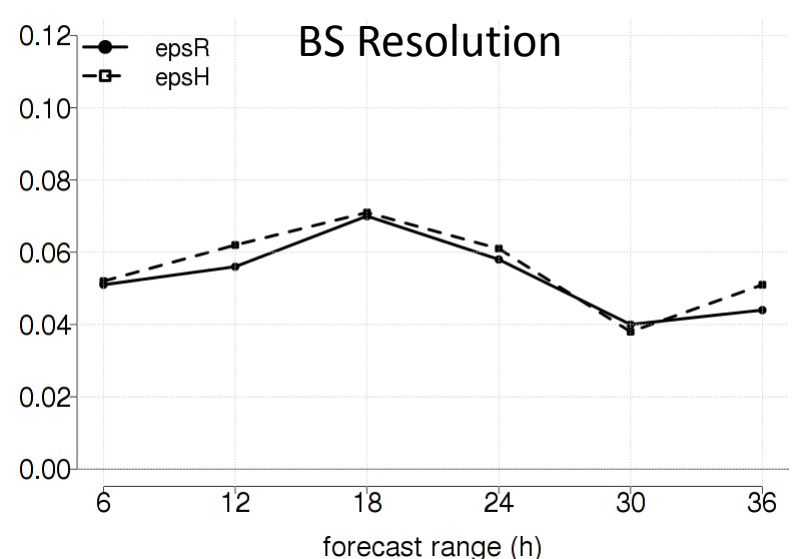
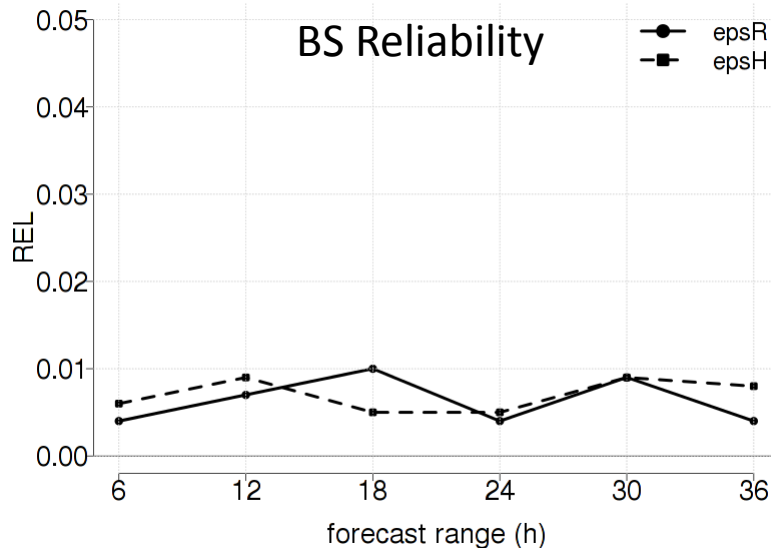
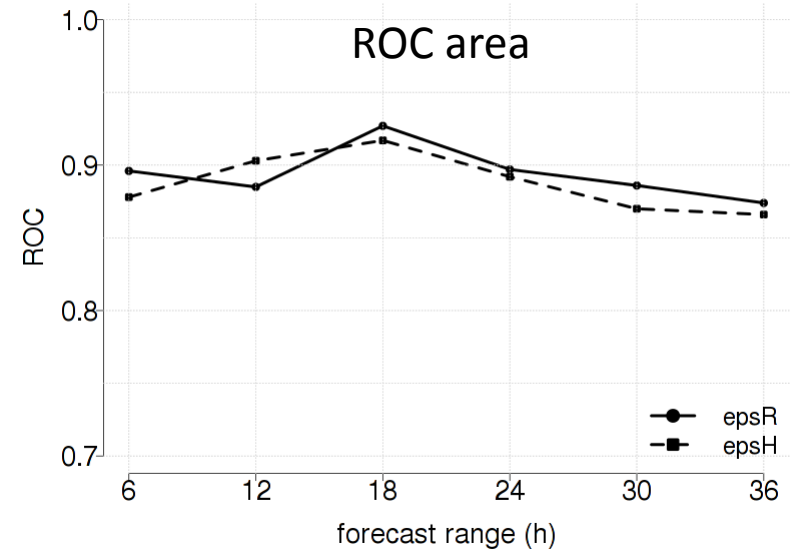
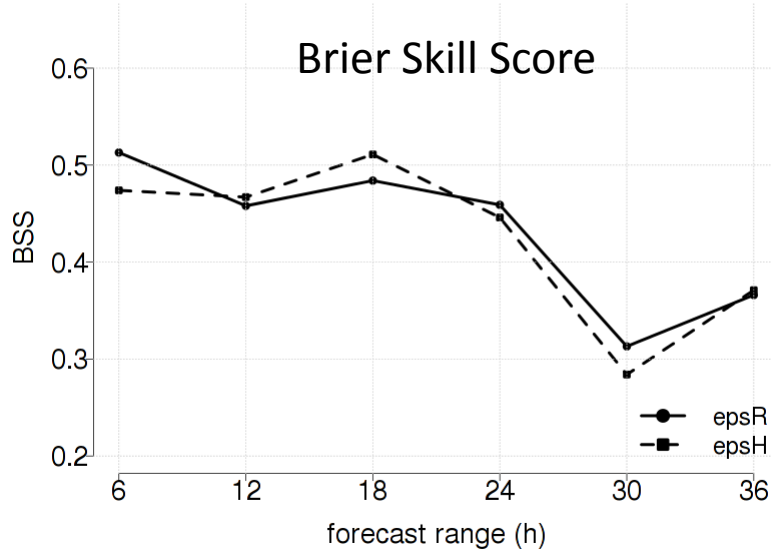
Northern Italy high-res – average over 0.2x0.2 deg boxes > 1mm



BS reliability lower is better
BS resolution higher is better

total precipitation over 6h

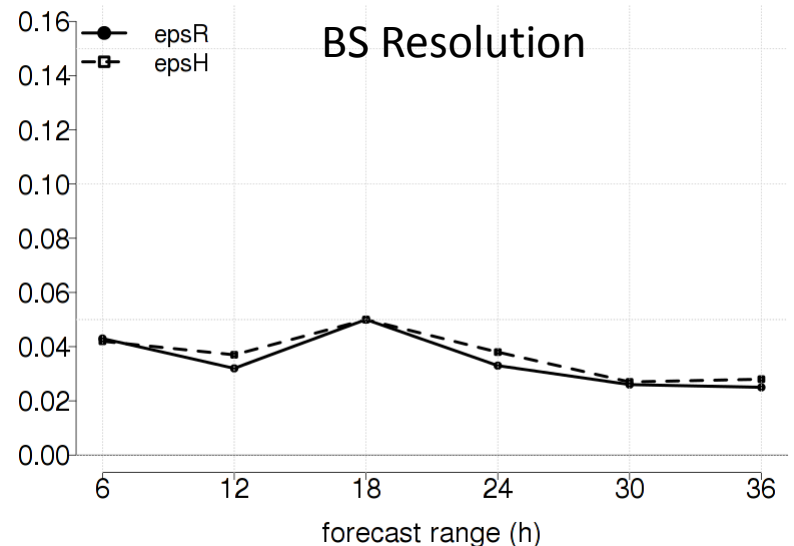
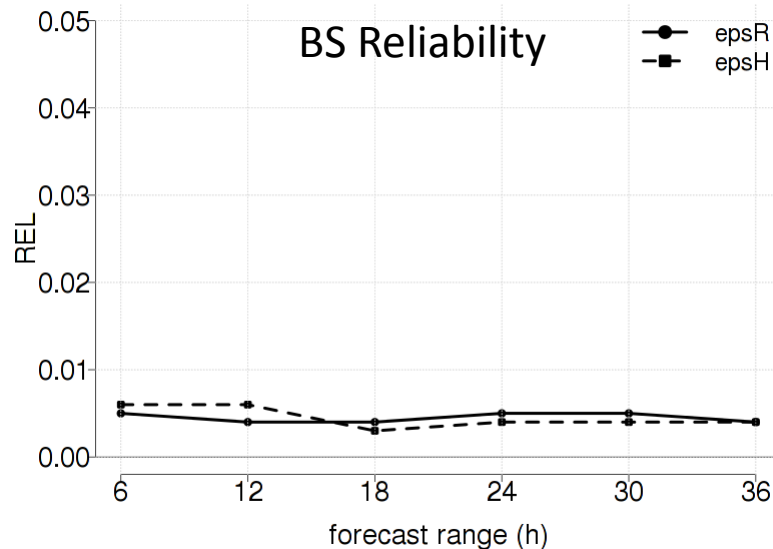
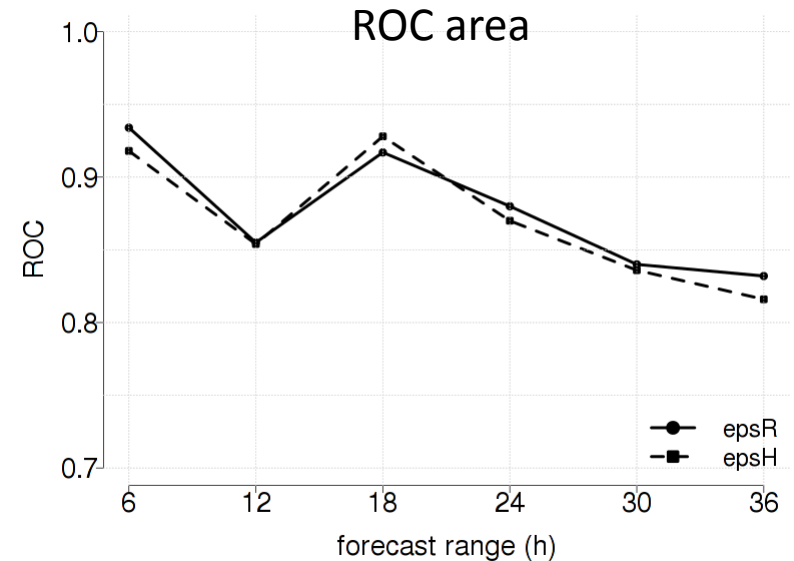
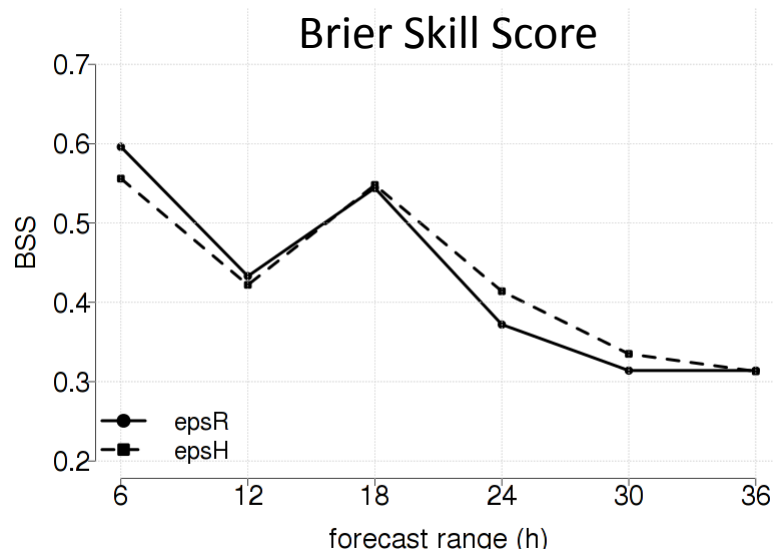
Northern Italy high-res – average over 0.2x0.2 deg boxes > 5mm



BS reliability lower is better
BS resolution higher is better

total precipitation over 6h

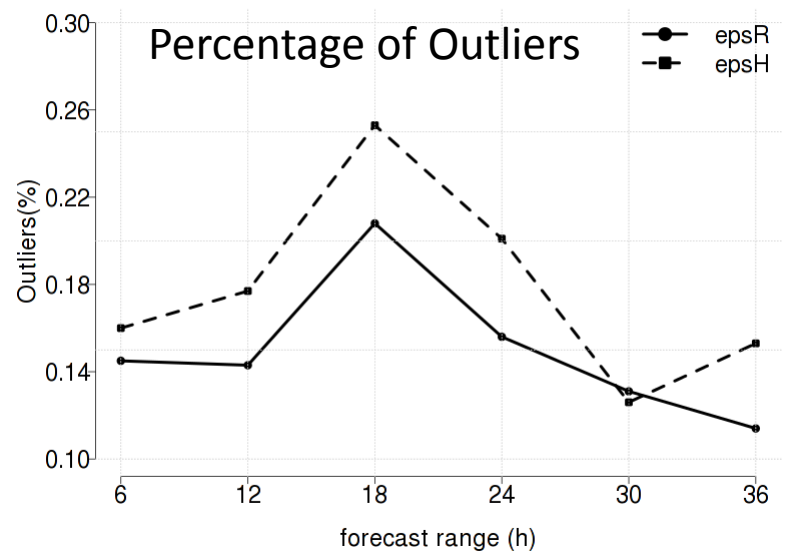
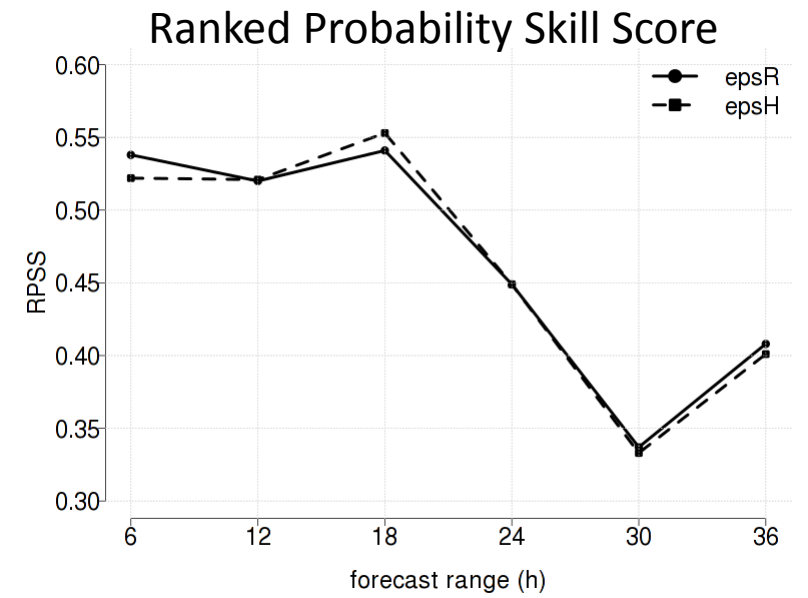
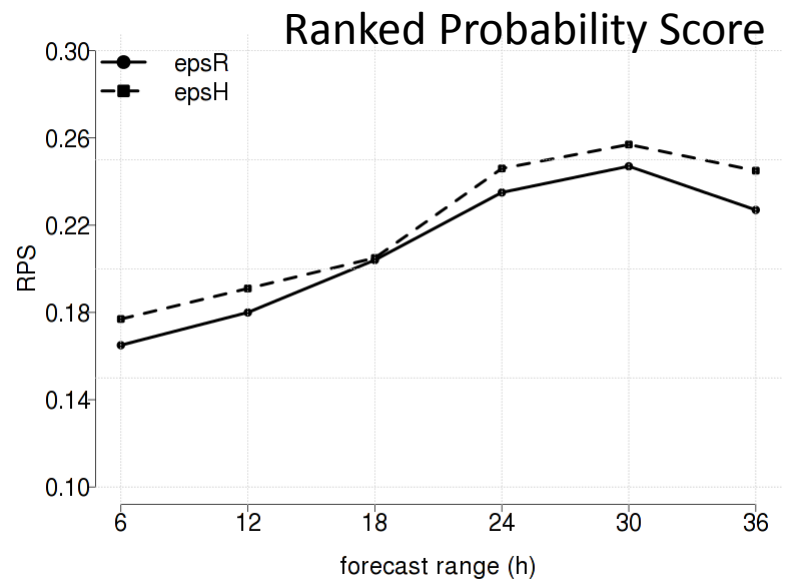
Northern Italy high-res – average over 0.2x0.2 deg boxes > 10mm



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

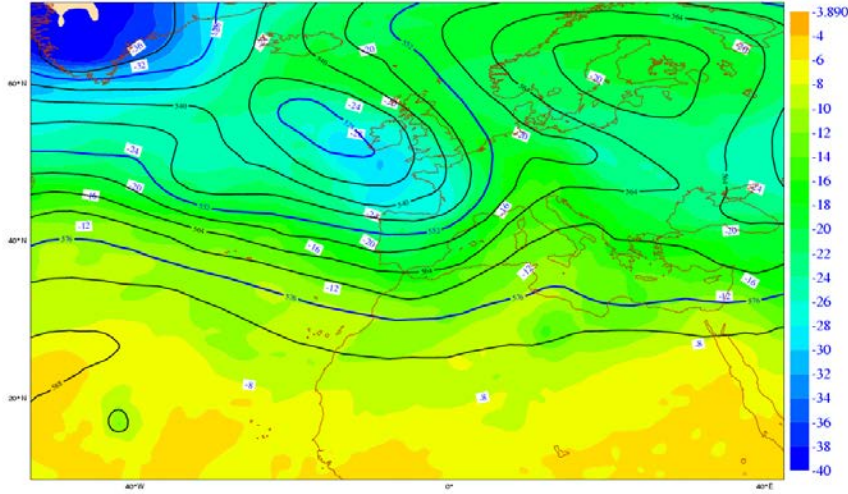


R slightly better

Two flood events

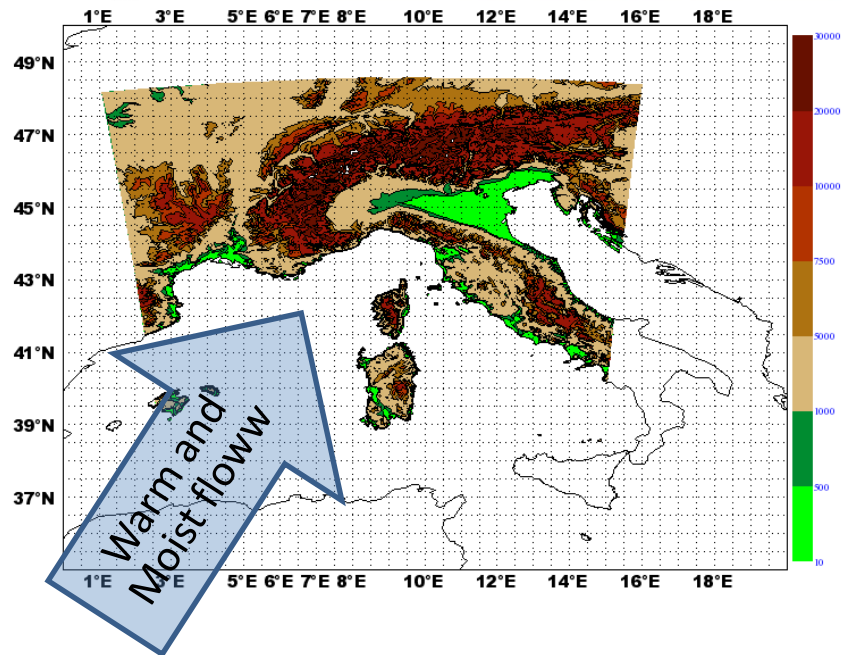
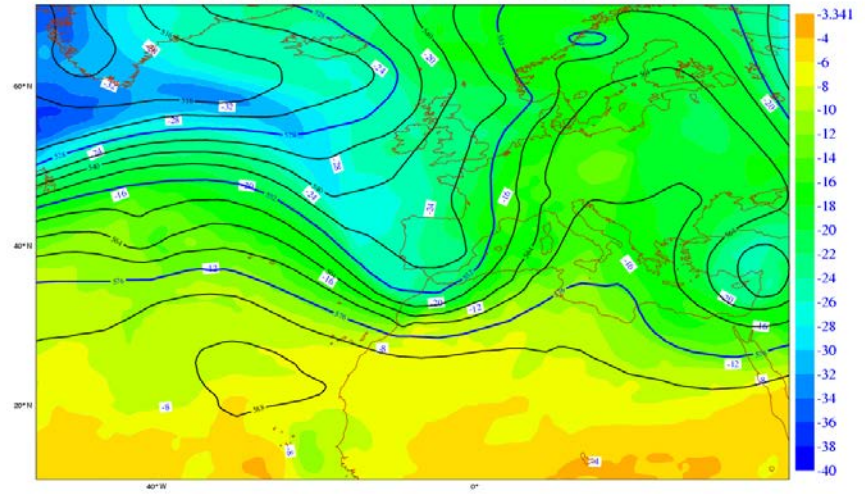
Liguria Cinque Terre - 25/10/2011

ECMWF AN VT:Tue 2011-10-25 12UTC 500hPa T/ Z



Genova – 04/11/2011

ECMWF AN VT:Fri 2011-11-04 18UTC 500hPa T/ Z

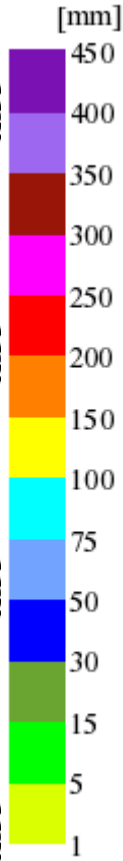
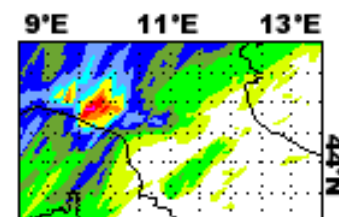
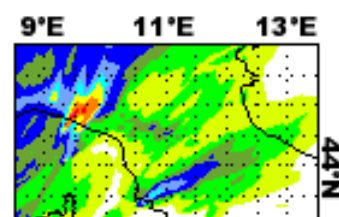
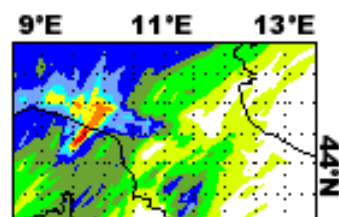
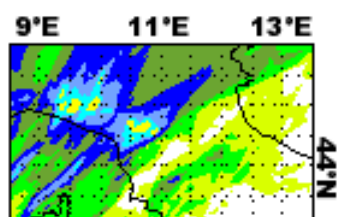
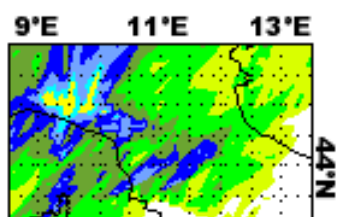
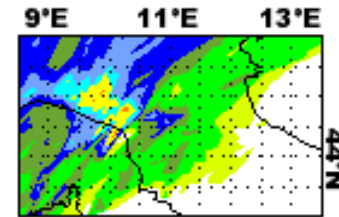
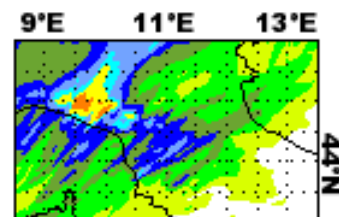
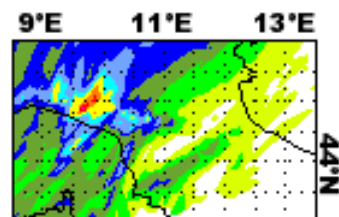
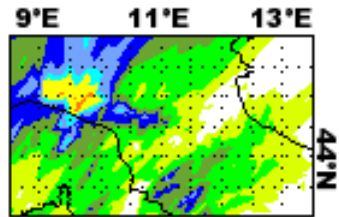
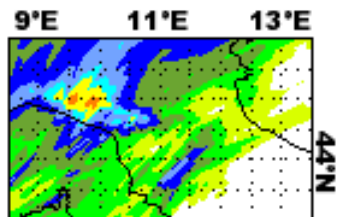
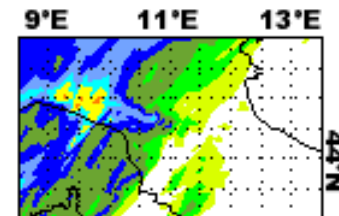
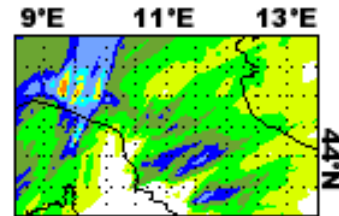
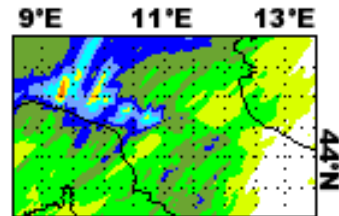
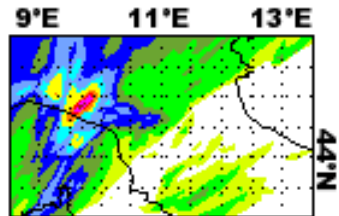
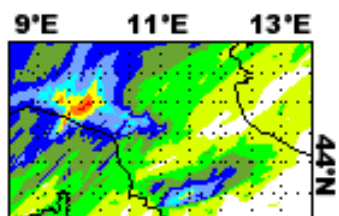
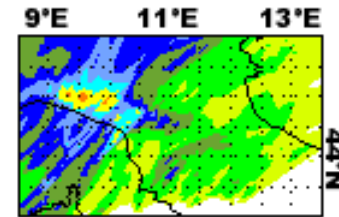
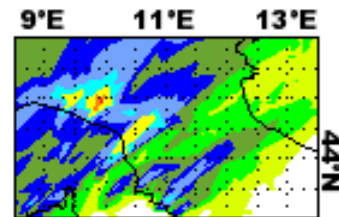
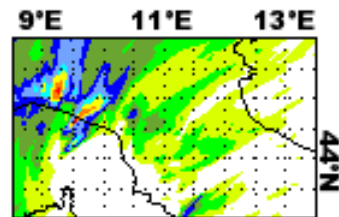
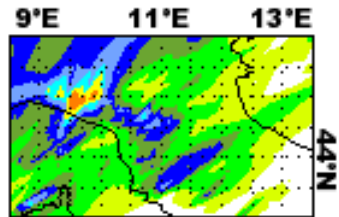
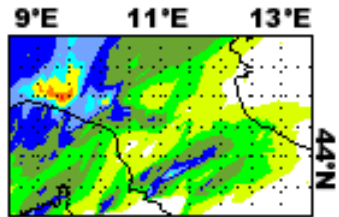
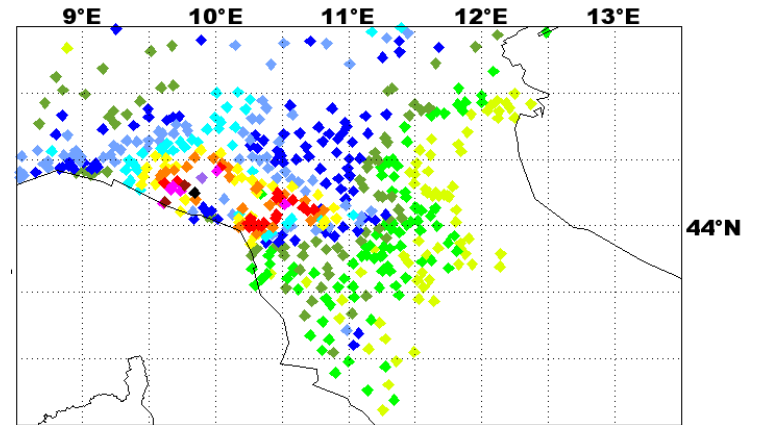
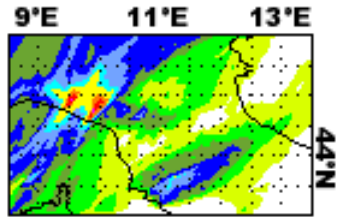


25 October 2011

5 Terre flood

epsH

+12-36h

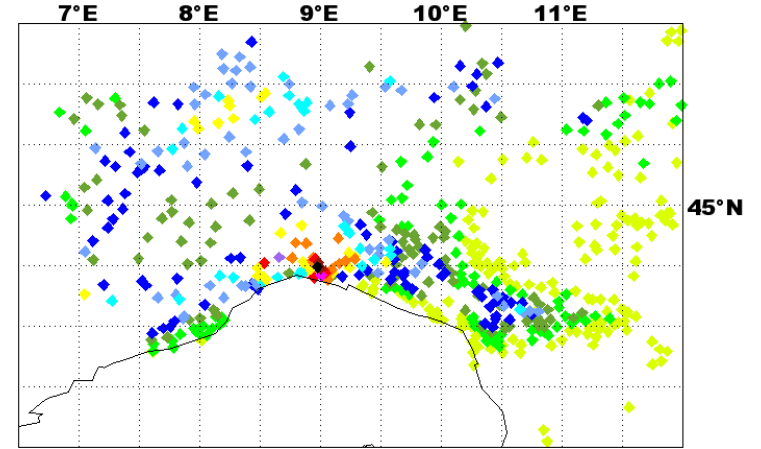
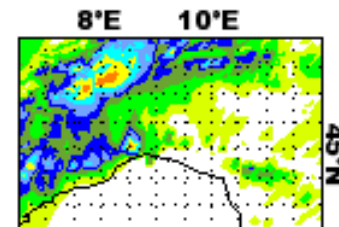
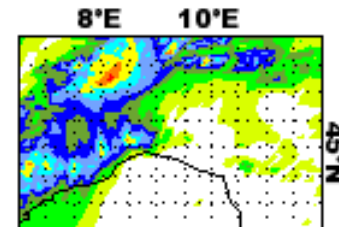
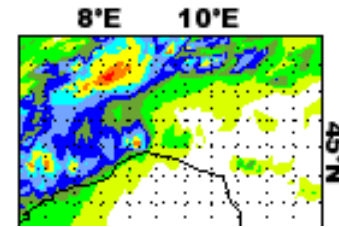
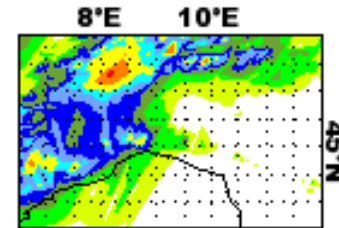
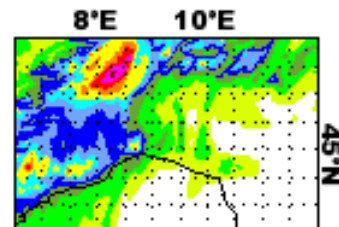
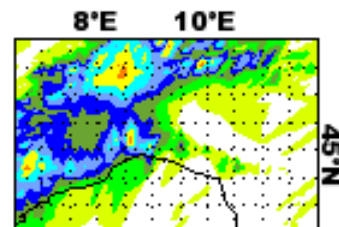
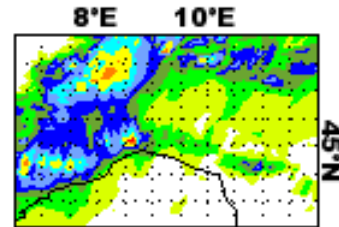
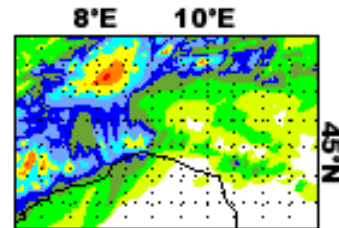
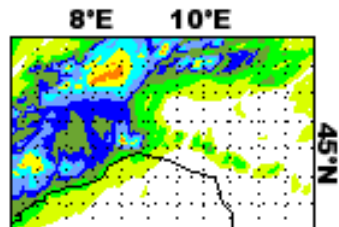
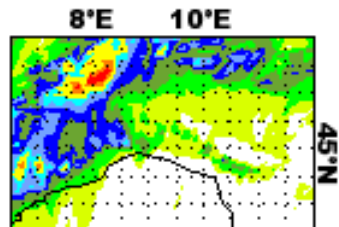
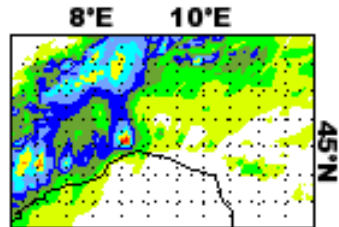
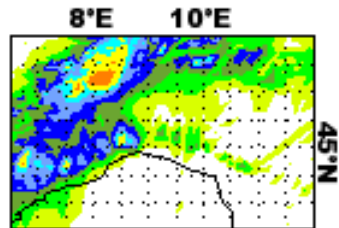
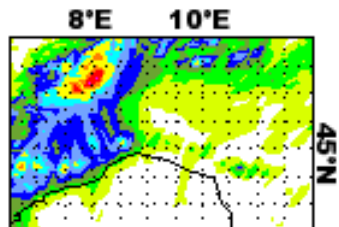
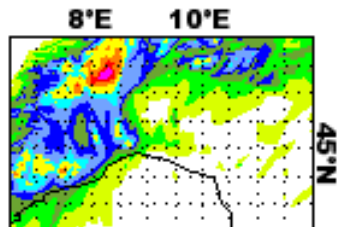
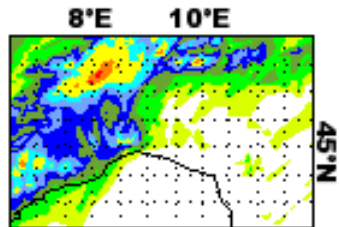
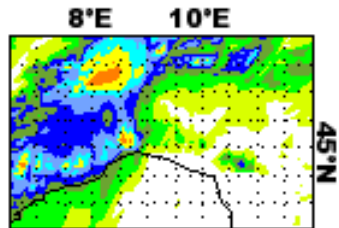
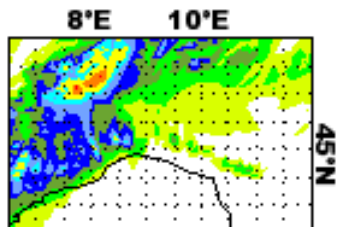
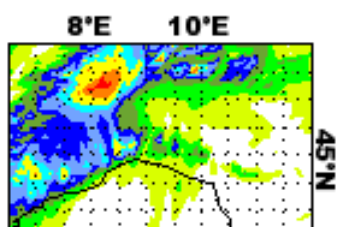
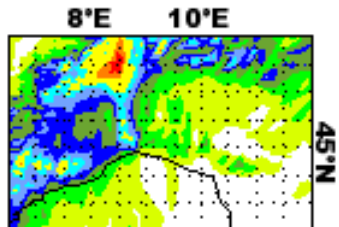
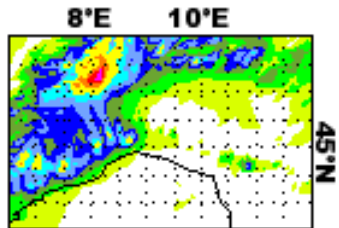
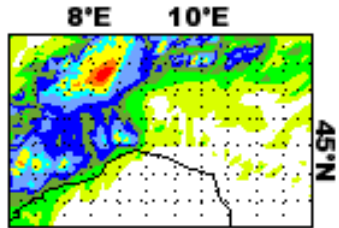


4 November 2011

Genova flood

epsR

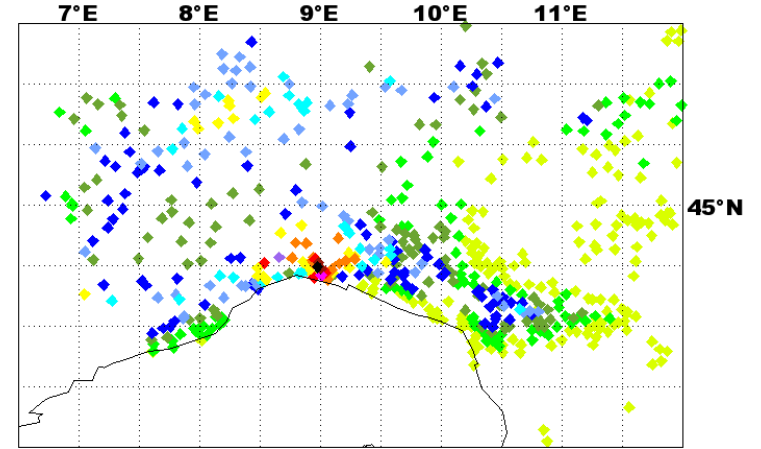
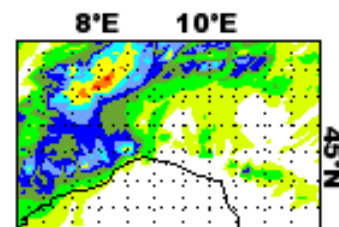
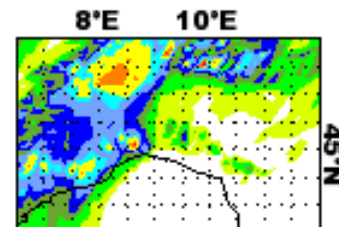
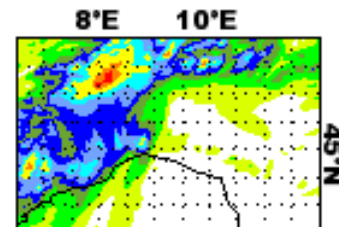
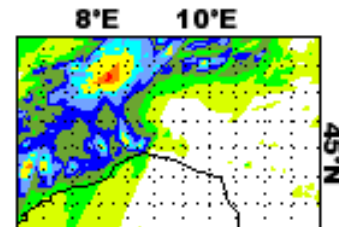
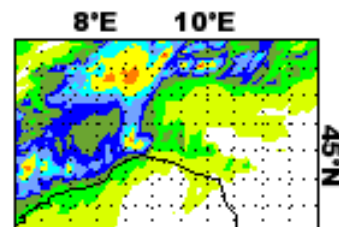
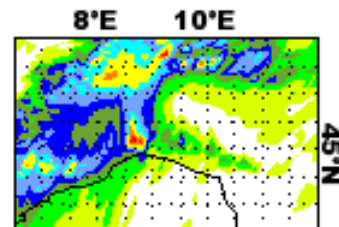
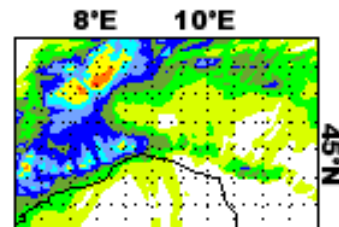
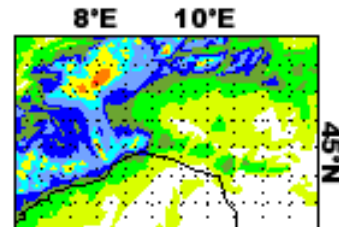
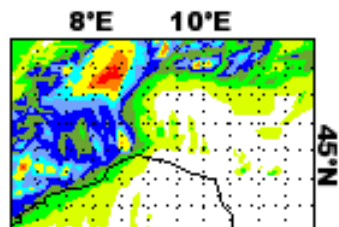
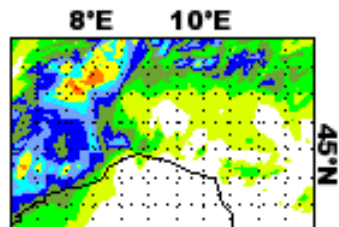
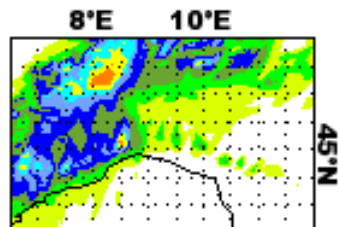
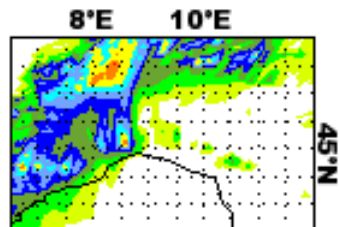
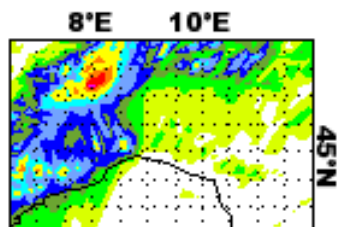
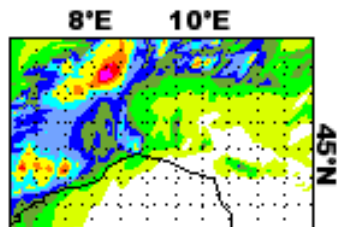
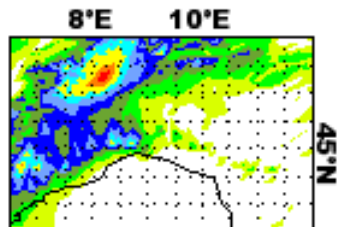
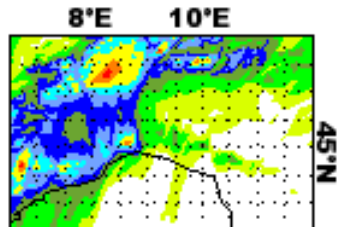
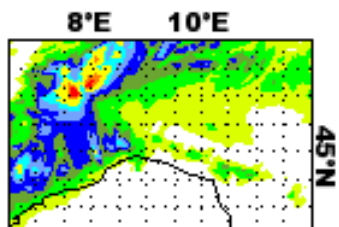
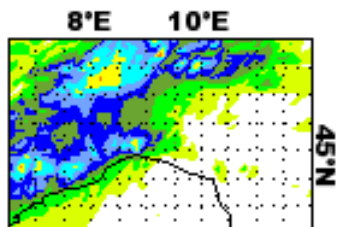
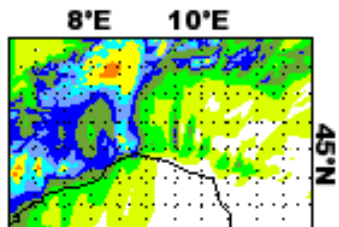
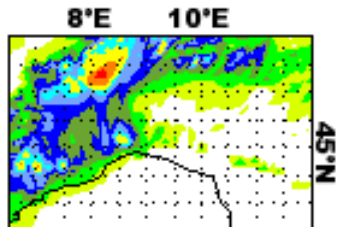
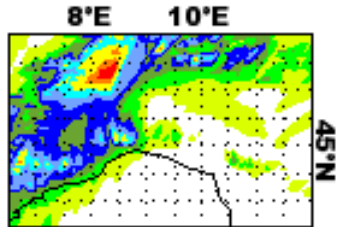
+12-36h



4 November 2011 Genova flood

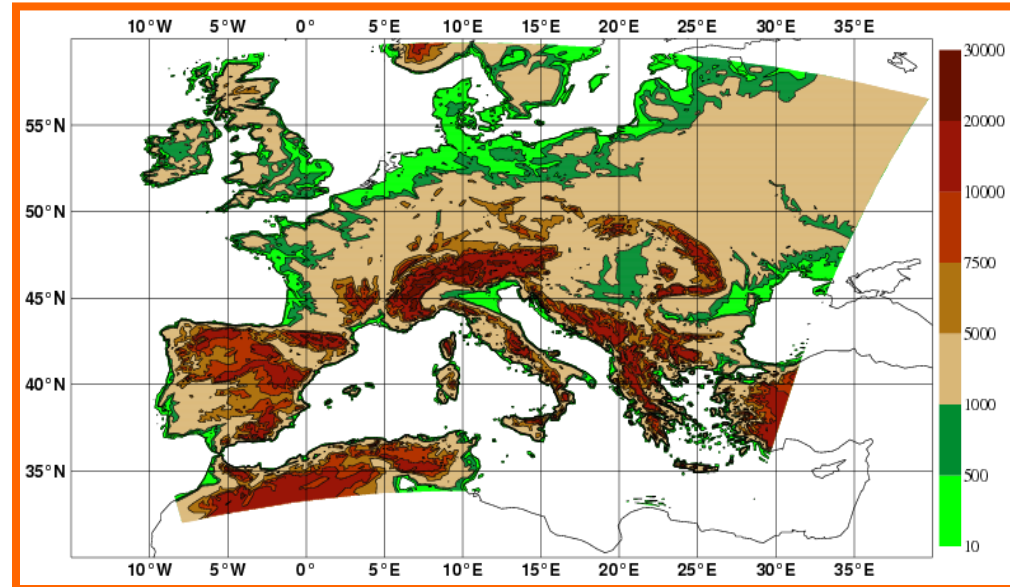
epsH

+12-36h



COSMO-LEPS

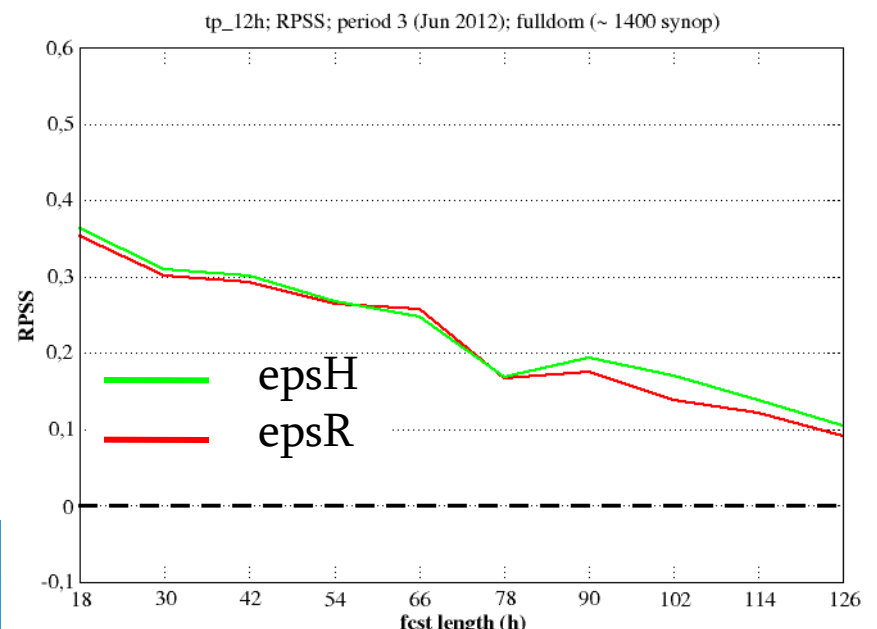
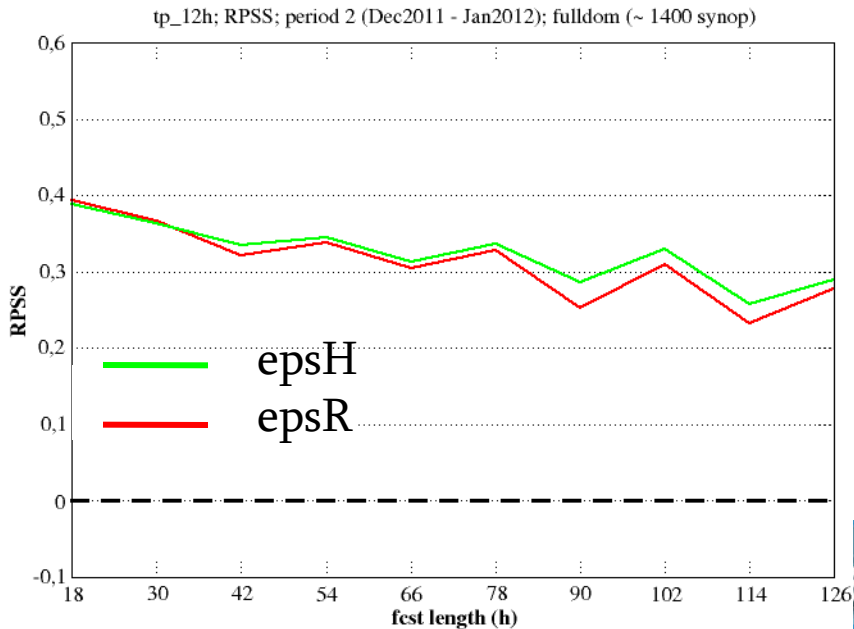
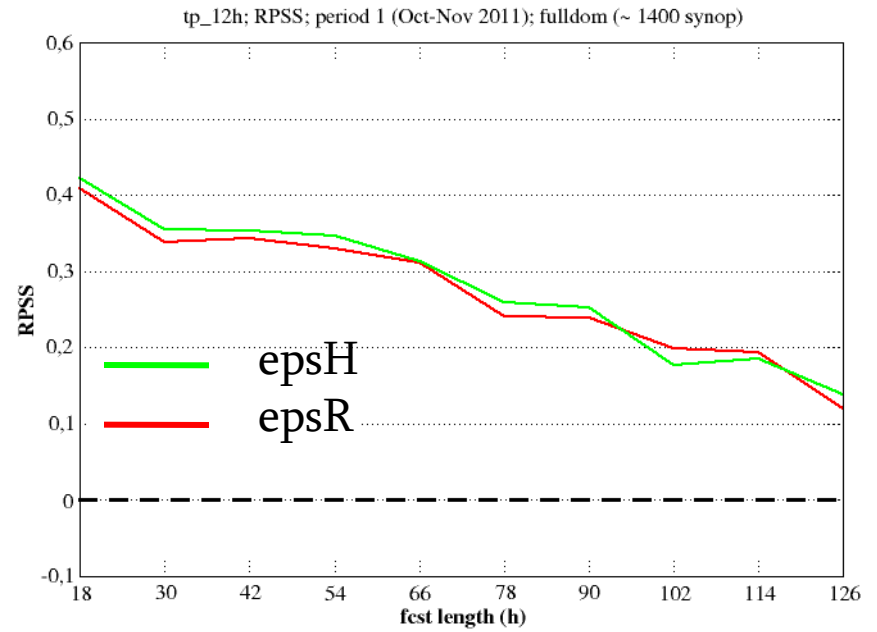
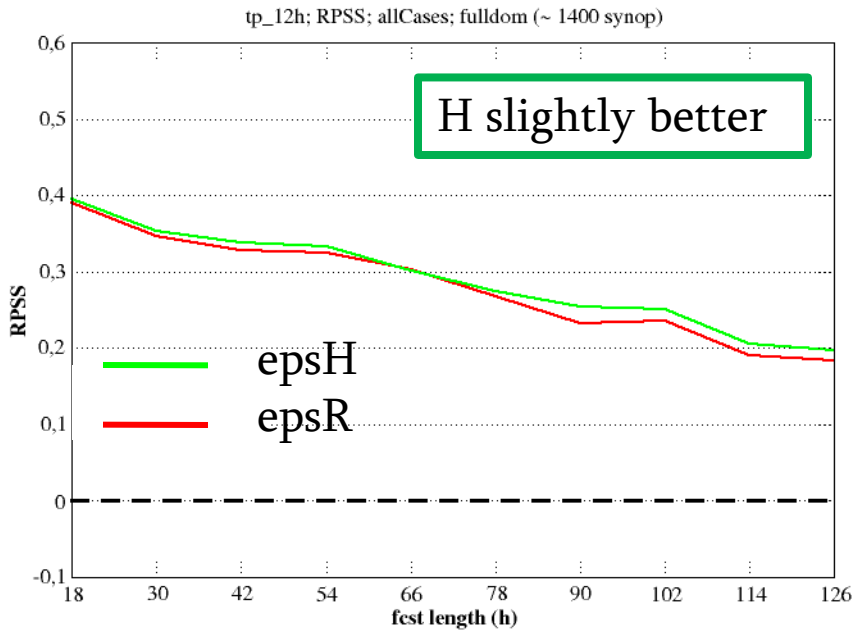
- COSMO Consortium ensemble, 7 km, 40 levels
- ICs and BCs from 16 members out of two (51+51) ECMWF ENSs
- The 16 member selection is made by:
 - Cluster Analysis (16 clusters) of the 102 EPS members
 - Selection of 16 members as representative of their own cluster
- Perturbations of the model physics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



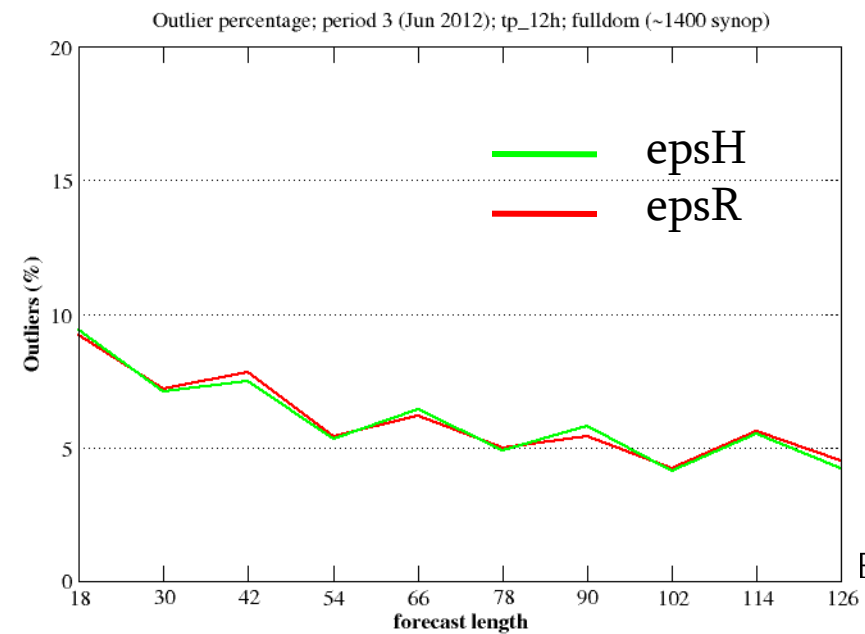
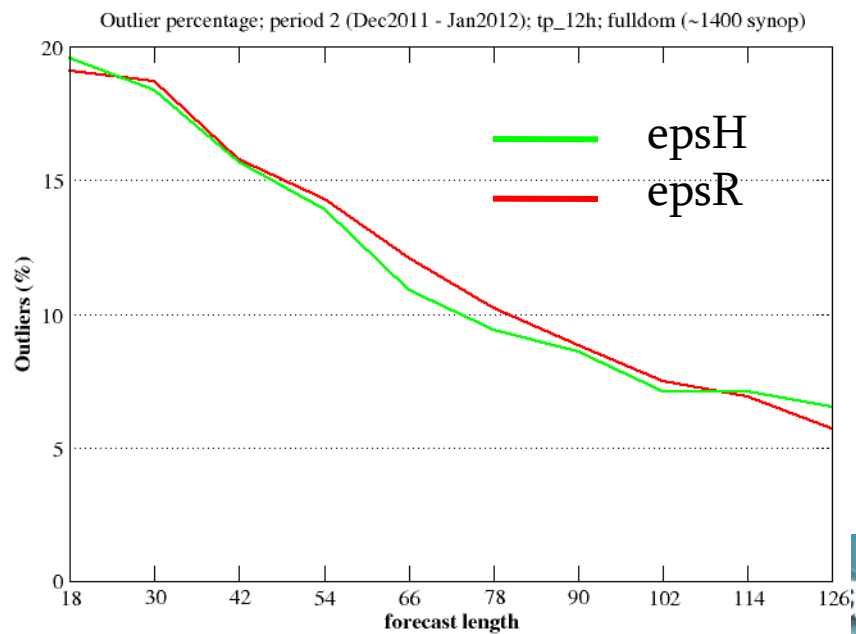
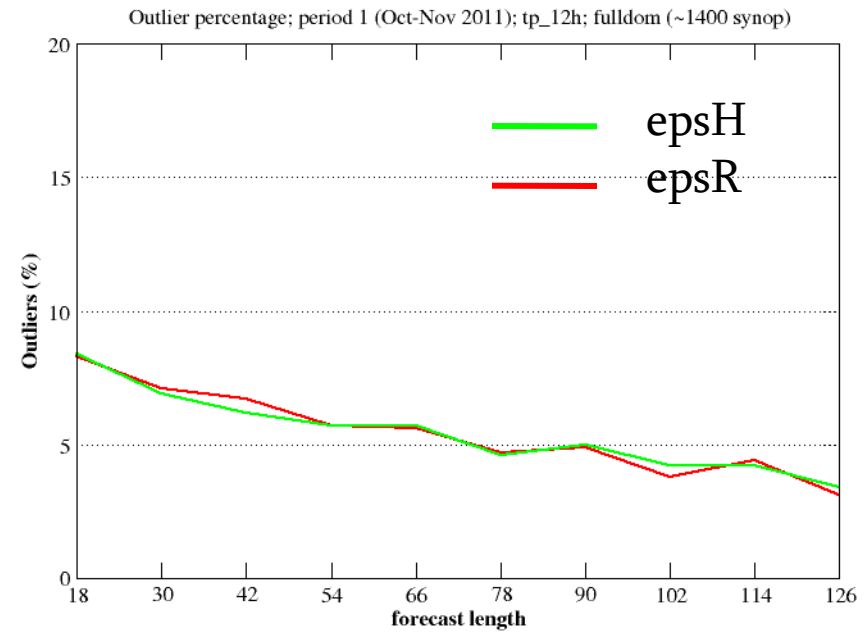
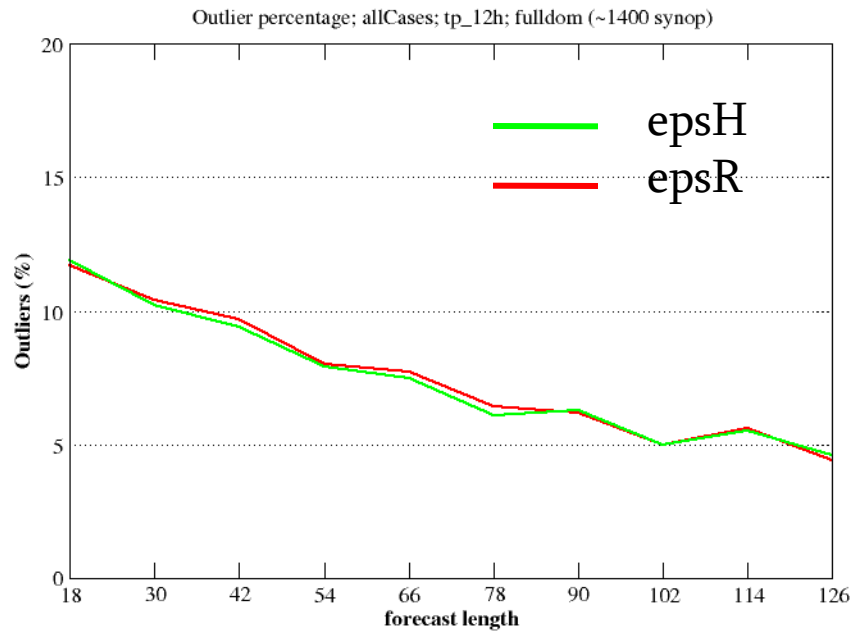
COSMO-LEPS

- 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**

total precipitation over 12h



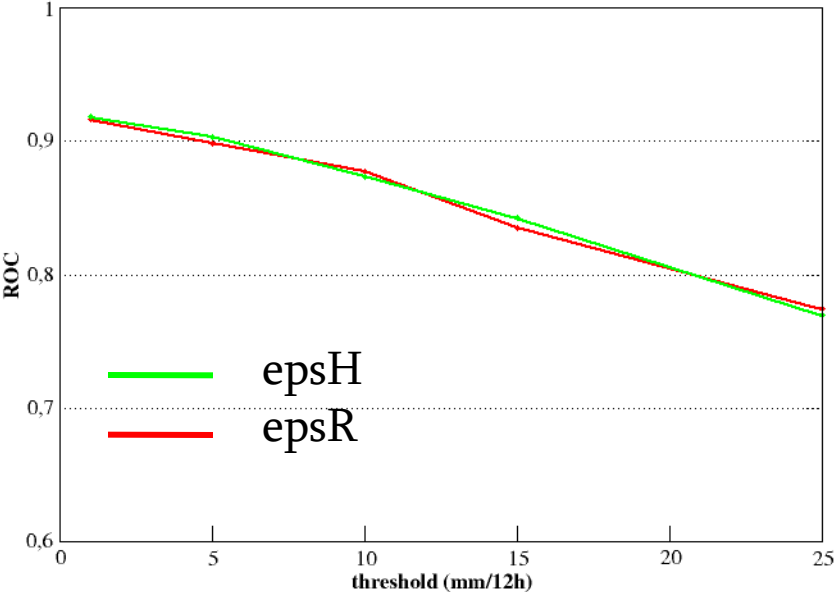
total precipitation over 12h



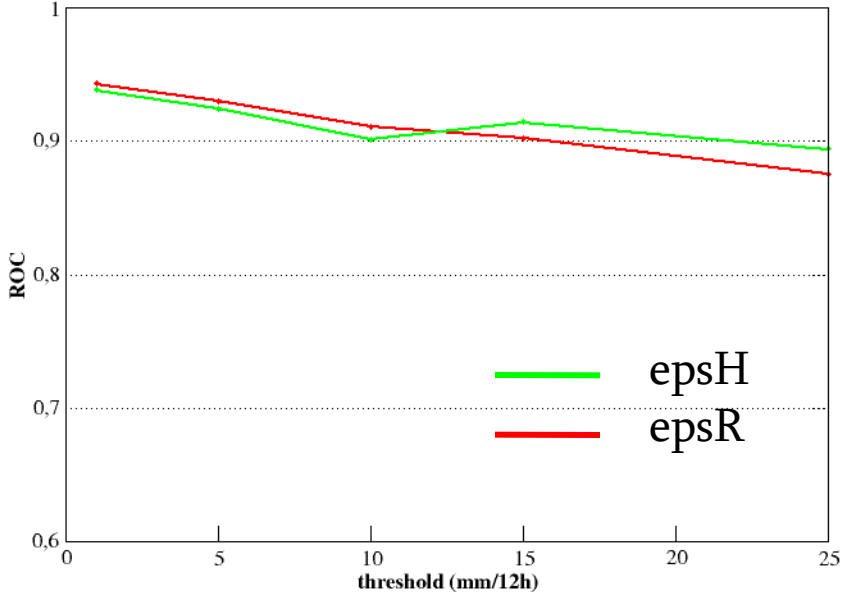
ROC area higher is better

total precipitation over 12h (fulldom)

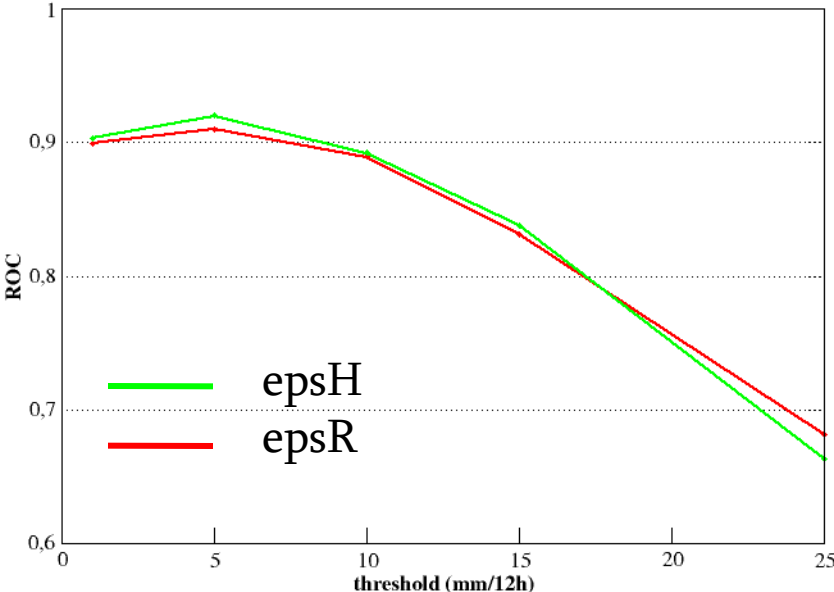
ROC area values; allCases; fc 30-42h; fulldom (~1400 synop)



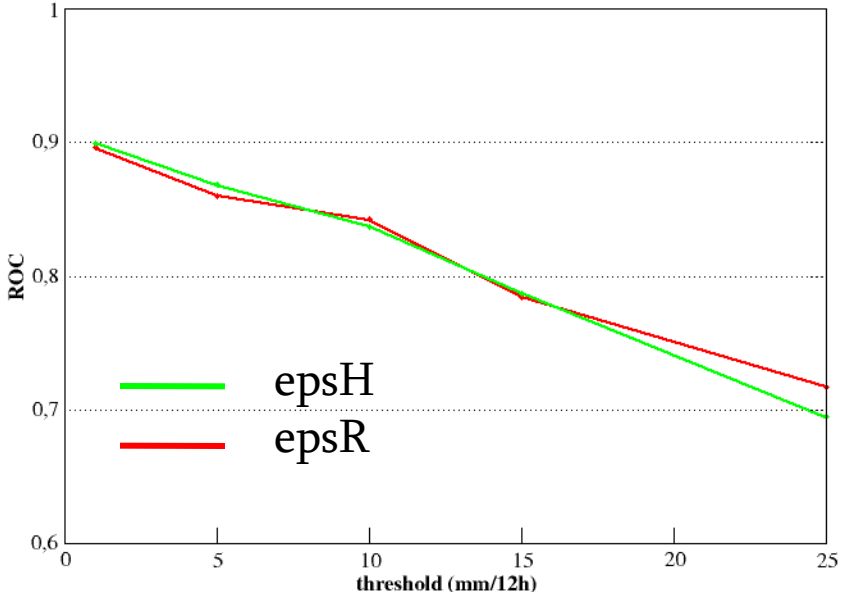
ROC area values; period 1 (Oct-Nov 2011); fc 30-42h; fulldom (~1400 synop)



ROC area values; period 2 (Dec2011 - Jan2012); fc 30-42h; fulldom (~1400 synop)



ROC area values; period 3 (Jun2012); fc 30-42h; fulldom (~1400 synop)



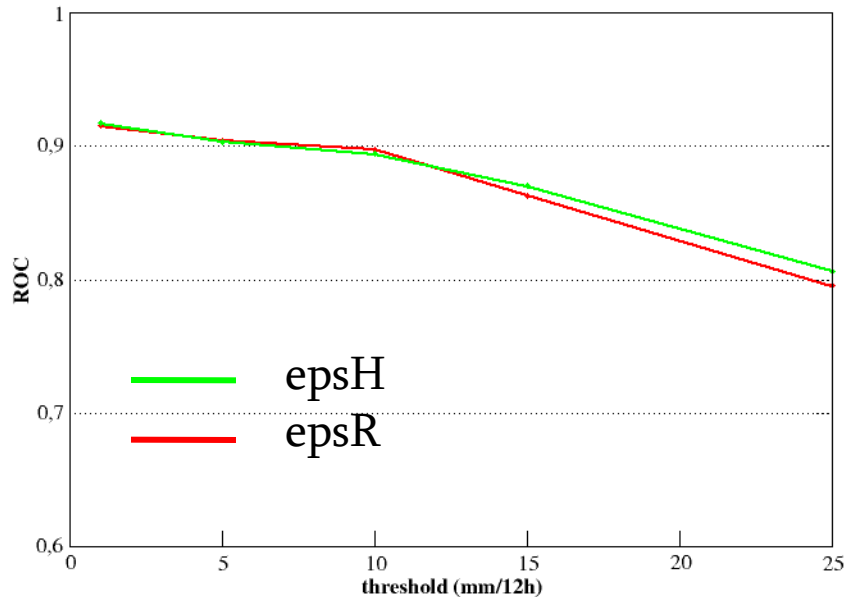
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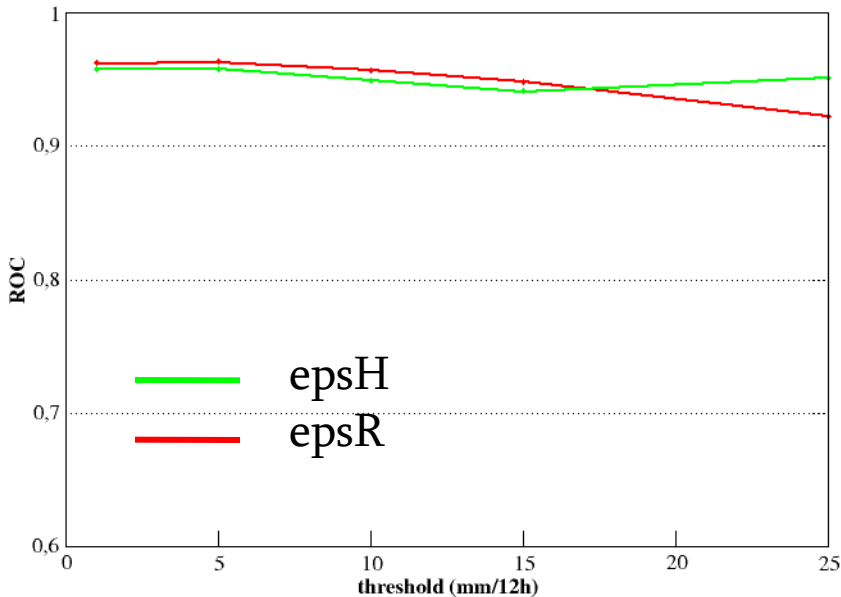
ROC area higher is better

total precipitation over 12h (mapdom)

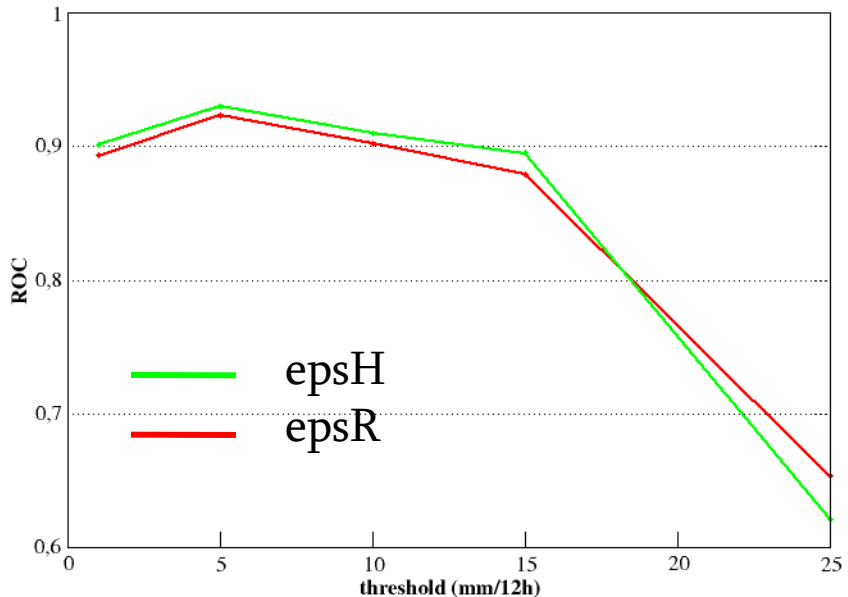
ROC area values; allCases; fc 30-42h; mapdom (~400 synop)



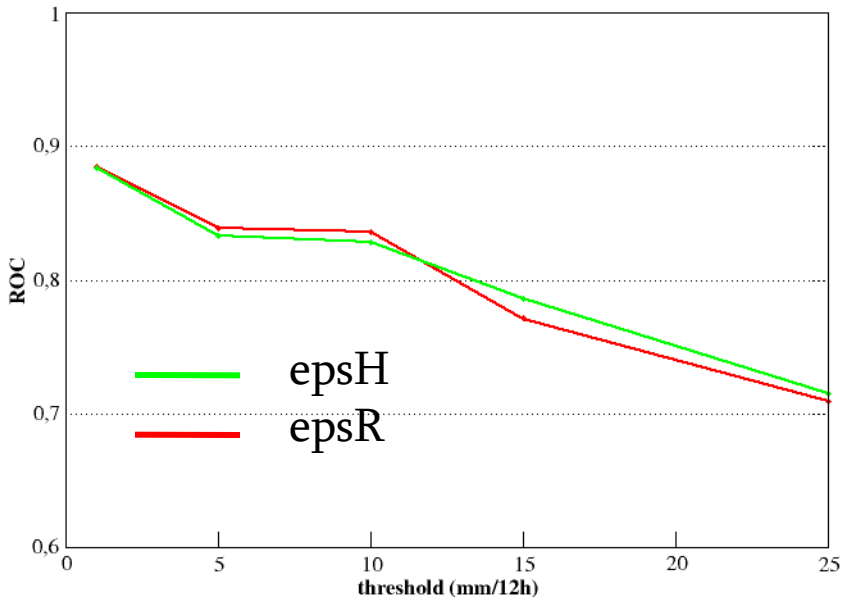
ROC area values; period 1 (Oct-Nov 2011); fc 30-42h; mapdom (~400 synop)



ROC area values; period 2 (Dec2011 - Jan2012); fc 30-42h; mapdom (~400 synop)



ROC area values; period 3 (Jun2012); fc 30-42h; mapdom (~400 synop)



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 these 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 !