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# Probabilistic verification of COSMO-LEPS using VERSUS: what is good, what is bad.

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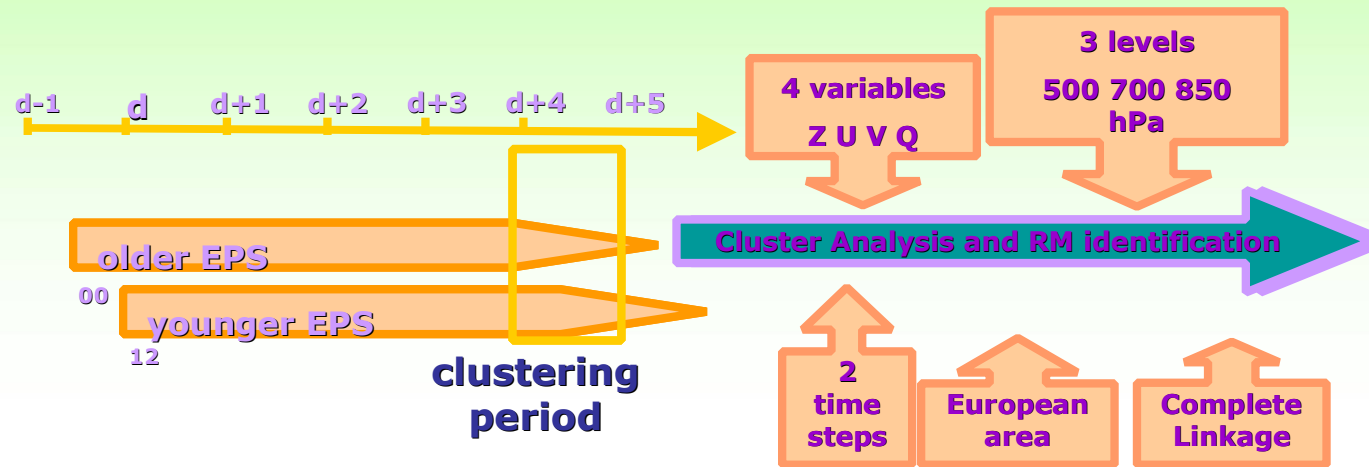
# Aim

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Compare the verification results of COSMO-LEPS using 2 different verification packages:

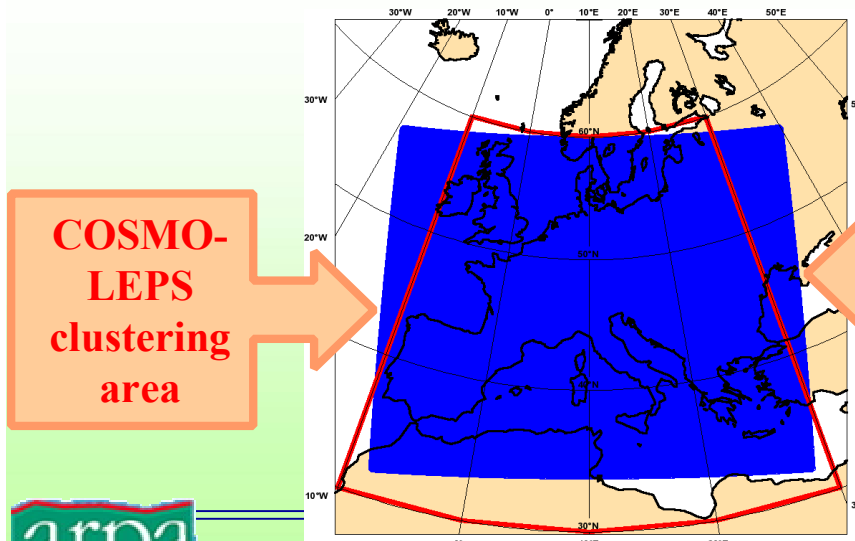
- **ARPA-SIMC “verifica” package**, operationally used for monthly and seasonal verification of COSMO-LEPS since December 2002 (with different forecast ranges from those used in this intercomparison),
- **VERSUS**

# COSMO-LEPS time-critical suite @ ECMWF



16 Representative Members driving the 16 COSMO-model integrations (weighted according to the cluster populations)

using either Tiedtke or IFS-Bechtold convection scheme (members 1-8 T, members 9-16 IFS-B) + perturbations in turbulence scheme and in physical parameterisations



- suite runs twice a day (00 and 12UTC) as a "time-critical application" managed by ARPA-SIMC;
- $\Delta x \sim 7$  km; 40 ML; fc+132h;
- COSMO v5.0 since Feb 2014;
- computer time (50 million BUs for 2013) provided by the ECMWF member states in COSMO.



A.Montani; The COSMO-LEPS system.



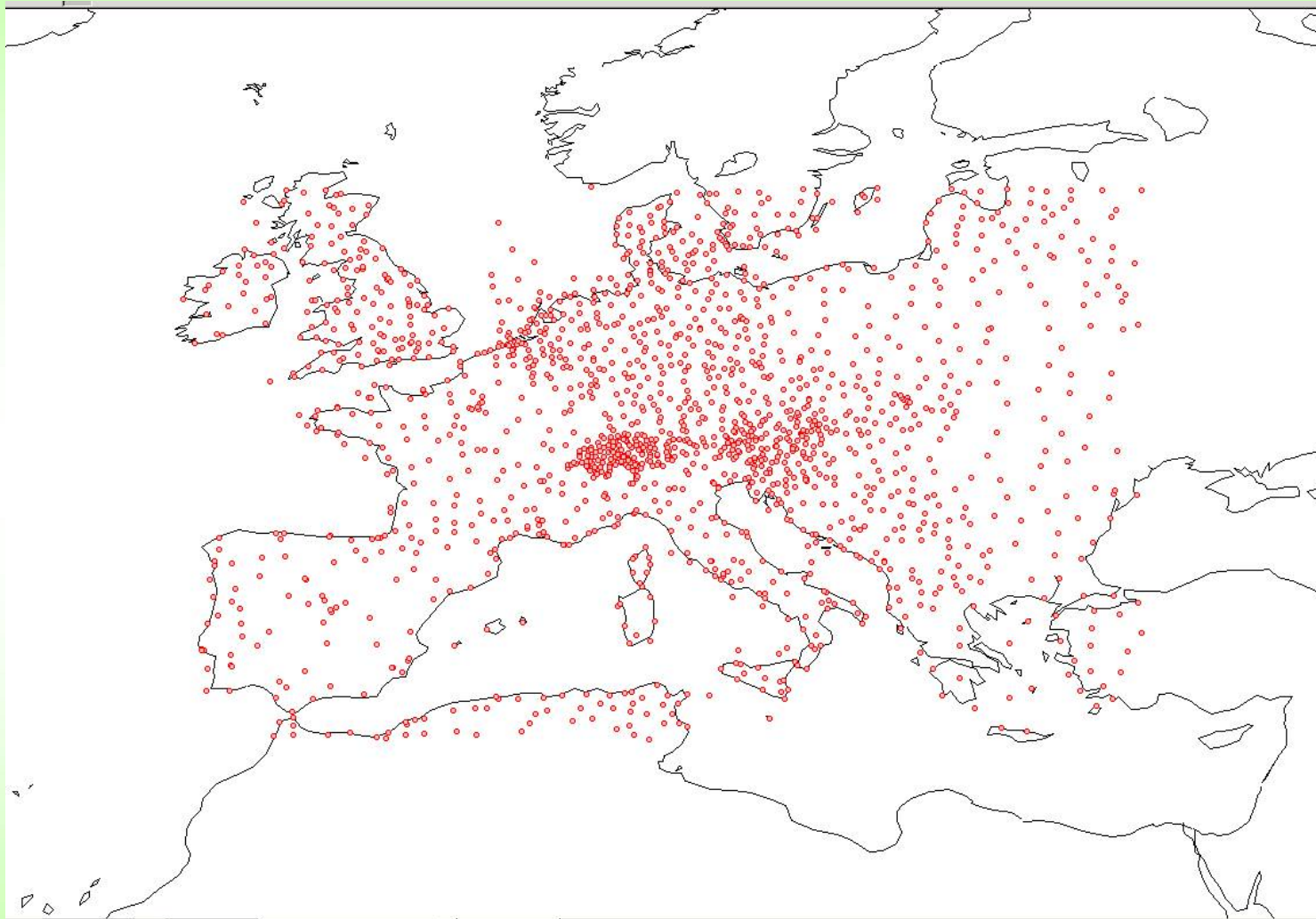
# Verification features

variable: 12h cumulated precip (00-12, 12-24 UTC);  
period : 10-20 March 2014;  
region: 35-58N, 10W-30E;  
grid points: 212065;  
method: nearest grid point; no-weighted fcst;  
obs: synop reports (~ 1770 in ECMWF bufr file; ~ 2882 in Versus);  
fcst ranges (10): 0-12h, 12-24h, ..., 108-120h;  
thresholds (6): 1, 5, 10, 15, 25, 50 mm/12h;  
scores: ROC area, BS, BSS, RPSS.

## Approximate timing

	<b>verifica</b>	<b>Versus</b>
• Load obs	30 min	240 min
• Load forecast	60 min	60 min
• Scores	90 min	120 min
Total	180 min (1.5 h)	420 min (7 hours)

# Verification network

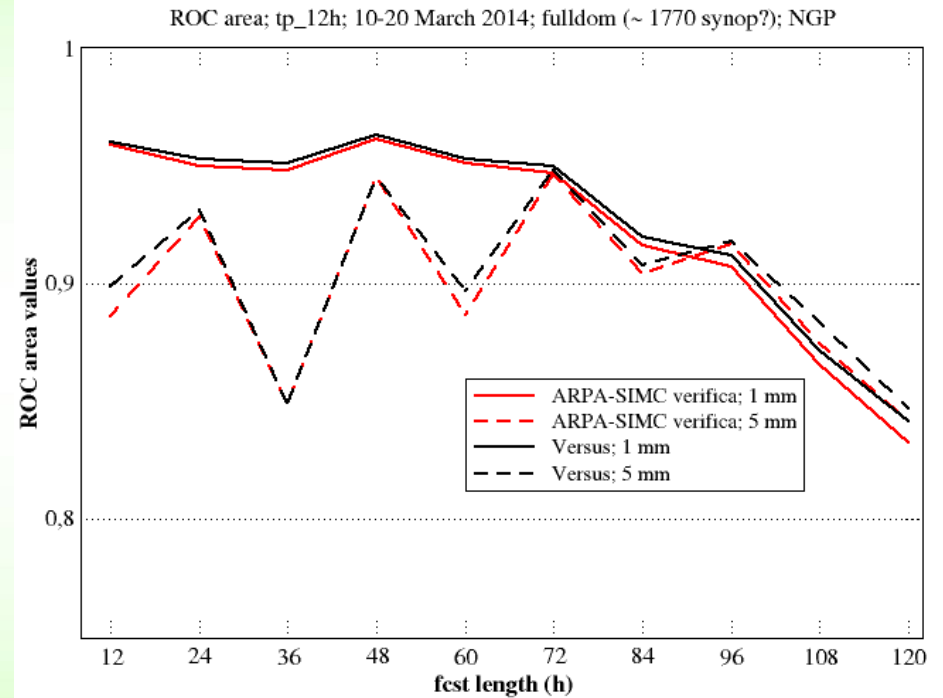
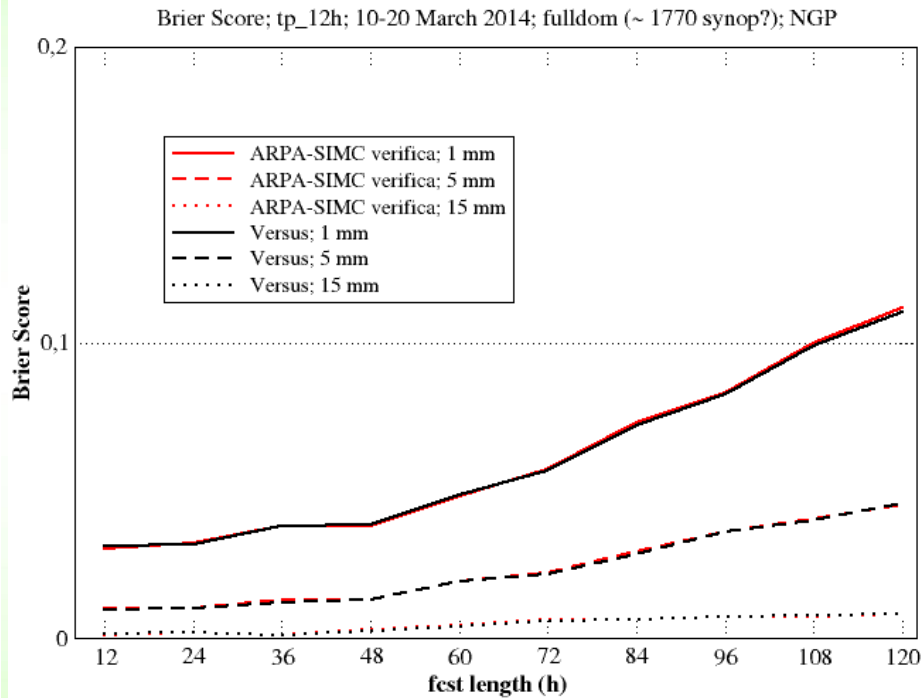


synop reports

# Nice results: Brier Score and ROC area

➤ BS measures the mean squared difference between forecast and observation in probability space (the lower, the better); it is equivalent to MSE for deterministic forecast.

➤ Area under the curve in the HIT rate vs FAR diagram (the higher, the better); valuable forecast systems have ROC area values  $> 0.6$ .



BS: identical scores

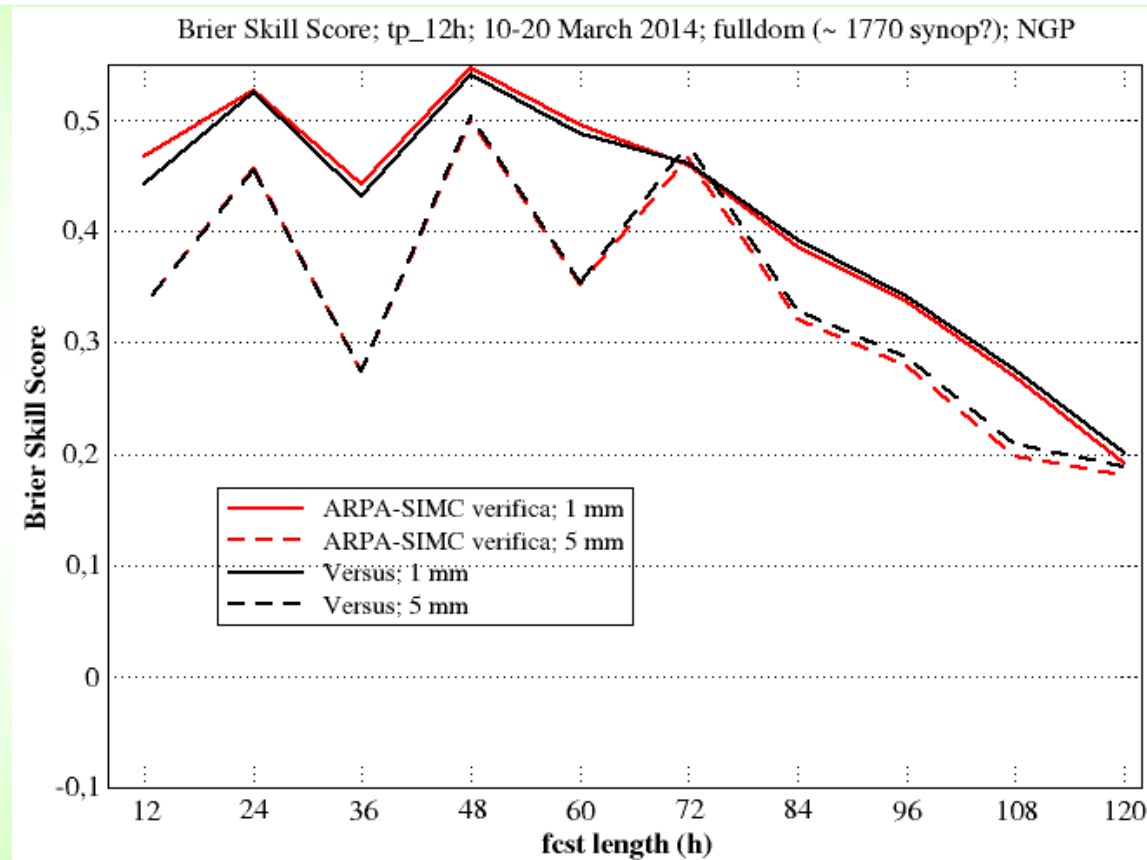
ROC area: very similar scores.

**Verifica** and **VERSUS** do NOT use exactly the same numbers of stations → small differences.  
Similar results for the other thresholds.



# Still nice results: Brier Skill Score

- BSS is written as  $1 - BS / BS_{ref}$ . **Sample climate** is the reference system. Useful forecast systems if  $BSS > 0$ .
- $BSS = (BS_{resolution} - BS_{reliability}) / BS_{uncertainty}$



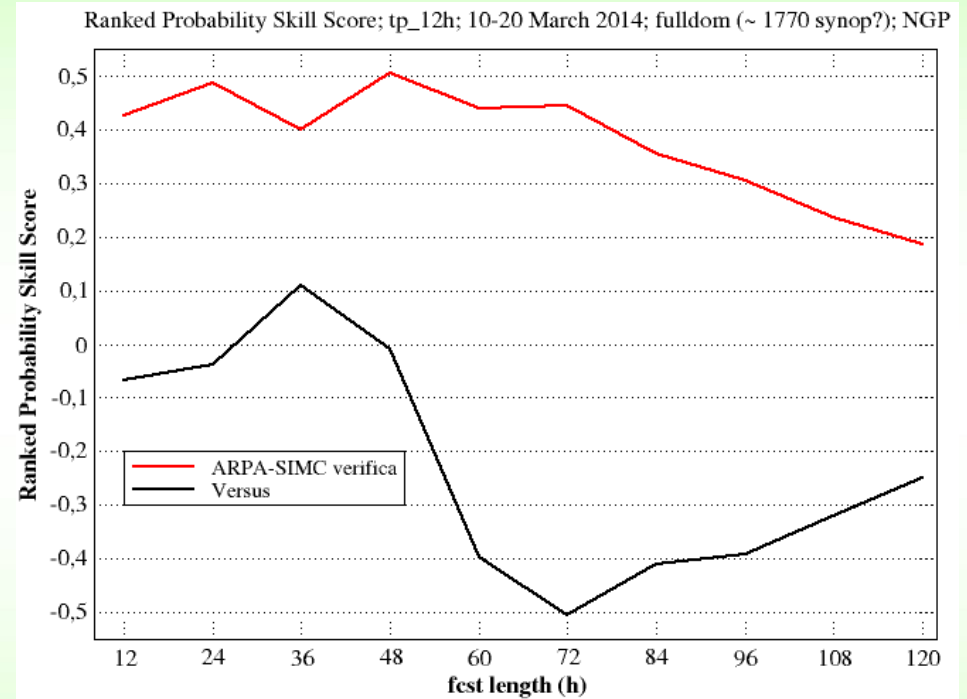
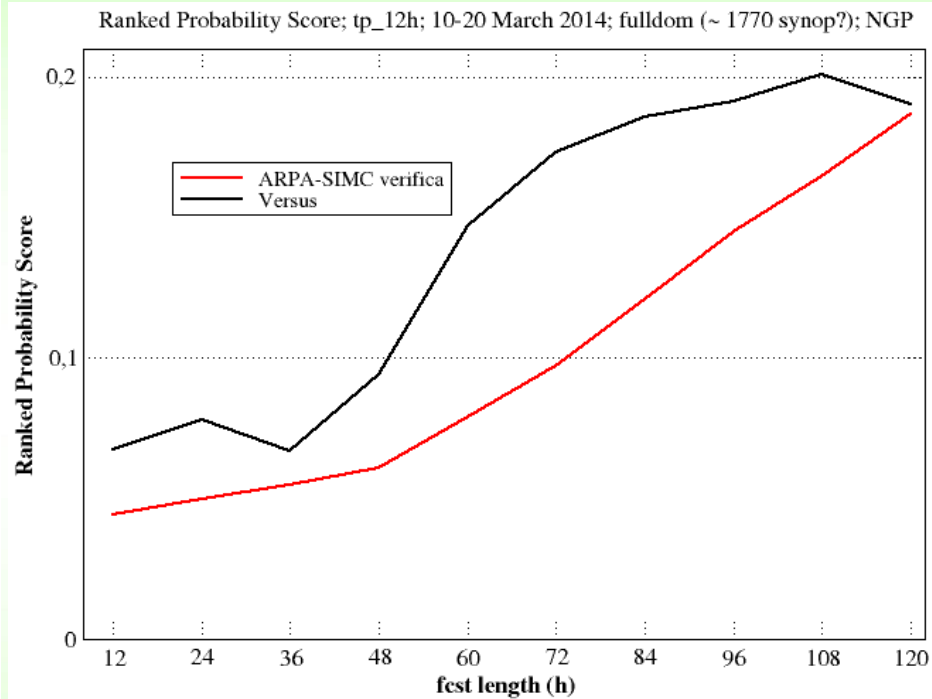
Very high similarity for the scores obtained with the 2 packages (check the 1mm threshold at +12h).

**Verifca** and **VERSUS** do NOT use exactly the same numbers of stations → small differences.

# Less nice results: Ranked Probability (Skill) Score

➤ RPS is the extension of the BS to the multi-event situation. It is a sort of BS “cumulated” over all thresholds; the lower the better.

➤ RPSS is written as  $1 - RPS / RPS_{ref}$ . **Sample climate** is the reference system; useful forecast systems for  $RPSS > 0$ .



At all forecast ranges, very different results for scores cumulated over different thresholds.  
 “Worse” scores using VERSUS (RPSS almost ways negative).





# Versus features

- Versus 3.2
- Problem with stratification registration for all COSMO-LEPS domain (2882 stations)
  - Need to modify php.ini in /etc/php5/apache2/ & /etc/php5/cli/ max\_input\_vars=20000
  - With this parameter set we succeed in running verification for 10 days
  - 1 month verification didn't work

10-day verification

1-month verification

Description	Date	Data Avail.	Susp. OBS	Numeric Results	Graphic
<a href="#">10 qq new cleps monthly 12 ore nearest marzo 2014</a>	2014-03-10 2014-03-20	pairs=11			<a href="#">Modify</a> <a href="#">Show</a> <a href="#">Down.</a> <a href="#">Delete</a>
[PRECIPITATION]					
<a href="#">10 qq prova cleps monthly 12 ore nearest marzo 2014</a>	2014-03-10 2014-03-20	pairs=11			<a href="#">Modify</a> <a href="#">Show</a> <a href="#">Down.</a> <a href="#">Delete</a>
[PRECIPITATION]					
<a href="#">120 h 10 qq new cleps monthly 12 ore nearest marzo 2014</a>	2014-03-10 2014-03-20	pairs=11			<a href="#">Modify</a> <a href="#">Show</a> <a href="#">Down.</a> <a href="#">Delete</a>
[PRECIPITATION]					
<a href="#">120h cleps 12 ore nearest MAM 2014</a>	2014-03-01 2014-05-31	Yes			
[PRECIPITATION]					

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MODELING

# Open issues

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- Outliers are not computed.
- In the file NumericalData.txt,
  - numerical values of the ROC area are not written (appear only in PDF files); have them in the same way as BS/BSS/RPS/RPSS;
  - have Outliers, Rank Histograms values reported;
  - write results for all thresholds anyway, although no occurrences are found.
- Forecast-based verification: need to match forecast ranges and observations (in one month, you may lose up to 7 days).
- COSMO-LEPS verification is operationally performed over the ranges 06-18Z, 18-06Z to distinguish between day-time and night-time performance; at the moment, this cannot be done.

# About thresholds

Consortium  
Related links  
Contact



Documents

User Manual  
Technical Manual  
Glossary

Criteria: 120 h 10 gg new\_cleps monthly 12 ore nearest  
marzo 2014

Index: BRIER

From: 2014-03-10 To: 2014-03-20

Step	Index Value	Number Value	Start Threshold	End Threshold
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From: 2014-03-10 To: 2014-03-20

12	0.030964	12715	1	9999
12	0.0092942	12715	5	9999
12	0.00315511	12715	10	9999
12	0.00124975	12715	15	9999
12	0.000261748	12715	25	9999
12	0.0000789545	12715	50	9999
24	0.0317394	12556	1	9999
24	0.0101866	12556	5	9999
24	0.00440775	12556	10	9999
24	0.00165944	12556	15	9999
24	0.000234885	12556	25	9999
36	0.0375814	12715	1	9999
36	0.0121098	12715	5	9999
36	0.00327185	12715	10	9999
36	0.000996301	12715	15	9999
36	0.000152072	12715	25	9999
48	0.0383079	12564	1	9999
48	0.0130482	12564	5	9999
48	0.00631828	12564	10	9999
48	0.00245338	12564	15	9999
48	0.000477244	12564	25	9999
60	0.0482649	12726	1	9999
60	0.0188802	12726	5	9999
60	0.00727902	12726	10	9999
60	0.00389581	12726	15	9999



Configuration



Verification



Report

Data Availability

Verification Archive

On-site

Analysis

Verification Removal

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**Thanks for your attention !**