Intercomparison of limited-area ensemble systems during the MAP D-PHASE OP

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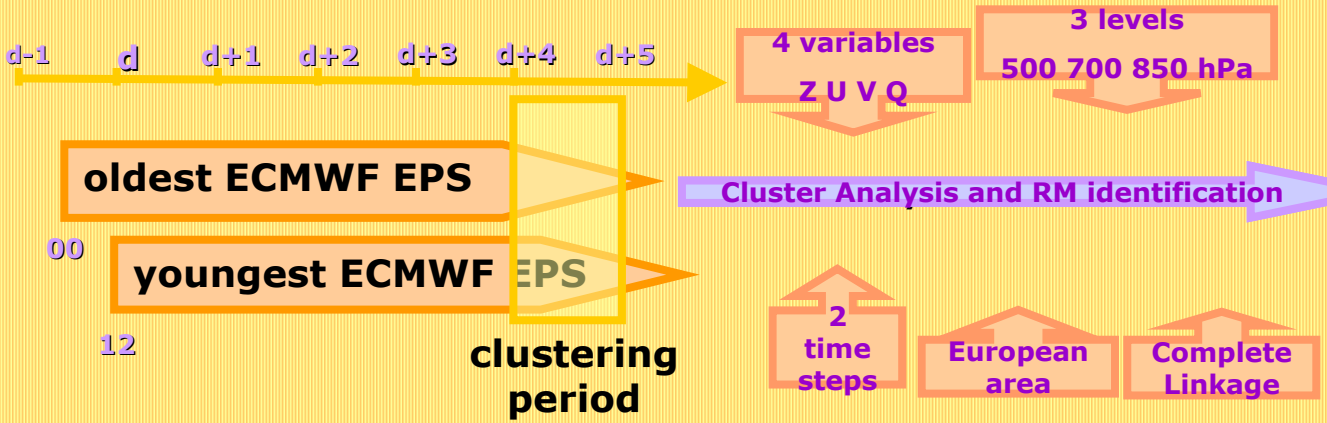
Motivation

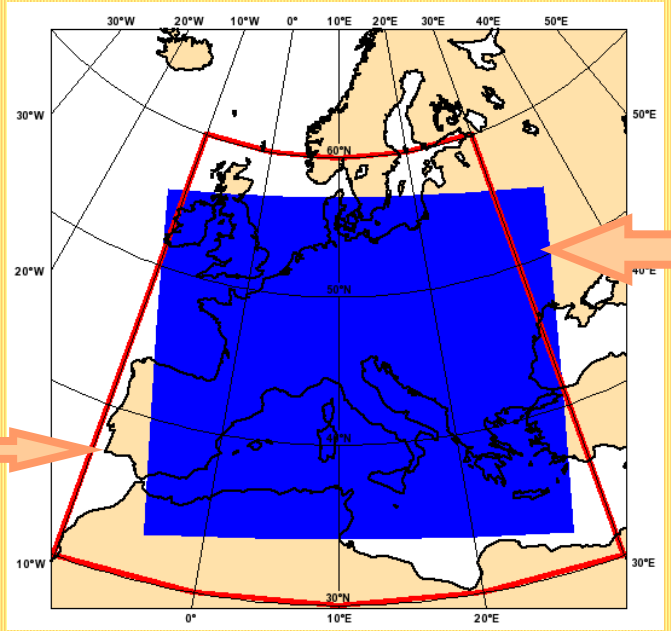
- several different limited-area ensemble systems are currently running over Europe:
  - using different models
  - using different large scale perturbations
  - using different (if any) model perturbations
- are the LAM ensembles of comparable quality?
- what is more important in providing skill? (population, spatial resolution, the model...)
- SRNWP and TIGGE-LAM framework
- MAP D-PHASE:
  - several LAM ensembles took part to the project
  - data available for the period June-November 2007 (DOP)

COSMO-LEPS



16 Representative Members driving the 16 COSMO model integrations

physics perturbations: Tiedtke or Kain-Fritsch convection scheme + 2 turbulence parameters



integration domain

clustering area

- COSMO
- 12 UTC
- 10 km
- 40 levels
- 16 members
- 132 h

LAM-EPS AT (Austria)

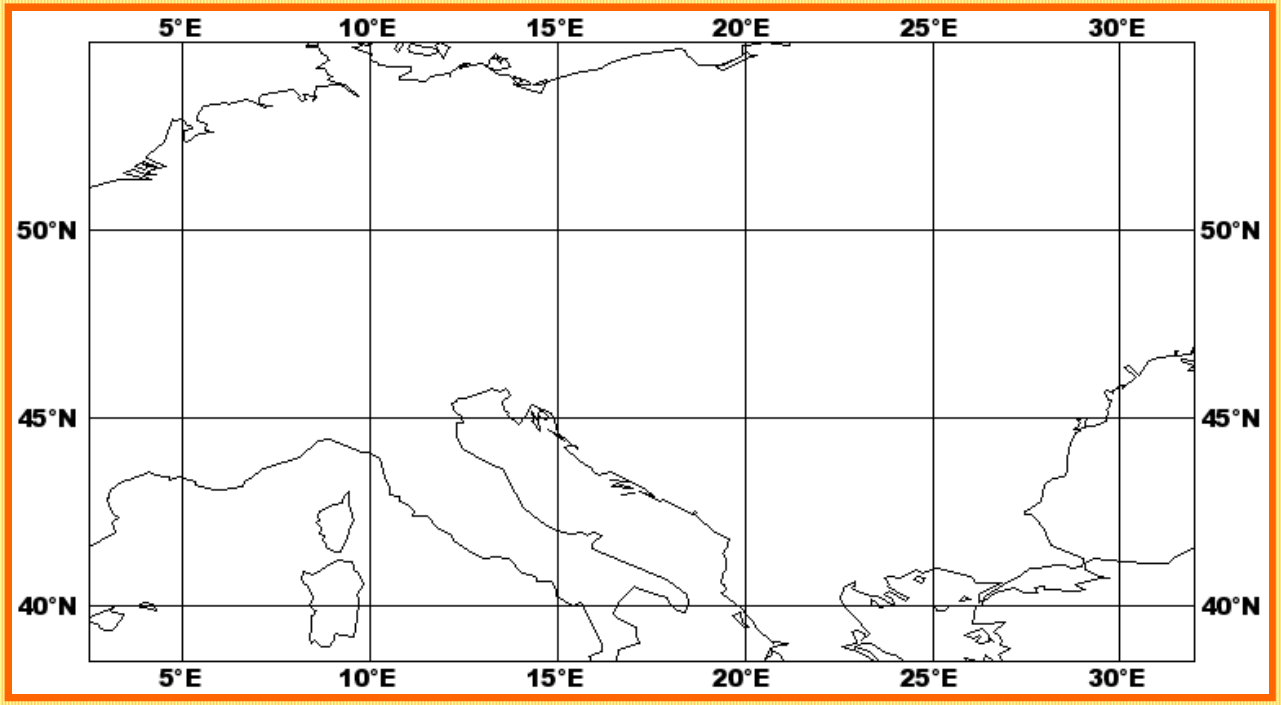
- Initial perturbations:

downscaling of the ics of the ECMWF EPS members

- Lateral boundary perturbations:

coupling with the ECMWF EPS system

- first 16 members of the ECMWF EPS



- ALADIN
- 00 and 12 UTC
- 18 km
- 37 levels
- 16 members
- 48 h

IFS – ECMWF global

COSMO
HIRLAM
HRM
MM5
UM

GME – DWD global

COSMO
HIRLAM
HRM
MM5
UM

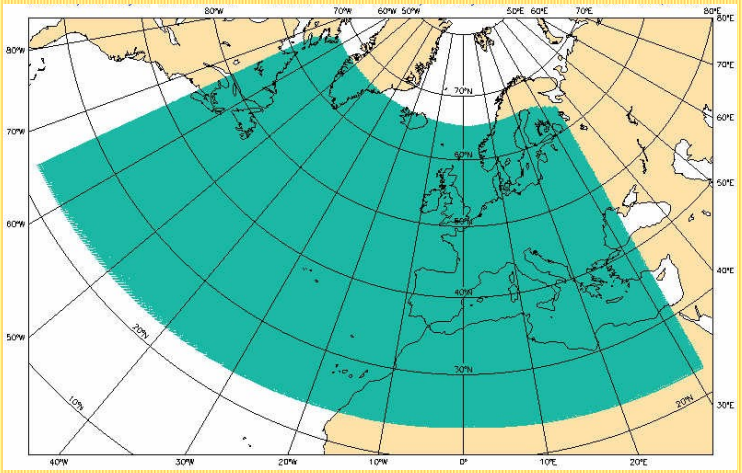
UM – UKMO global

COSMO
HIRLAM
HRM
MM5
UM

GFS – NCEP global

COSMO
HIRLAM
HRM
MM5
UM

INM-SREPS
(now AEMET)



- MultiLAM
- 00 and 12 UTC
- 25 km
- 40 levels
- 20 members
- 72 h

COSMO-SREPS

P1: control (ope)
P2: conv. scheme (KF)
P3: tur_len=1000
P4: pat_len=10000

IFS – ECMWF global

COSMO at 25 km on IFS

GME – DWD global

COSMO at 25 km on GME

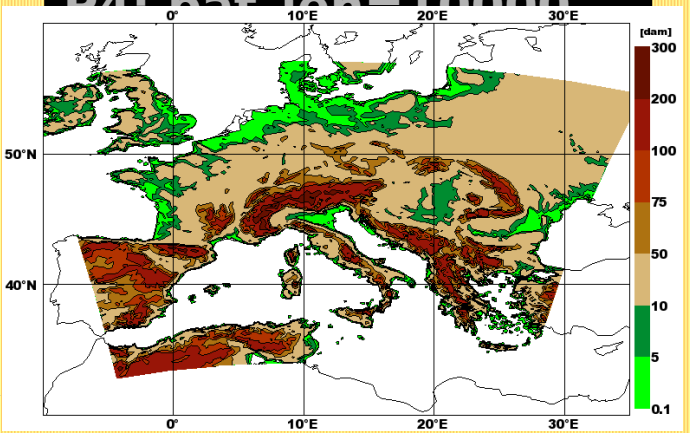
UM – UKMO global

COSMO at 25 km on UM

GFS – NCEP global

COSMO at 25 km on GFS

by AEMET Spain

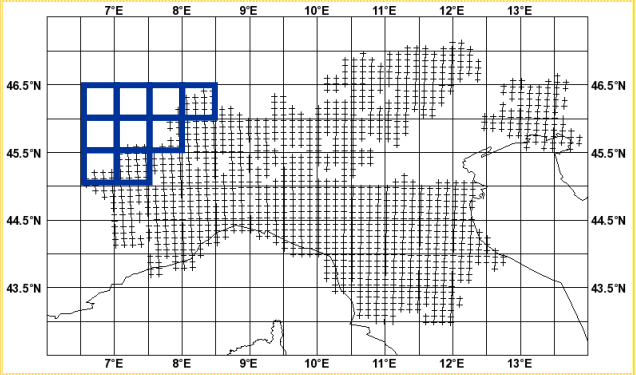


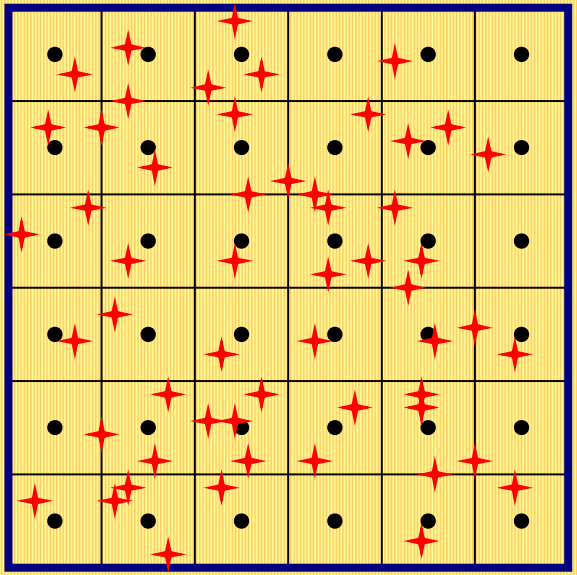
- COSMO
- 00 UTC (12 UTC)
- 10 km
- 40 levels
- 16 members

Problems

- comparison of systems having:
  - **different horizontal resolution**
  - **different number of members**
  - availability over **different sub-periods of the DOP**
- verification of precipitation issued at high spatial resolution
- use of raingauge observations, sparse but with high density

Verification methodology





- Station observation
- Grid point forecast

DIS
T

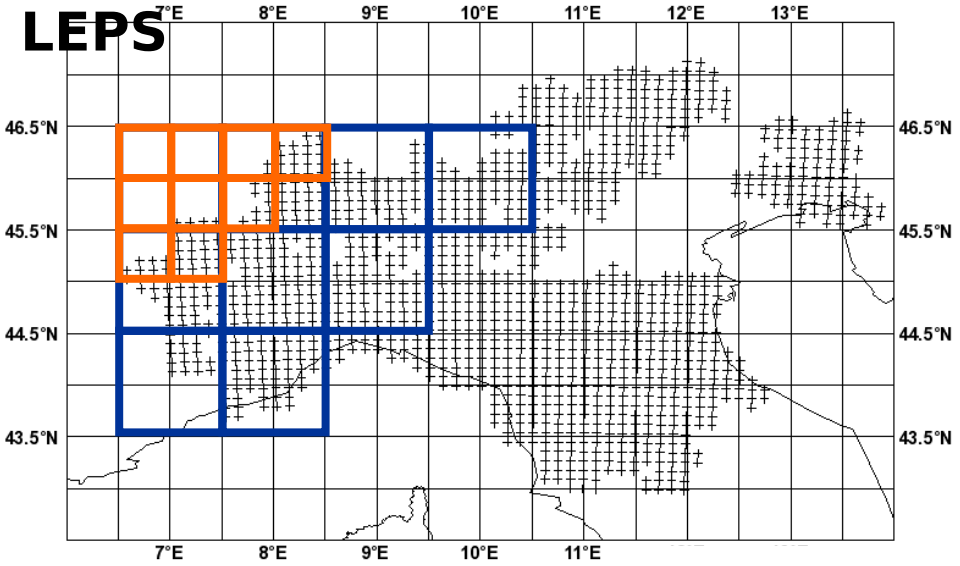
- **Average value**
- **Maximum value**
- **Median**
- **Percentiles**

in a box

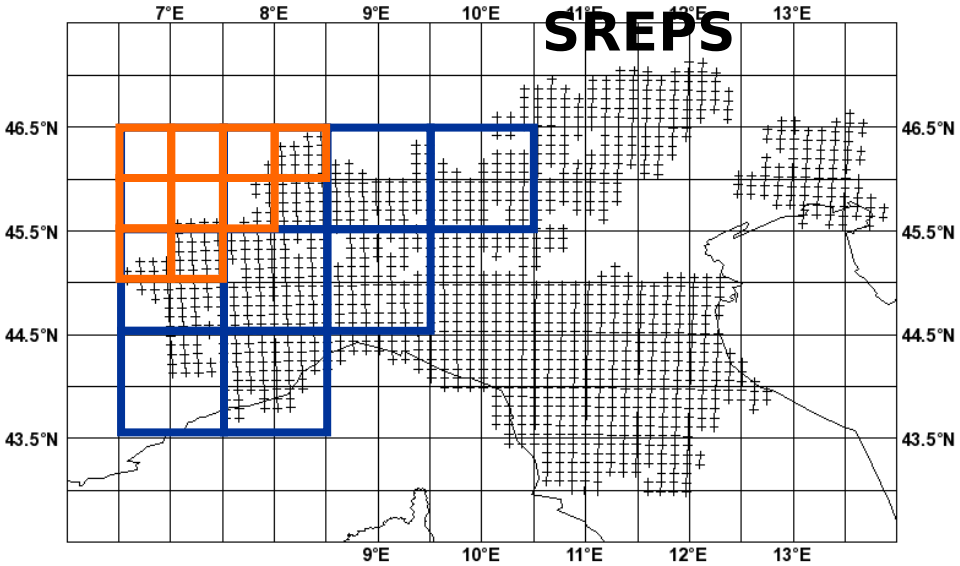
- 700 stations over north-central Italy (COSMO data-set)
- SON 2007
- precipitation accumulated over 24h
- 0-24 h and 24-48 h forecast ranges
- boxes: 0.5 x 0.5 and 1.0 x 1.0 degrees
- 00 and 12 UTC ensembles have been compared separately

observation masks

COSMO-LEPS



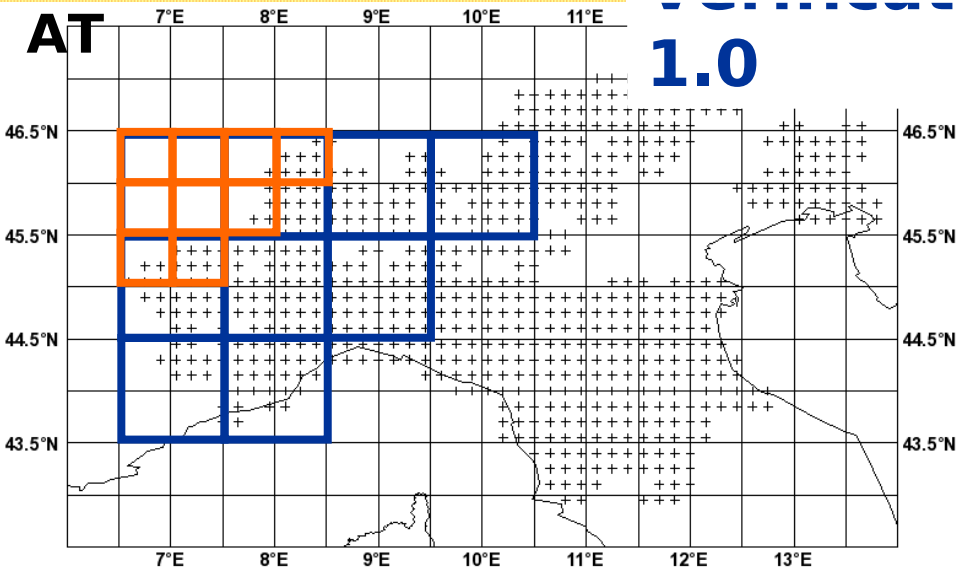
COSMO-SREPS



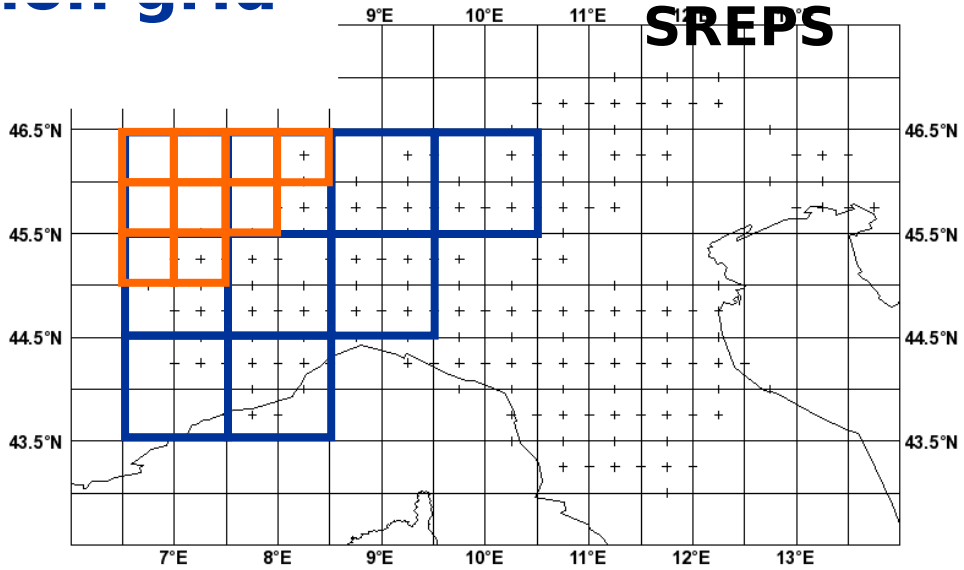
Verification grid 0.5

1.0

LAM-EPS AT



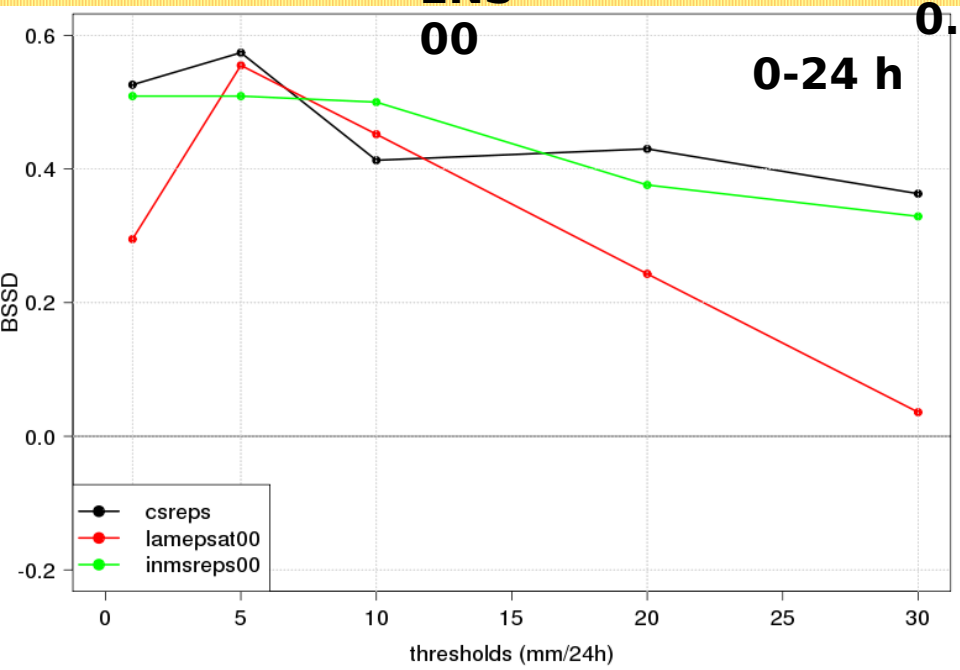
INM-SREPS

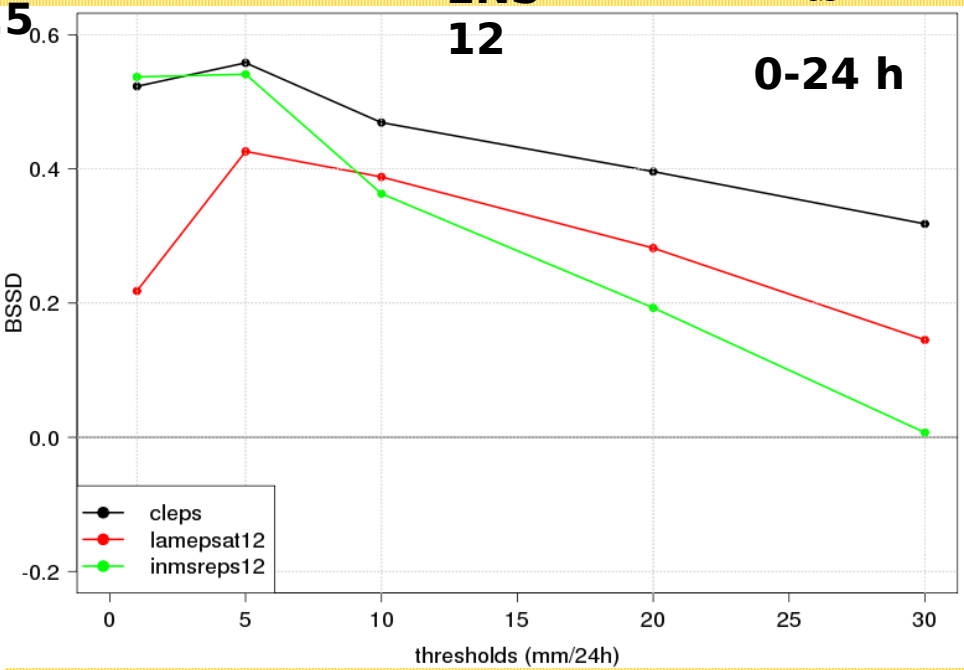


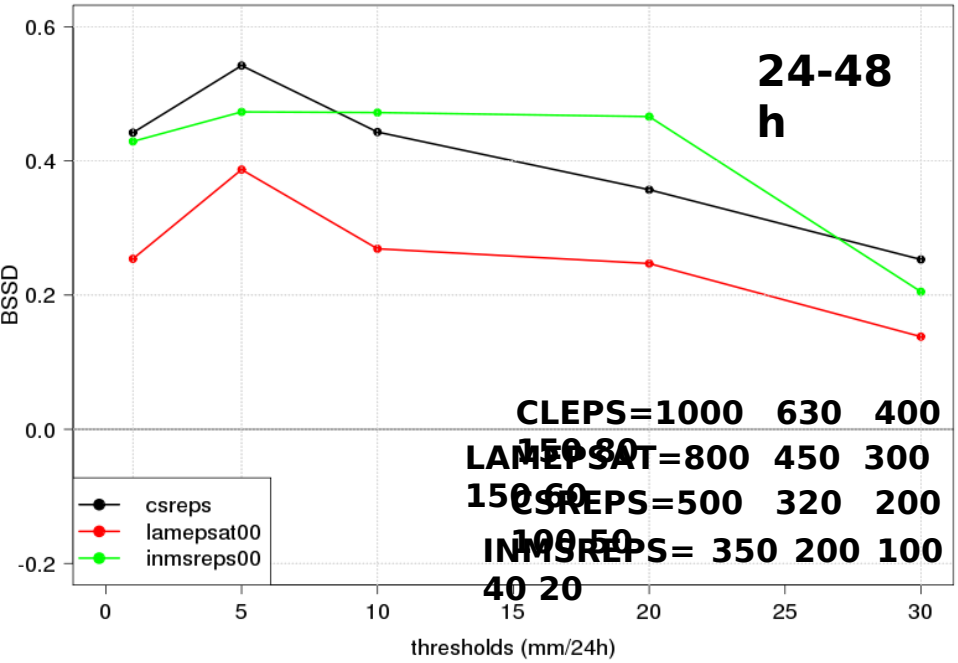
BSS Debiased

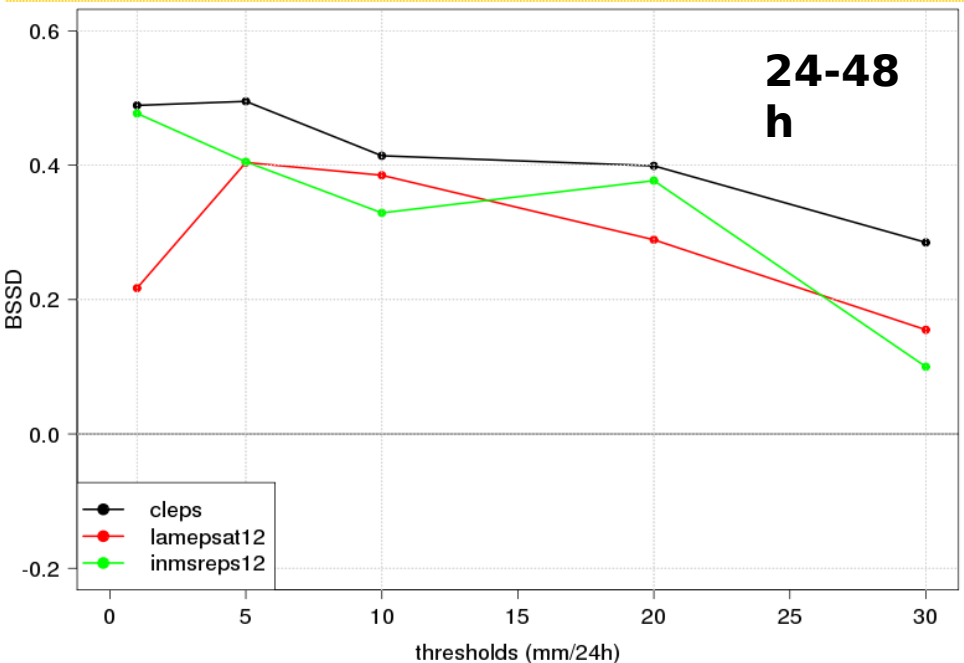
Average values over boxes

$$BSSD = 1 - \frac{BS}{BS_{cli} + \frac{1}{M}\bar{o}(1-\bar{o})}$$



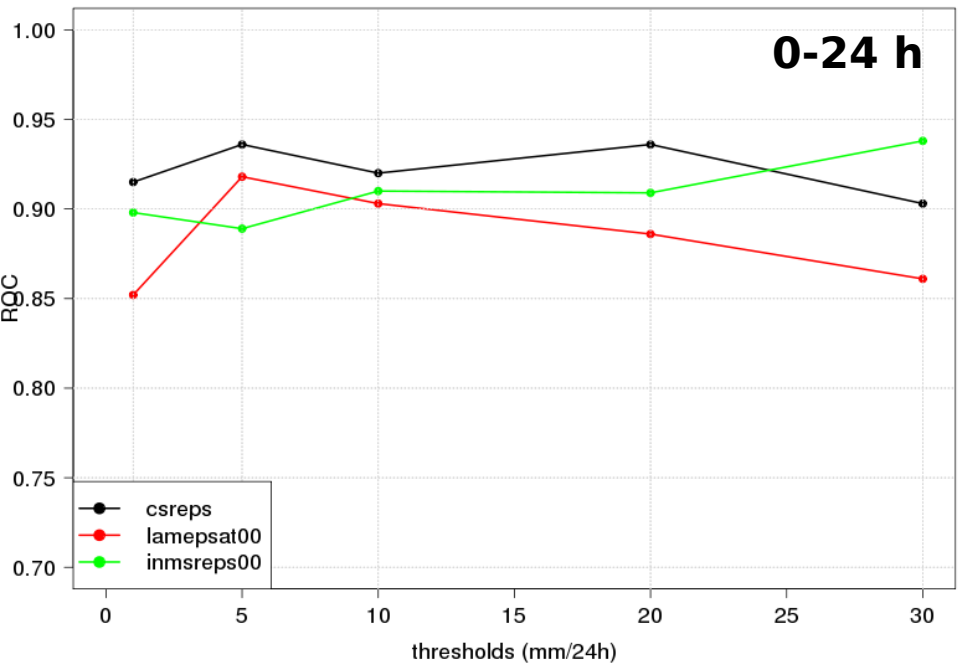


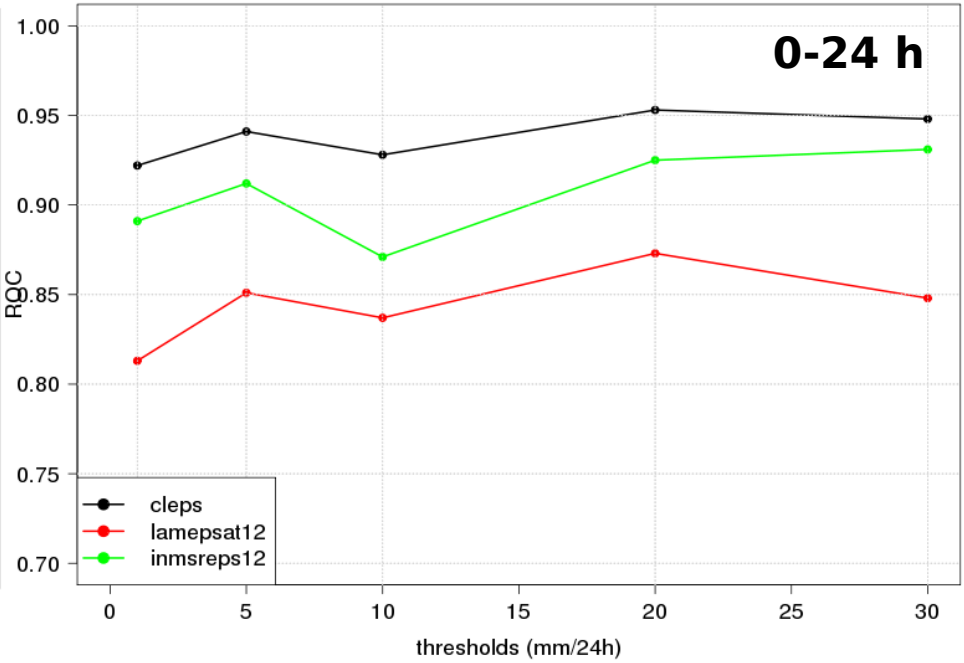


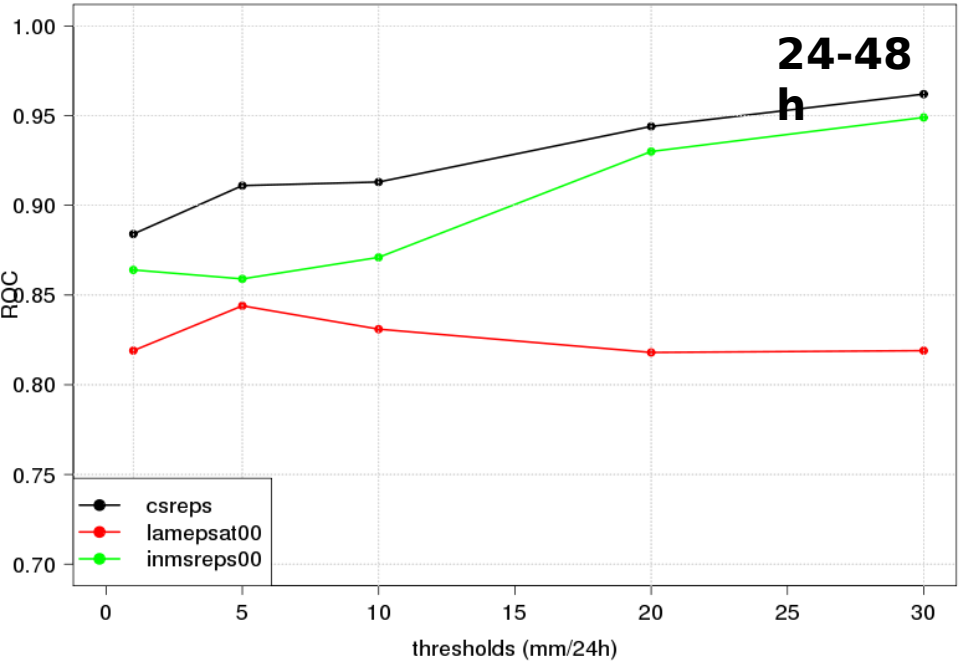


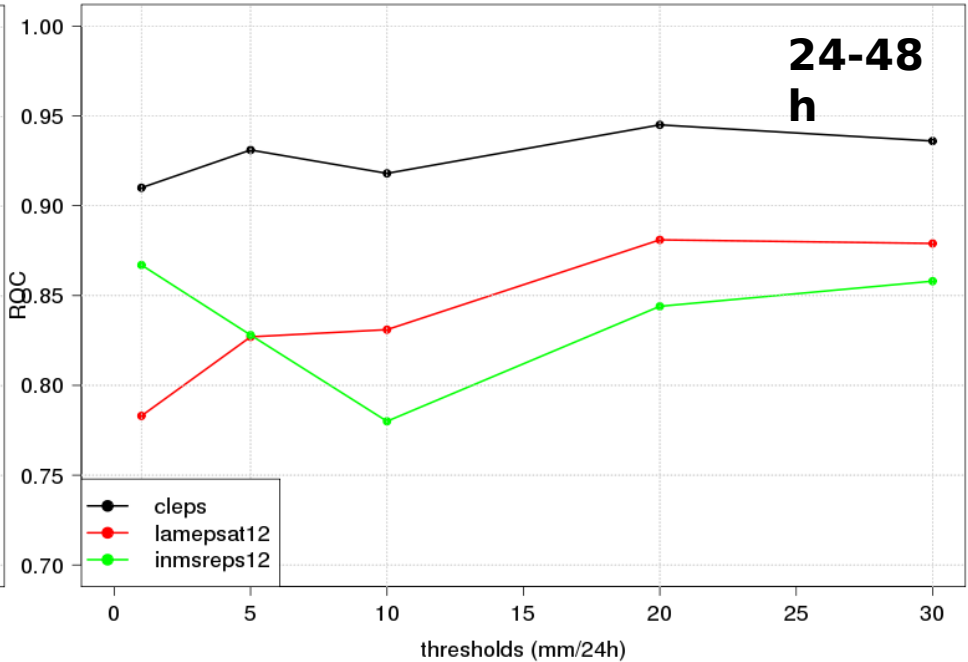
ROC area

ENS Average values over boxes 0.5 ENS





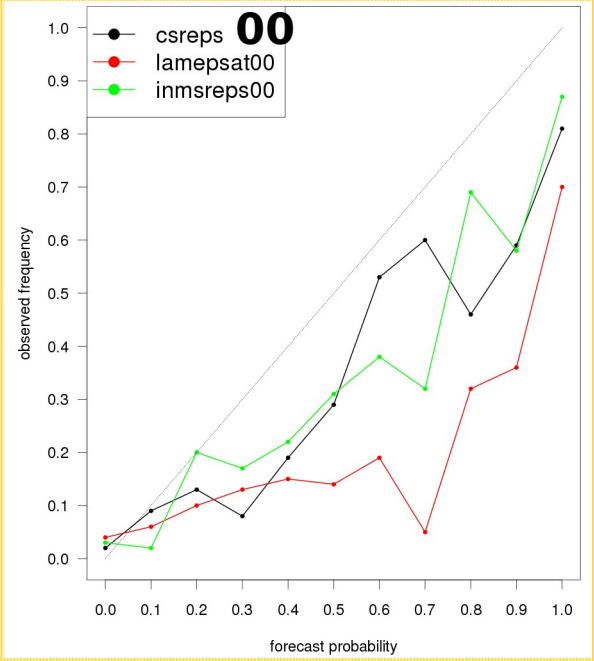




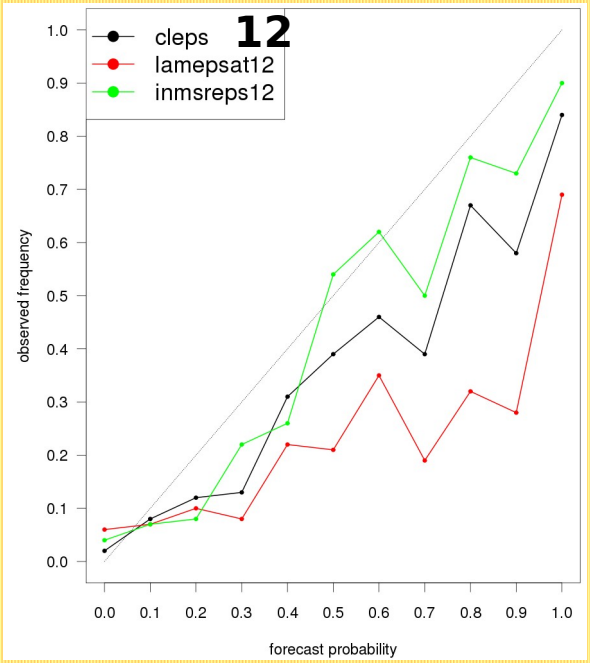
Reliability diagrams

ave 0.5 - 1mm/24h

ENS 00

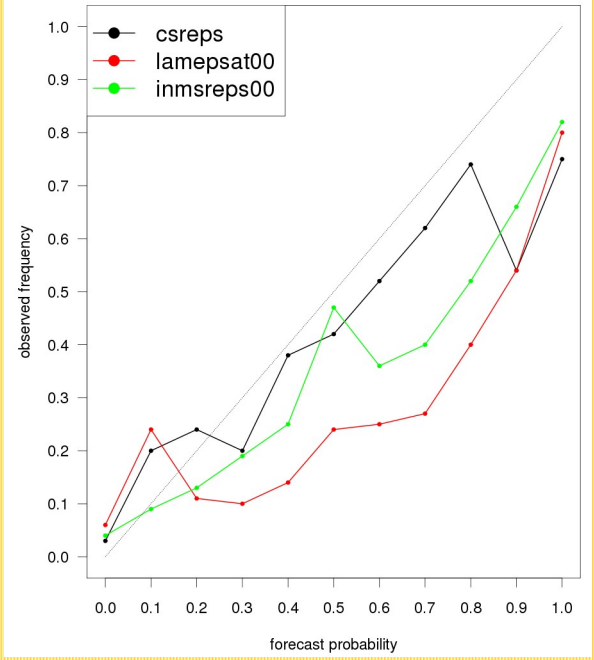


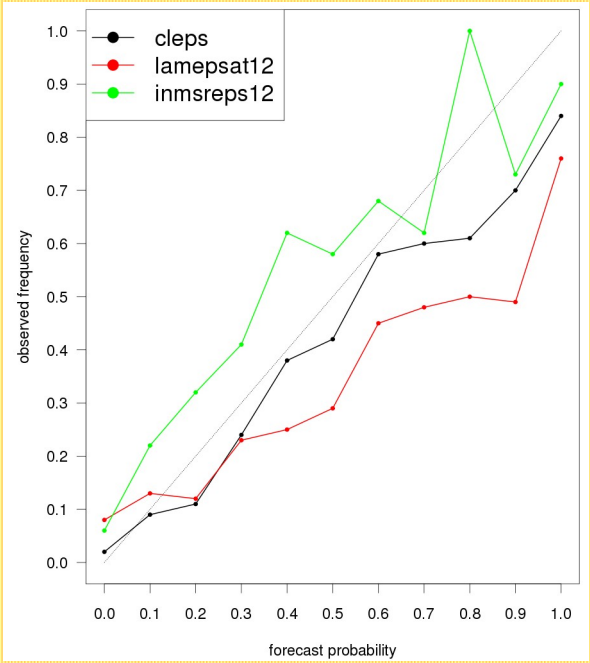
ENS 12



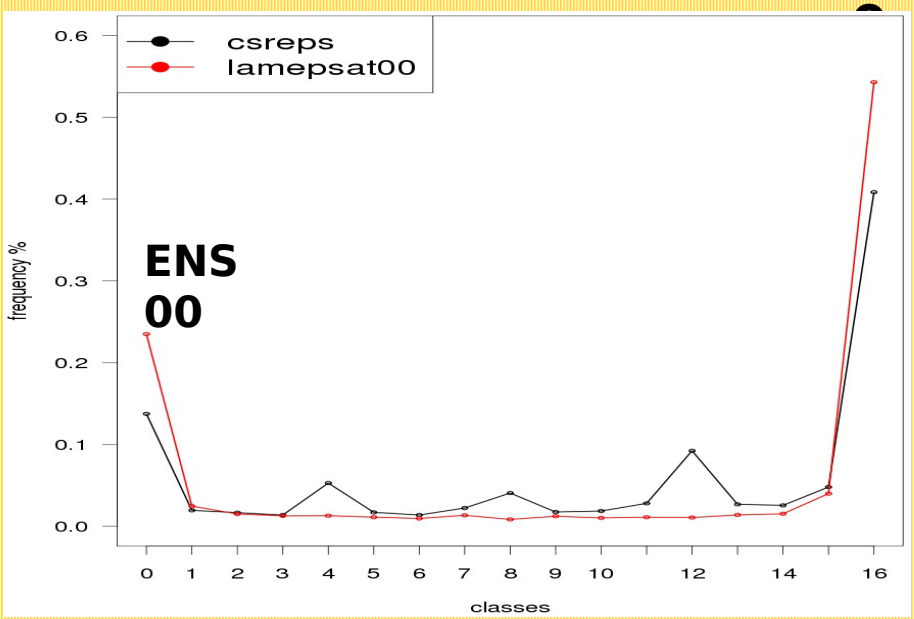
0-24 h

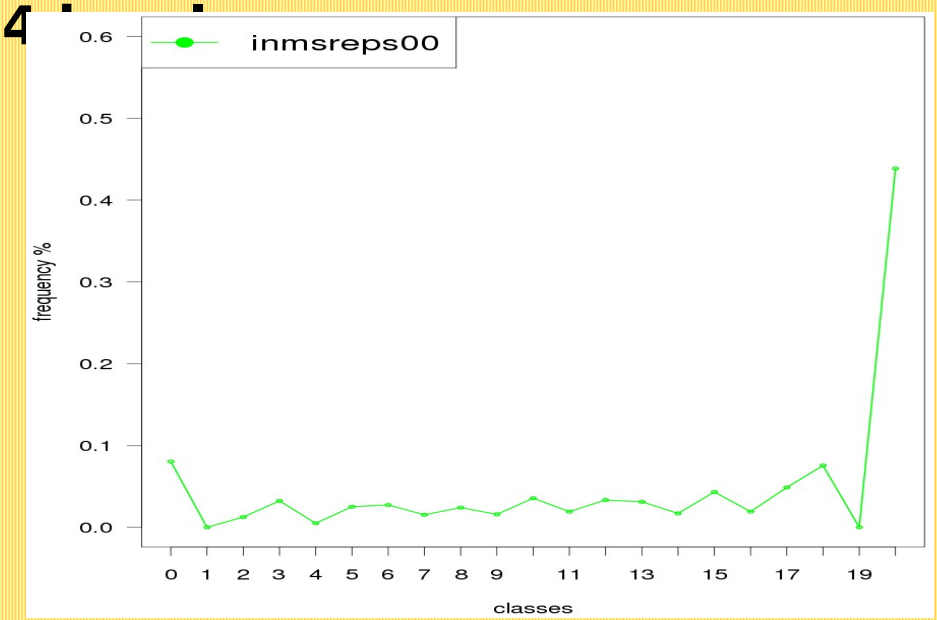
24-48 h

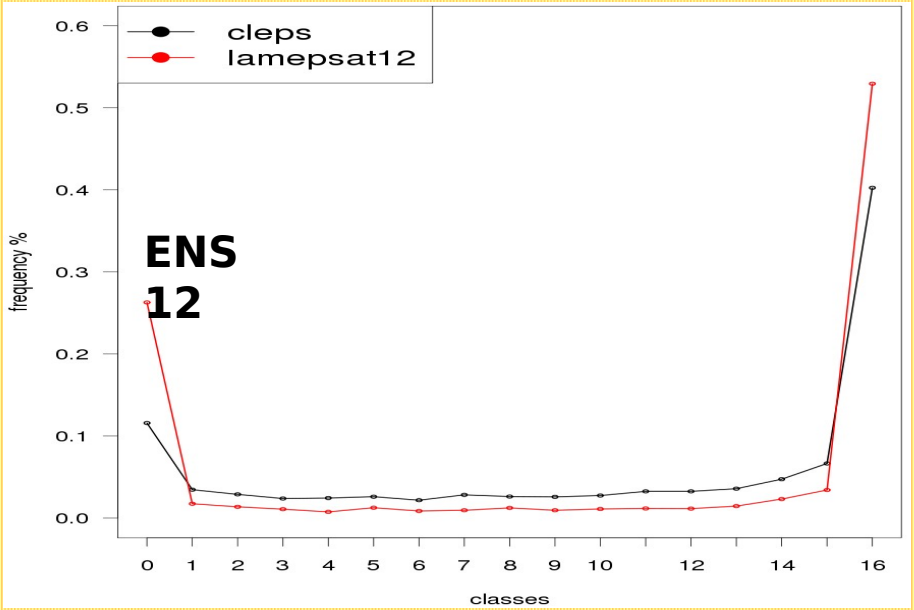


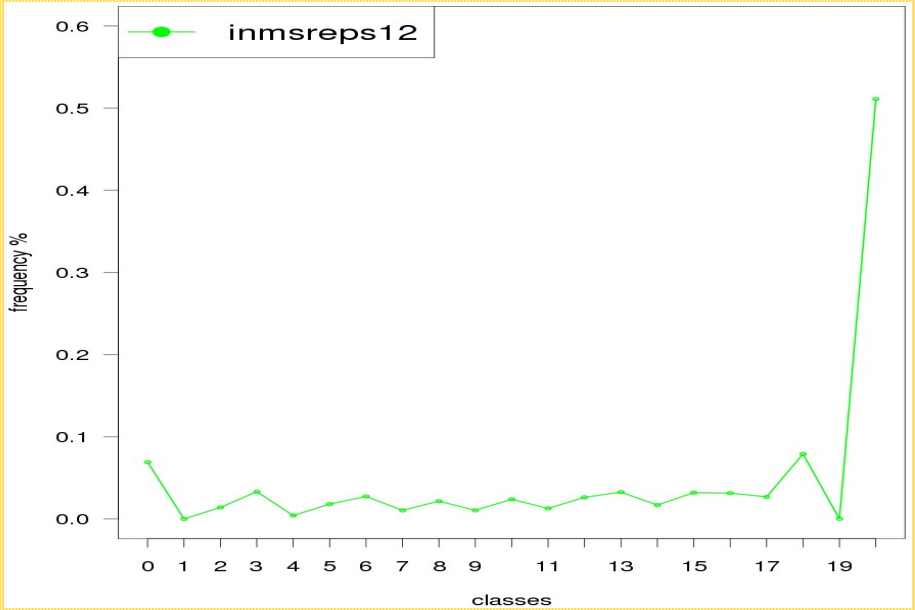


Talagrand diagram



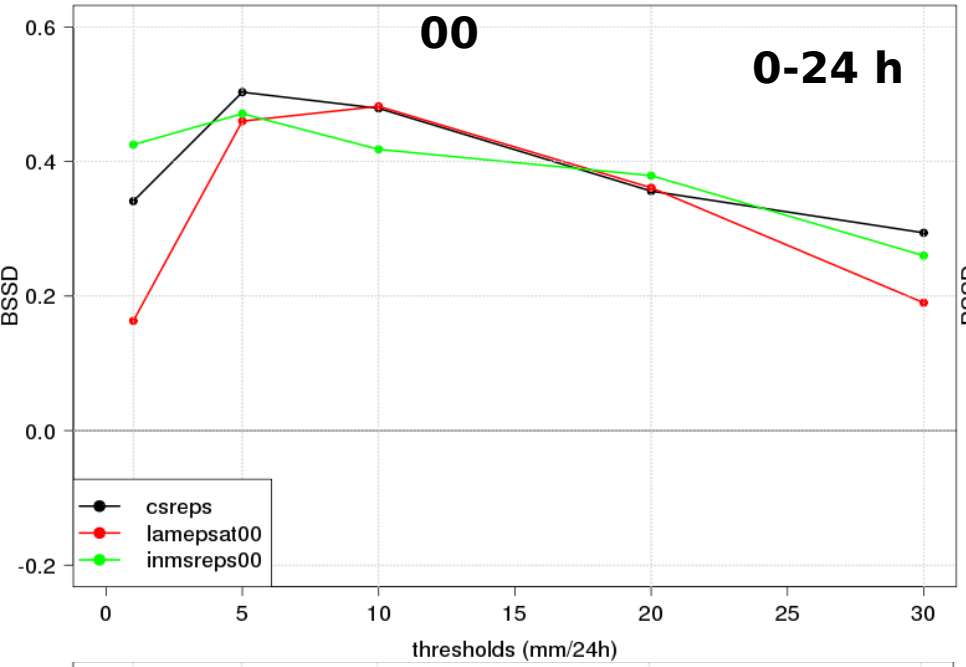


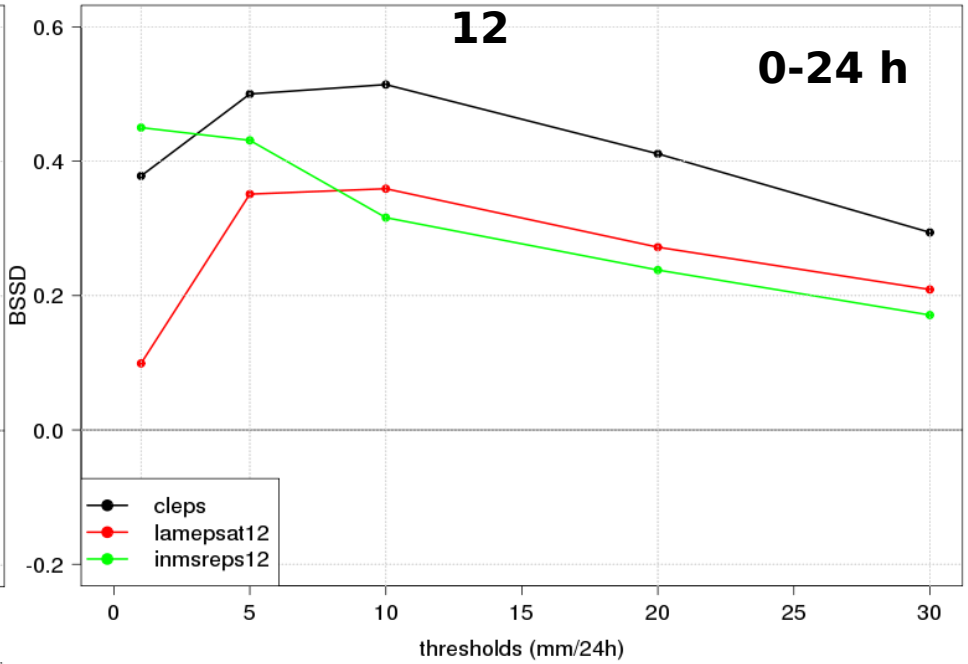


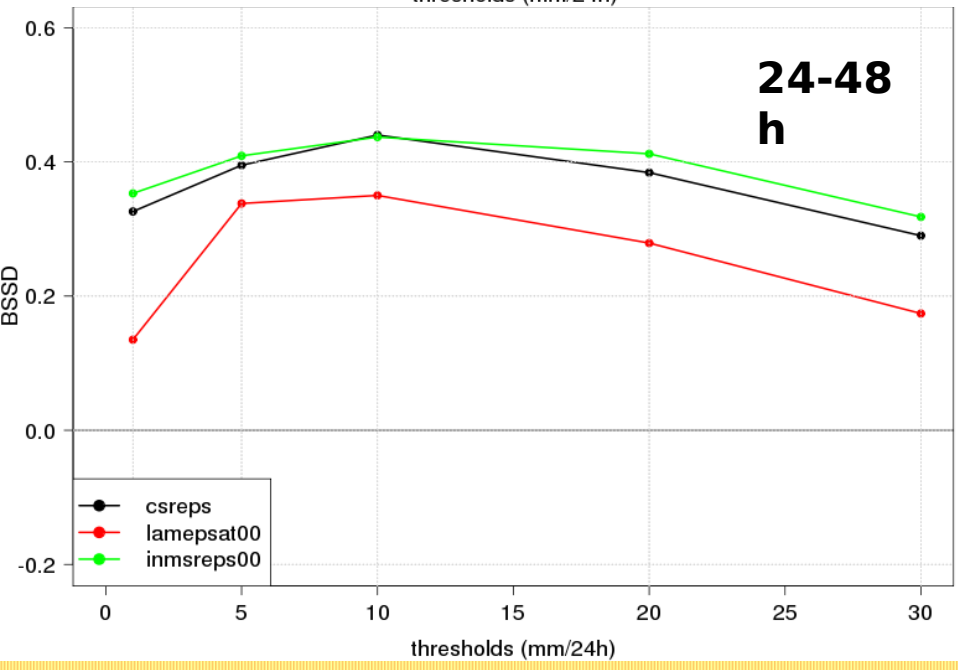


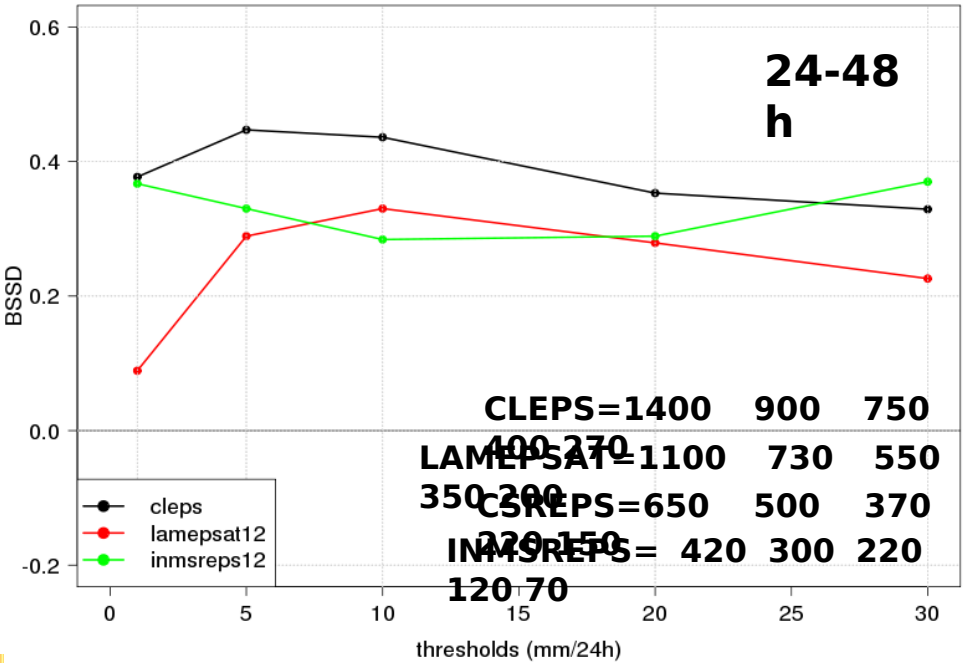
BSS Debiased

ENS 00 Maximum values over boxes 0.5 ENS 12



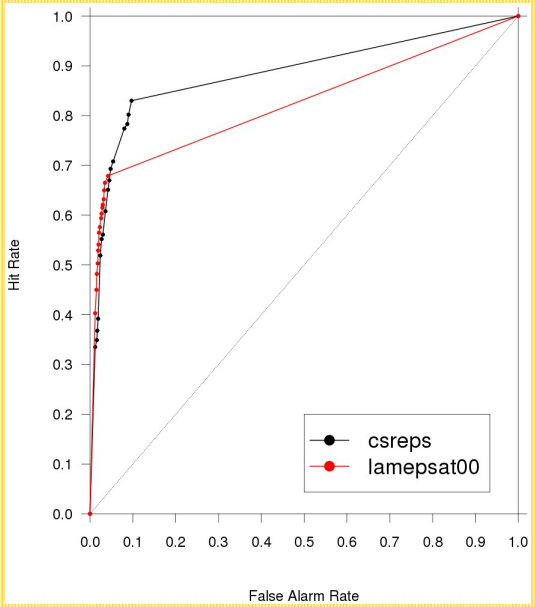


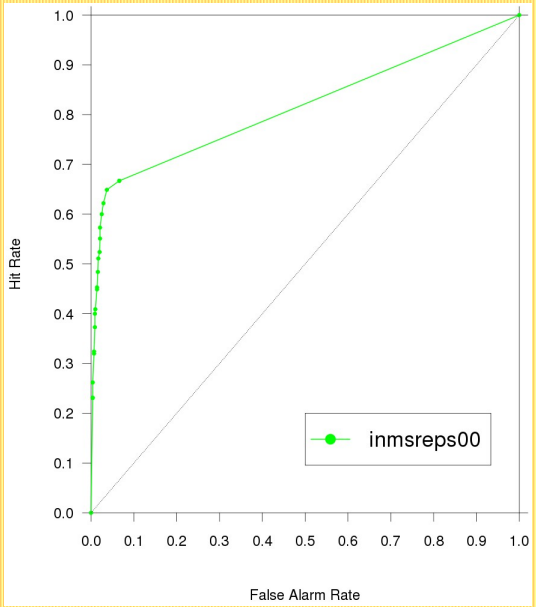




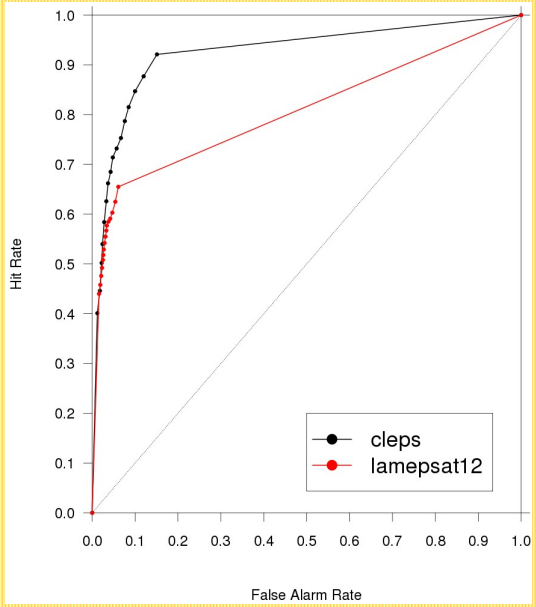
ROC Curves
max 0.5 - 10mm/24h

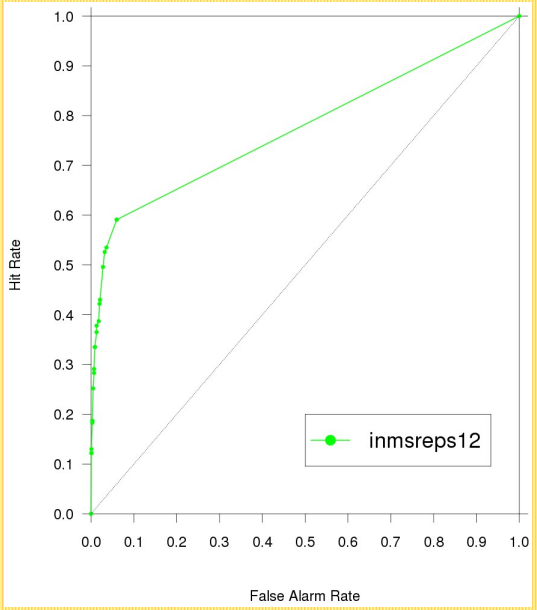
0-24 h





ENS 00

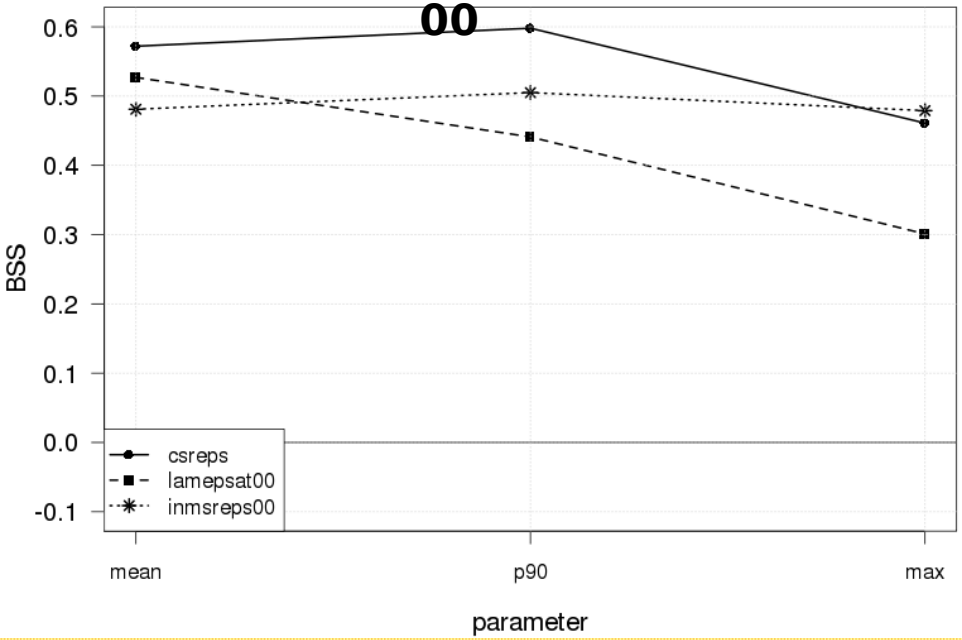


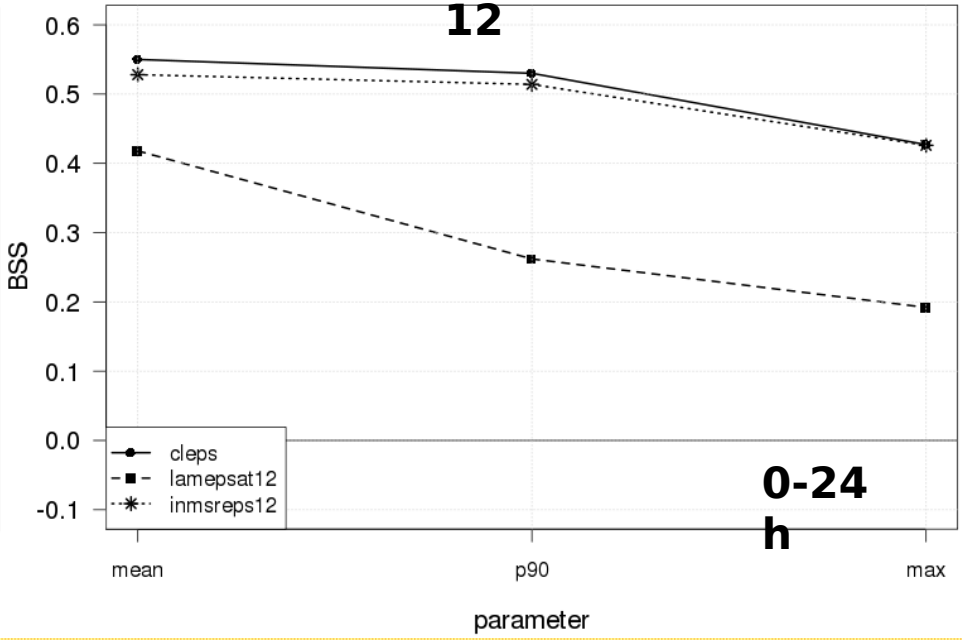


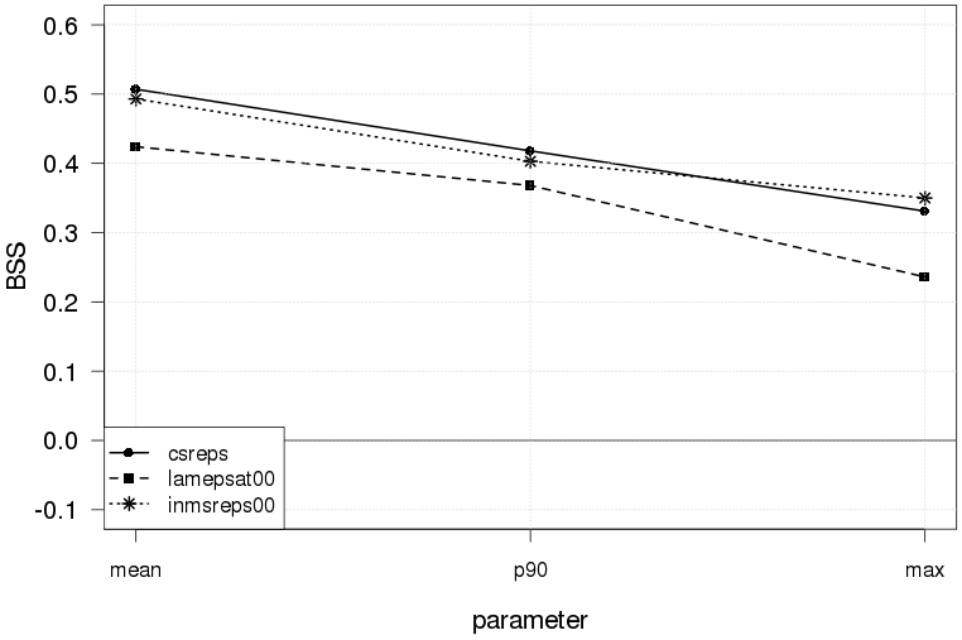
ENS 12

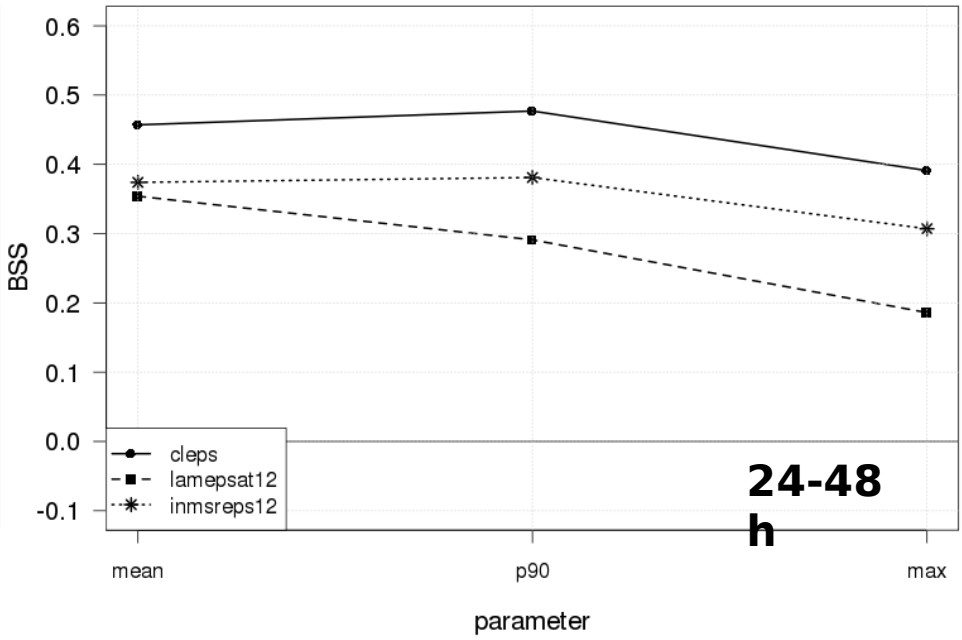
BSS

ENS 00 boxes 1.0 – thr=5mm/24h ENS 12



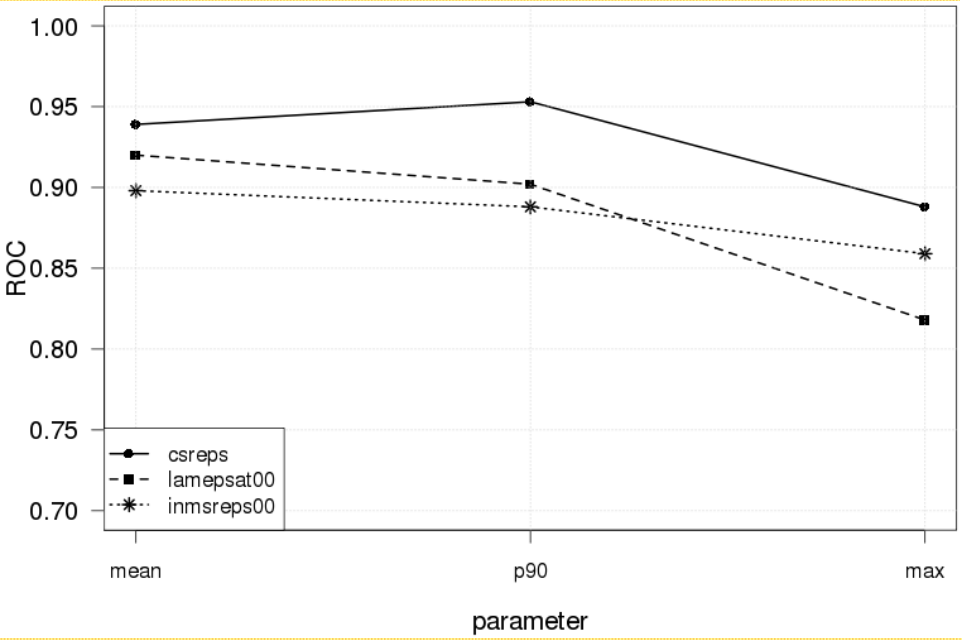


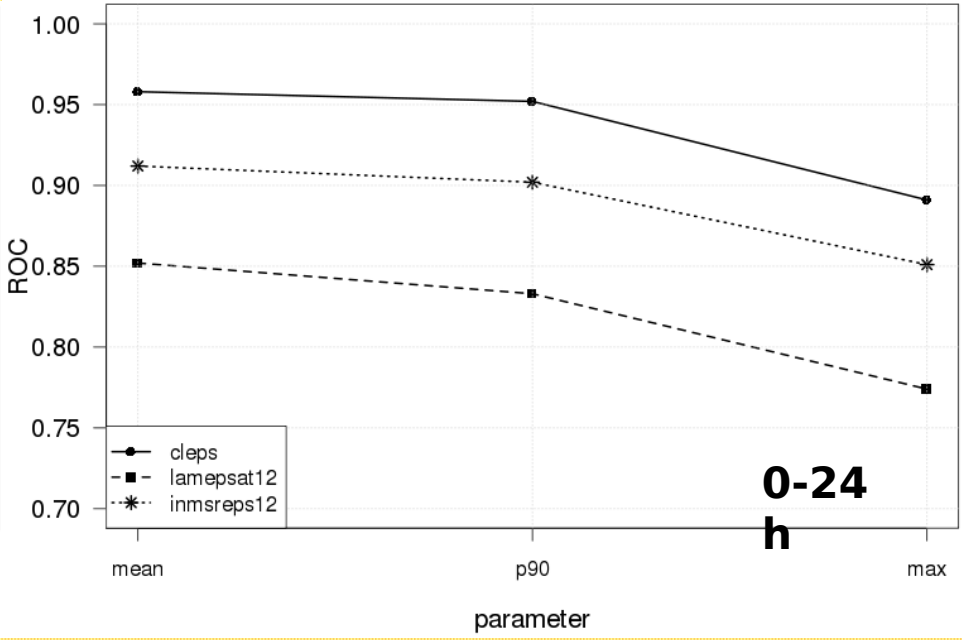


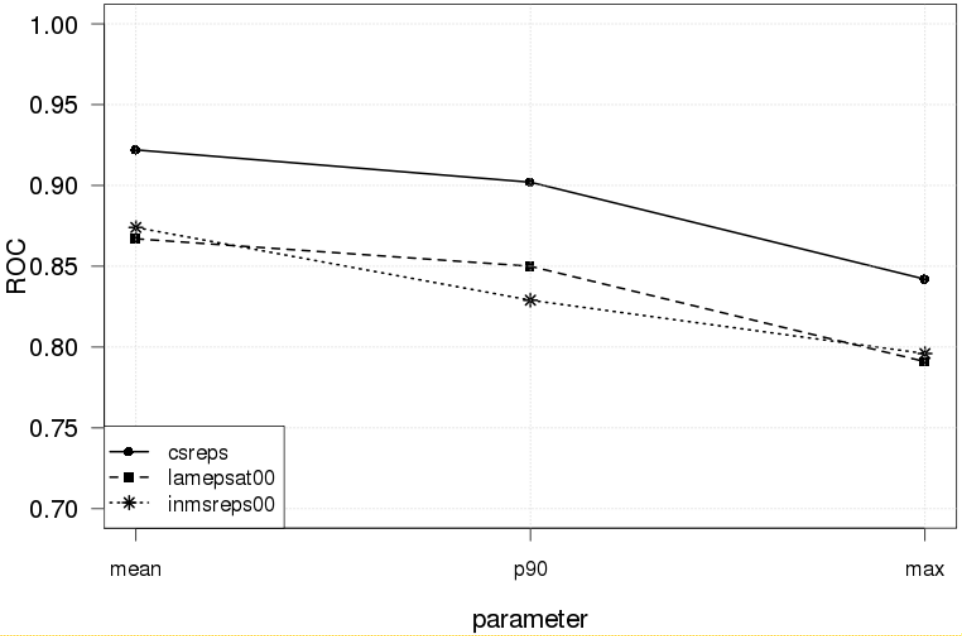


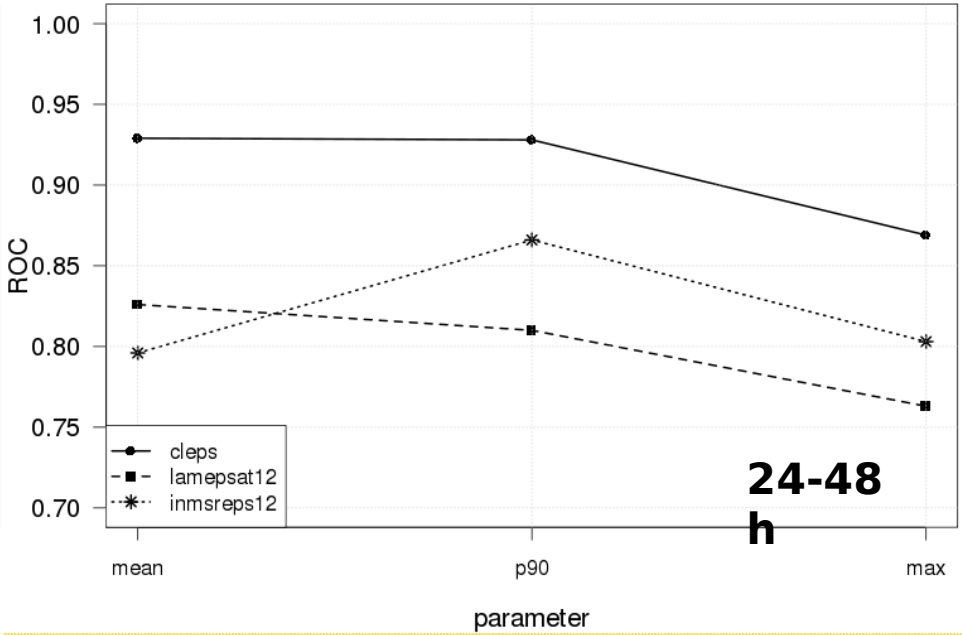
ROC area

ENS boxes 1.0 – thr= 5mm/24h ENS





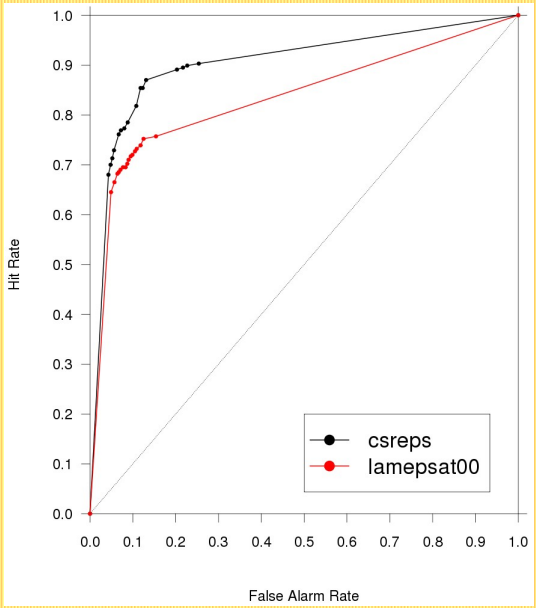


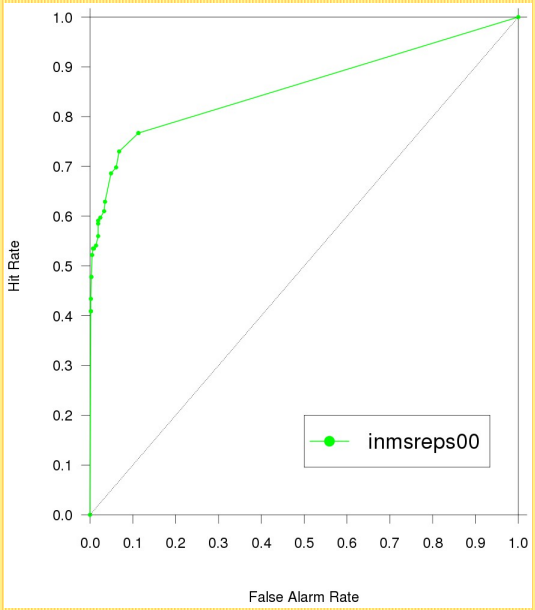


ROC Curves

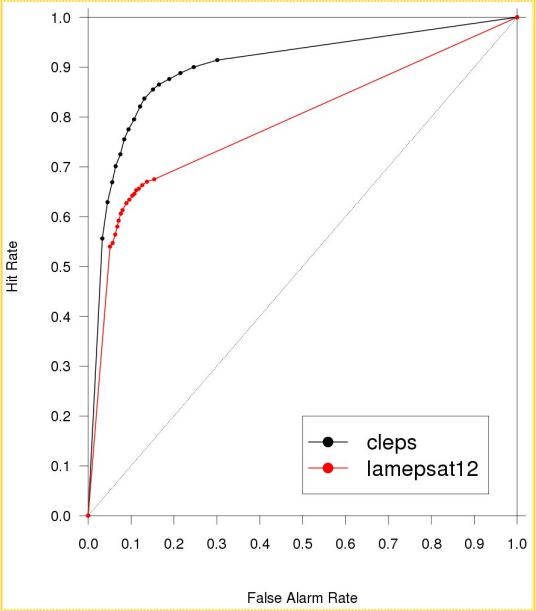
max 1.0 - 10mm/24h

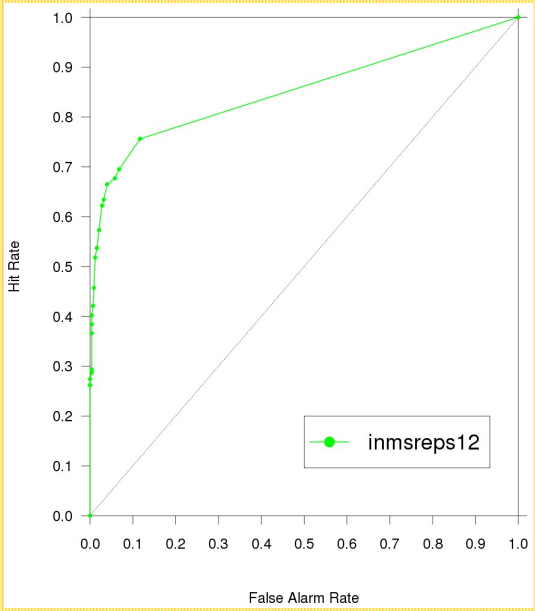
0-24 h





ENS 00





ENS 12

Concluding remarks

- the comparison is strongly affected by the difference of the samples
- 00 and 12 UTC ensembles exhibit different behaviours
- INMSREPS is very reliable (multi-model?) but is not that skilful in terms of ROC area (lower hit rates due to lower spatial resolution?)
- when maximum over larger boxes are considered, false alarms penalize the high resolution systems
- to be added:
  - confidence intervals
  - verification of PEPS
  - verification against JDC data
  - spread/skill relationship