# Statistical evaluation of COSMO–LEPS ensemble–size reduction technique

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## Overview

- Starting point

- COSMO–LEPS project
  - Operational layout
  - Ensemble–size reduction technique

- Statistical evaluation
  - Comparison of the 3 ensembles (Brier Skill Score)
  - Weighting/No weighting
  - Outliers
  - Cluster area

- Summary

# COSMO–LEPS Project (Operational Layout)

Since the beginning of November 2002, COSMO–LEPS has been operationally running at ECMWF, where every day a limited–area ensemble is produced nesting Lokal Modell into 5 EPS members.

- **super–ensemble** configuration is obtained joining together three consecutive (12–hour lagged) EPS ensembles, so as to generate a unique ensemble with 153 members;

- all super–ensemble members are equally weighed;

- 12–00–12 is the initial UTC time configuration adopted;

## COSMO–LEPS Project (Ensemble–size reduction technique)

- Hierarchical cluster–analysis:
  - Complete linkage method;
  - fixed 5 clusters;
  - Z, U, V and Q at 500, 700 and 850 hPa;
  - European area (30N–60N and 10W–30E);
  - two forecast steps:

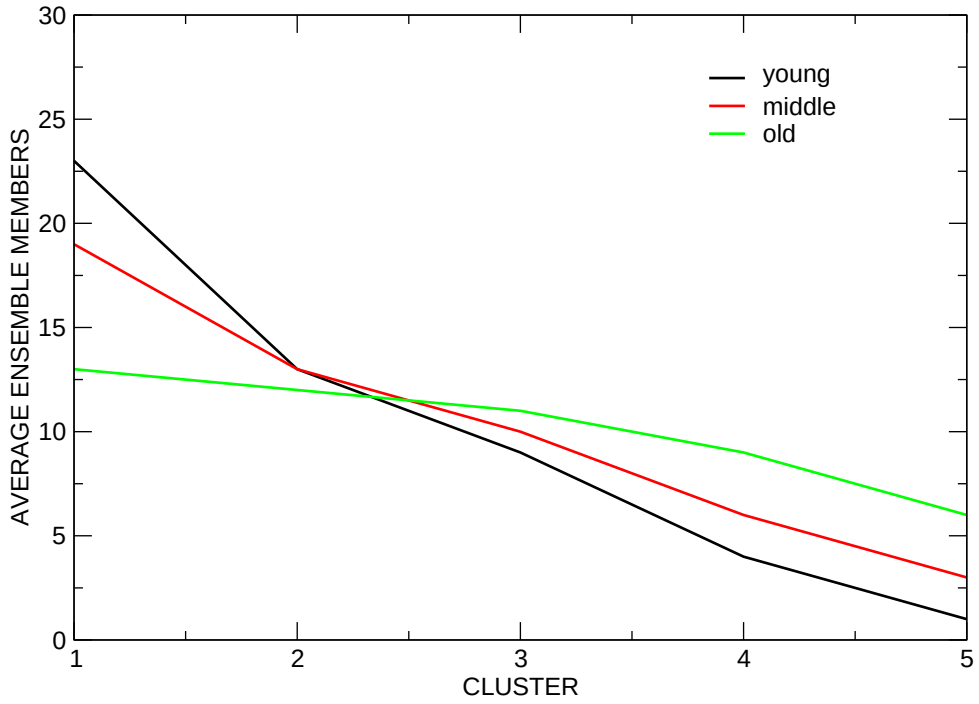
    +144 h and +168 h for the oldest ensemble;

    +132 h and +156 h for the middle ensemble;

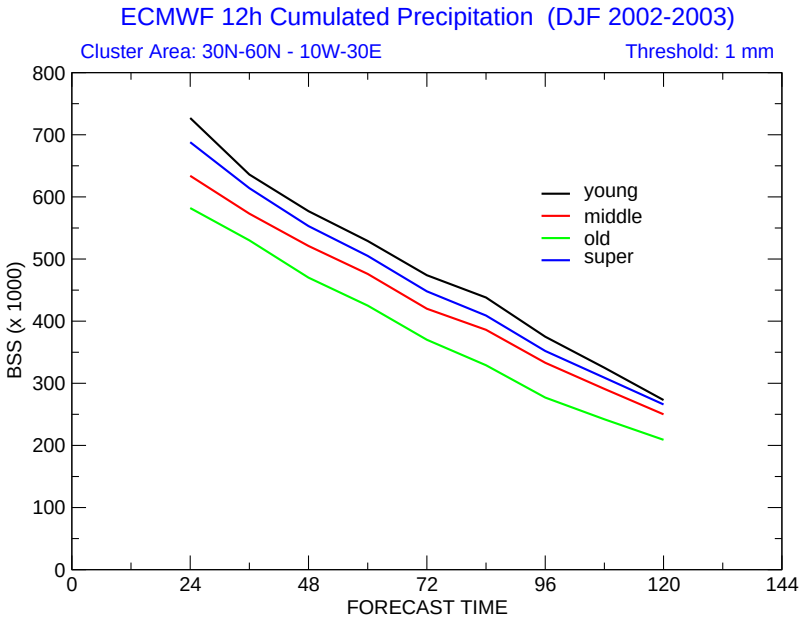
    +120 h and +144 h for the youngest ensemble;
- Selection of the cluster representative member: it is chosen the member which is the closest one to the members of its own cluster and the most distant from the other clusters' members;
- 5 integrations of Lokal Modell nested on the representative members;

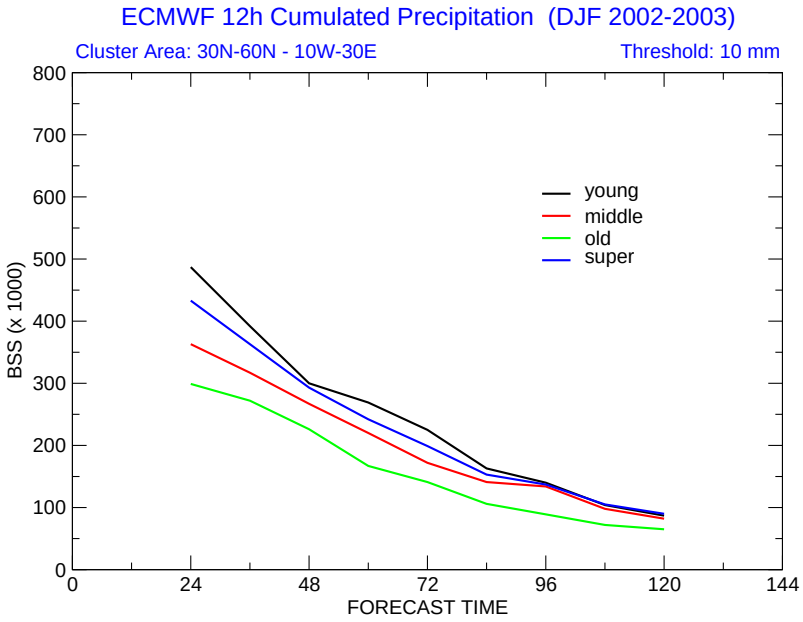
# Comparison of the 3 ensembles

Z,U,V,Q at 500/700/850 hPa (DJF 2002-2003)

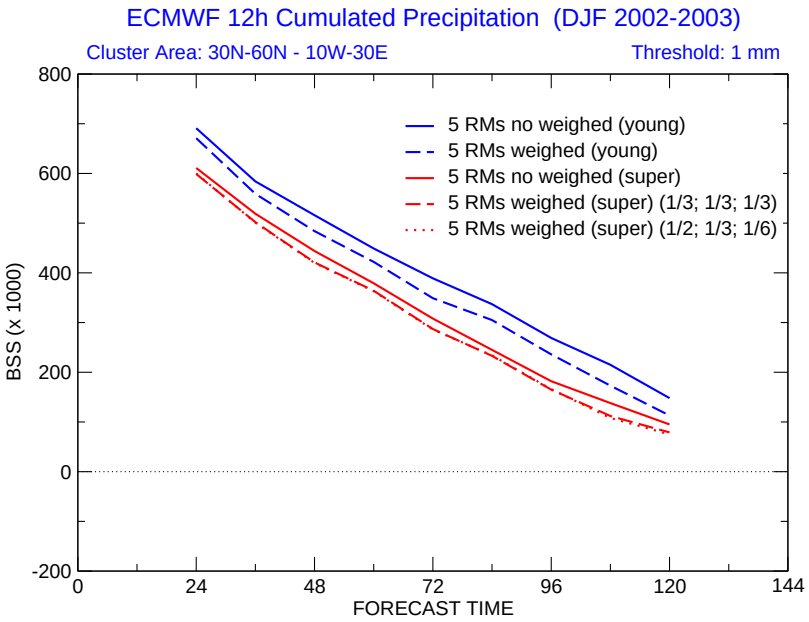


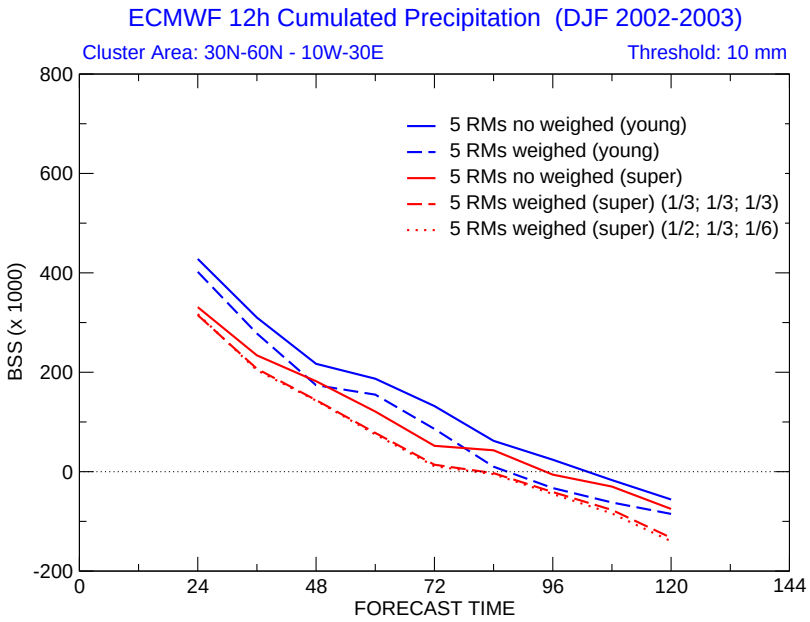
# Comparison of the 3 ensembles



# Weighting/No weighting



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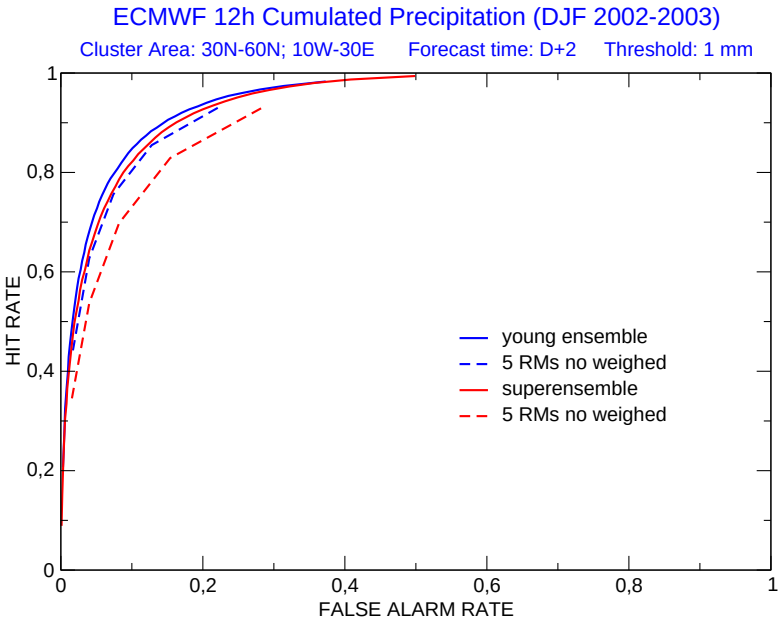


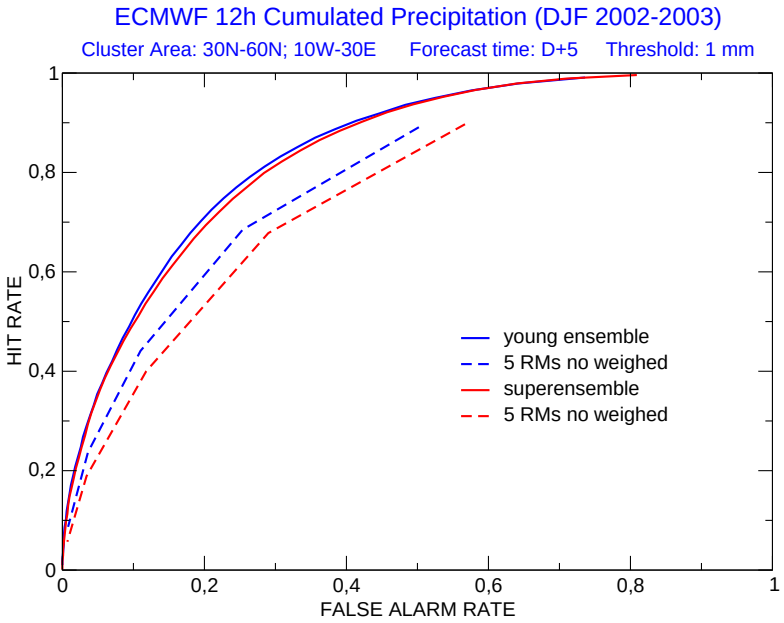

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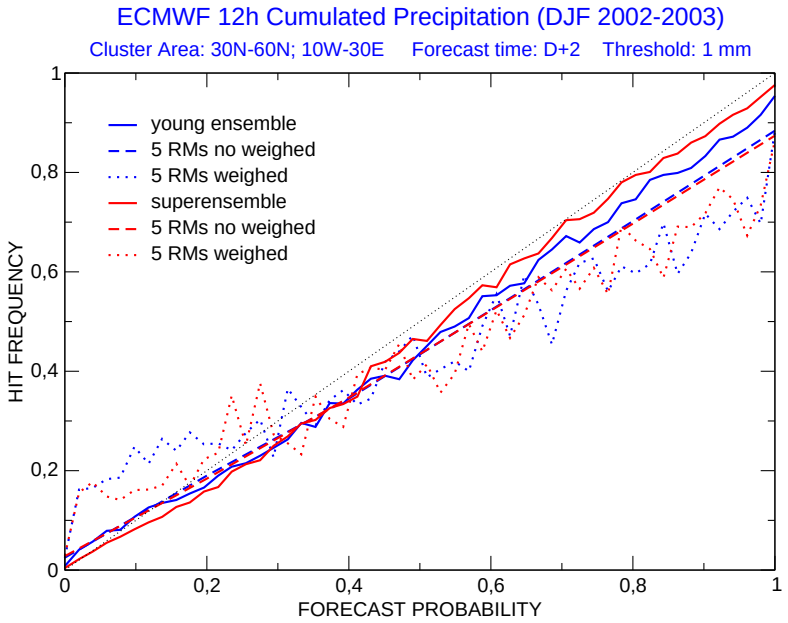
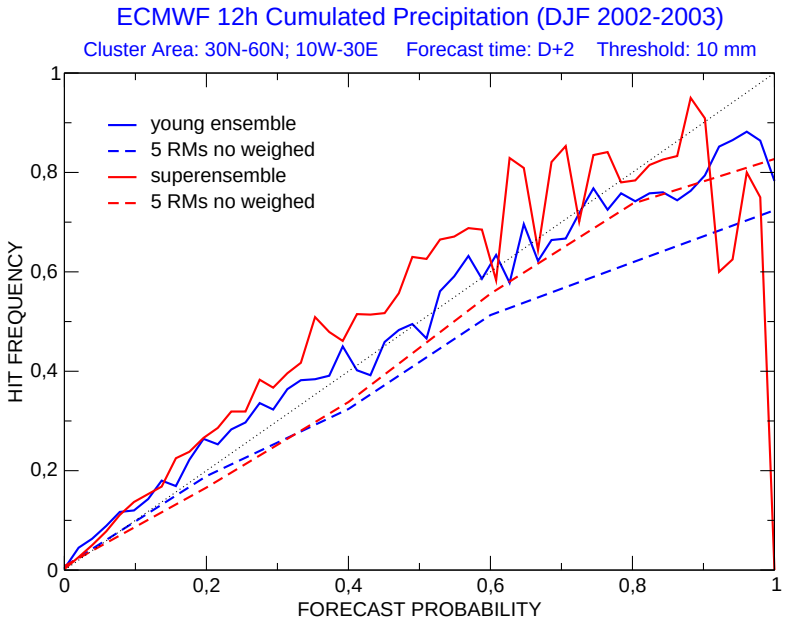
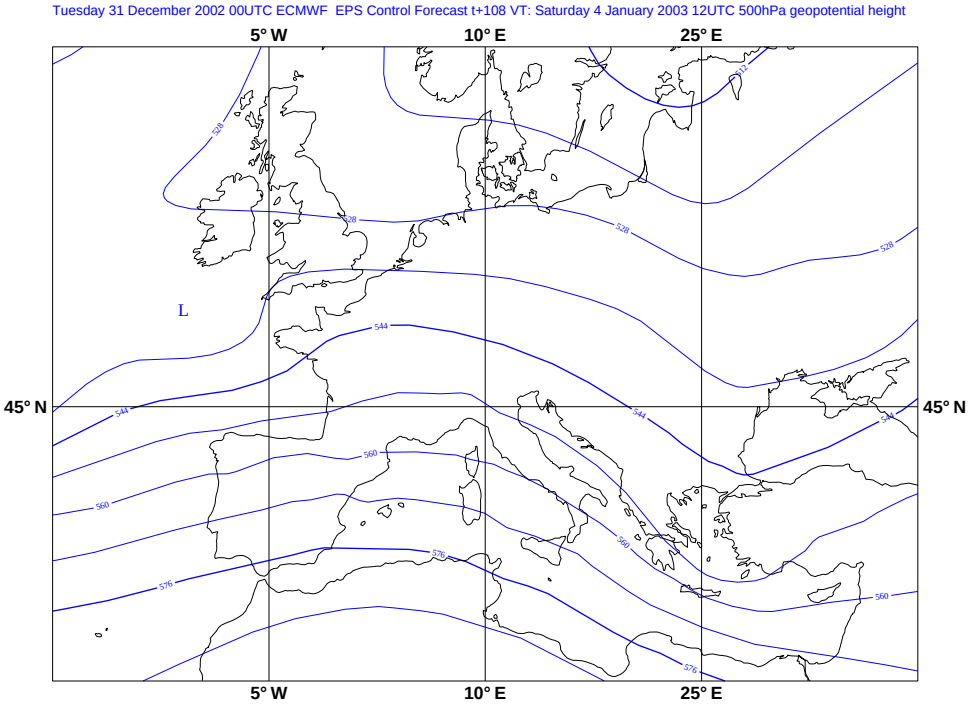
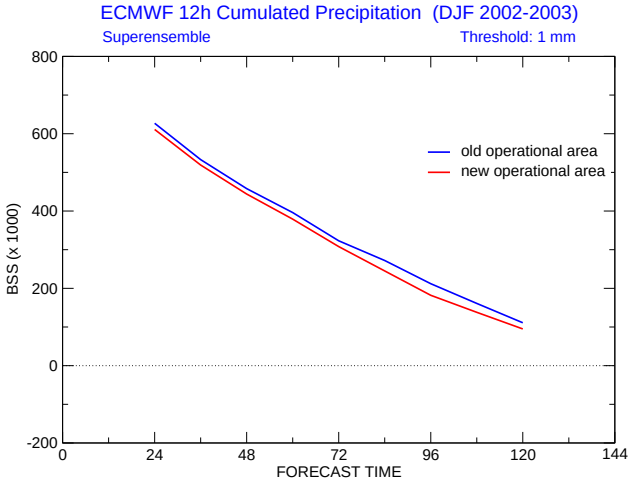


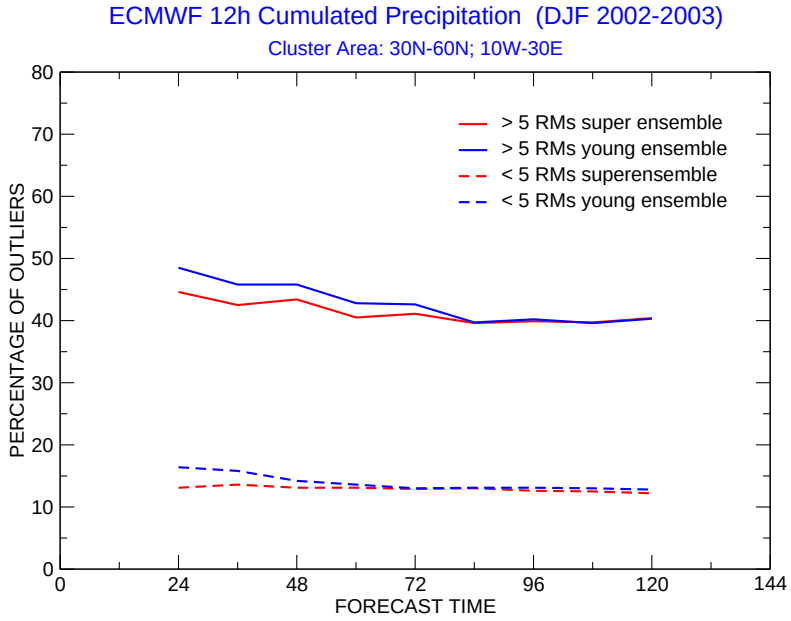



# COSMO–LEPS cluster area



# Outliers


ECMWF 12h Cumulated Precipitation (DJF 2002-2003)
Cluster Area: 30N-60N; 10W-30E
PERCENTAGE OF OUTLIERS
FORECAST TIME
0
10
20
30
40
50
60
70
80
0
24
48
72
96
120
144
> 5 RMs super ensemble
> 5 RMs young ensemble
< 5 RMs superensemble
< 5 RMs young ensemble

## Summary

- Members of the youngest ensemble stand mostly in the first cluster. Whereas, members of the oldest ensemble are more uniformly distributed.
- Generally, the first cluster is the most populated (about 1/3 of the overall population).
- Different weights for super–ensemble members, (1/3, 1/3, 1/3) and (1/2, 1/3, 1/6), do not show remarkable differences. Anyway, best scores are exhibited by RMs not weighed.
- The duration of the forecast range is related to the event. For precipitation greater than 10 mm at most +96 hours. Representative members of the youngest ensemble are better than the superensemble's ones.
- Better the old operational cluster area.
- Outliers are different only in the first 3 forecast days. The advantage of superensemble is limited to the short range. Perhaps it is better clustering during the interval 24 – 72 hours.