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Recent developments in TEPS for Europe

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TEPS for Europe

- TEPS = *Targeted Ensemble Prediction System*

- TEPS is a special version of ECMWF EPS that is designed to be optimal for Europe in the short range (day 1-3)
- "TEPS for Europe" is a part of the GLAMEPS-project
- TEPS for Europe will provide initial and lateral boundary perturbations for multi-model limited area EPS for the short range for the HIRLAM and ALADIN countries

Details of the experimental setup for TEPS for Europe

- Targeted singular vectors (TSVs):
  - The SVs are targeted to the European area
  - Europe is divided into 3 target areas to make sure there is spread in all parts of Europe: target areas
  - Computed with T159 (as opposed to T42 for operational SVs at ECMWF)
  - Optimization time is 24 hours (as opposed to 48h for operational SVs at ECMWF)
  - Targeted in the vertical to the troposphere
  - Targeted SVs are based on the total energy norm
  - The TSVs are selected to be orthogonal to the operational SVs and also mutually orthogonal

Details of the experimental setup for TEPS for Europe - continued

- The perturbations
  - The perturbations from which TEPS runs are made from a combination of the following SVs using Gaussian sampling:
    - 10 TSVs from each of the three European target areas
    - 10 evolved TSVs from each of the three European target areas
    - 50 SVs from the operational EPS (NHSVs)
    - 50 evolved SVs from the operational EPS
  - Different amplitudes are assigned to the different sets of SVs, to give the desirable spread/skill relation

EXPERIMENTS 1

CY32R2

- 21 days in summer 2007:
  - 20070618-20070624
  - 20070808-20070814
  - 20070820-20070826
- First experiment:
  - The amplitude for operational SVs is kept unchanged at 0.020
  - The amplitude for the targeted SVs is reduced by 75% compared to operational Norwegian TEPS (which had too large spread at the time of the experiments). This gives an amplitude of 0.008
  - The ratio (TSV amplitude / NHSV amplitude) = 0.4
- Second experiment:
  - SV amplitude reduced by 25% to 0.015
  - TSV amplitude reduced by ~50% to 0.015
  - Ratio = 1

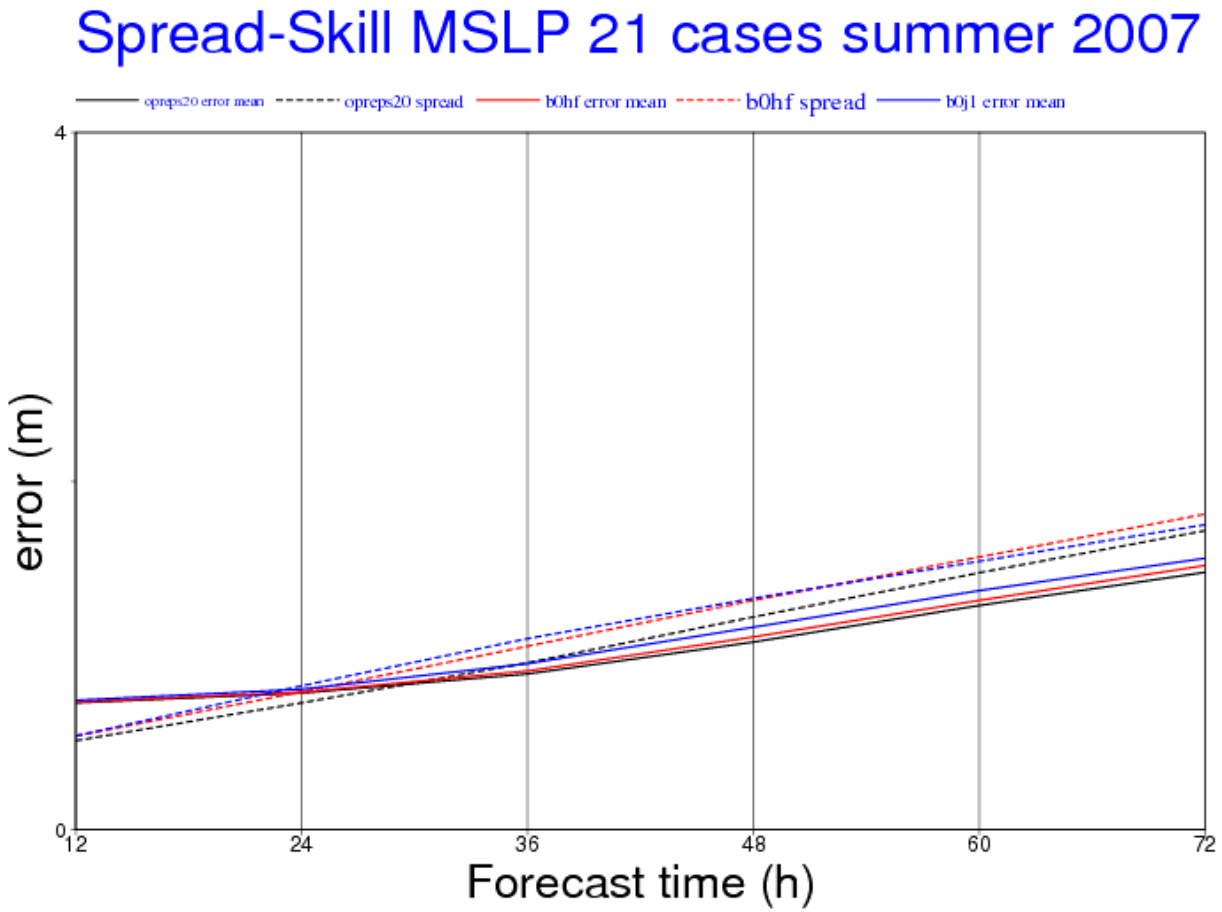
COST

- TSVs for all three target areas: ca 600 SBUs
- TEPS for Europe: ca 3000 SBUs

A total cost of ~3600 SBUs per run

Spread/Skill relationship

MSLP, 21 summer cases 2007



___ error of EM, EPS20

___ error of EM, exp1

___ error of EM, exp2

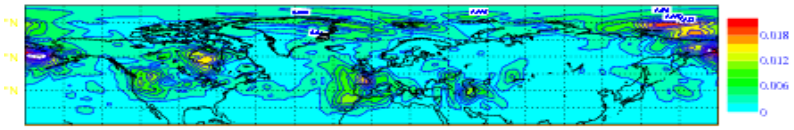
---- spread around EM, EPS20

---- spread around EM, exp1

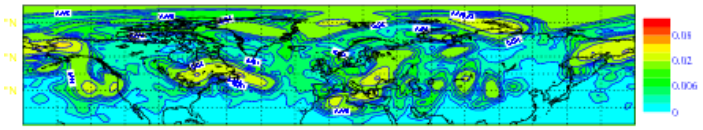
---- spread around EM, exp2

Example of SVs. Mean of absolute value of the SVs/SVEVOs

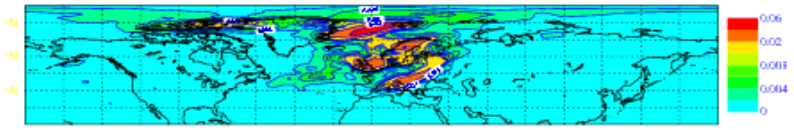
mean NHSV. Temp. Lev 35 20070626



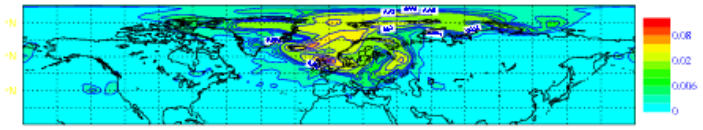
mean NHSVEVO. Temp. Lev 35 20070626



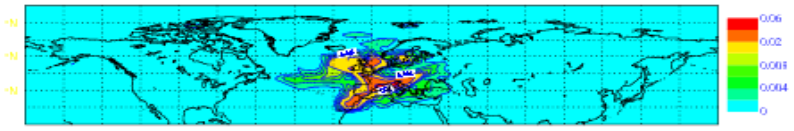
mean TSV north. Temp. Lev 35 20070627



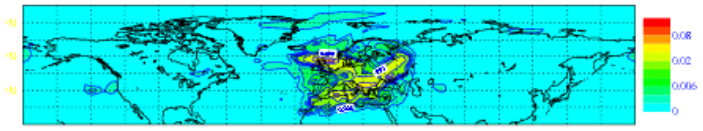
mean TSVEVO north. Temp. Lev 35 20070627



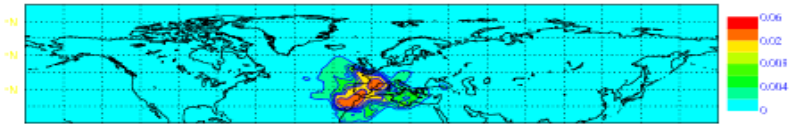
mean TSV central. Temp. Lev 35 20070627



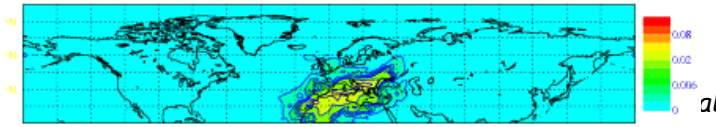
mean TSVEVO central. Temp. Lev 35 20070627



mean TSV south. Temp. Lev 35 20070627

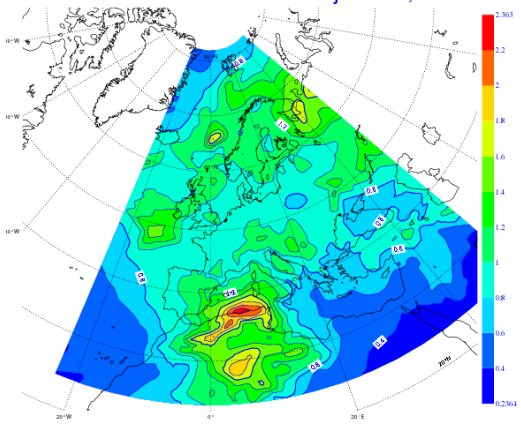


mean TSVEVO south. Temp. Lev 35 20070627



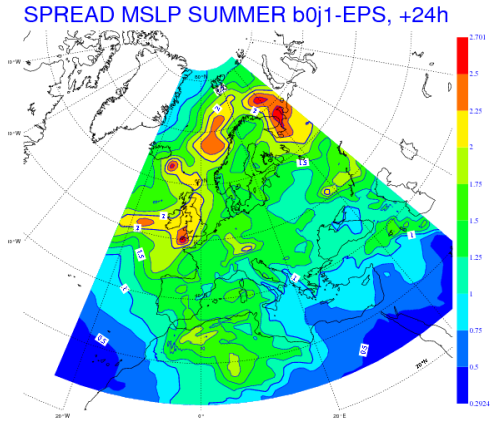
Difference in spread between European TEPS and EPS (21 summer cases)

SPREAD MSLP SUMMER b0j1-EPS, +12h



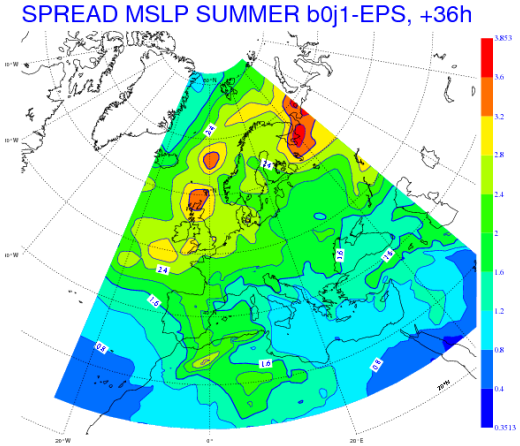
+12h

SPREAD MSLP SUMMER b0j1-EPS, +24h



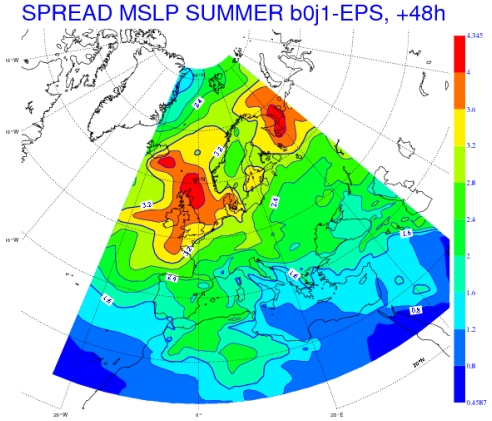
+24h

SPREAD MSLP SUMMER b0j1-EPS, +36h



+36h

SPREAD MSLP SUMMER b0j1-EPS, +48h



+48h

EXPERIMENTS 2

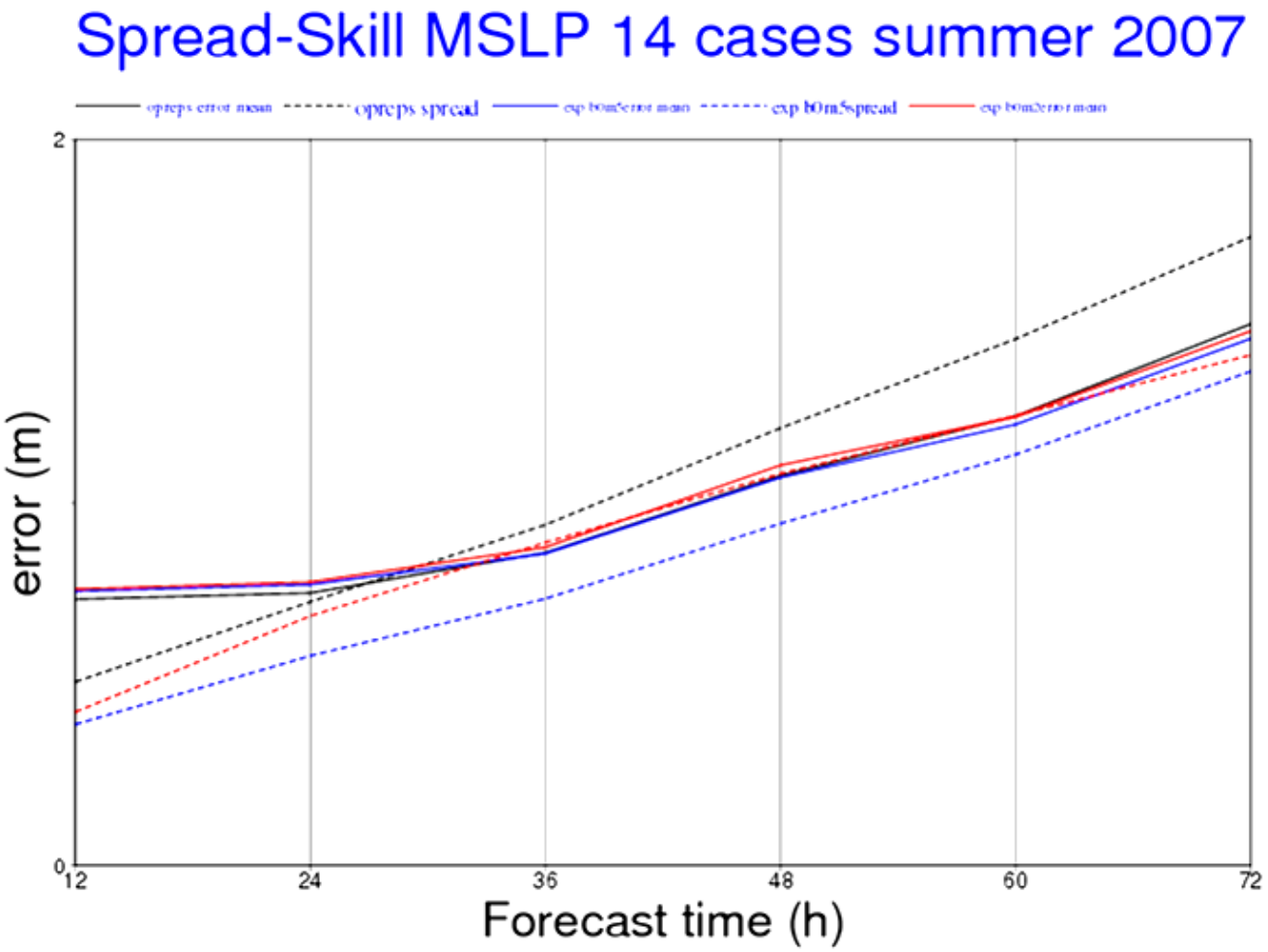
CY32R3

- 14 days in summer 2007:
  - 20070812-20070825
- Experiment:
  - The amplitudes were reduced by 30% due to the more active model in CY32R3, this is in line with what was done for operational EPS at ECMWF
  - SV amplitude reduced by 25% to 0.0105
  - TSV amplitude reduced by ~50% to 0.015
  - Ratio = 1

TEPS for Europe: production

- The LAM models need input on model levels
- Too much data and too slow to use MARS
- In agreement with ECMWF the model level data needed for HIRLAM and ALADIN are stored on:
  - hpce: hpce/tmp/ms/no/fai/hirlam/bnd/teps_eur
  - ecfs: ec:/hirlam/bnd/teps_eur/
- So far data from 20070812 – 20070825 are available. Both 00UTC and 12UTC.

Spread/skill relationship



solid: error of ens. mean
dash: spread

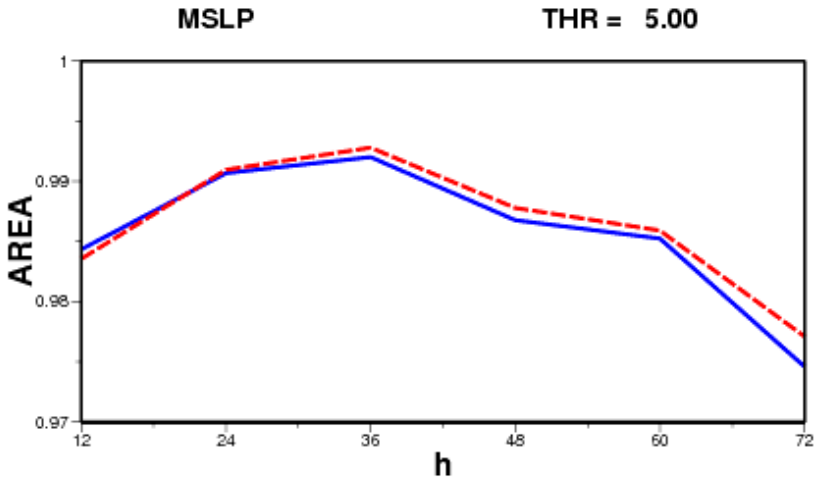
---EPS
CY32R2

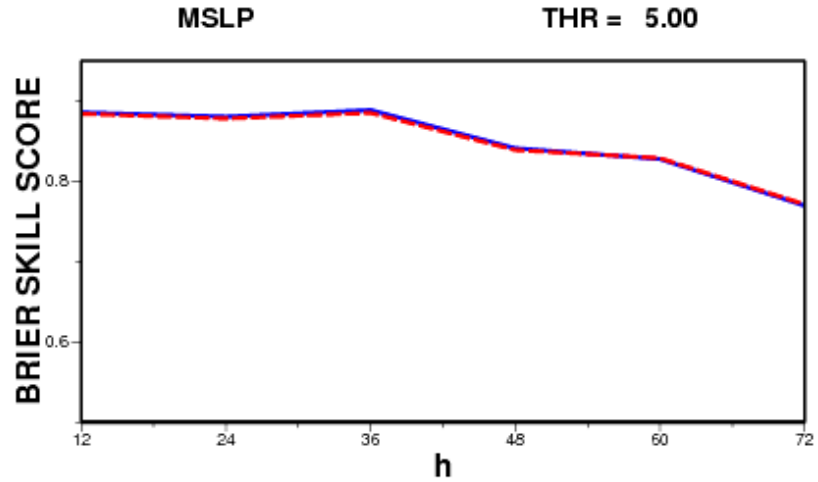
---EPS20 (”clean” run)
CY32R3

---TEPS for Europe
CY32R3

MSLP, Area ROC and BSS

THR = 5



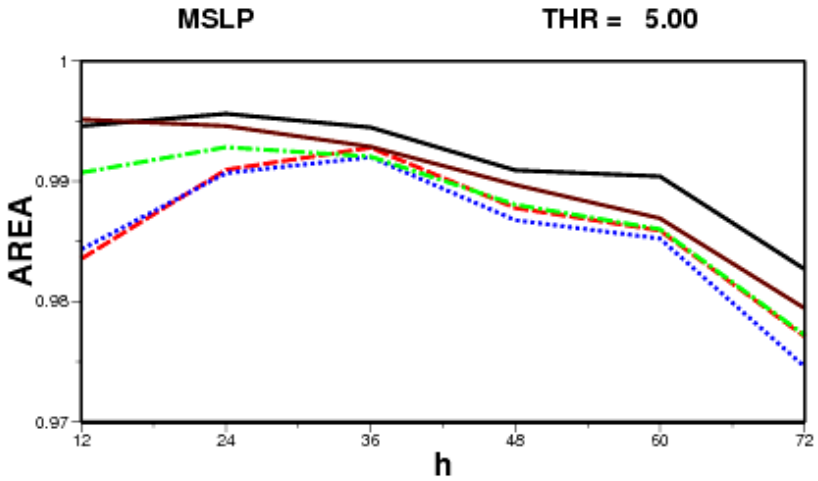


TEPS for Europe

EPS20 ”clean” run

MSLP, Area ROC and BSS

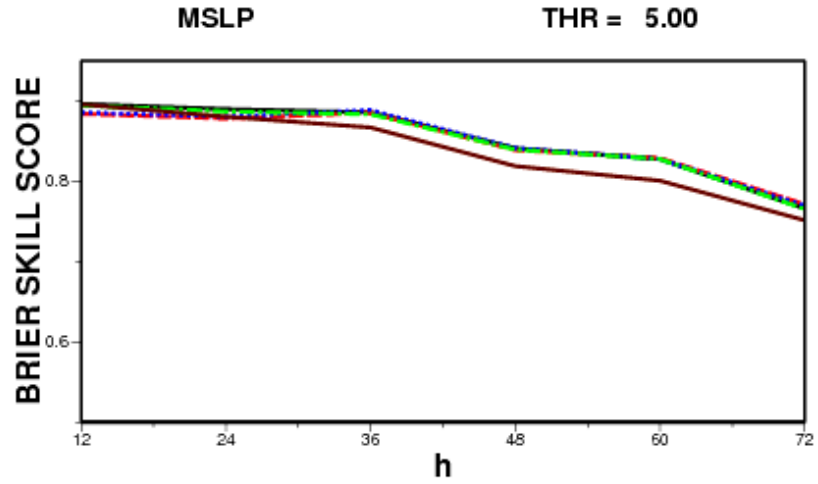
THR = 5



TEPS for Europe

EPS20 ”clean” run

EPS

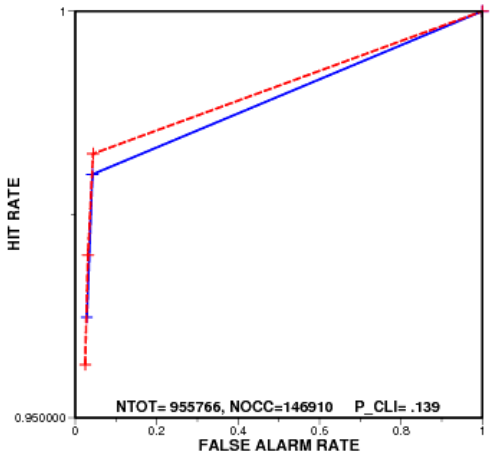


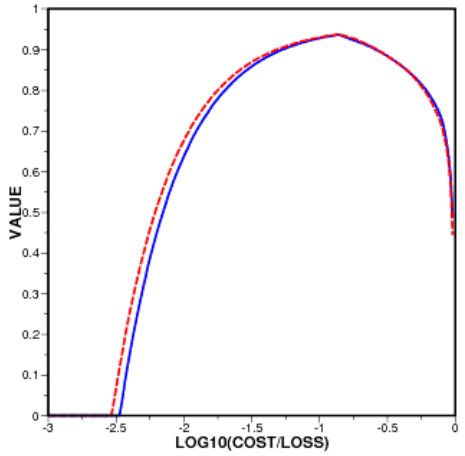
EPS20

TEPS for Norway

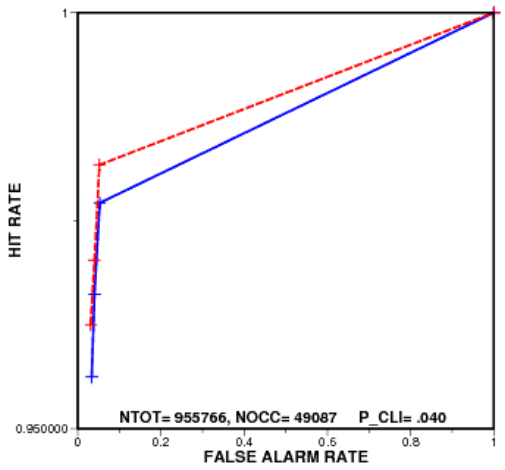
MSLP, ROC and COST/LOSS

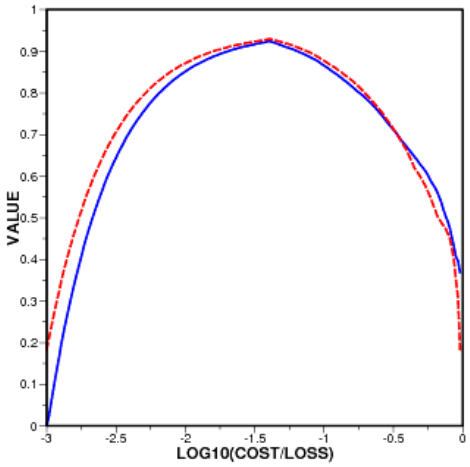
THR = 5, +48h





THR = 10, + 72h



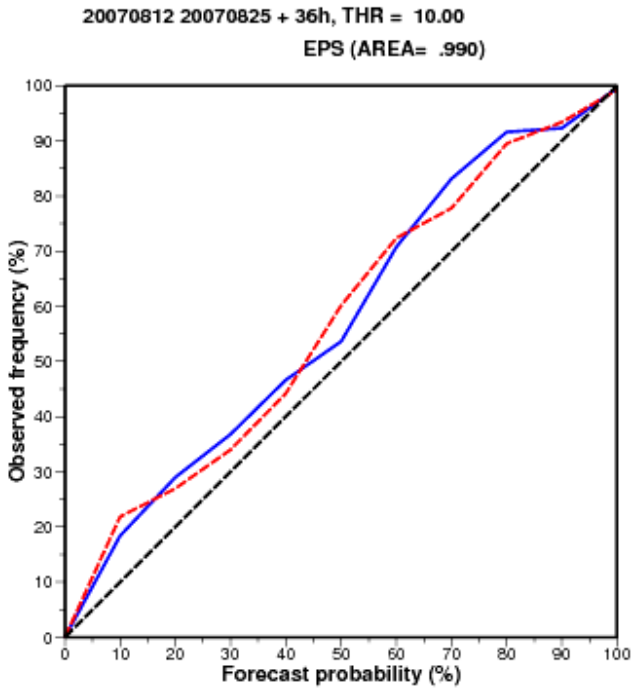


TEPS for Europe

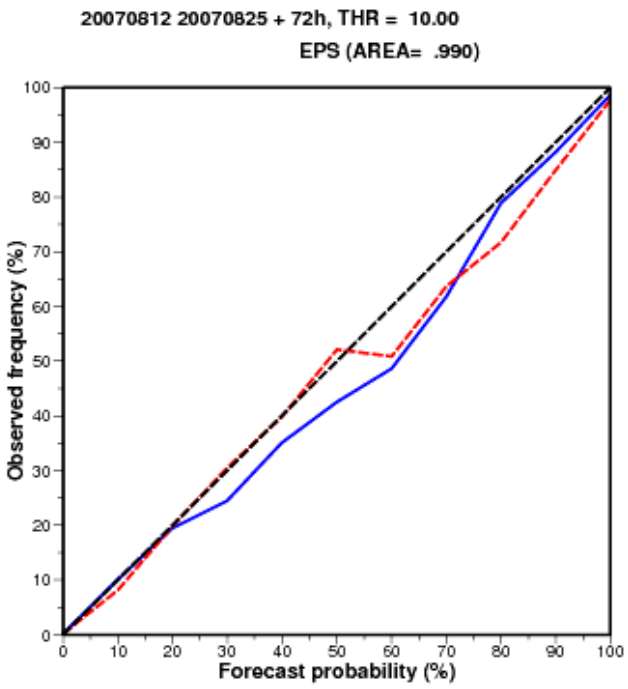
EPS20, ”clean” run

MSLP, RELIABILITY DIAGRAM

THR = 10, +36h



THR = 10, +72h

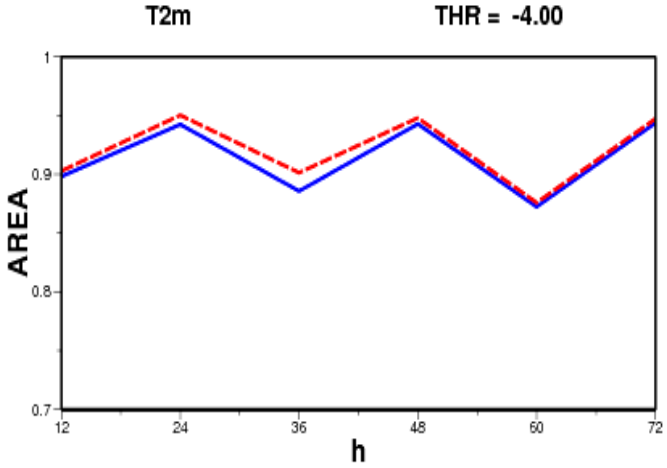


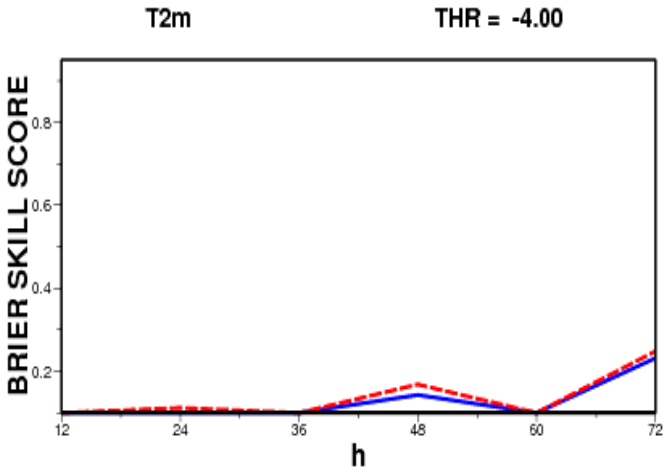
TEPS for Europe

EPS20, ”clean” run

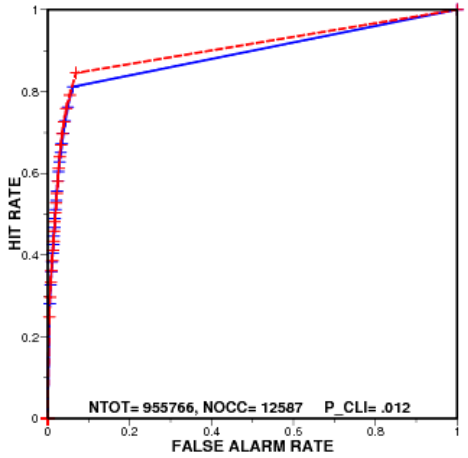
T2m

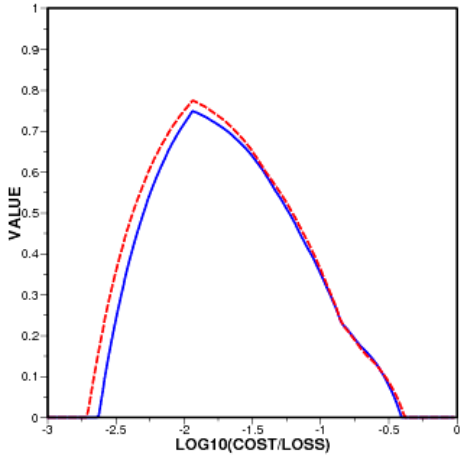
THR = -4





THR = -4, +36h



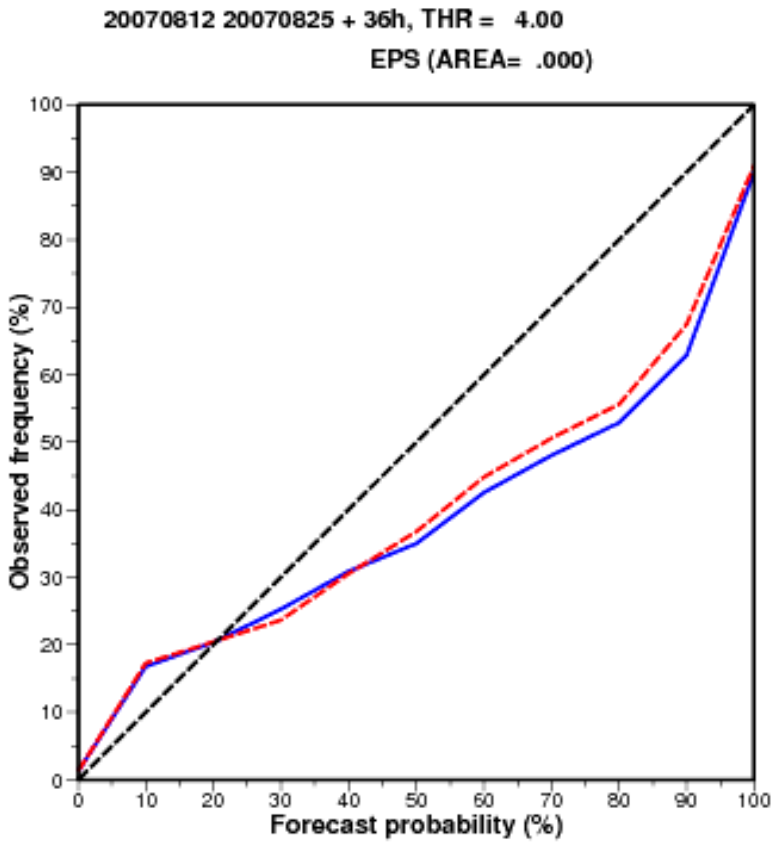


TEPS for Europe

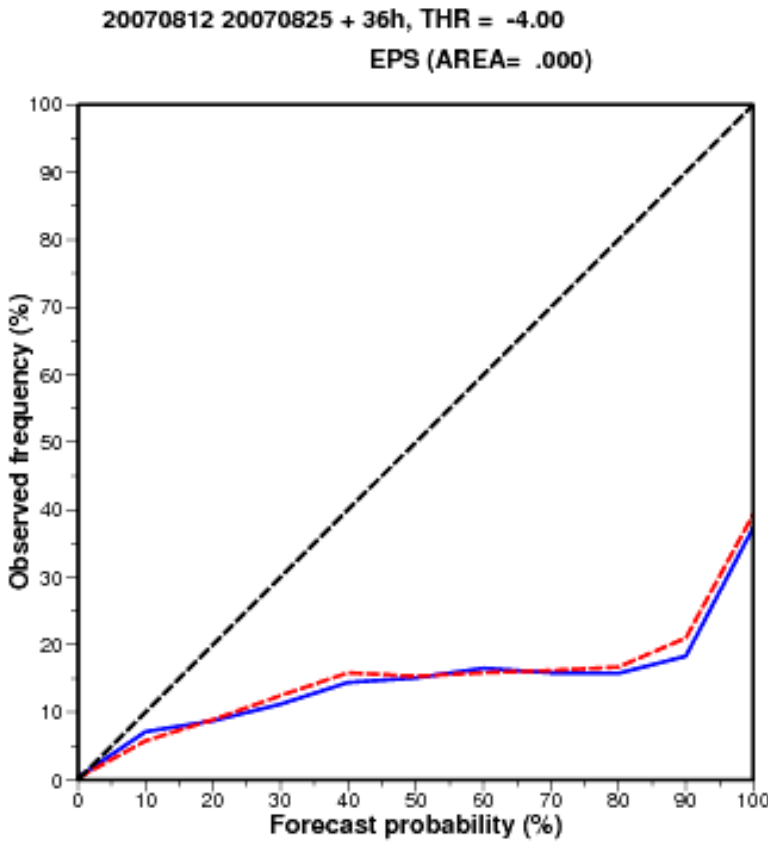
EPS20, ”clean” run

T2m, Reliability diagram

THR = 4, +36h

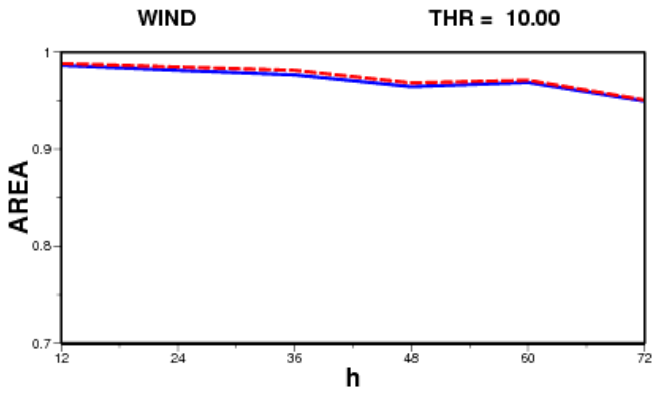


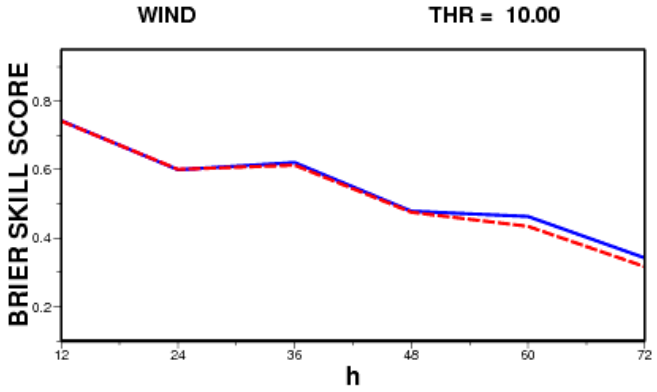
THR = -4, +36h



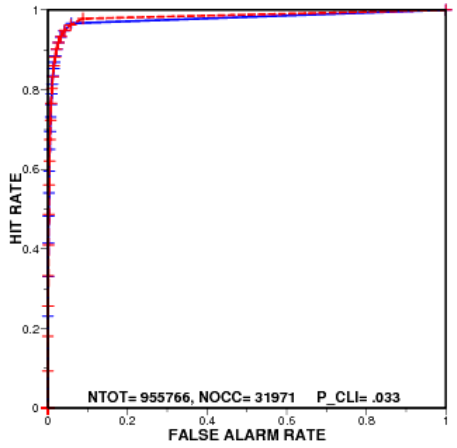
10 meter wind speed

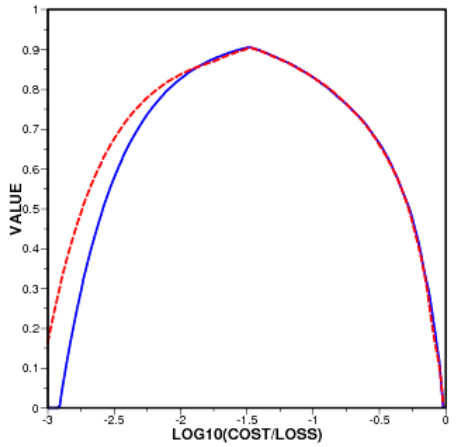
THR = 10





THR = 10, +36h



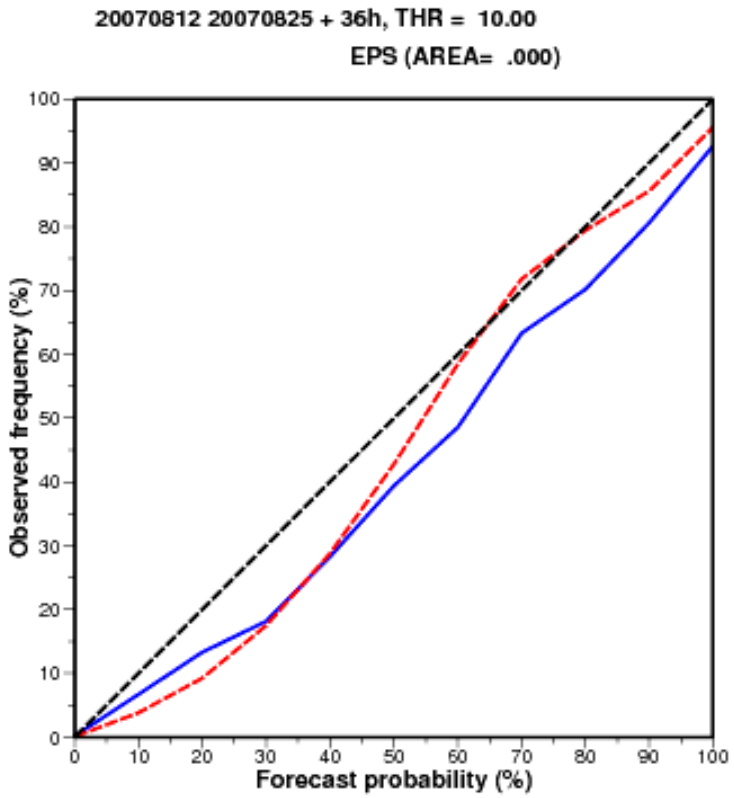


TEPS for Europe

EPS20, ”clean” run

10 meter wind speed, Reliability diagram

THR = 10, +36h



TEPS for Europe

EPS20, ”clean” run

Conclusions TEPS for Europe

- The experiments are now running without any technical problems, including saving of model levels for LAMs.
- Model level data are now available from TEPS for Europe

- The TSVs targeted to the three European areas are behaving as expected, i.e. the structures are reasonable, both horizontally and vertically, and they are located in the right places.
- The spread is too small for the first hours of the forecasts, but the spread/skill relationship is very good from about 24 h (CY32R3)
- TEPS for Europe is capable of giving spread in the whole area of interest, that is in all parts of Europe for all forecast lengths.
- TEPS for Europe scores better or equal to EPS20 for the three parameters looked at (MSLP, Tm and wind speed)

Further work

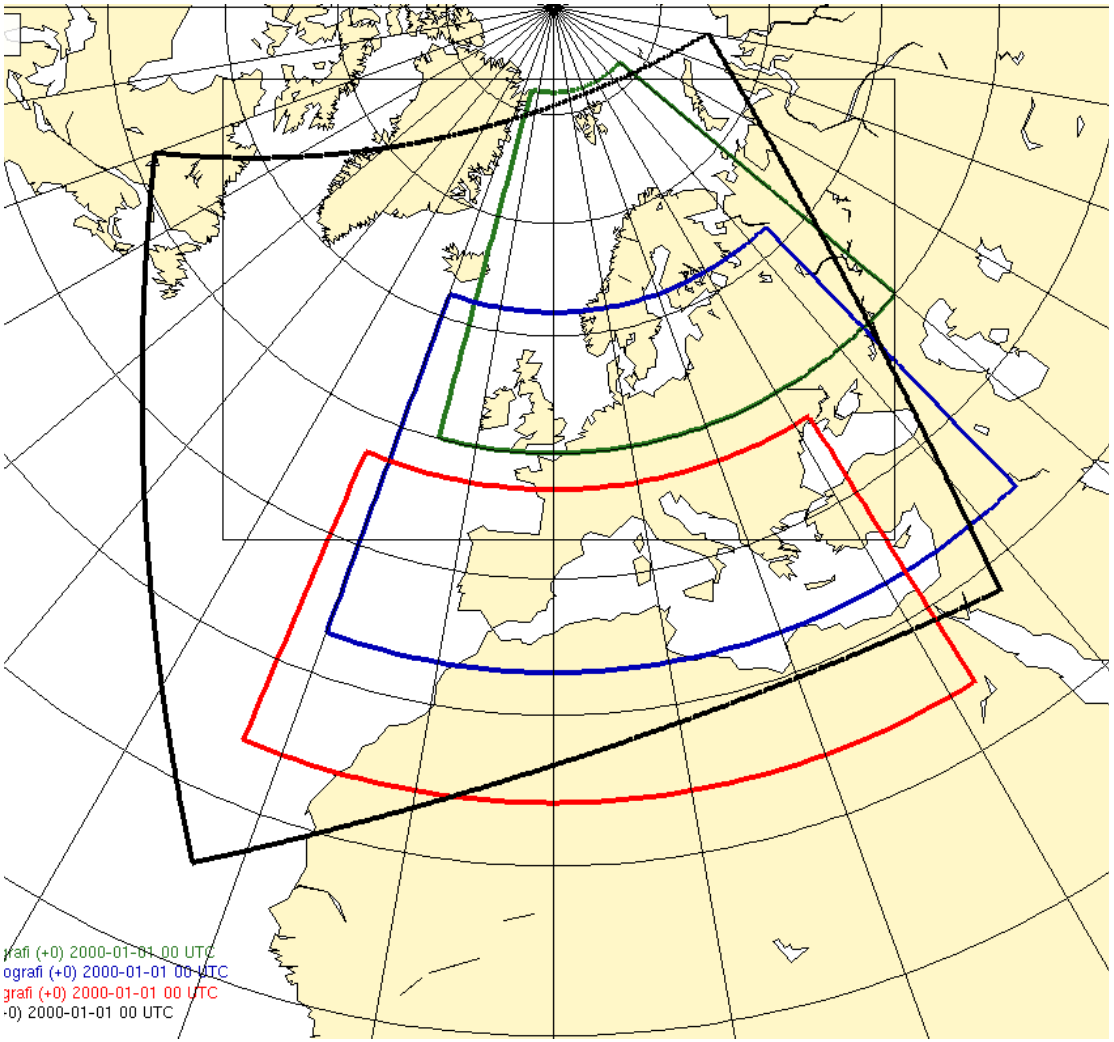
- Try diabatic singular vectors (the increased resolution implies that diabatic processes increase in importance)
- Try Hessian singular vectors (shorter optimalisation time implies that the initial error more and more should resemble the observational error)
- Investigate methods to increase the spread in the ensemble for the first 24 hours.

- Check the effect of the increased resolution of the TSVs
- Check the effect of the three overlapping target areas as opposed to one big target area

- A winter period will also be run.


Thank you for your attention

TARGET AREAS



GLAMEPS integration domain
(HIRLAM version)

Target area north
(82N,15W,50N,50E)

Target area central
(62N,20W,33N,44E)

Target area south
(47N,23W,24N,32E)