ECMWF medium-range / monthly ensemble

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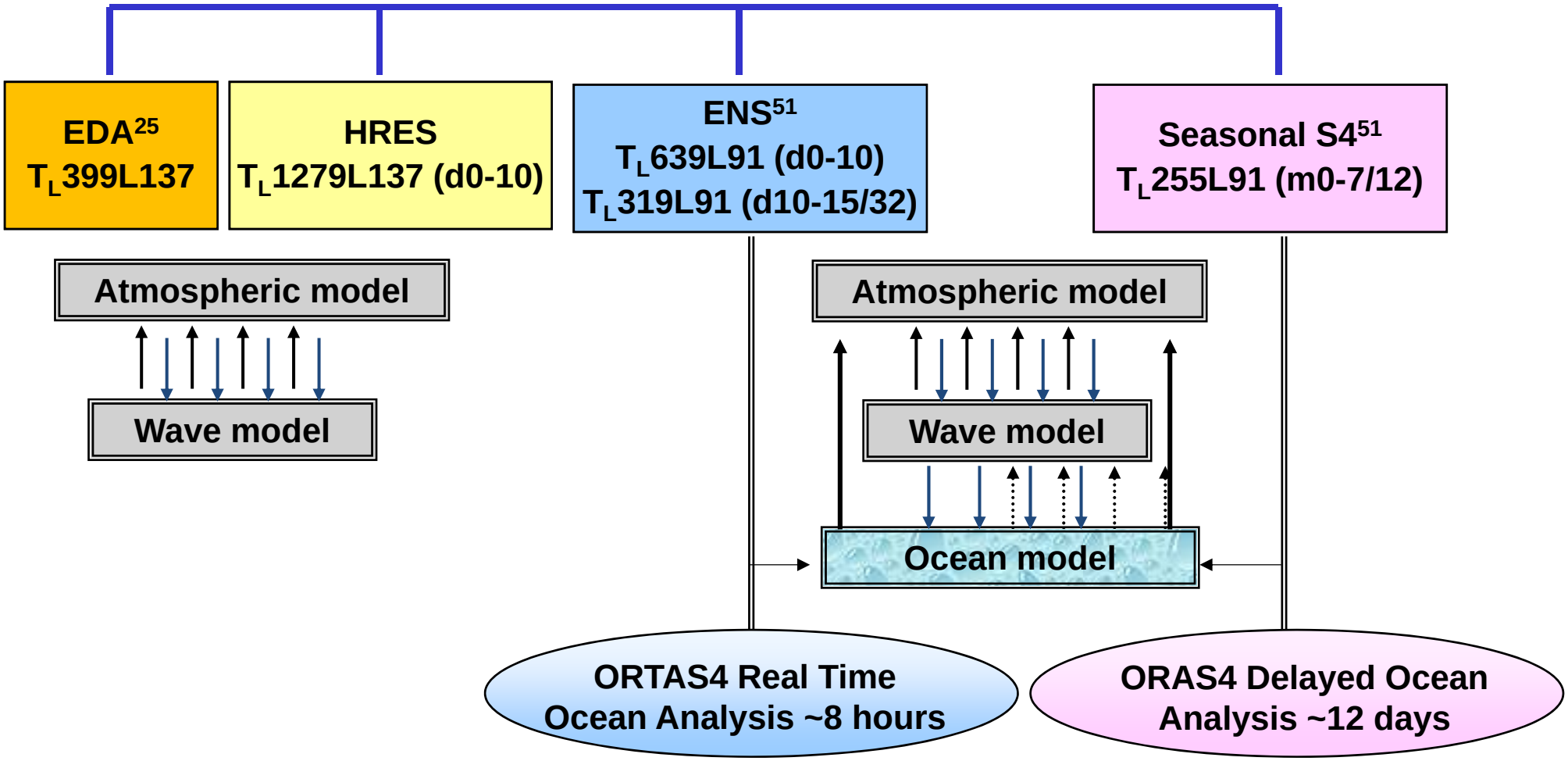
European Centre for Medium-range Weather Forecasts

The ECMWF Integrated Forecasting System (IFS)

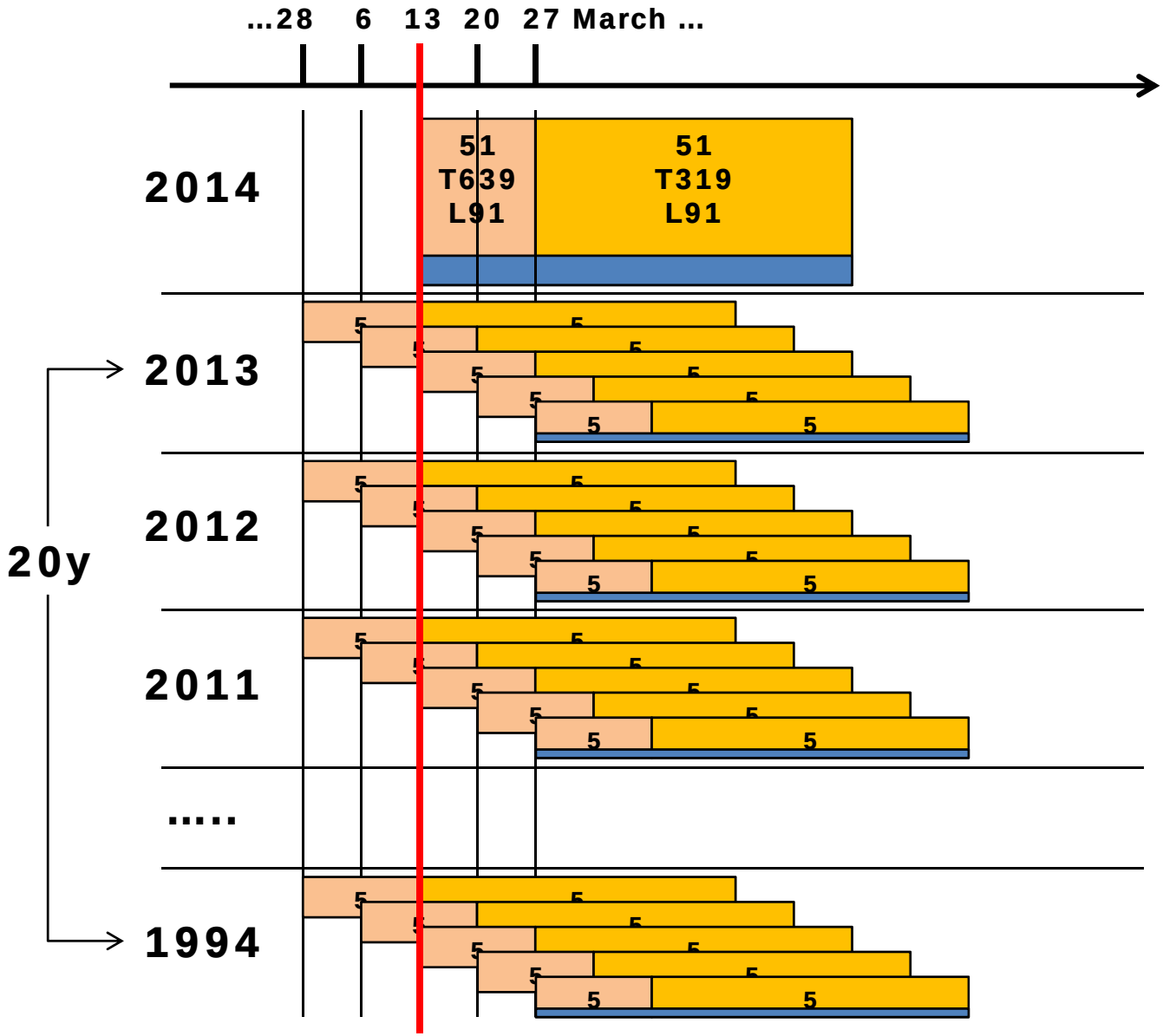


The ENS re-forecast suite to estimate the M-climate

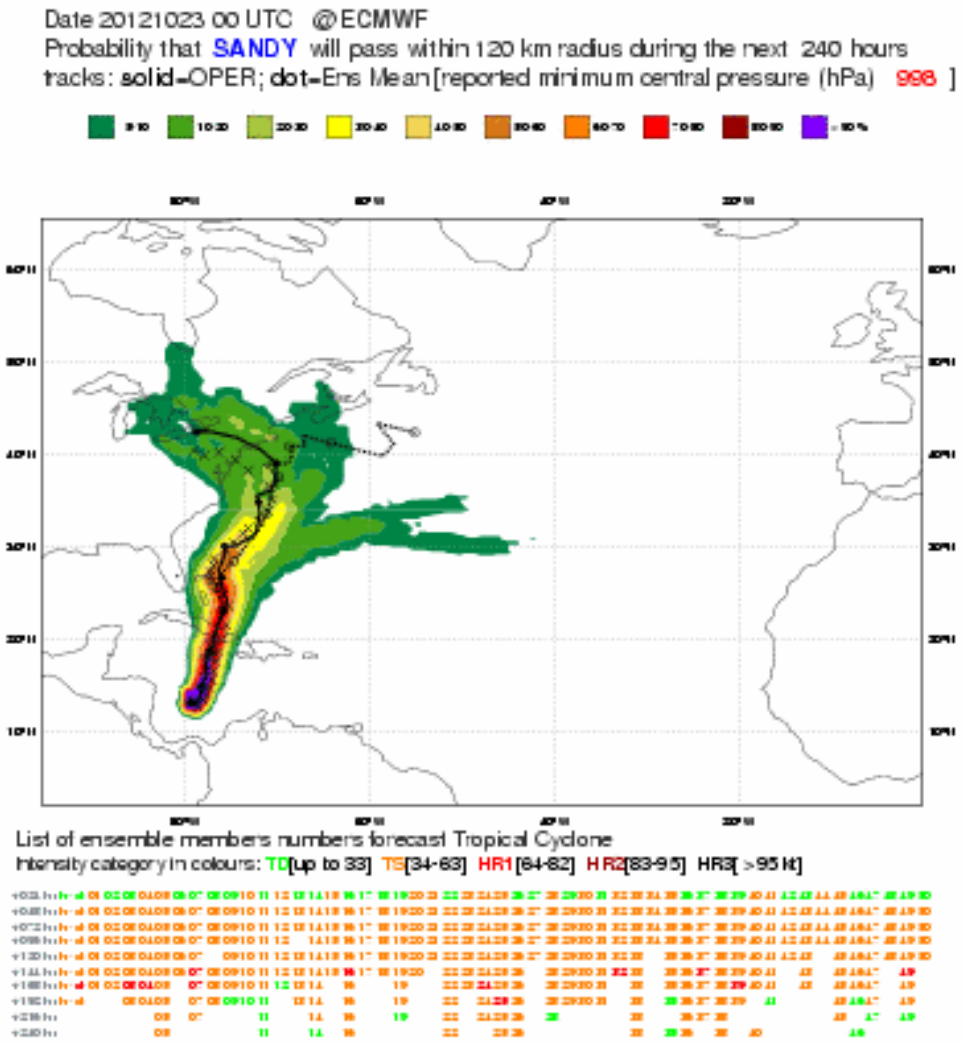
Following *Thomas Hamill* work, a re-fc suite is part of all ECMWF ensemble systems. Each day, the M-climate is estimated using **500 EPS re-forecasts**:

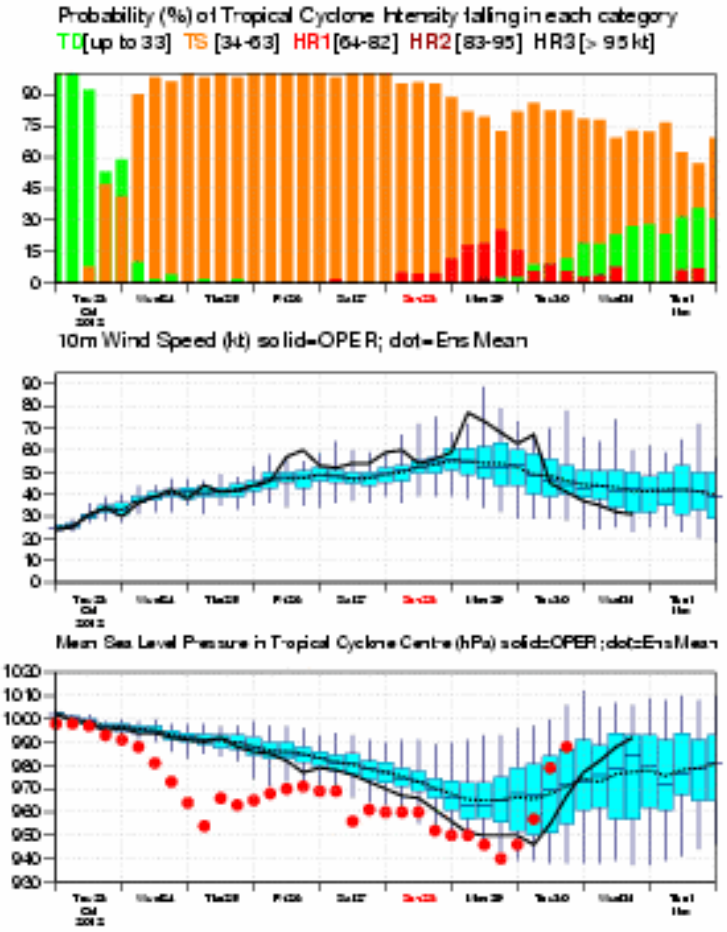
- 20 years (1994 – 2013)
- 5 ICs (-14d,-7d,0,+7d, +14d)
- 5 members

Some of the ENS products (e.g. the Extreme Forecast Indices) are bias corrected and/or calibrated using the model climate.

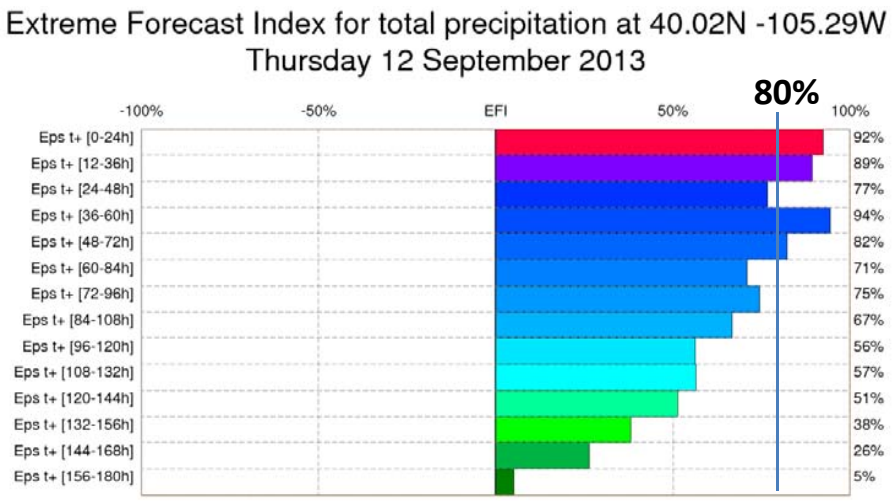


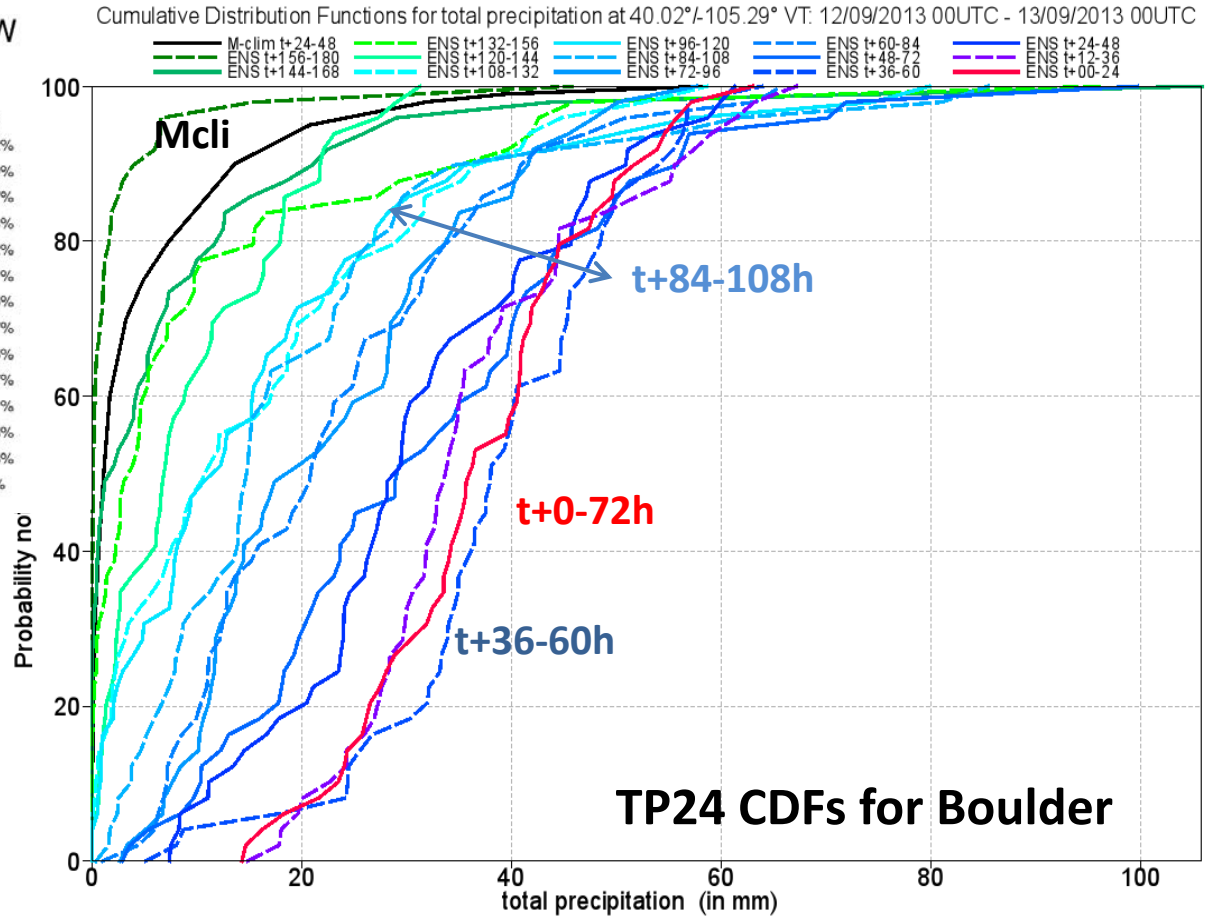
ENS to provide probabilities of weather scenarii





ENS to identify rare events





Boulder, 12-13 Sep 2013.

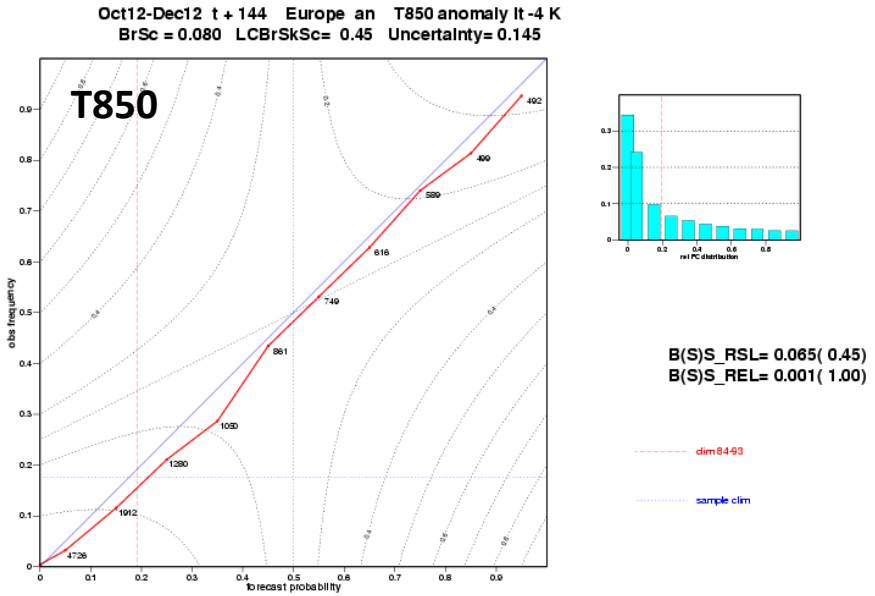
This plot shows EFI fcs for TP24 valid for the 24-hours between 00 UTC of 12 and 13 September 2013.

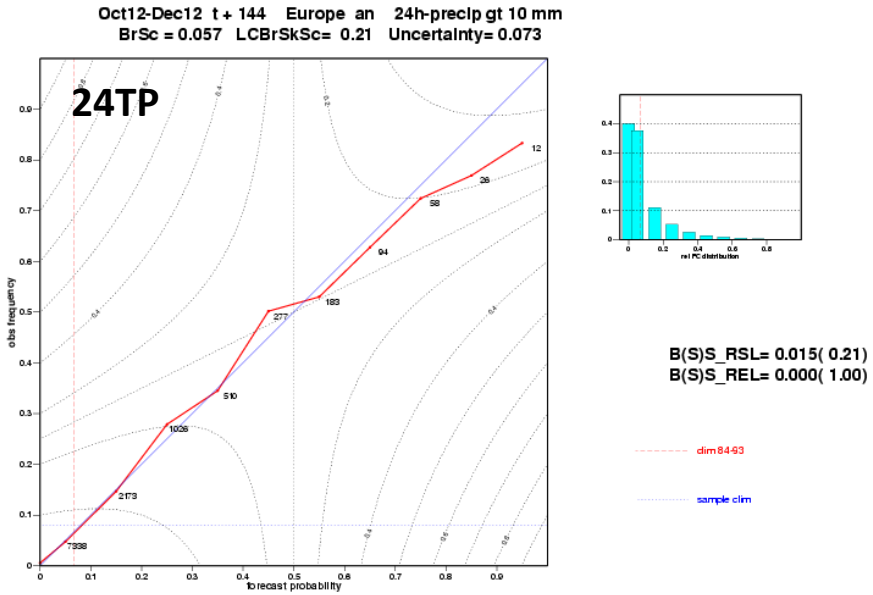
EFI was increasing approaching the date.

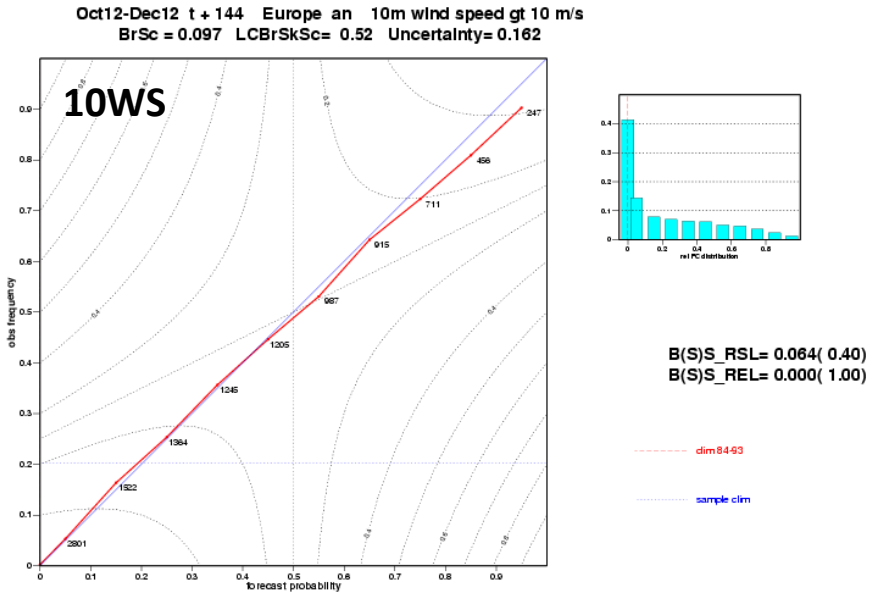
(From Ivan Tsonevski)

How do they perform? Ensembles must be reliable

Reliability is a key property that probabilistic forecasts must have.



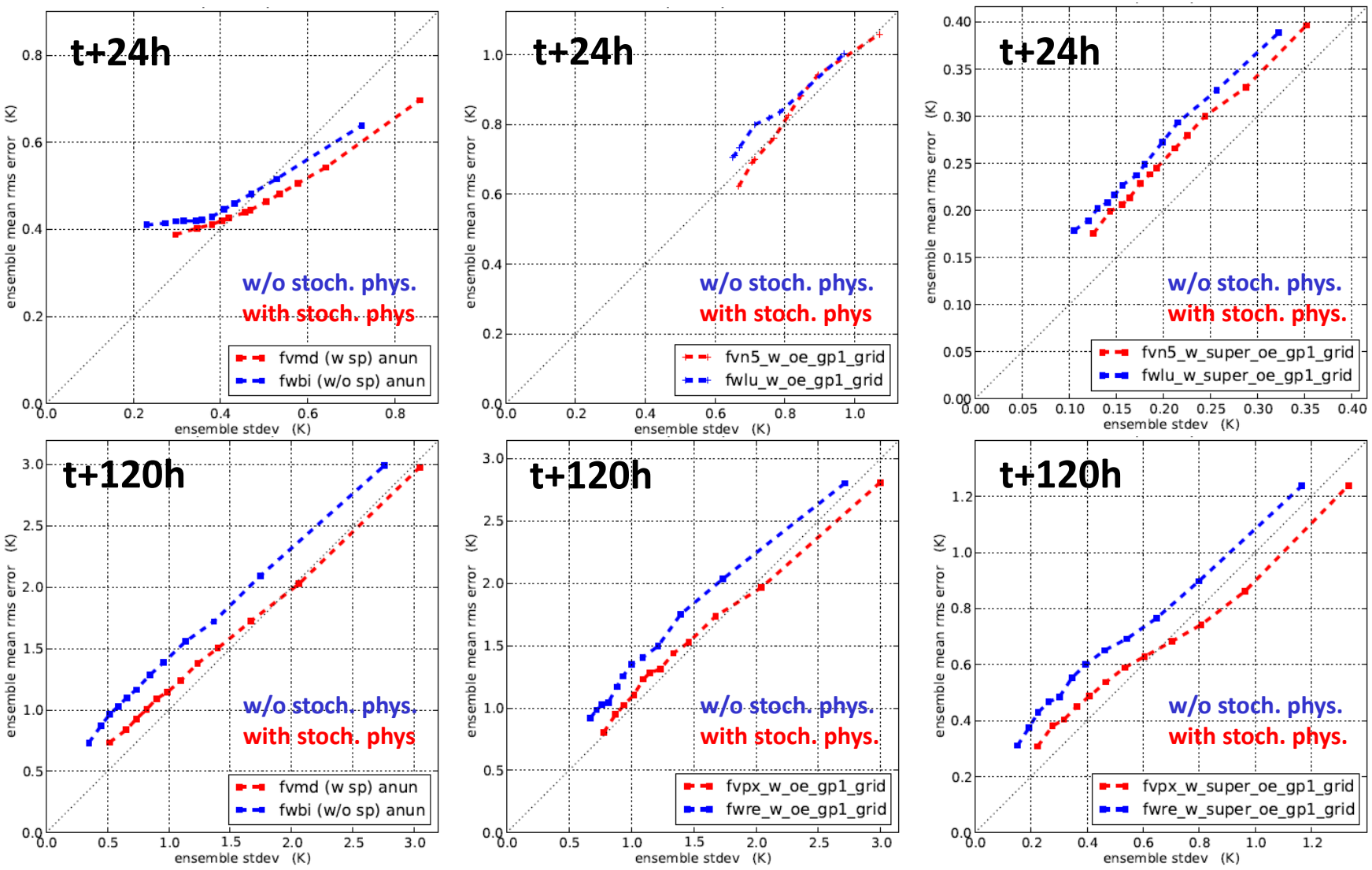




How do they perform? Ensembles must be reliable

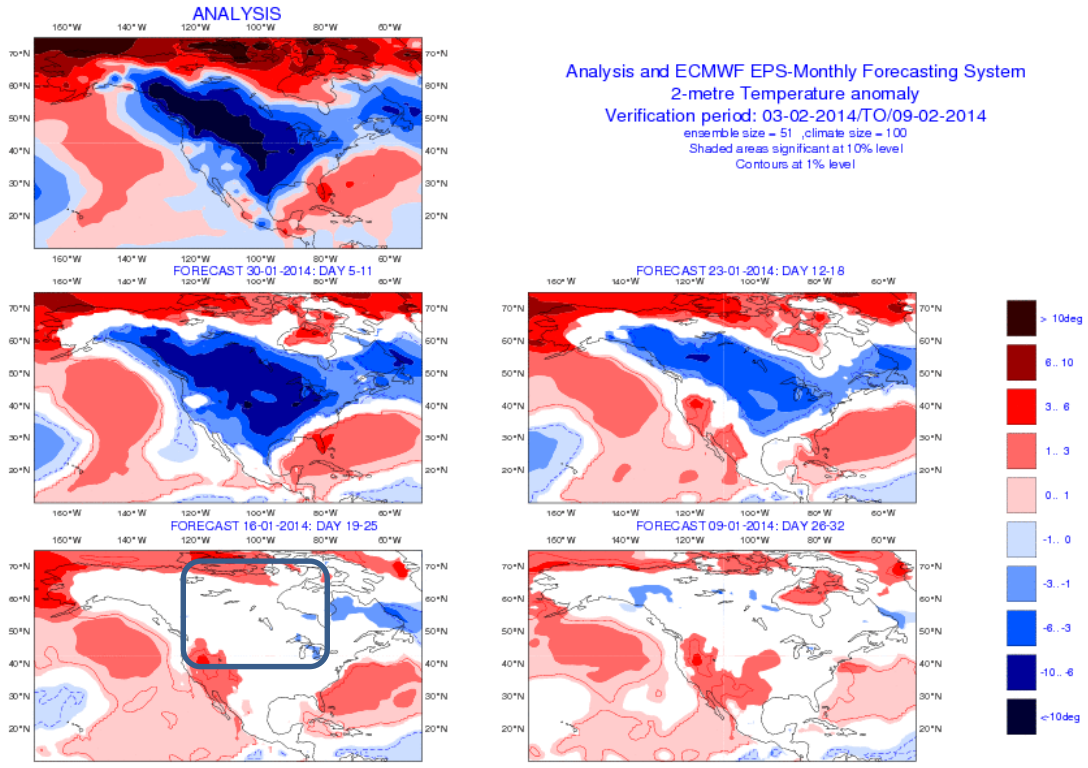
ENS reliability is sensitive to verification field (analysis or obs).

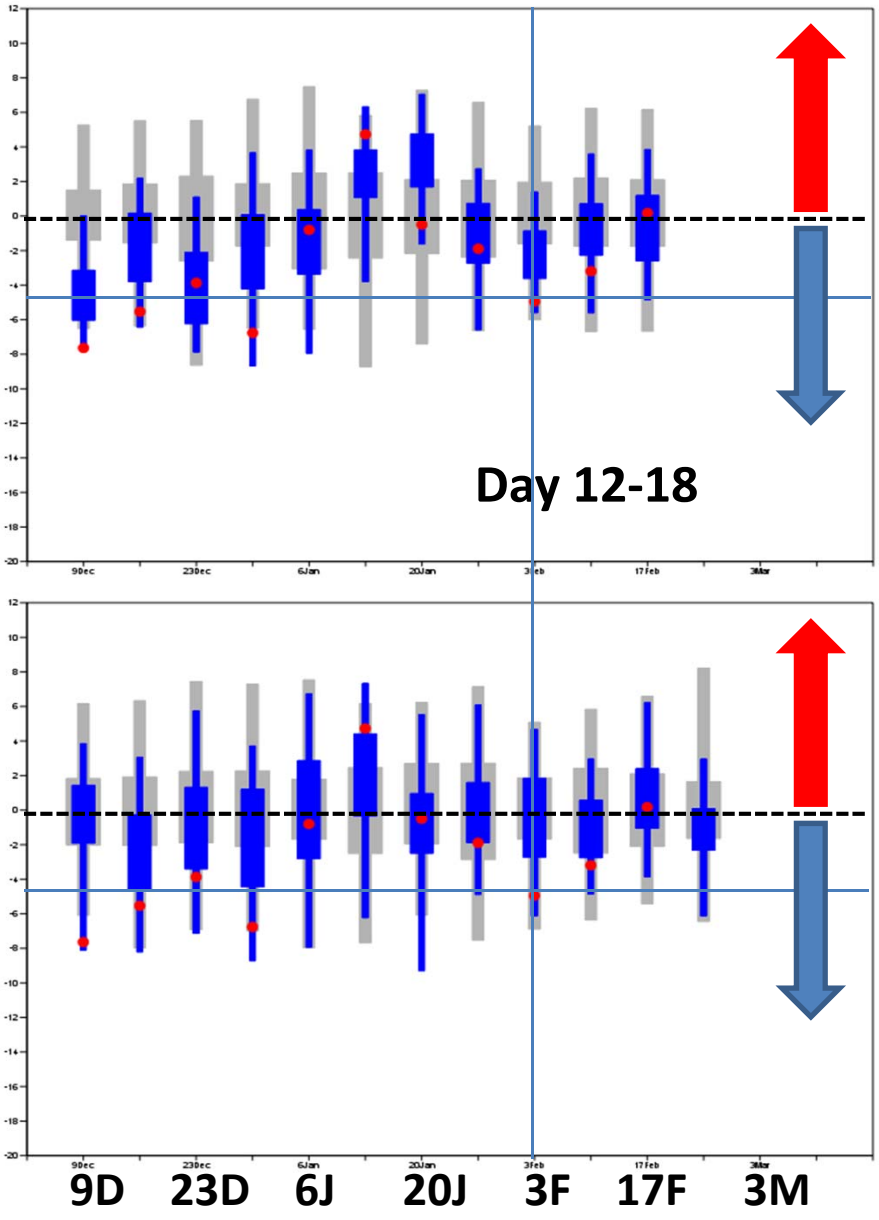
NH T500 – fc v analysis | **NH T500 – fc v radiosondes** | **NH T500 – fc v AMSUA**



(From M Yamaguchi)

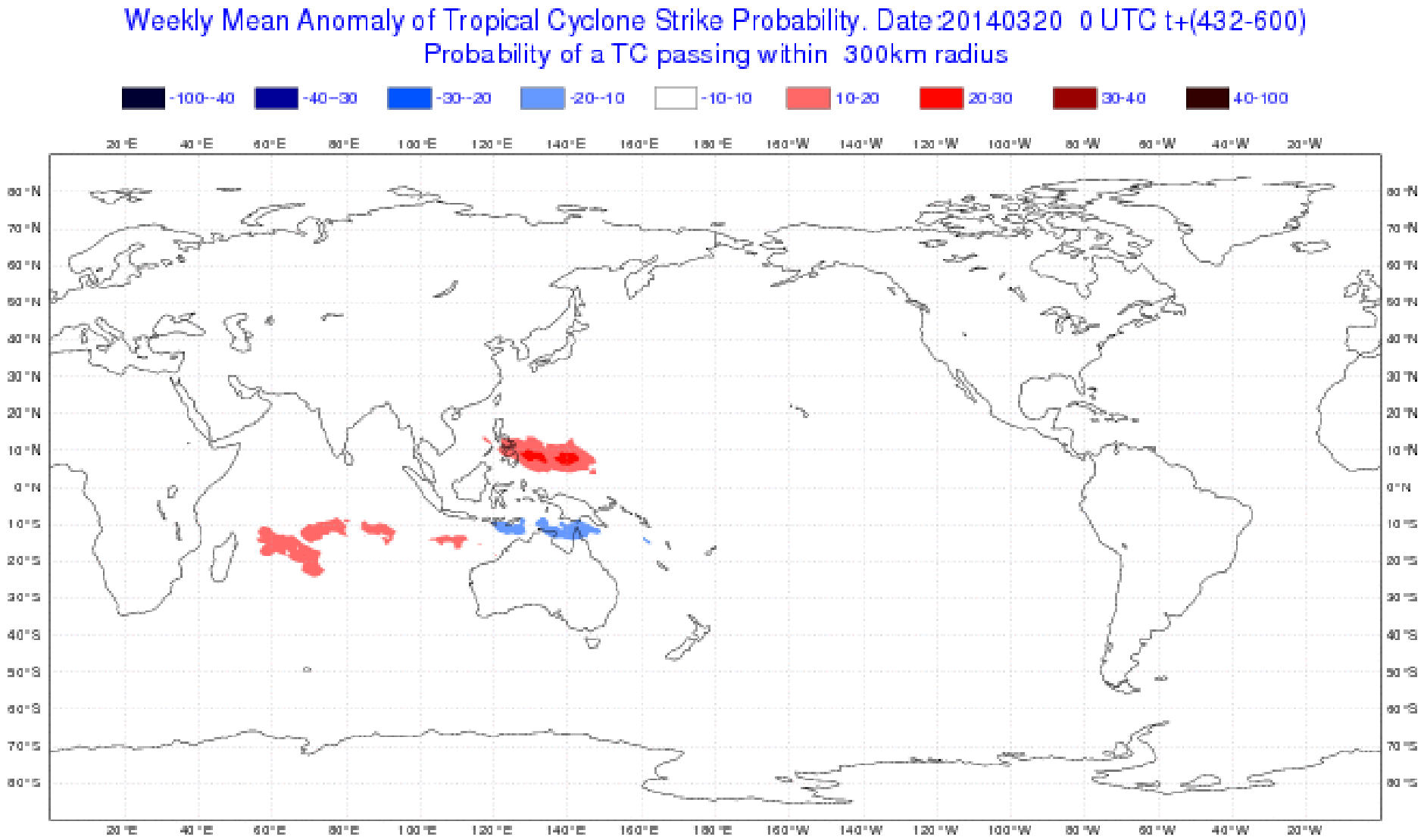
ENS to predict anomalies weeks ahead



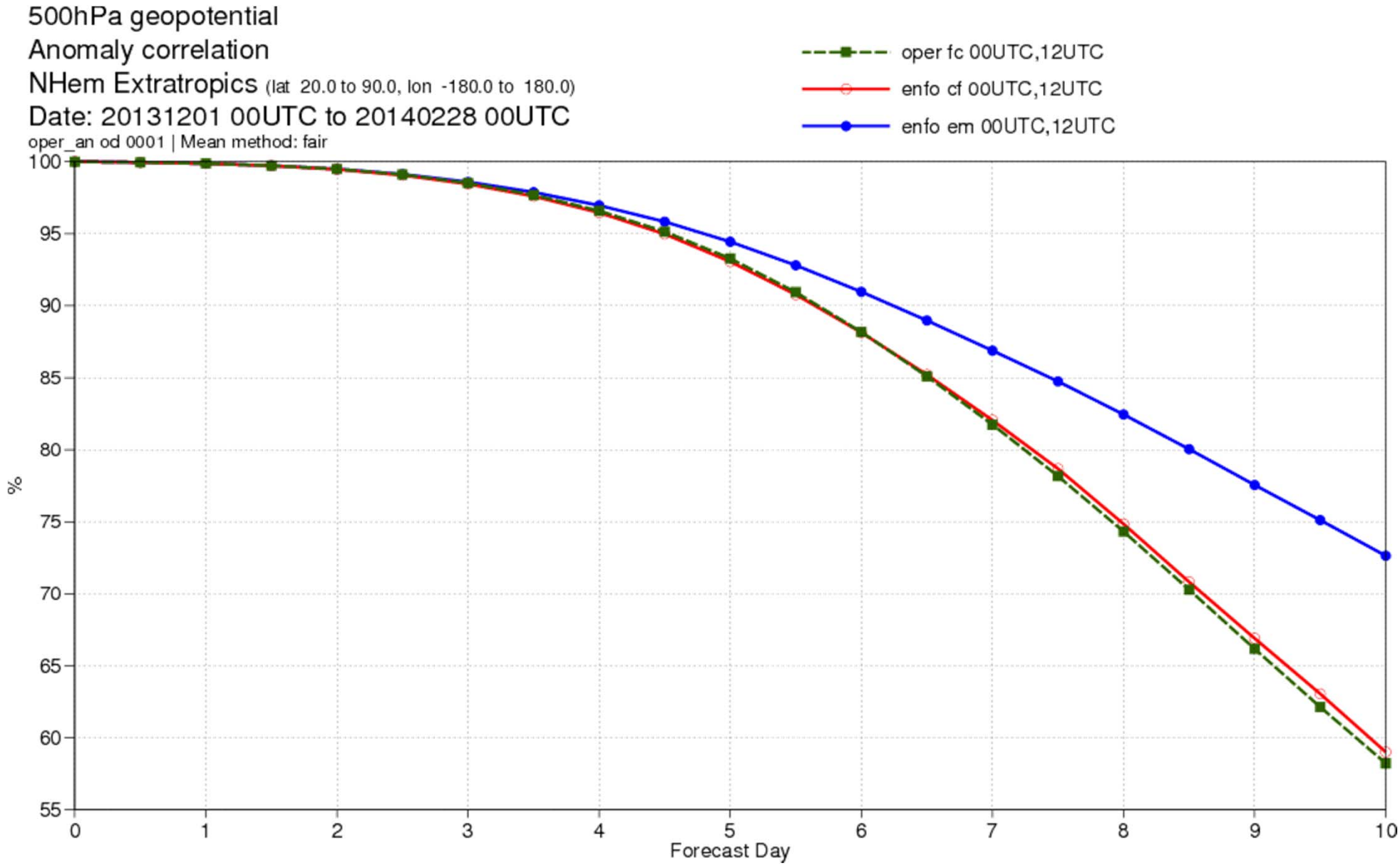


This plot shows ENS weekly anomaly forecasts over North America in D13-JFM13 (the right panels show average 2mT over (120-60W;40-70N).

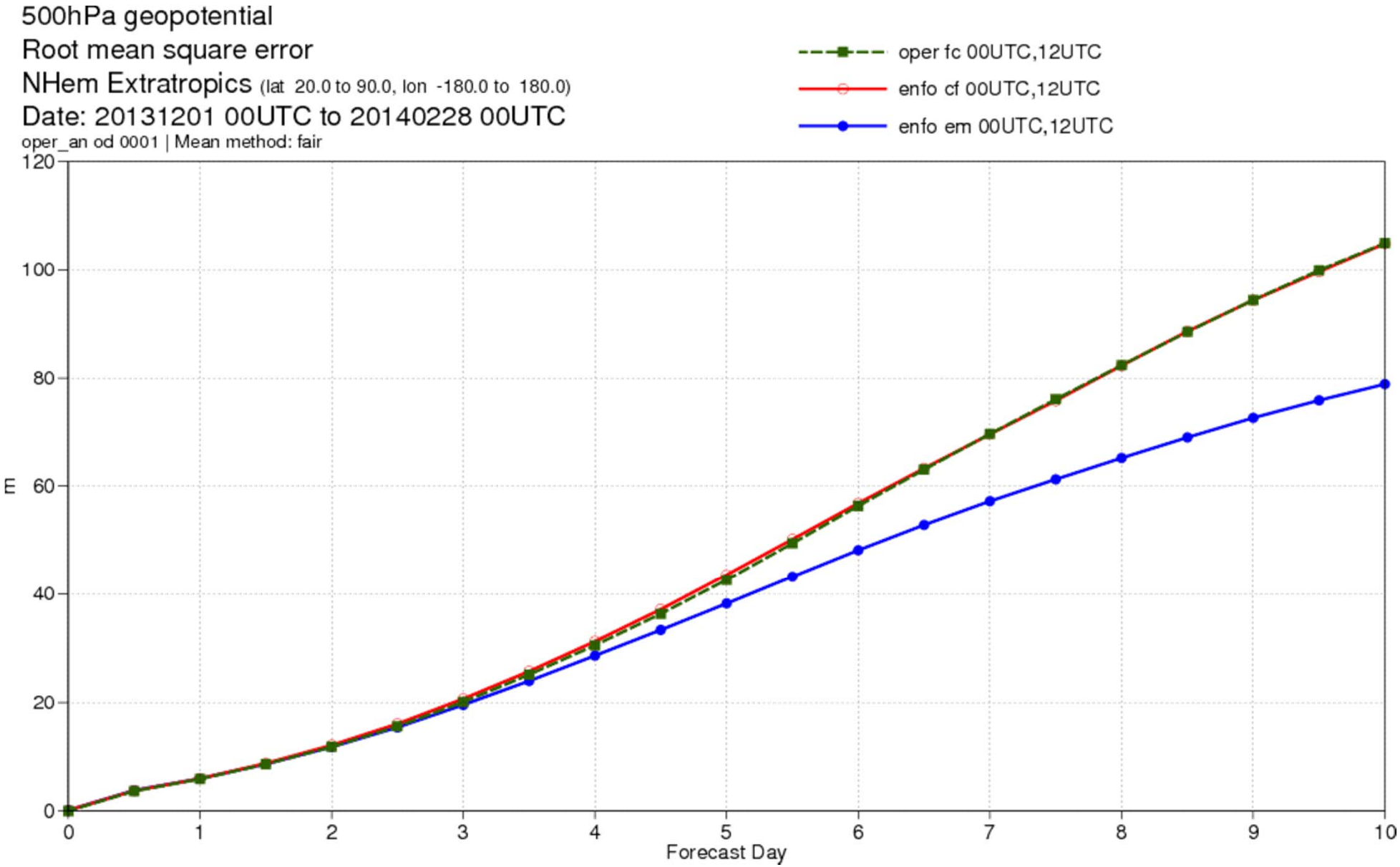
ENS to predict TC genesis (anomalies) weeks ahead



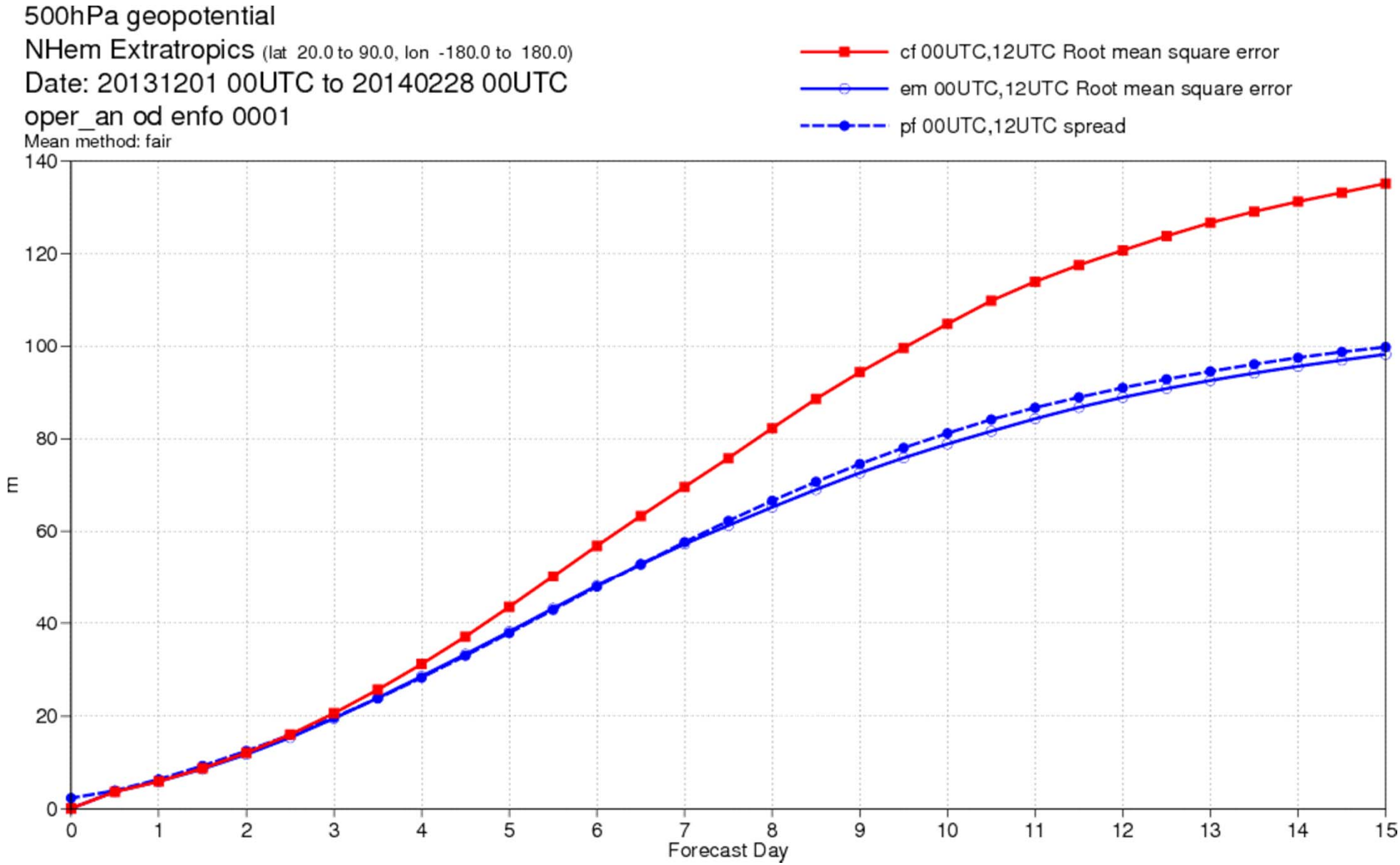
How do the ensembles perform? HRES, ENS-C, ENS-M



How do the ensembles perform? HRES, ENS-C, ENS-M



How do the ensembles perform? ENS-C, ENS-M, ENS-std

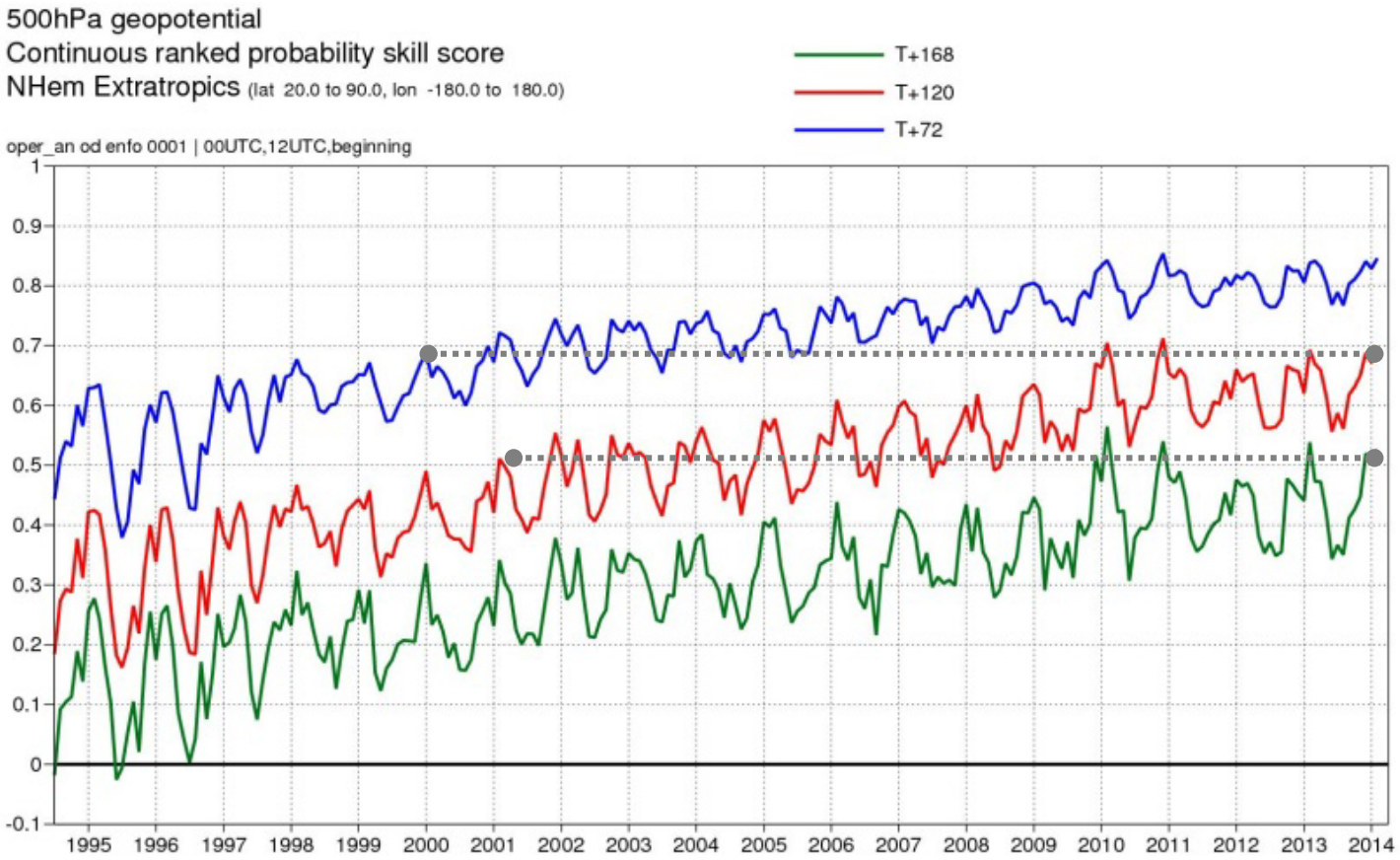


How do ensembles perform? Scores' trends CRPSS Z500 NH

Scores' trends can be used to monitor progress.

This plot shows that for upper-level fields over the NH extra-tropics , performance has been improving continuously.

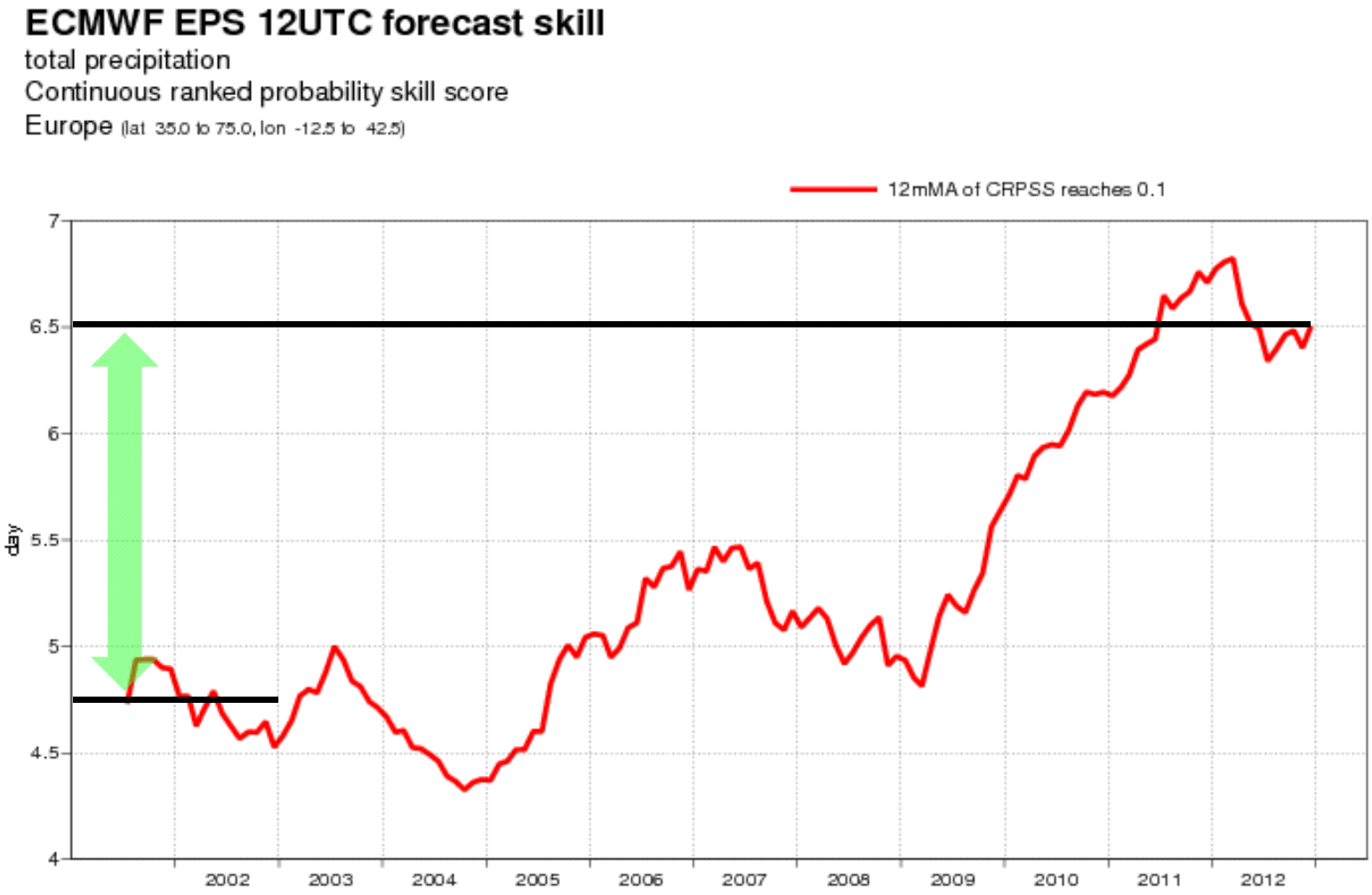
Results indicate predictability gains of 1.5-2.0 days per decade.



How do ensembles perform? Scores' trends CRPSS TP24 EU

Similar, although smaller in size, improvements can be seen by looking at 24h total precipitation, with skill gains of about 1.75 days between 2001 and 2012.

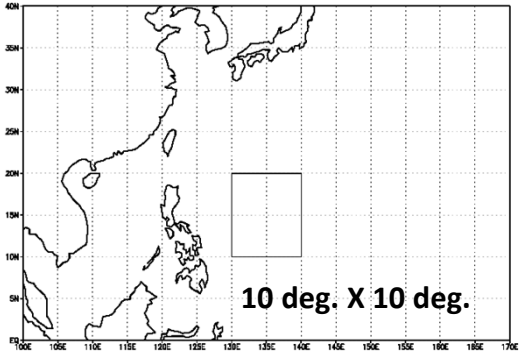
The plot shows the forecast lead time when CRPSS crosses a 10% value.

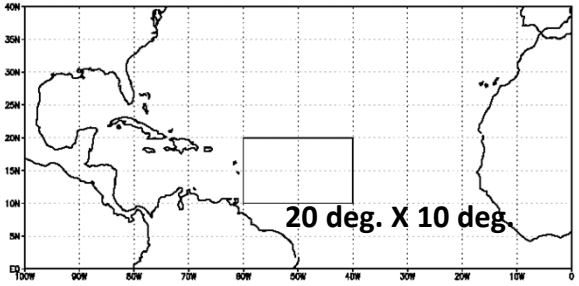


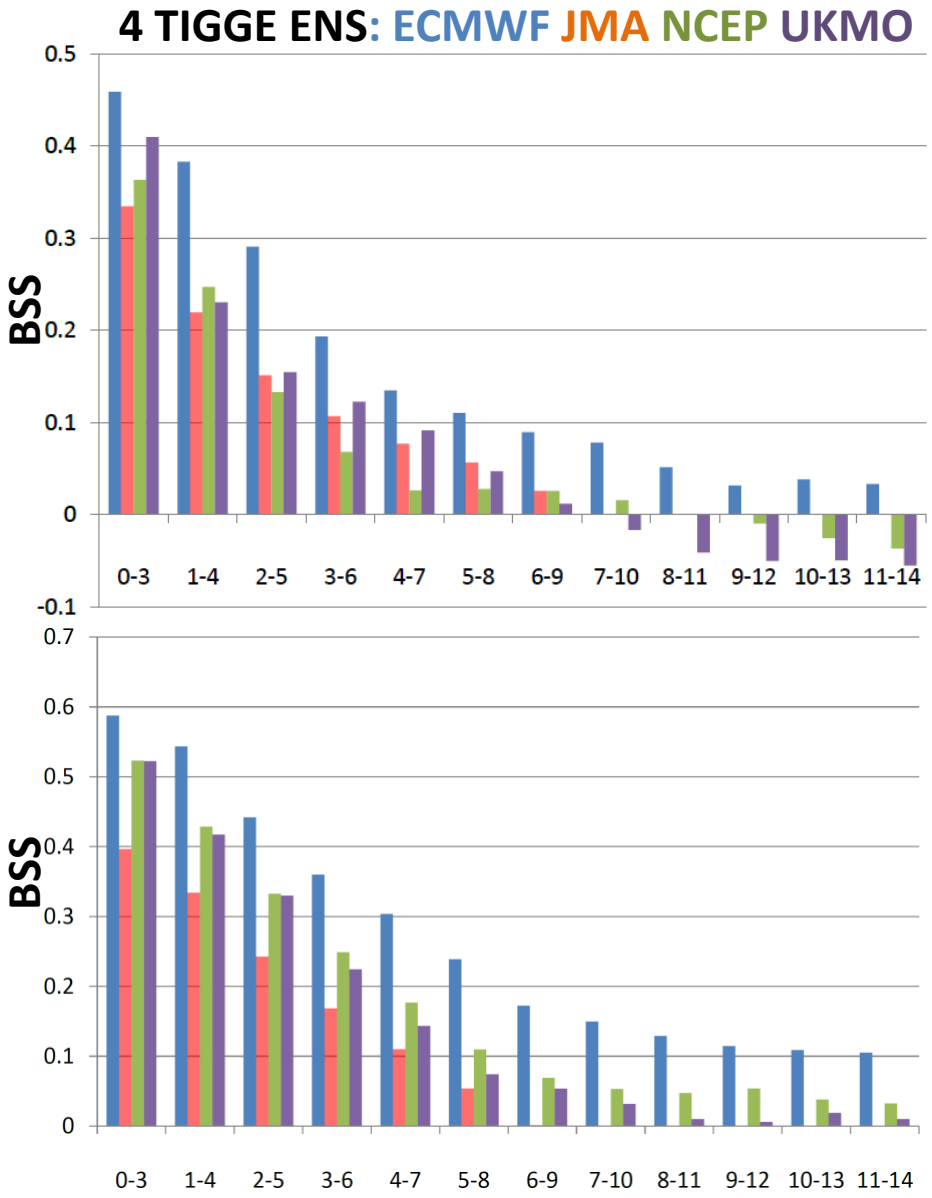
How do they perform? Ensembles must be reliable

TIGGE-based results for Jul-Oct 2012. TC tracking data have been created with the ECMWF vortex tracker (Vitart et al. 1997, JC). Verified TCs are storms with a 'Tropical Storm' intensity or stronger (>35 knots).

Verification Areas

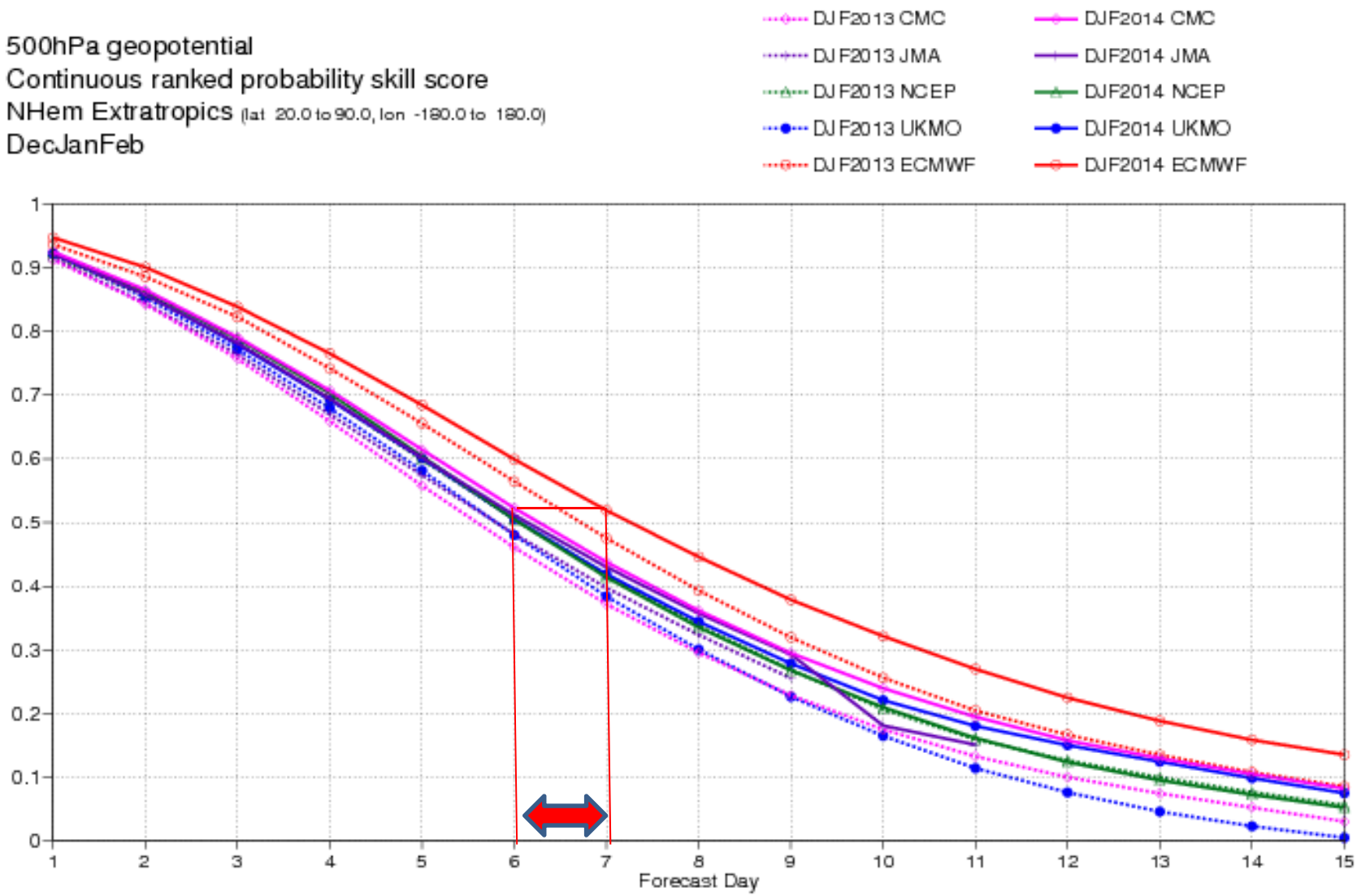






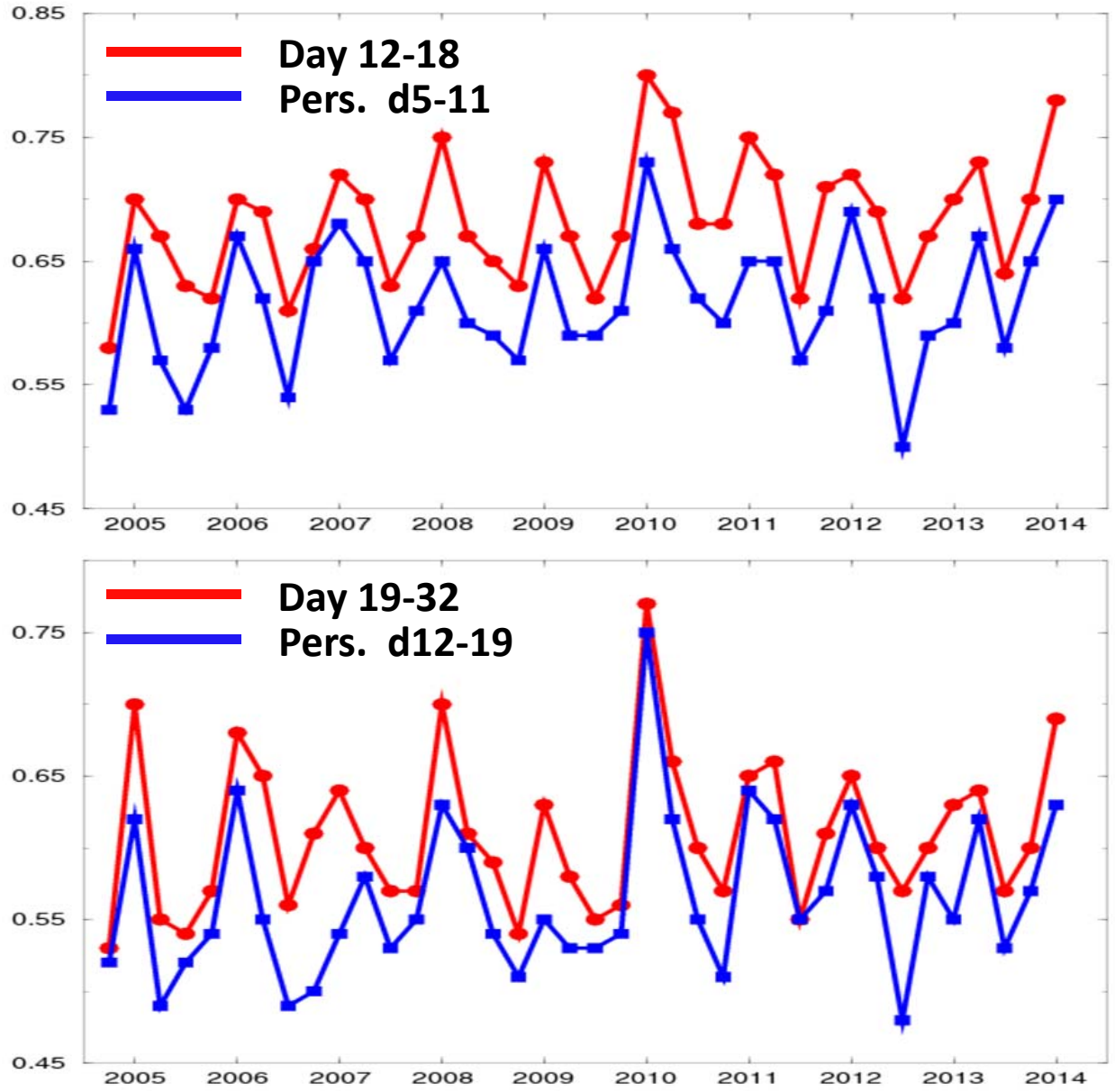
(From M Yamaguchi)

How do the ensembles perform? TIGGE ENS



How do the ensembles perform? ROCA[PR(2mT>U3)] NH

ROC score for prob. Fc of 2-meter temperature in the upper tercile.

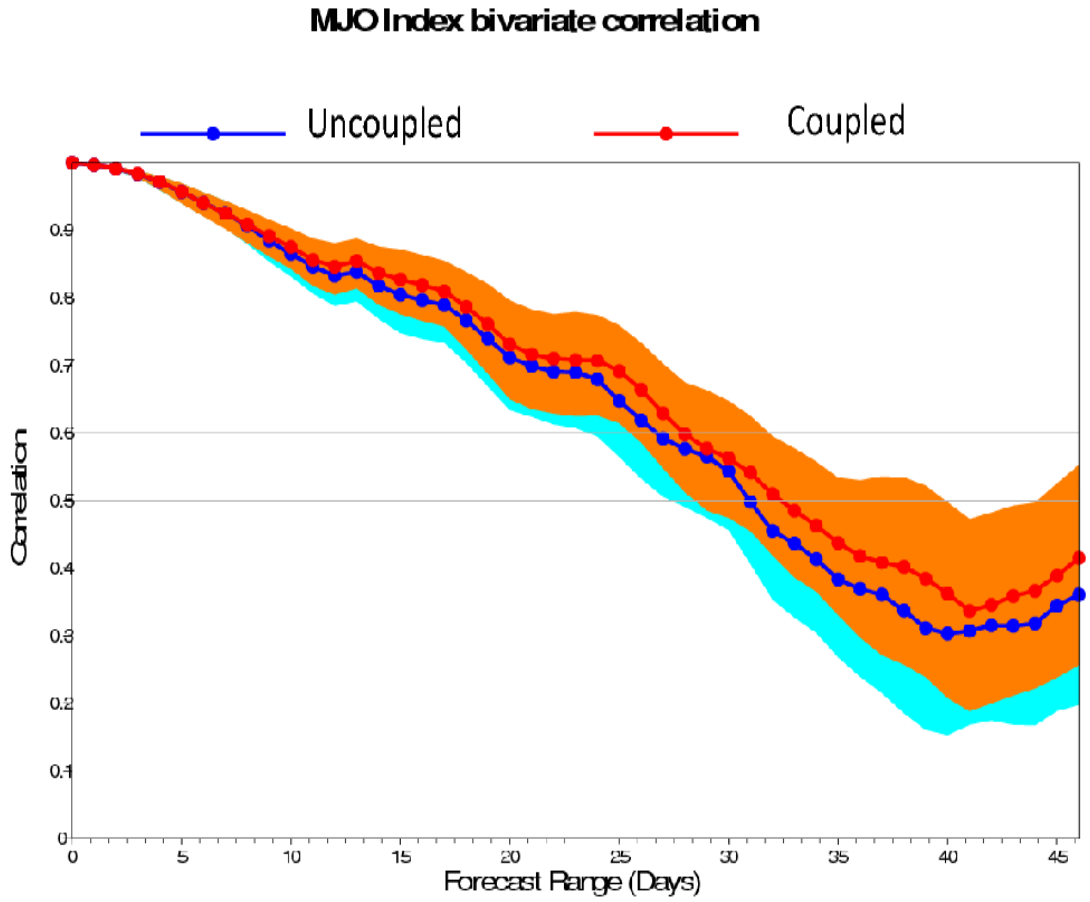


Nov 2013: ENS coupling from d0 to a better marine model …

Nov 2013: **coupling from initial-time** to a new version of the ocean model (NEMO), with 1-way wave-currents coupling, improved skill, especially in the monthly time-range.

Work is progressing to introduce a better, unified wave-currents-sea-ice model (LIM). The new model based on NEMO is under testing at higher resolution, ORCA_025_Z75.

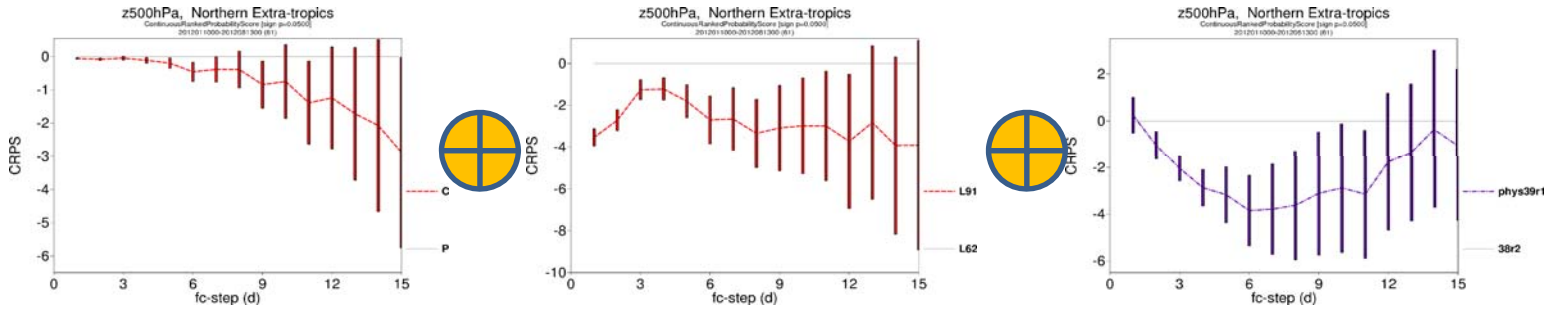
In 2014 we will complete a ¼ degree NEMOVAR re-analysis, and we will then implement the ¼ model first in ENS, and then in the seasonal system (S5, planned for 2016/17).

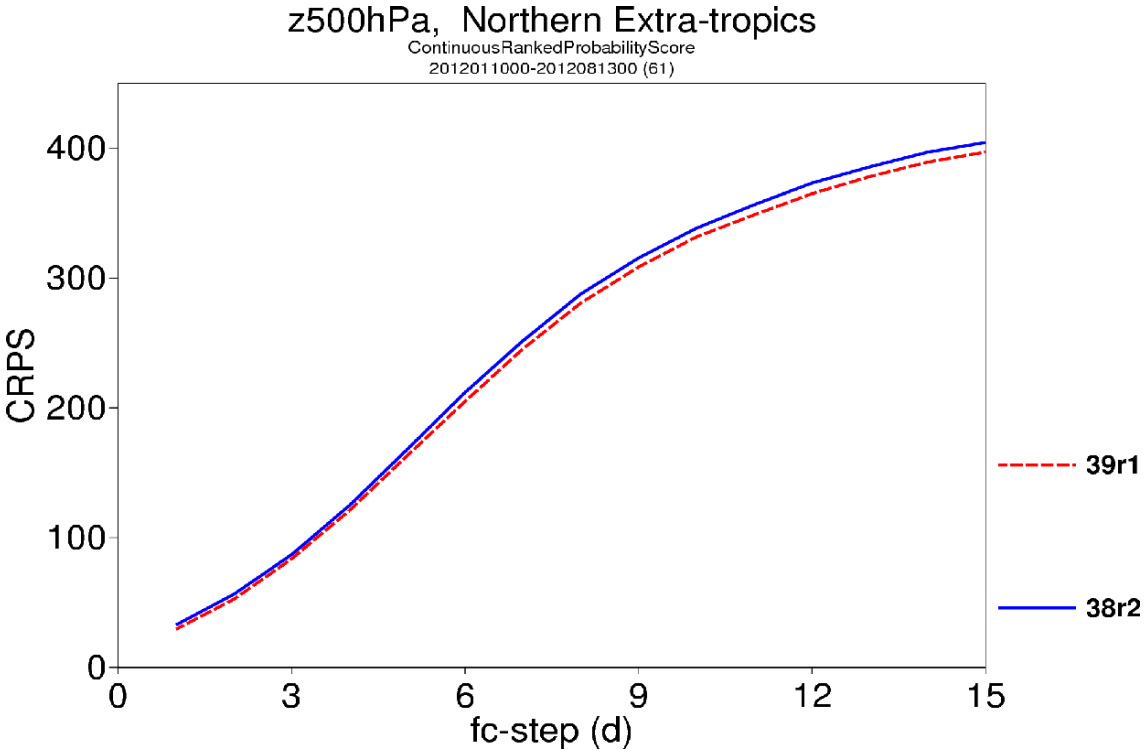


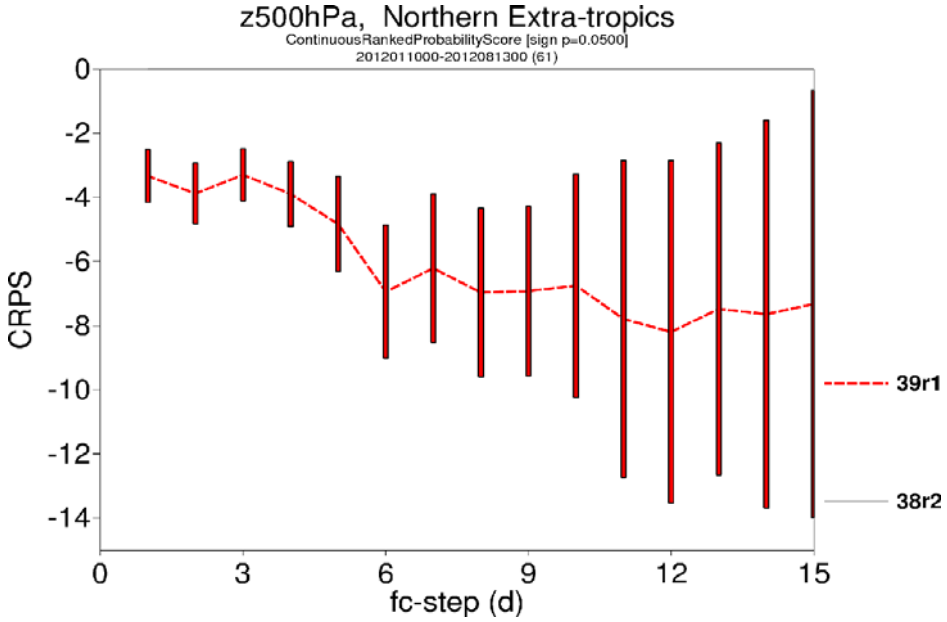
(From F Vitart)

Nov 2013: ENS coupling d0, L62>L91, new physics+SKEB

Results based on 61 cases (JFM12, JJA12); 38r2 analyses and EDA perturbations.







(From M Leutbecher)

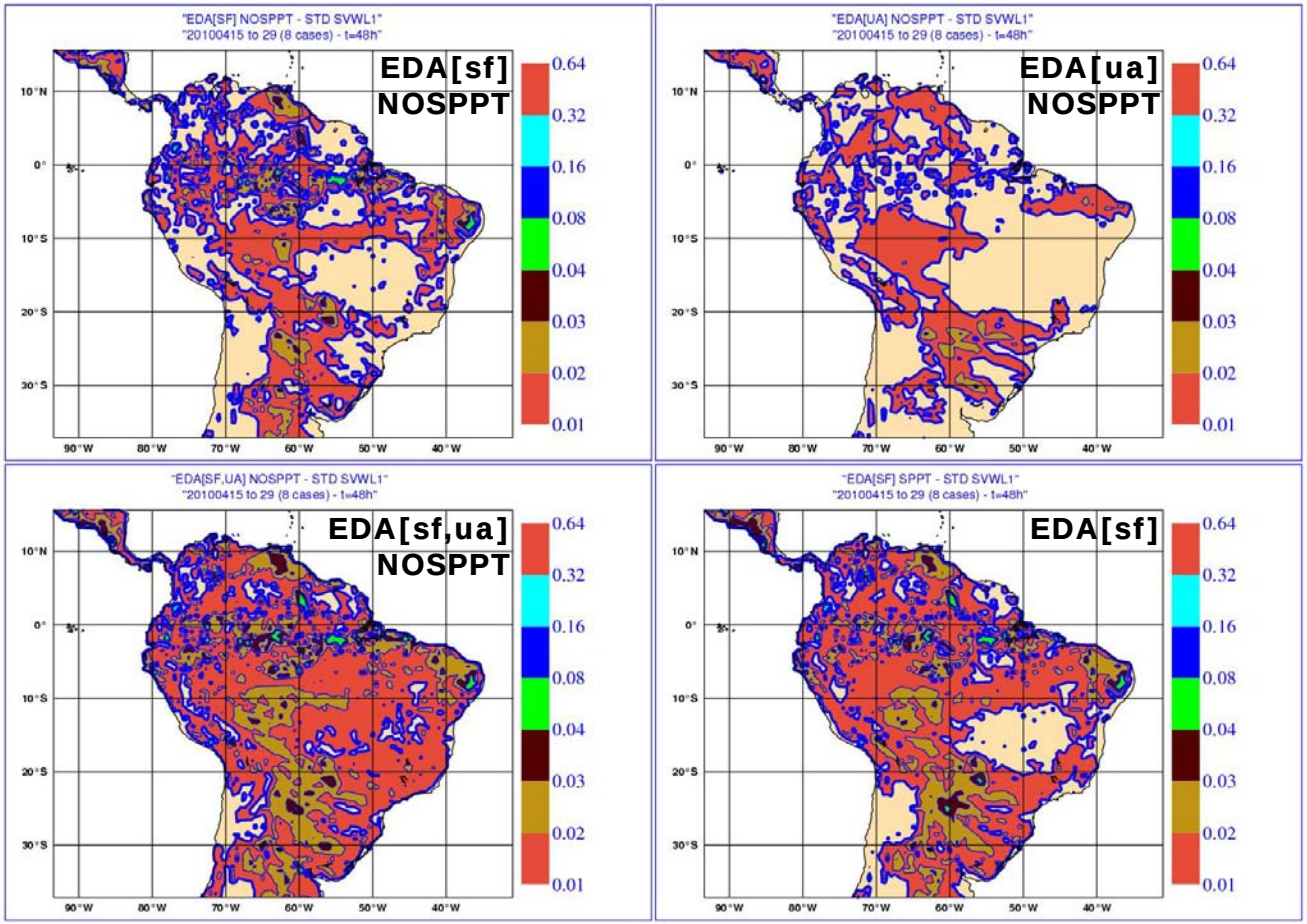
Nov 2013: EDA-based land-surface pert. in ENS ICs

Initial perturbations improved by coupling more the ensemble of analyses and forecasts.

Nov 2013: EDA-based **surface initial perturbations** introduced in ENS.

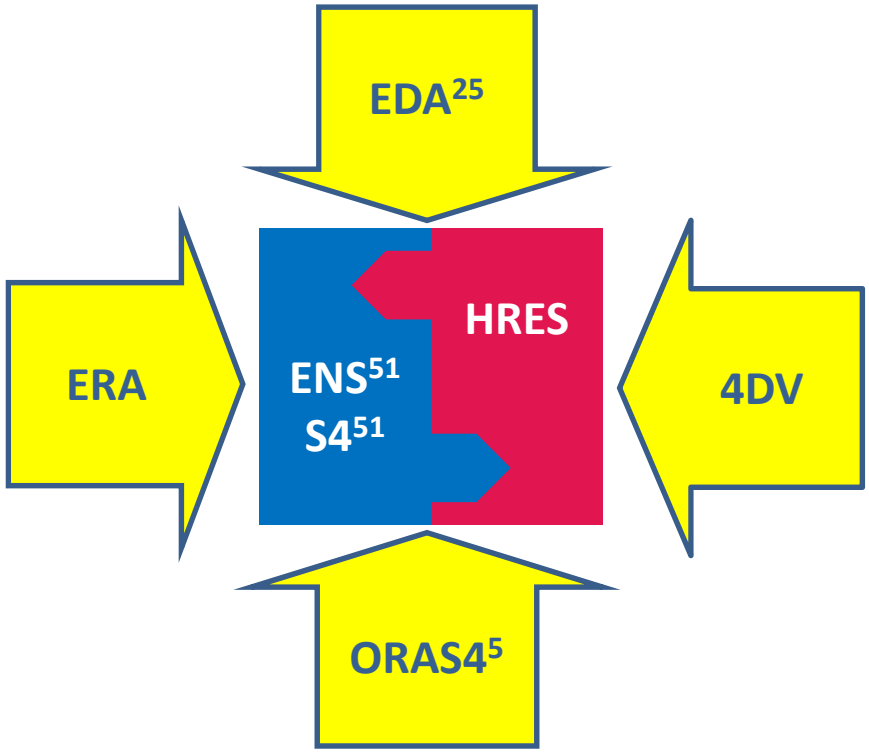
Preliminary results indicate increased reliability in the short forecast range, due to small spread improvements.

SWVL1 – std(t=48h)



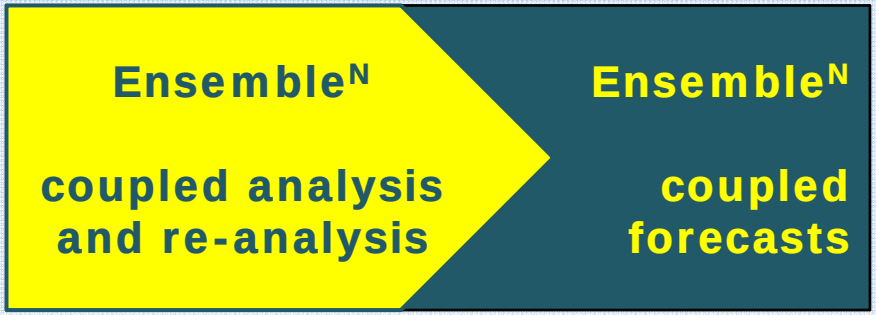
The future: moving towards a more integrated approach

Today



PDF(0) << 4DV+EDA+ORAS4
PDF(0) << ERA+ORAS4 (past)
PDF(T) << HRES+ENS/S4

The future



PDF(0) << coupled analysis and re-analysis (past) stream
PDF(T) << medium/long range stream