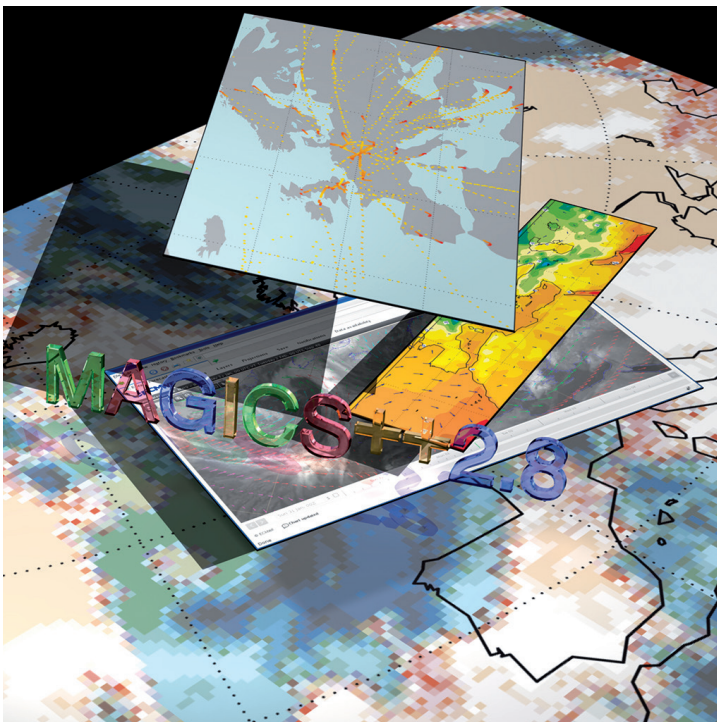


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Performance of ECMWF forecasts in 2008/09



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Performance of ECMWF forecasts in 2008/09

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Each year, comprehensive verification statistics are prepared to evaluate the performance of all the components of the ECMWF forecasting system. The results for 2008/09 have recently been published in *ECMWF Tech. Memo. No. 606*. A couple of this year's main results are shown here.

A verification summary is presented to the ECMWF advisory committees and the Council. Box A contains the overall view of the Technical Advisory Committee about the recent performance of ECMWF's operational forecasting system.

Overall performance in the medium-range

Long time series of skill scores reflect the combined impact of all the improvements made to the forecasting system over the years: increased resolution, improved forecast model, better data assimilation, and the availability of many more satellite observations.

Figure 1 shows the evolution of the skill of the deterministic forecast of 500 hPa geopotential height over Europe since 1980. Each curve is a 12-month moving average of root mean square (rms) error, normalised with reference to the rms error of persistence (a forecast that persists initial conditions into the future). The last month included in the statistics is July 2009. The resolution of the forecast model was T63 (320 km) initially, and was increased to T106 in 1987, T213 in 1993, T319 in 2000, T511 in 2001 and T799 (25 km) in 2006.

We can see that the skill for the European region has increased substantially: the skill of a 7-day forecast (orange curve) this year is as skilful (on average) as a 3-day forecast (dark green curve) was in 1980. For the most part, there has been a steady improvement since 1997, i.e. over the entire period that 4D-Var data assimilation has been operational. Over the last four years, it is the 5–8 day range that has improved most rapidly over Europe.

Overall view of ECMWF's Technical Advisory Committee, 8–9 October 2009

A

In regard to its overall view of the operational forecasting system:

- i congratulated ECMWF on the very high performance levels of all its forecast systems during the previous year and on its continued leading position in relation to other centres;
- ii noted that the skill of the ensemble prediction system had continued to improve and was impressed by the results of recent work on the TIGGE dataset, which showed the ECMWF ensemble to be the best in the world;
- iii noted with satisfaction that ECMWF wave forecasts remain the best in the world; also noted the importance of freak wave forecasts and that further progress is needed in this area;
- iv was encouraged by the promising results from the use of cloud-affected and surface-affected radiances in the data assimilation;
- v welcomed the development work on interactive EFI products and stressed the great potential value of such products for the early detection of high impact weather events;
- vi very much appreciated the introduction of new verification statistics for the EFI, showing a positive trend in performance over recent years;
- vii with respect to deterministic forecasts of weather parameters:
 - welcomed the marked improvement in the skill of precipitation forecasts;
 - noted that, although the accuracy of snowfall forecasts has been improved, there is still an overprediction of snow in certain conditions;
 - noted, with some concern, a significant cold bias over Europe at night during the last winter and spring;
 - appreciated the value of the wind gust predictions but queried whether there is sufficient differentiation in their treatment over land and sea.

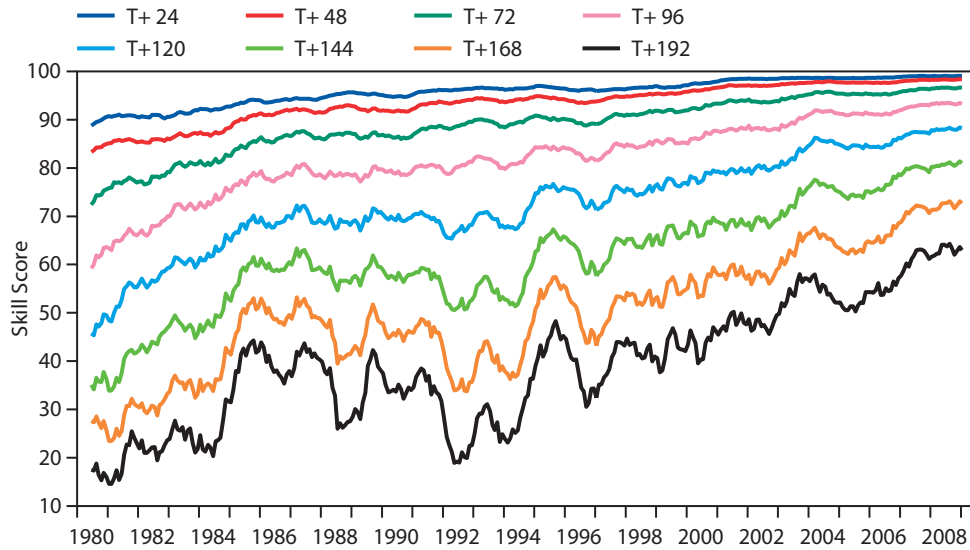


Figure 1 Skill score for 500 hPa geopotential height for Europe from 1980 to 2009. The curves show 12-month moving averages for forecast ranges from 24 to 192 hours (1 to 8 days) in different colours as indicated by the legend. The last point on each curve is for the 12-month period August 2008 to July 2009.

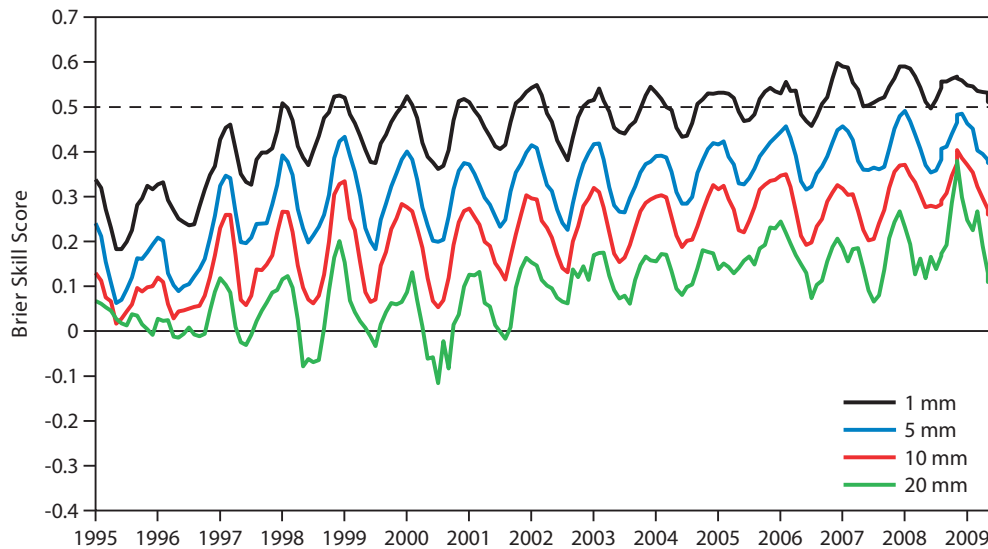


Figure 2 Time series of Brier Skill Score for EPS probability forecasts of precipitation over Europe at day 4 exceeding four thresholds: 1, 5, 10 and 20 mm/day as indicated in the legend. The skill score is calculated for three-month running periods.

Precipitation

There is an increasing emphasis on evaluating forecasts in terms of weather parameters, in addition to the more traditional height scores. Near-surface air temperature, precipitation, wind gusts, clouds and humidity are verified operationally. As ECMWF focuses on providing early warning for severe weather, it is the heavy rainfall events and wind storms that are of special interest. For these parameters, verification is performed through comparison against observations from meteorological stations (SYNOP). For verification of Ensemble Prediction System (EPS) precipitation, however, the 0–24 hour model forecast is used as a proxy for a model-scale analysis.

The long-term trend in precipitation skill for Europe is shown in Figure 2, for thresholds up to 20 mm per day. A consistent improvement in rainfall forecasts has been noted since the introduction of cycle 31r1 in September 2006. For both 10 mm/day (red) and the higher threshold of 20 mm/day (green curve), the exceptional performance over 2007–2008 was matched in 2008–2009. The graph shown here shows a probabilistic score (Brier Skill Score) derived from the EPS for day 4.

Further information

The complete set of annual verification results is available in ECMWF Technical Memoranda on 'Verification statistics and evaluations of ECMWF forecasts', downloadable from:

<http://www.ecmwf.int/publications/library>.

The results, starting with those for 2000/01, can be found in *ECMWF Tech. Memo. No. 346, No. 414, No. 432, No. 463, No. 501, No. 504, No. 547, No. 578 and No. 606*.

Verification pages have been created on the ECMWF web server and are regularly updated. Currently they are accessible at the following addresses:

- **Medium range:** <http://www.ecmwf.int/products/forecasts/d/charts/medium/verification/>
- **Monthly range:** <http://www.ecmwf.int/products/forecasts/d/charts/mofc/verification/>
- **Seasonal range:** <http://www.ecmwf.int/products/forecasts/d/charts/seasonal/verification/>

Note that all forecasting system cycle changes since 1985 are described and updated at:

http://www.ecmwf.int/products/data/operational_system/index.html

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