Verification of ECMWF products at the Finnish Meteorological Institute

by Juha Kilpinen, Pertti Nurmi and Matias Brockmann

1. Summary of major highlights

The new verification system is under pre-operational testing and will hopefully become operational by the end of the year (Kilpinen, 2007). The system will mainly replace the previous one with some new features. The technical structure is totally new giving larger opportunities to enhance and develop the system (see Figure 1.). The new system will allow direct comparison of direct model and post-processed model output and end products based on edited data by forecasters.

A study of the verification results covering end forecasts during the past 28 years has been made by Nurmi and Brockmann (2007). Some of the results are presented here.

2.1. Objective verification

2.1.3. Post-processed products

Tests with calibration of EPS and error dressed deterministic wind speed forecasts have been continued with new data set from winter 2005-2006 (Figure 2). The results indicate similar behaviour as before. The methods are matured enough to be used in operational forecasting and warning services (Kilpinen, 2006). The post-processing system for wind speed and gust forecasts and new tools for SmartMet I workstation will be develop in near future.

Figure 2 shows some of the recent results. The resolution of ECMWF EPS has increased during winter 2005-2006. However, the possible effects are not yet to be seen in the results because the stations have been chosen so that they are off the coasts and the period of better resolution is short. The calibration of EPS increased the usefulness of forecasts 1-2 days and calibration of the first moment of the distribution (EPS mean) gives a larger part of the quality increase than calibration of the second moment (spread).

In accordance with this the error dressing method has been applied for several other variables of ECMWF deterministic output to provide probabilistic forecast guidance for Finnish Armed Forces. Among these experimental variables are the common ones like temperature, relative humidity and wind speed. Some variables are derived like ceiling height. Some of the variables are treated as continuous and some as categorical (probability of each category).

2.1.4. End products delivered to users

The old verification system has produced verification statistics for a selection of stations and weather parameters covering the past 28 years. This dataset has formed the basis for a study by Nurmi & Brockmann (2007). Some of the results are shown as Figures 3-9. The positive trend in most of the statistics is quite obvious.

3. References

Juha Kilpinen, 2006: Comparison of probabilistic wind speed forecasts produced from ECMWF deterministic and EPS outputs. Second THORPEX International Science Symposium (STISS), 4-8 December 2006, Landshut, Bavaria, Germany. *http://www.pa.op.dlr.de/stiss/*

Juha Kilpinen, 2007: The use and evaluation of ECMWF forecasts at FMI. ECMWF Forecast Product User Meeting (ECMWF, Reading, England, 13-15 June 2007).
http://www.ecmwf.int/newsevents/meetings/forecast_products_user/Presentations2007/Kilpinen.pdf

P. Nurmi and **M. Brockmann**, 2007. A quarter century of operational end forecasts verification. 7th EMS Annual Meeting/8th European Conference on Applications of Meteorology, San Lorenzo de El Escorial, Spain, 01 - 05 October 2007. *http://meetings.copernicus.org/ems2007/annotation.html*

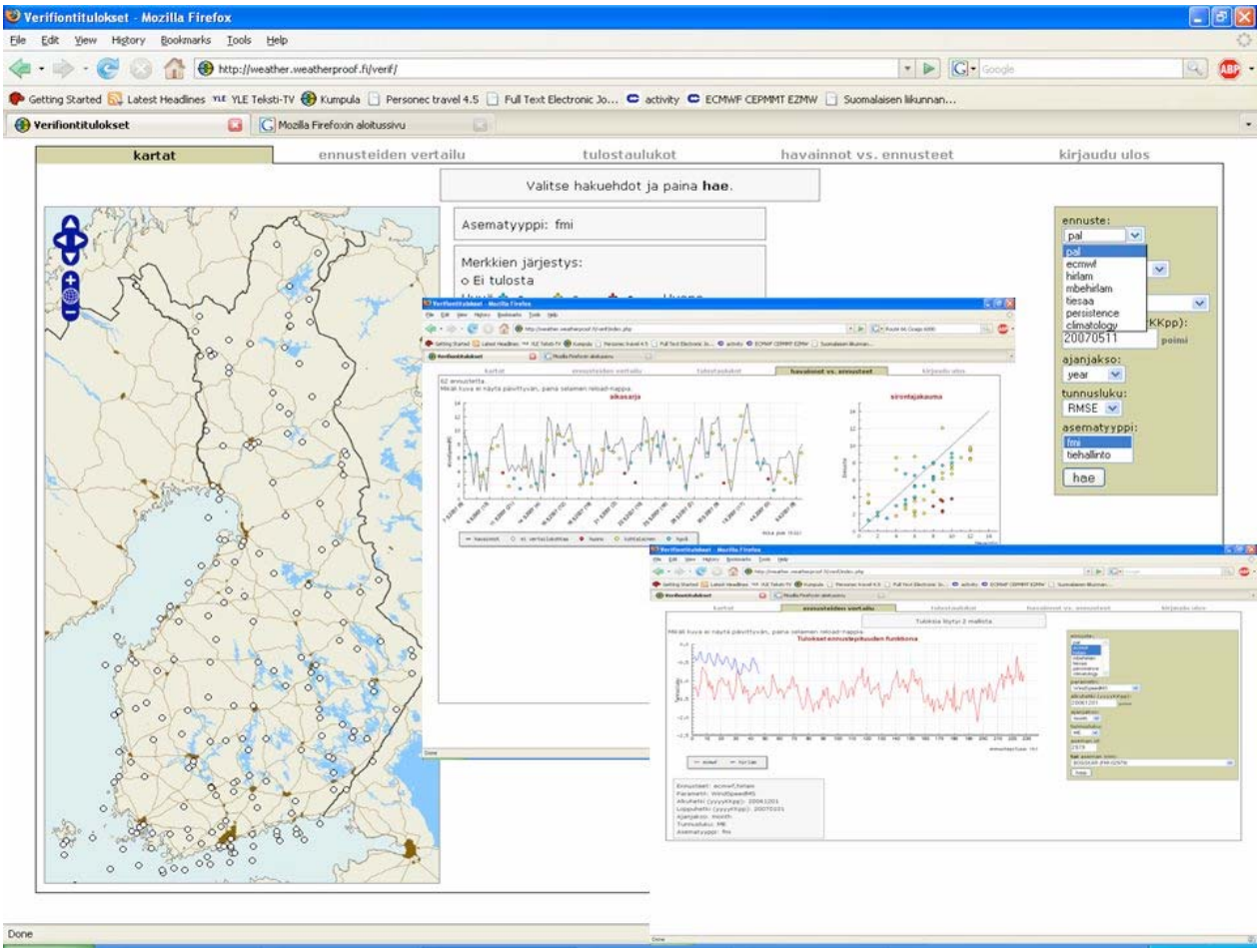

Fig. 1 The user interface of the new forecasts verification system at FMI.

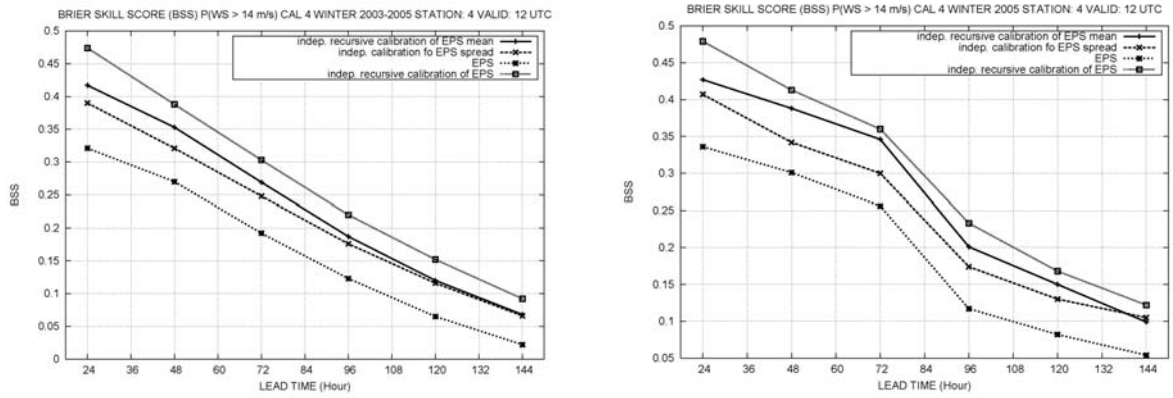

Fig. 2 Brier Skill Score (BSS) of ECMWF EPS and calibrated EPS wind speed forecasts exceeding 14 m/s for four stations in Finland. Results from winters 2002-2003 to 204-2005 are in left panel and winter 2005-2006 in right panel.

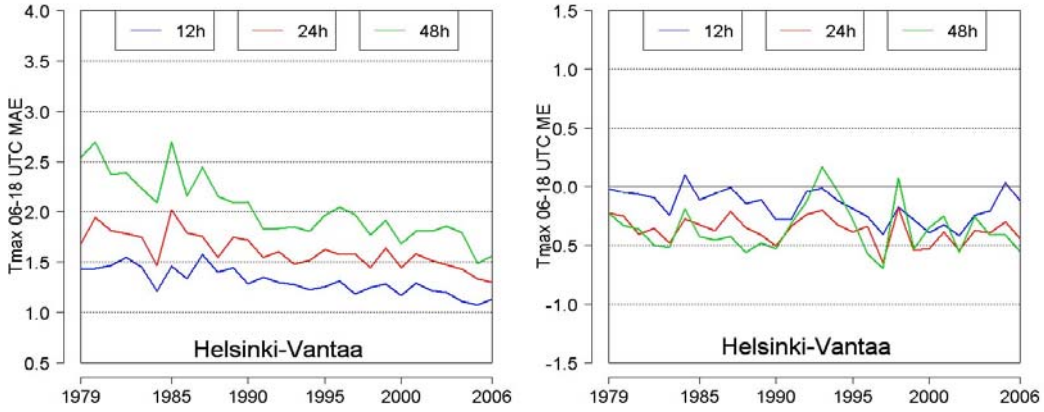

Fig. 3 Evolution of the MAE (left panel) and the ME (right panel) of maximum temperature forecasts at Helsinki-Vantaa airport, 1979-2006, for lead times +12h, +24h and +48h.

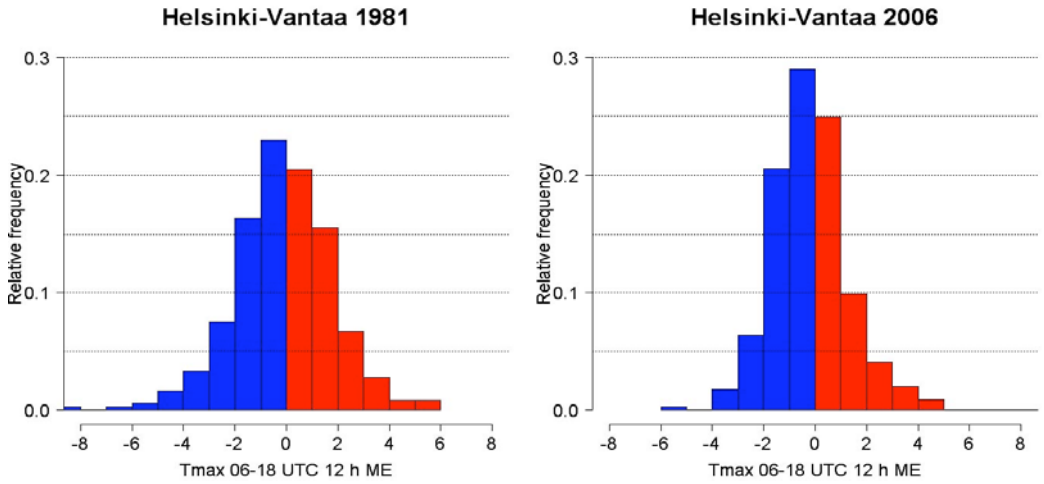

Fig. 4 Error histograms (1981 in the left panel and 2006 in the right panel) of +12h maximum temperature forecasts at Helsinki-Vantaa airport.

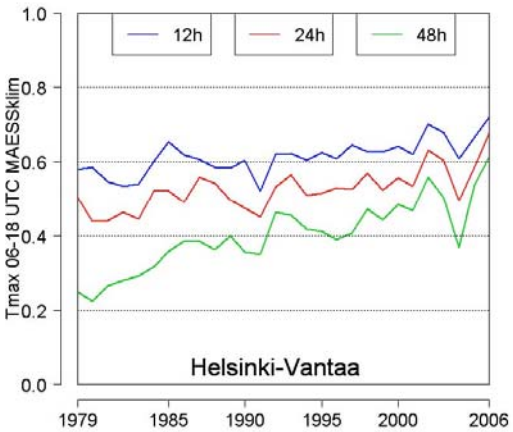

Fig. 5 Evolution of the MAE skill score against climatology of maximum temperature forecasts at Helsinki-Vantaa airport.

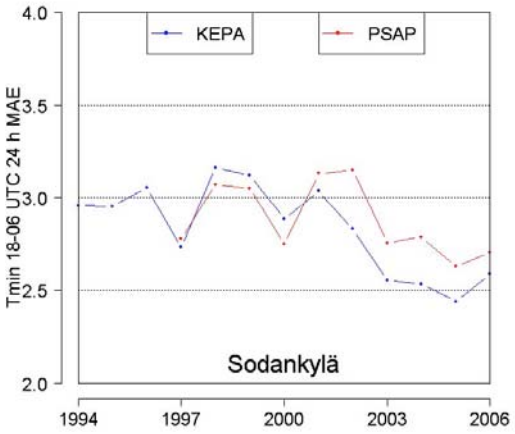

Fig. 6 Evolution of the MAE of minimum temperature forecasts at Sodankylä observatory. Forecasts are made at the Central Forecasting Office (Kepa) and Rovaniemi regional forecasting forecasting office (PSAP), respectively.

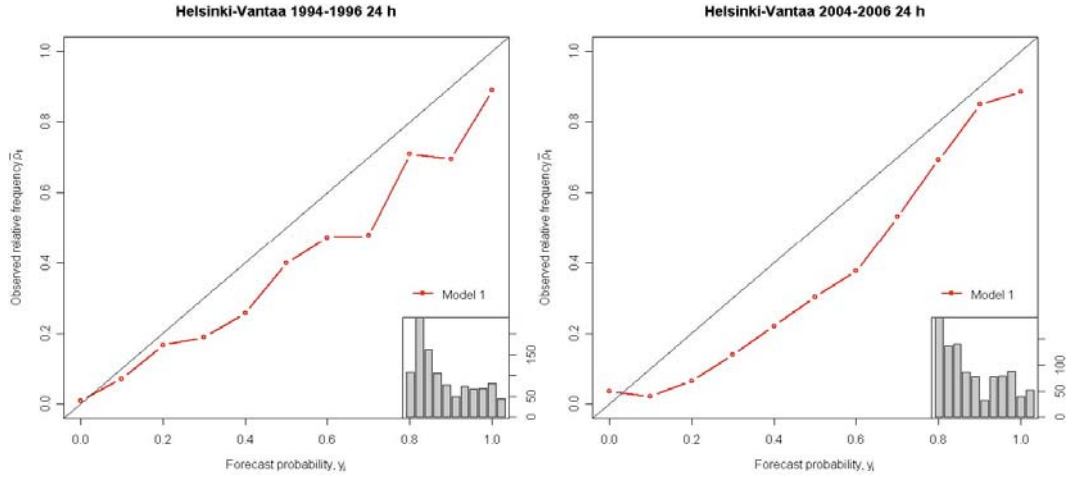

Fig. 7 Reliability diagrams of 24 hour Probability of Precipitation forecasts at Helsinki-Vantaa airport for 1994-1996 (left panel) and for 2004-2006 (right panel).

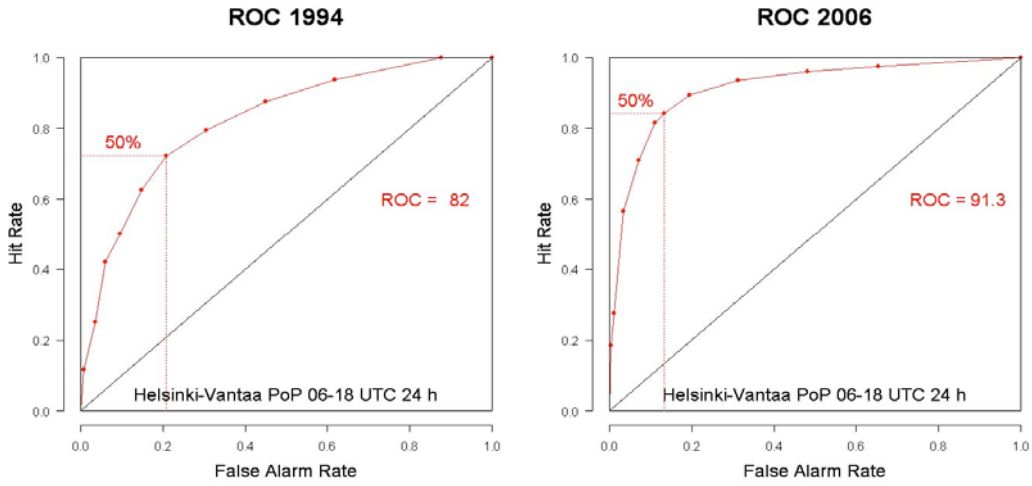

Fig. 8 ROC curves of +24 hour Probability of Precipitation (PoP) forecasts at Helsinki-Vantaa airport for 1994 (left panel) and for 2006 (right panel).

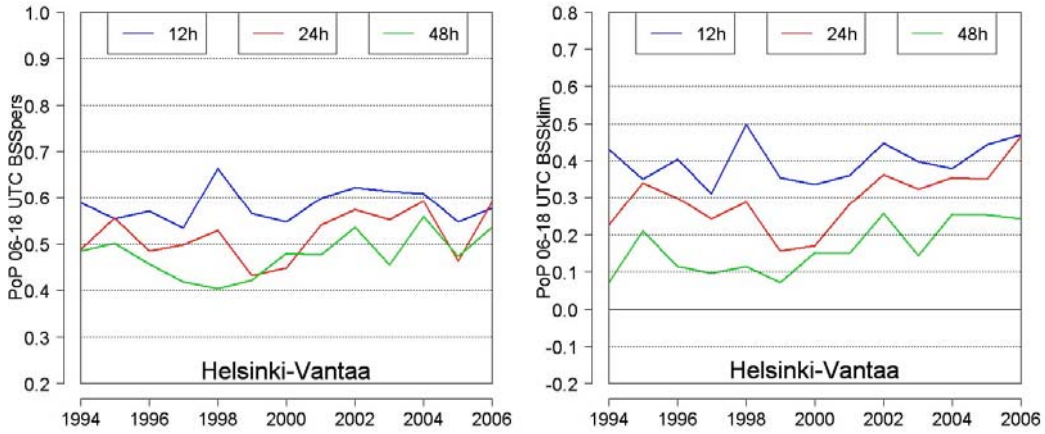

Fig. 9 Evolution of the Brier Skill Score (BSS) of PoP forecasts at Helsinki-Vantaa airport against persistence (left panel) and climatology (right panel).

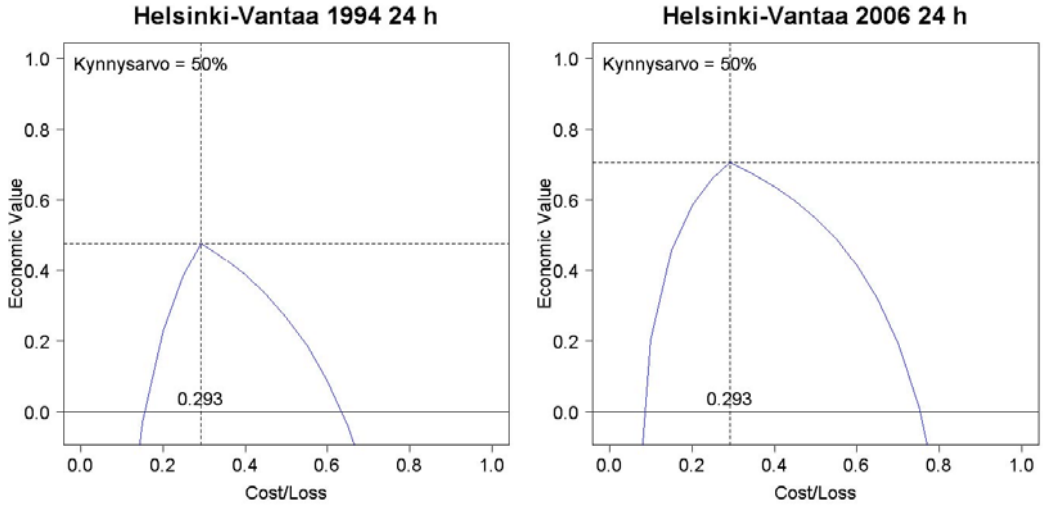

Fig. 10 Cost/Lost diagrams of +24h PoP forecasts at Helsinki-Vantaa airport for 1994 (left panel) and for year (right panel).