Application and verification of ECMWF products 2010 at the Finnish Meteorological Institute

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1 . Summary of major highlights

ECMWF products are the basement of the FMI production system. The higher resolution models help forecasting extreme weather in a short period. In medium range and long range forecasting the ECMWF products are crucial in early warning of weather extremes.
In most cases the ECMWF products works well, but inversion cases there exist still difficulties to forecast the temperature accurately.
FMI has developed a new verification system. Using that, it is possible to compare the quality of the model outputs against manually edited fields or automatically postprocessed fields. First studies using that systems shows, that using Kalman filtering over model output, man can improve model output of 2 m temperature forecasts in Finland. Manually edited fields are sometimes still even better than these filtered one. With wind forecasts we have recongized, that in light wind cases ECMWF model output is very good and editing doesn't give any more value, but in strong wind and storm cases we improve the model output remarkably by editing the fields. FMI is still working to develop the verification of our products and better use a new verification system. We hope that we could inform more about the result during next year.

2. Use and application of model output

ECMWF output are used widely supporting the traditional weather service, and also as input for various applications like limited area NWP modelling (HIRLAM, AROME), dispersion and trajectory models, hydrological models (run by Finland's Environmental Administration), road condition models, and wave models.
The format of our monthly and seasonal forecasts is as a text, which is based mainly by ECMWF products.
New EPS-based probability products are now available in FMI's meteorological workstation - Smartmet. The probilities are made for the several weather parameters and the limits are fitted for the Finnish weather conditions. Products, weather events and limits are now:

- 10 min avg wind > 11, 14, 17, 21, 25, 30
- Gust wind > 15, 20, 25, 30, 35
- Tmax > 27, 30, 35C Tmin < -15, -20, -25, -30
- CAPE > 50, 500, 1000, 1500 J/kg
- 24 h rainfall > 10, 30, 50, 70, 120 mm
- 6 h rainfall > 1, 5, 10, 15, 30, 50, 70 mm

2.1. Post-processing of products

2.1.2. Statistical adaptation

2.1.2. Physical adaptation

2.2 Use of products

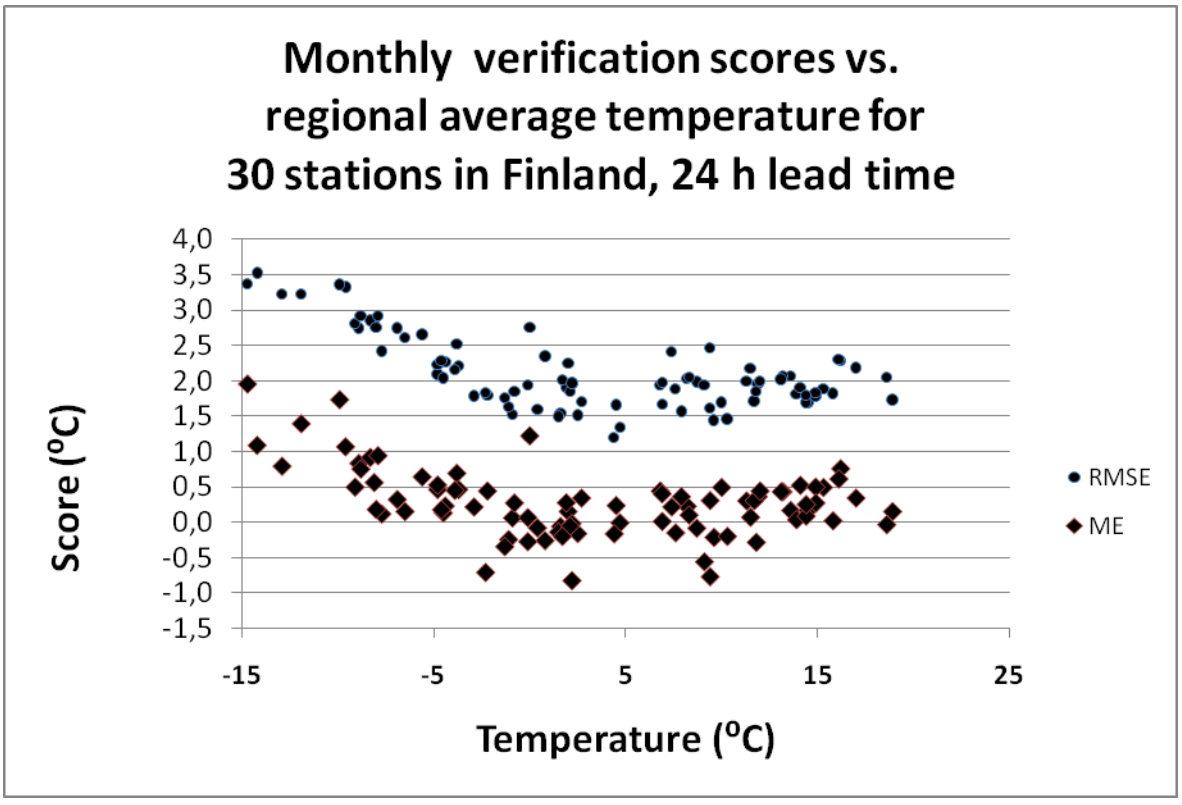
The base of most of the forecasts is ECMWF products.

3. Verification of products

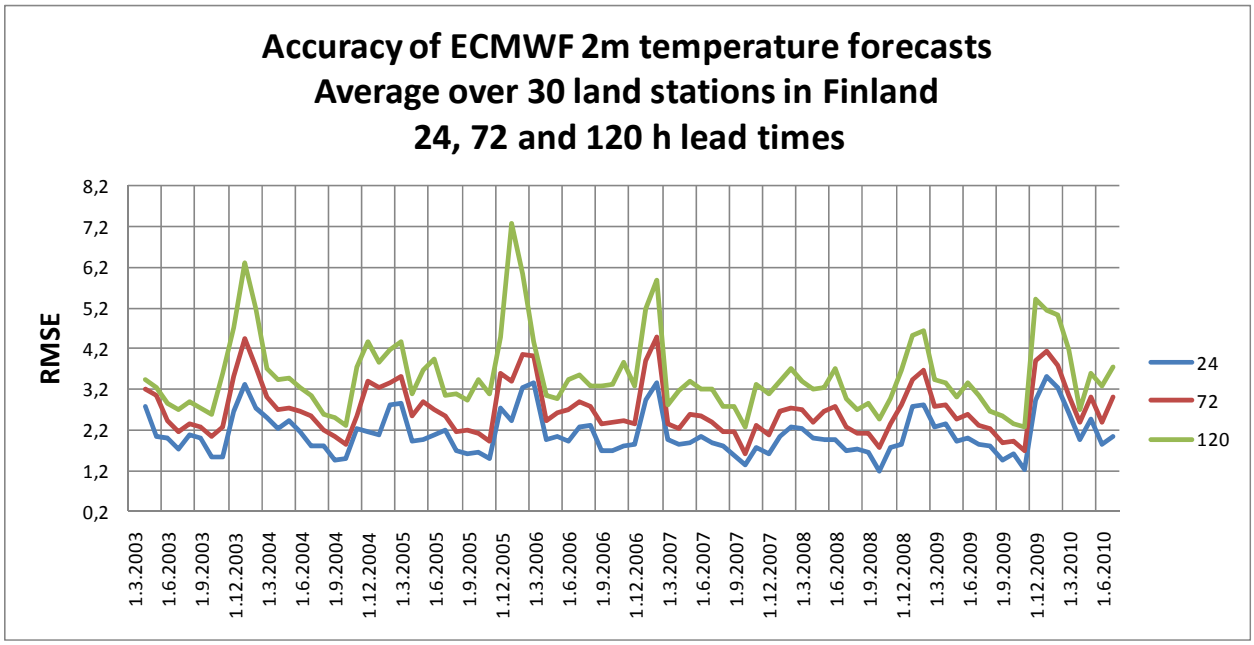
3.1 Objective verification

3.1.1 Direct ECMWF model output (both deterministic and EPS)

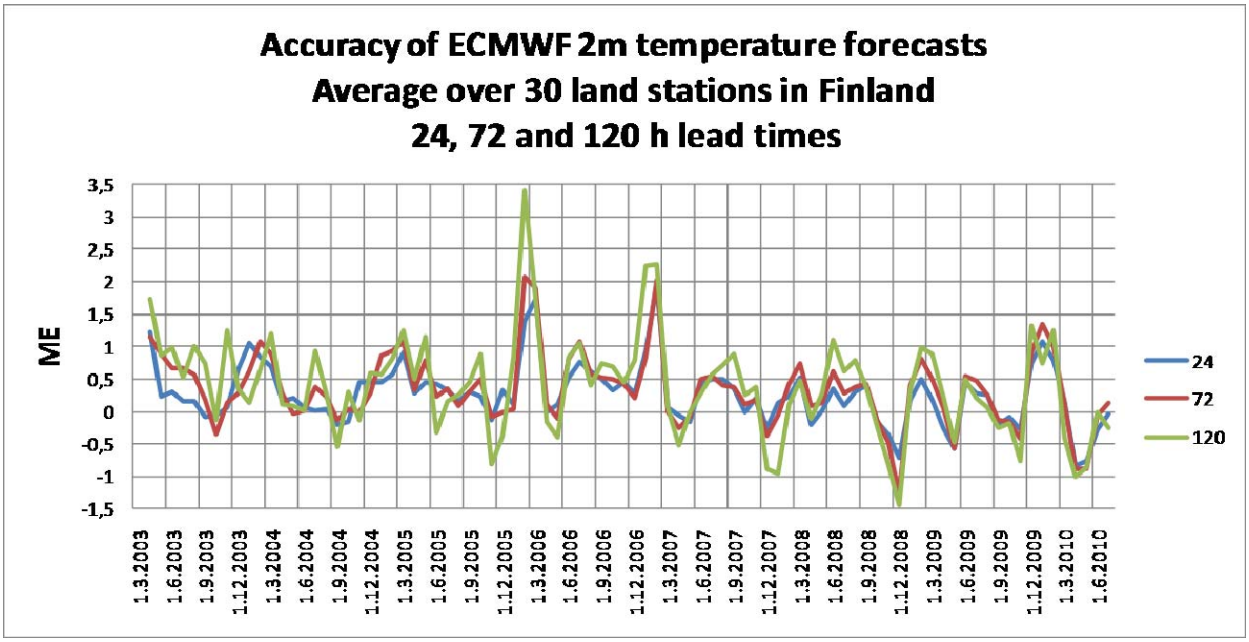
According to the FMI's verification system ECMWF is very good at temperature forecast during the spring, summer and autumn. In wintertime and sometimes also in spring the ECMWF model has big difficulties to forecast cold weather situations, which can be seen clearly in pictures 1-3. Due to the coarse resolution doesn't perform that well in rain and wind forecasts. However, the improving resolution should improve the results as well.



Picture 1. The result demonstrates linear dependence of forecast accuracy on surface air temperature at below 0 ^{0}C conditions



Picture 2. Large RMSE values have occurred especially during cold winters in 2003, 2005, 2006 and 2009-2010



Picture 3. Monthly variation of ME can be especially large during winter and spring time

3. 1.2 *ECMWF model output compared to other NWP models*

Compared to other NWP-models, used in FMI, the ECMWF-model is very reliable and has a very practical forecast period, and therefore it plays very important role in FMI's weather forecast production. ECMWF-model is most often used as a background field in a meteorological gridded database. If necessary, this background field can be very easily corrected by a forecaster.

3.1 .3 Post-processed products

3. 1.4 *End products delivered to users*

3.2 Subjective verification

3.2.1 Subjective scores (including evaluation of confidence indices when available)

In storm and hard wind situations a forecaster improves remarkably the wind forecast of ECMWF model. In heavy rain situations the fine grid models forecasts better the maximum of precipitation than ECMWF products, but the place of the maximum precipitation is often in some distant of the forecasted place.

3.2.2 Synoptic studies

4. References