

Application and verification of ECMWF products 2012

Danish Meteorological Institute – Author: Erik Hansen, Administrator MSc., Weatherservice Department

1. Summary of major highlights

Headlines for the development at DMI for medium and long term forecasts over the last year is

- Early warnings of hazardous weather
- Presentation on new smart phone app
- Improved graphic presentation of world weather for travellers

The new smart-phone app has directly television transmissions featuring the duty forecaster at the central DMI weatherservice. The forecaster is using the NinJo presentation system for preparing the weather maps, which is directly based on ECMWF data for the medium range charts. The app is also showing radar, satellite pictures and short range weather maps based on HIRLAM. ECMWF products are the basis for the two build in applications ‘City Weather’ and ‘the early warning of hazardous weather’.

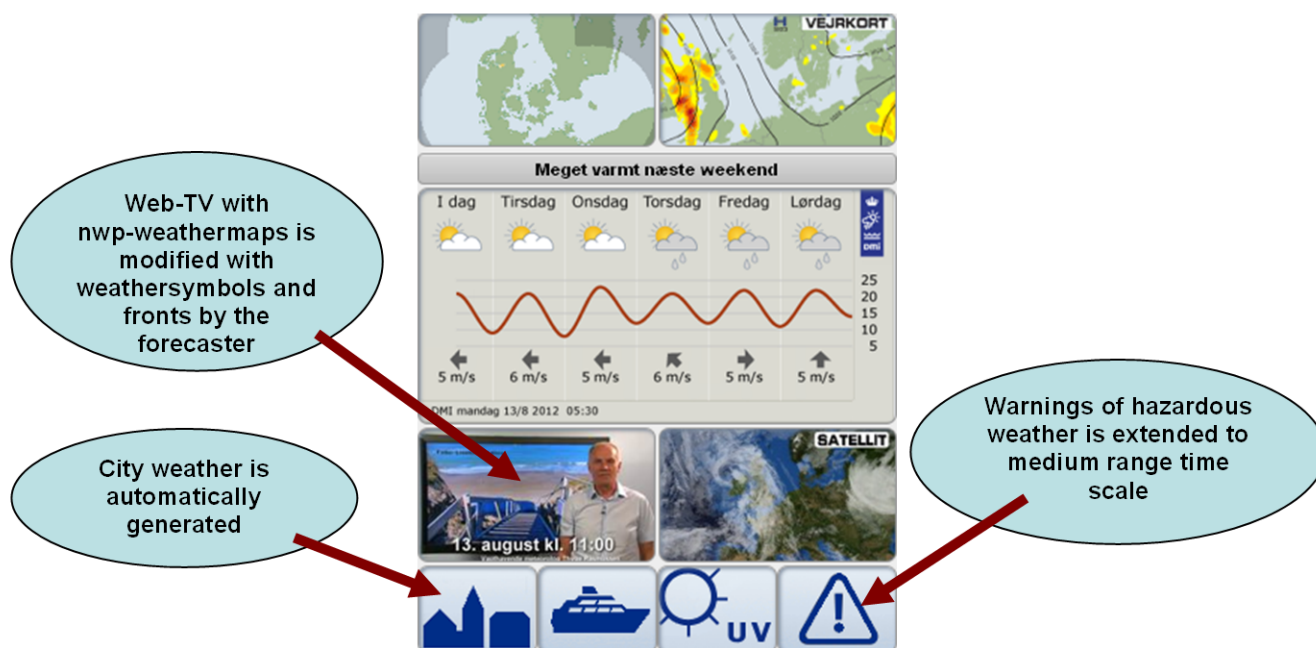


Figure 1 User interface of the new smart-phone app

The operational forecasters are using both deterministic ECMWF as well as the Extreme Forecast Index as basis for the warnings of hazardous weather.

2. Use and application of products

DMI has in 2012 introduced early warning of hazardous weather in the medium-range weather forecasts. The categories of hazardous weather follow the same criteria as the well known warnings, which DMI for over 10 years have been broadcasting to the authorities and the public up to 24 hours before a phenomenon is expected to occur. If the duty forecaster expects warning criteria to be exceeded, the phenomenon is discussed in the 7-day forecast

and there will be a flag with brief information of the expected phenomenon in the warning box at dmi.dk. The duty forecaster is using both HIRLAM and HIRLAM EPS as well as ECMWF EPS forecasts for the whole time range in order to decide whether there should be issued a warning. During the last year the forecasters has adopted the ECMWF Extreme Forecast Index (EFI) which are now being used extensively for these warnings.

Forecast of severe weather for 5 days issued by the DMI
25th of June 2012 at 05.30

Wednesday
Be prepared for risk of storm at the West Coast of Jutland

Thursday
Be prepared for flooding due to rising water level at the West Coast of Jutland

Friday
Be aware of risk of torrential rain in Jutland

Saturday
Be aware of risk of heavy rain in southern Zealand

VARSLER 24 TIMER FREM

Ingen varslere de kommende 24 timer

- Varseldefinitioner
- Voldsomt vejr, 5 dage

NYHEDER

- ATJUH!... 11.04.2012
- Voldsomt skælv udløste tsunamialarm i Indonesien

Figure 2 Presentation of 5 days weather warnings at dmi.dk

Most of the DMI operational production on the medium range timescale is based on ECMWF deterministic and EPS data. The forecasters at the public weather service are using ECMWF data for both text forecast and graphics. Also the automatic generated forecasts are based on ECMWF after the first 48 hours.

Figure 3 The ECMWF model fields are modified with fronts and additional graphics for the DMI Web-TV

The DMI Web-TV has been around for a couple of years and are designed for smart-phone, iPad and standard internet browsers. The broadcasts are updated 6 times a day and each broadcast has typically around 5000-10.000 unique viewers. Some of the content is based on ECMWF output, which can be manipulated in the NinJo presentation system. Many graphical features as for instance weather symbols and fronts can be added by the forecasters.

Every week the ECMWF EPS monthly forecast are used for a text forecast to the public at dmi.dk as well as different commercial products for the energy supply business.

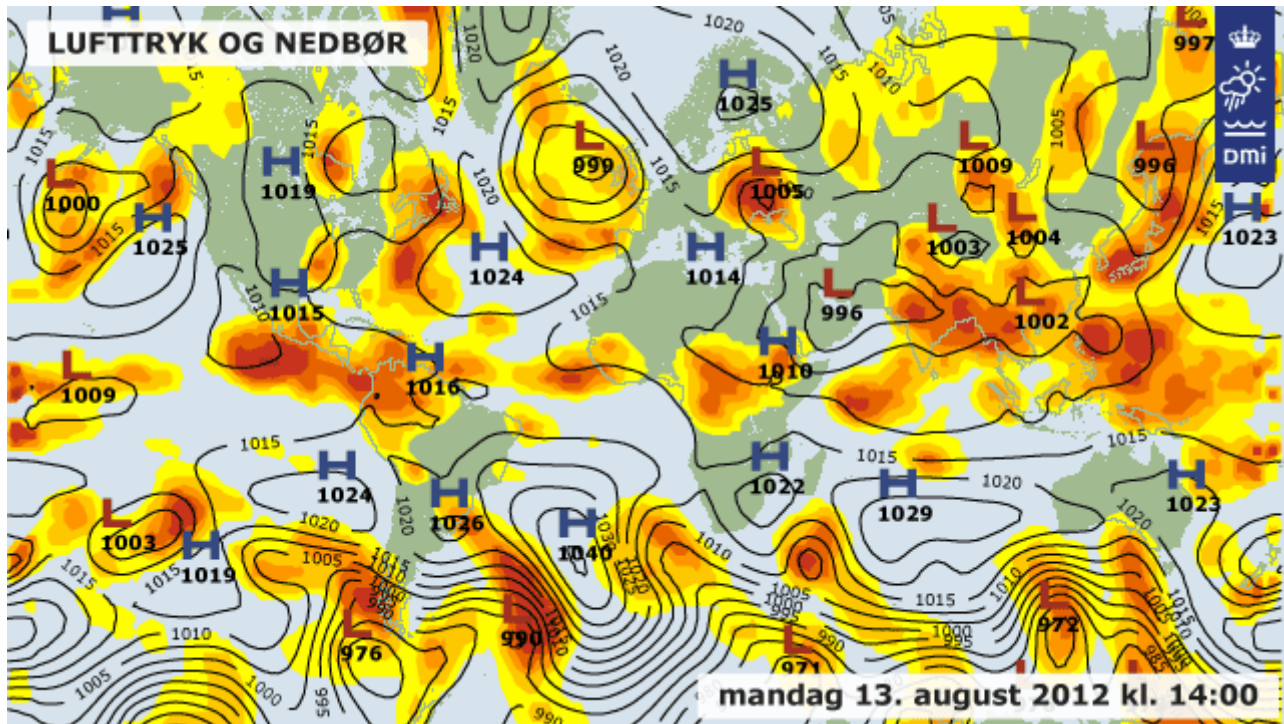


Figure 4 For travellers DMI has ECMWF based weather map of the world with pressure and precipitation

DMI are generating world wide point forecasts based on ECMWF especially targeted to Danish travellers. These forecasts have been supplemented with a graphic presentation of the world weather which is displayed in figure 4 above.

2.1 Post-processing of model output

2.1.1 Statistical adaptation

Filtering and statistical treatment of model data are not used in any products.

2.1.2 Physical adaptation

The HIRLAM model suite consists of different resolutions between 3 and 15 kilometres in three domains. All models are running ECMWF boundary conditions as the nested HIRLAM models have been phased out. DMI is also operation a Harmonie model suite for both Denmark and Greenland, both running on ECMWF boundaries. An important element of the Danish disaster preparedness setup is a dispersion model (DERMA) which is based on ECMWF input. This model is able to make a trajectory calculation of pollutants as volcanic ash and radioactive emissions.

2.1.3 Derived fields

DMI is not using any derived fields from EC NWP data, except for the seasonal temperature anomaly chart for North-western Europe, which are sometime used for energy briefings of commercial customers. The Danish ‘City Weather’ product is using EPS data without any filtering.

2.2 Use of products

The ECMWF medium range products including the EPS are extensively used as a primary source of information in the public weather service. Also our commercial service is highly dependent of both the deterministic forecast worldwide as well as the quality of the ECMWF WAM model. The forecasters of the DMI Maritime Service are using the EC-models worldwide in order to produce forecasts and provide commercial ships with routing advices. The onboard systems of the costumers of Maritime Service are supported with ECMWF GRIB data as part of the service provision. In potential severe weather situations the preferred models are the high resolution DMI-HIRLAM models, the DMI-WAM model and our 3-D seamodel DKSS 2010. The in-house models are our primary source for information in severe weather situation, but as mentioned in the heading of this chapter, both the deterministic ECMWF and the EFI are now coming into use as important tools for the disaster preparedness.

3. Verification of products

Include medium-range deterministic and ensemble forecasts, monthly forecast, seasonal forecast. ECMWF does extensive verification of its products in the free atmosphere. However, verification of surface parameters is in general limited to using synoptic observations.

More detailed verification of weather parameters by national Services is particularly valuable.

3.1 Objective verification

3.1.1 Direct ECMWF model output (both deterministic and EPS)

The direct ECMWF model output is verified against observations for day 0, 3 and 5 which is corresponding to forecast lengths of +12hrs, +84hrs and +132hrs. We are making a monthly verification of max- and minimum temperatures. The observed maximum and minimum temperatures over Denmark are estimated as the 80 % quantile of all synop observations. This technique filters errors and outliers and provides some representative extreme values. The shown figures for the extreme temperatures are Hit Rate for ± 2 degrees. The score is valid for the entire Danish area, and is not taking the Faroe Islands and Greenland into account.

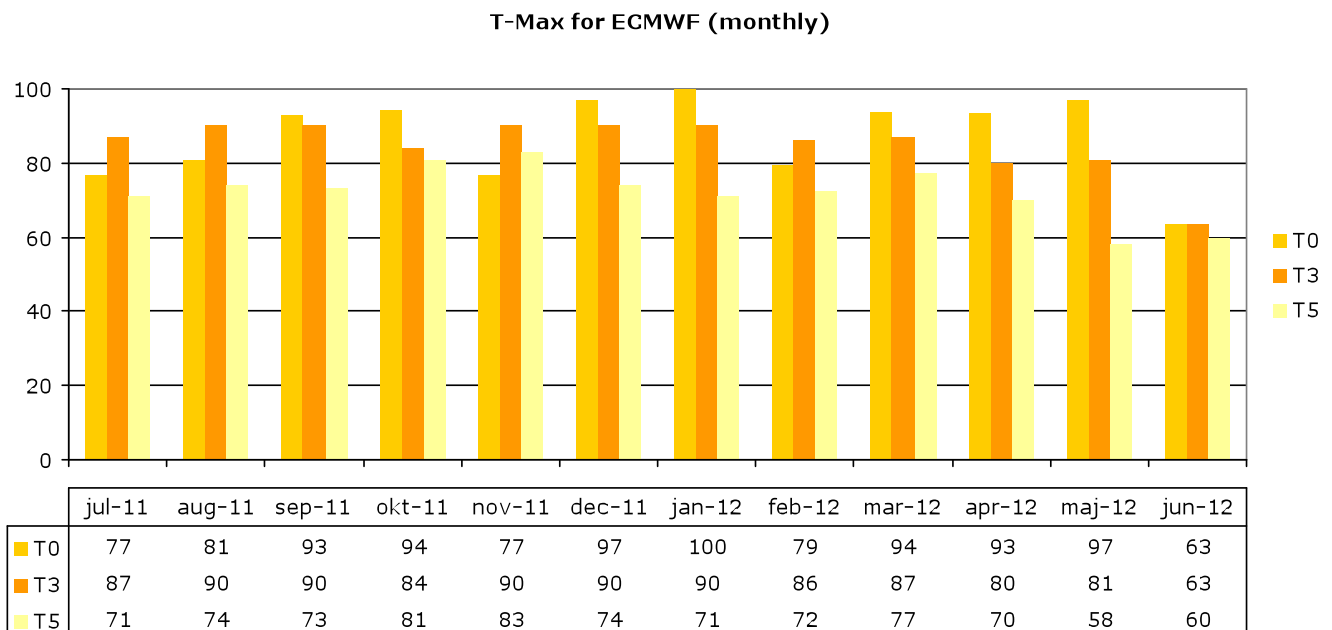


Figure 5 Monthly HR ± 2 for T max. of ECMWF raw output verified against the Danish synop network. T0, T3 and T5 corresponds to +12hrs, +84hrs and +132hrs. The scores show rather steady scores except for a significant drop in June 2012.

T_max ECMWF (1 yr. running mean)

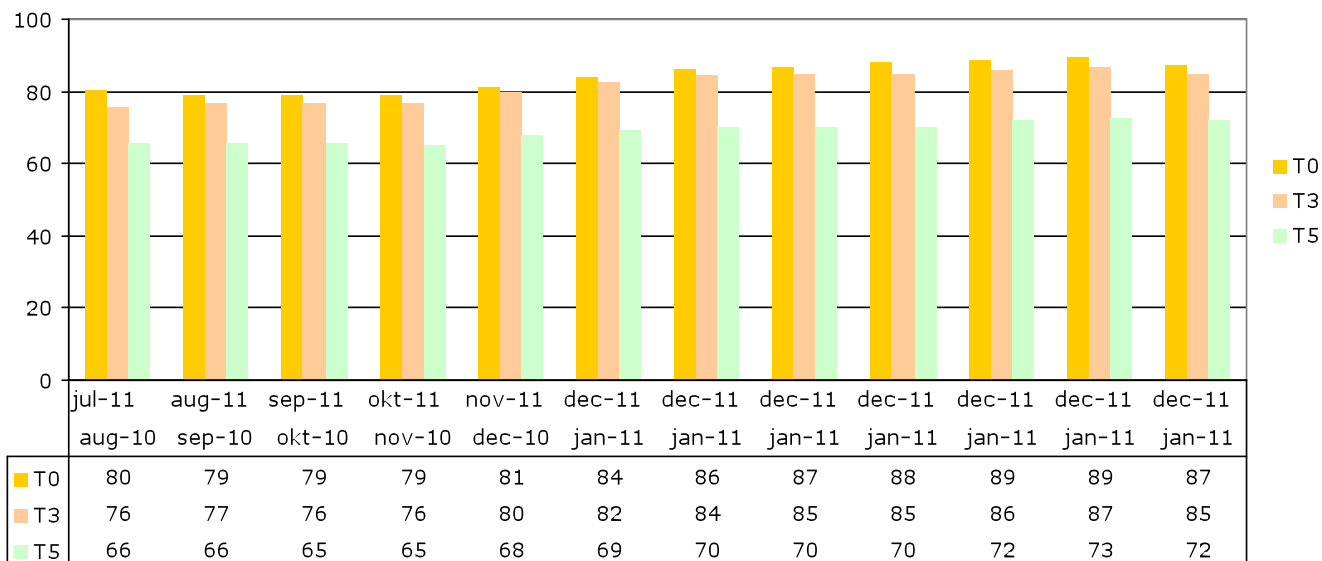


Figure 6 Running mean HR ± 2 for T max. of ECMWF raw output verified against the Danish synop network. T0, T3 and T5 corresponds to +12hrs, +84hrs and +132hrs. The scores show improvement during the latest year.

T-min for ECMWF (monthly)

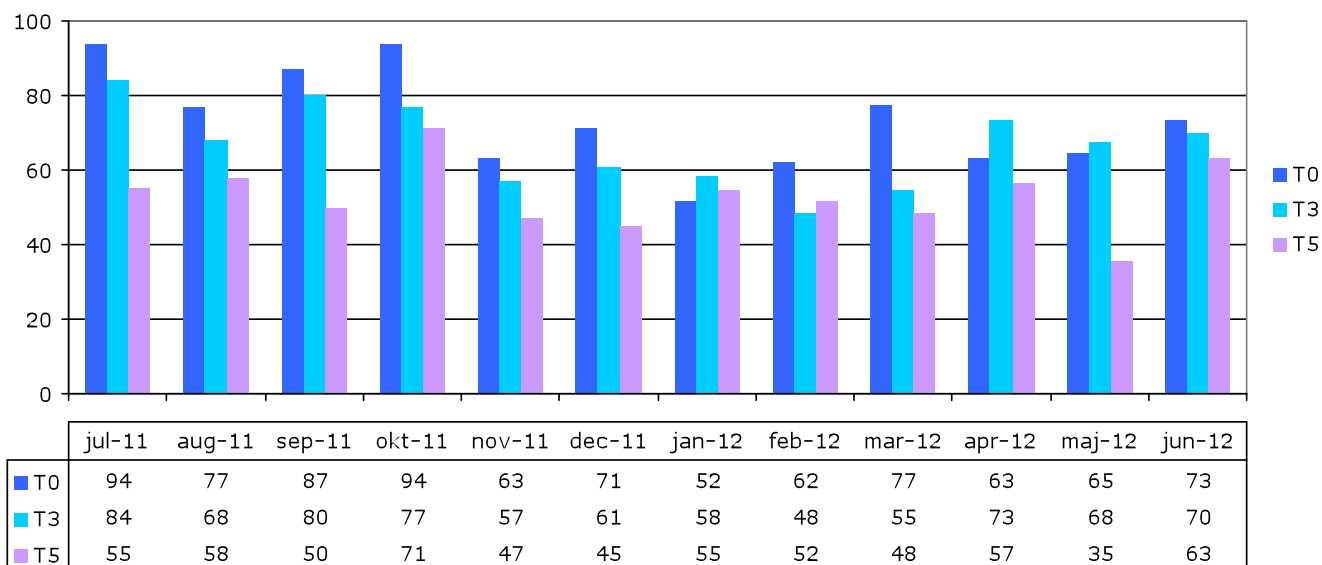


Figure 7 Monthly HR ± 2 for T min. of ECMWF raw output verified against the Danish synop network. T0, T3 and T5 corresponds to +12hrs, +84hrs and +132hrs. Especially during winter the scores have improved but scores are still not at the same level as the maximum temperatures.

T_min ECMWF (1 yr. running mean)

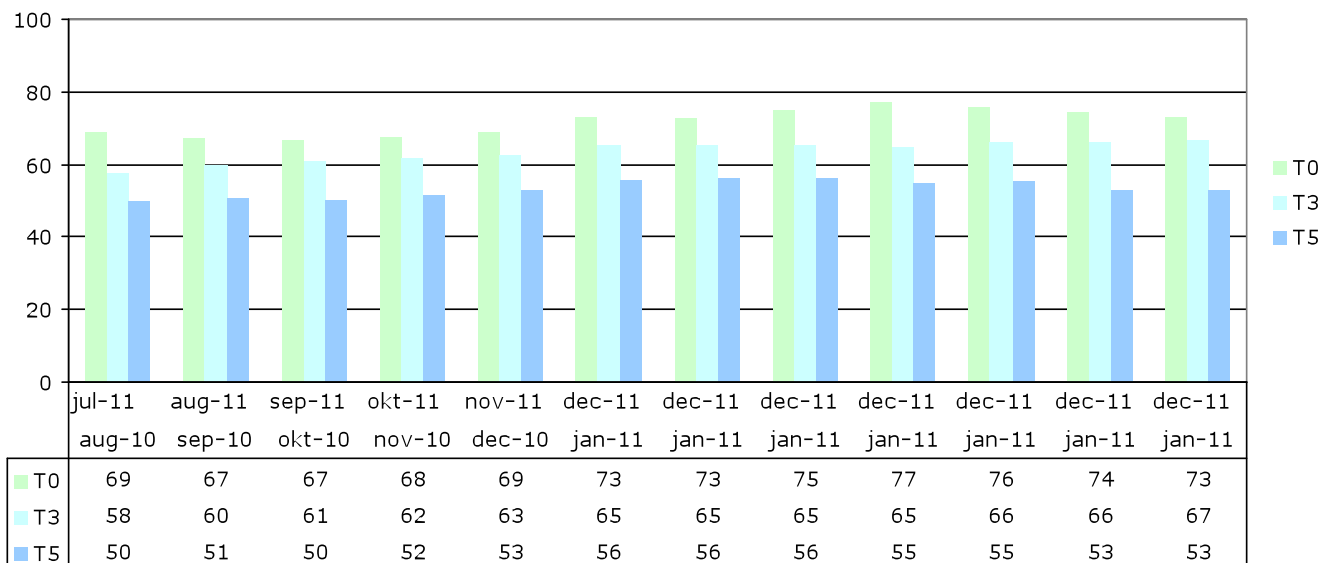


Figure 8 Running mean HR ± 2 for T min. of ECMWF raw output verified against the Danish synop network. T0, T3 and T5 corresponds to +12hrs, +84hrs and +132hrs. The scores show improvement during the latest year.

3.1.2 ECMWF model output compared to other NWP models

DMI is highly satisfied with ECMWF high resolution boundary files for use in Limited area models. This supply from ECMWF is of great value to secure quality of products generated from Limited area models (Hirlam and Harmonie) run at DMI.

3.1.3 Post-processed products

No verification.

3.1.4 End products delivered to users

No verification.

3.2 Subjective verification

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

The forecasters are still very pleased with the performance of the ECMWF in general and especially the cloud cover. Also they have noticed improvements in description of the surface which has provided better minimum temperatures. Here are a few reactions from the forecasters:

- Surface temperatures has become very good indeed and are now considered better than HIRLAM
- The presentations at the ECMWF website is both nice and very usable

Wishes for the future:

- More parameters for the monthly EPS forecasts

3.2.2 Synoptic studies

Reactions from the forecasters:

- ECMWF seems to be catching the general pressure pattern better on a time scale of 5-10 days than the GFS.
- However the ECMWF a tendency to wobble with periodic fluctuations following respectively the 00 and 12 run of the deterministic model.

4. References to relevant publications

Only DMI internal verification has been used, so no references to publications.