

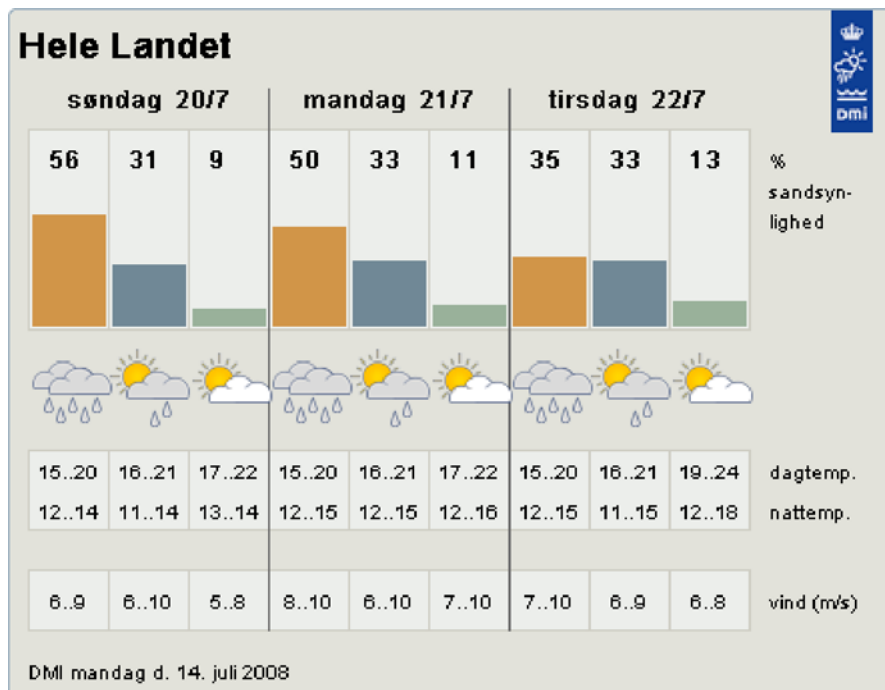
# Application and verification of ECMWF products in Denmark 2008

## 1. Summary of major highlights

The ECMWF deterministic forecasts are used extensively by the duty forecasters and also to produce a wide range of automatic forecasts. The ocean model is primarily used by the Danish Maritime Service, one of the largest ship routing services in Europe.

The ensemble forecasts are used to produce automatic probability forecasts for Denmark day 7-9.

An example of a EPS based forecast for all of Denmark (Hele Landet = whole country):



This presentation of probabilistic information has been well received and is widely used by the public. Although questions regarding the use of the information are received. It seems that the additional short explanation on the website satisfies the curiosity of most people even the ones wondering why the percentages do not add up to 100%.

The seasonal forecasts based on ECMWF data and presented on the DMI website have been extended to cover Greenland and the Faroe Islands.

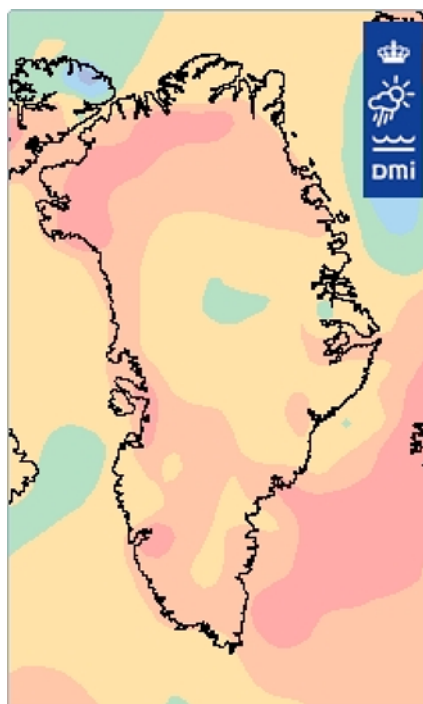


Fig. 1 Seasonal forecast for Greenland July-September 2008.

## 2. Verification of products

### 2.1 Objective verification

#### 2.1.1 Direct ECMWF model output

#### 2.1.2 ECMWF model output compared to other NWP models

Forecasts from ECMWF are used as boundary data for the DMI versions of HIRLAM. On a routine basis verification of 2 m temperature, 10 meter wind, MSL-P, 500 hPa height and temperature and 850hPa temperature are made against synop stations to measure the quality of the models compared to each other. When comparing Danish and foreign models the EWGLAM stations list is used. Further comparison is then made between more Danish model versions using only Danish stations in order to demonstrate the value of high resolution and to have available a Denmark specific verification. This verification is separated in verifications against land stations and coastal stations.

In Figure 1 the RMS error and bias for the 2 meter temperature and 10m wind for last quarter of 2007 is shown for ECMWF, UKL and two versions of the Danish HIRLAM of which T15 is the operational 15km resolution version. (ECMWF model extracted in 1 degree resolution daily from MARS).

It is seen that although the error is slightly less for the HIRLAMs the bias is lower for the ECMWF.

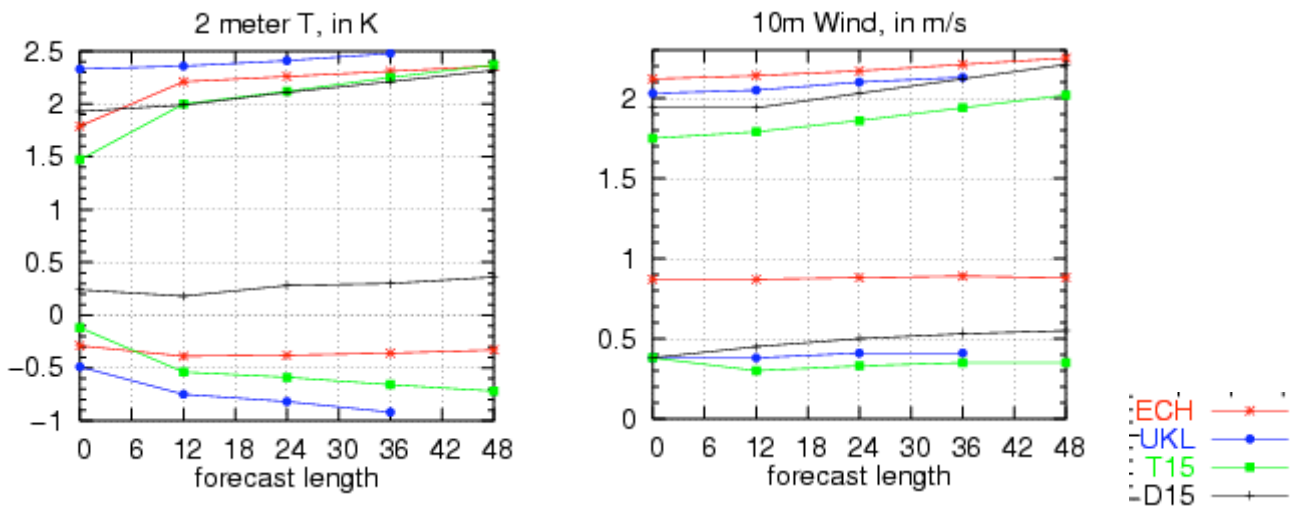


Fig. 2 verification comparison ECMWF, UKL and HIRLAM against EWGLAM stations list.

In Fig 3 is shown a verification comparison of the HIRLAM versions T15, D15 (both 15km resolution) and S05 (5km resolution). Verification in this example against Danish coastal stations.

It is seen that the high resolution model is performing slightly better than the more coarse resolution models as would be expected. Also the newer T15 is outperforming the older D15.

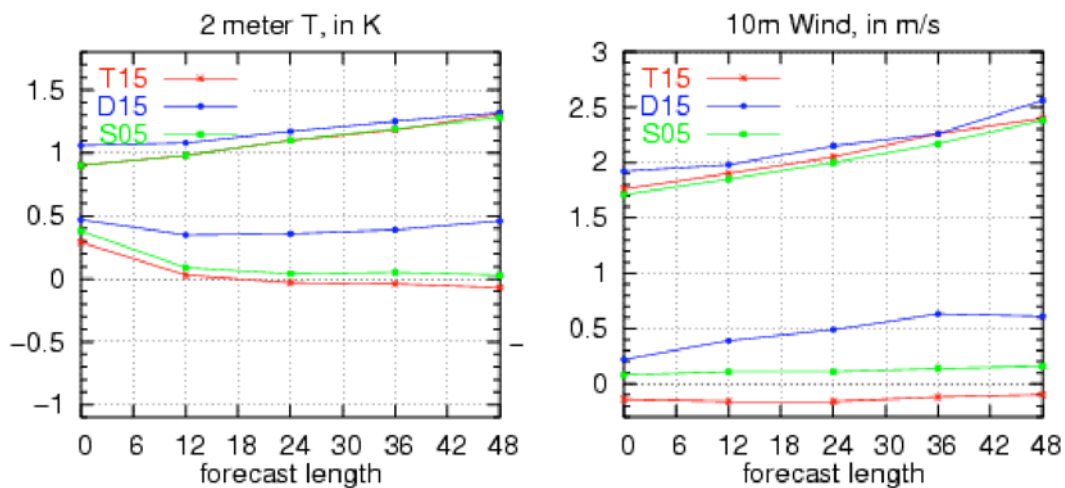


Fig. 3

### 2.1.3 Post-processed products

### 2.1.4 End products delivered to users

### 2.1.5 Seasonal forecasts

The Danish Meteorological Institute produces a deterministic seasonal forecast for the temperature in Denmark. The forecast lead is one month and the averaging period is three months. The forecast shows the seasonal mean temperature anomaly and currently it is based directly on the ECMWF dynamical forecast System 2. The skill of the deterministic forecast is highest in the spring. The forecasts are published in Danish on the DMI homepage on the Internet, and they are often discussed broadly in the media in particular when the summer (June, July, and August) or winter (December, January, and February) forecasts are made public.

## 2.2 Subjective verification

No formal and systemized subjective verifications is made.

## 3. References

Nil.