Application and verification of ECMWF products 2008 in Czech Republic

Czech Hydrometeorological Institute (CHMI)

1. Summary of major highlights

The Centre's products have been widely used by the Central and Regional Forecasting Offices in the Czech Hydrometeorological Institute for medium-range weather forecasts and to some extent also in short-range forecasting. The clusters, tubes, plumes and EPS-grams are considered in order to evaluate the credibility of the main deterministic forecast as well as to prompt for possible scenarios in situations of low determinism. The Extreme Forecast Index and other probabilistic products have been used especially in severe weather forecasting. The Centre's graphical products available on the web server are used also by the Weather Service of the Czech Army.

At the beginning of 2007 the CHMI bought and implemented weather station Visual Weather IBL soft. Most of the products of deterministic model and some probabilistic products are visualised on this weather station both at the Central Forecasting Office and at the Regional Forecasting Offices.

2. Use and application of products

2.1.1 Statistical adaptation

No statistical adaptation of the ECMWF products is carried out.

2.1.2 Physical adaptation

No limited area modeling using the ECMWF products is carried out.

Three-dimensional wind forecasts over the Northern Hemisphere up to +120 hrs are used as the input to the trajectory model used for assessing of risk of distant nuclear or other major accidents.

Experimentally we use the prediction of precipitation and temperature of deterministic model as an input to hydrological models to predict water levels of major rivers up to ten days in advance. Although the results are not always successful enough, the qualitative use is possible . Next time we plan to use 25% and 75% percentiles of precipitation from EPS to estimate the probability and the range of inundation in the rivers.

Some of meteorological parameters (pressure, temperature, wind) predicted by ECMWF are used as an automatic input to some our products that are controlled and modified by forecasters.

2.1.3. Derived fields

No derived fields are calculated out of the ECMWF products.

2.2. Use of products

The final medium-range forecasts produced by forecasters are currently used in the general weather forecasting for public and state authorities and in the national Warning and Alert Service. Warning system is becoming the most important component of our service. Both probabilistic products and the Extreme Forecast Index are used to issue warnings. Ensemble products are considered in order to evaluate the credibility of the main deterministic forecast and to issue weather forecasts more than approximately 5 days in advance.

The seasonal and monthly forecasts are consulted in the long-range forecast process. Currently the results of both deterministic and ensemble forecasts up to 15 days in advance and monthly forecasts are used for identification of the weather type in the analogue-based forecasting method for monthly forecasting.

3 Verification of products

There is currently no objective or systematic subjective verification of ECMWF medium range forecast products carried out. The general scores calculated and published by ECMWF are considered informative. For now we also use verification of ECMWF products from the Green Book. Considering the character of medium-range weather forecasts, the verification scores from neighboring countries are well applicable also for our service.

3.1 Objective verification

3.1.1 Direct ECMWF model output (both deterministic and EPS)

3.1.2 ECMWF model output compared to other NWP models

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)

Verification of the ECMWF monthly weather forecast

Introduction

The Czech Hydrometeorological Institute (CHMI) provides monthly weather forecast for the area of the Czech Republic three times a month. The forecast is prepared on statistical-analog basis. The selection of previous meteorological situations analogical to the current one is carried out using two methods. The first method compares average 10-day and monthly temperatures and precipitation over the Czech Republic. The other method is based on comparation and automatic evaluation of average pressure and temperature fields of 10-day and monthly periods of various vertical atmospheric levels over the Atlantic-Europe area. At the same time, the ECMWF medium range ensemble outputs are used for the first 10-day period of our monthly forecast as well.

The outputs of the ECMWF monthly forecast and the ECMWF medium range forecast for 10 to15 days are informatively considered as well. The aim of this evaluation is to evaluate the credibility of the ECMWF monthly forecast products.

The evaluation was carried out over the period from 23/07/2007 to 08/06/2008. The ECMWF weekly 2-meter temperature anomaly and weekly precipitation anomaly was compared to the real (measured) temperature and precipitation anomaly over the Czech Republic area, for all 4-week periods of monthly forecast.

Results of the evaluation

Absolute value of error of the 2-m temperature forecasts	**Forecasting period (days)**			
	5-11	**12-18**	**19-25**	**26-32**
0 to 1	24	15	13	12
1 to 2	13	11	11	12
2 to 3	6	9	13	12
3 to 4	2	8	5	5
4 to 5	1	3	2	4
5 to 6	0	0	0	1
6 to 7	0	0	2	0

Table 1 Number of weekly 2-meter temperature anomaly forecasts in dependence on absolute value of error.

The Table 1 shows the number of the ECMWF forecasts according to absolute value of error of the weekly 2-meter temperature anomaly compared to measured condition. The error value for the first week (5th to 11th day of the forecast) was less than 1 °C in 24 cases (52 %) , within 1 to 2 °C in 13 cases (28 %), and larger than 2 °C in 9 cases (20%). The error value for the second week (12th to 18th day of the forecast) was less than 1 °C only in 15 (33 %) cases, within 1 to 2 °C in 11 cases (24 %), and larger than 2 °C in 20 cases (43%). The results of the forecast for the third and fourth month were a bit worse.

Success rate in temperature anomaly forecasting (weekly period)	Forecasting period (days)			
	5-11	12-18	19-25	26-32
successful	30	20	9	10
no signal	12	18	32	31
unsuccessful	4	8	5	5

Table 2 Number of successful 2-meter temperature anomaly forecasts (both forecast and measured condition above-normal or both forecast and measured condition below-normal), no signal forecasts, and unsuccessful forecasts (forecast above-normal, measured condition below-normal, or vice versa).

The Table 2 shows the number of successful 2-meter temperature anomaly forecasts (both forecast and measured condition above-normal or both forecast and measured condition below-normal), no signal forecasts, and unsuccessful forecasts (forecast above-normal, measured condition below-normal, or vice versa).

In the first week (5th to 11th day of the forecast), the successful forecasts significantly dominate. In the second week (12th to 18th day of the forecast), the forecasts can still be used, however a number of the no signal forecasts is high. In the third (19th to 25th day of the forecast) and fourth week (26th to 32nd day of the forecast), the no signal forecasts significantly dominate - about 32 cases (70 %). However, when the model generates some output, about 65 % of the forecasts is still successful.

Success rate in temperature anomaly forecasting (weekly period)	Forecasting period (days)			
	5-11	12-18	19-25	26-32
successful	16	6	2	2
no signal	23	33	39	43
unsuccessful	7	7	5	1

Table 3 Number of successful precipitation anomaly forecasts (both forecast and measured condition above-normal or both forecast and measured condition below-normal), no signal forecasts, and unsuccessful forecasts (forecast above-normal, measured condition below-normal, and vice versa)

The Table 3 shows the number of successful precipitation forecasts (both forecast and measured condition above-normal or both forecast and measured condition below-normal), no signal forecasts, and unsuccessful forecasts (forecast above-normal, measured condition below-normal, and vice versa).

Apparently only the first week forecasts (5th to 11th day of the forecast) can be used, although the number of the no signal forecasts is high, i.e. 23 (50 %) cases. The forecasts for the next three weeks are virtually useless, since the ratio of the no signal forecasts is high, and the number of the successful and unsuccessful forecasts is almost equal.

Conclusion

Temperature anomaly forecasts for the first week (5th to 11th day of the forecast) are useful, for the second week (12th to 18th day of the forecast), are partly useful, the use of the forecasts for the third and fourth week is very limited since there is about 70 no signal forecasts. The ratio of the no signal precipitation anomaly forecasts for the first week is 50 %, the rest of the forecasts is only partly successful. The forecasts from the second week are unusable.

3.2.2 Synoptic studies

The seasonal and monthly forecast products are considered as having some informative value. However, the frequency of "no signal" of these forecasts is considered still too high.

4. References to relevant publications