Application and verification of ECMWF products 2019

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1   Summary of major highlights

ECMWF products have been widely used by the Central and Regional Forecasting Offices in Czech Hydrometeorological Institute (CHMI) for short-range and medium-range weather forecasts. The clusters, plumes, EPS-grams and probability outputs are considered 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 are used especially in severe weather forecasting.

A great number of products of deterministic model and some probabilistic products are visualised at weather station Visual Weather (IBL soft.) both at the Central Forecasting Office and at the Regional Forecasting Offices. Using this weather station, also products of other models, including Aladin model (operated in CHMI), GFS and ICON are displayed and compared to ECMWF products.

The goal of the internal project at CHMI aimed at agrometeorology is to focus on several ECMWF parameters forecast analysis. Its results could be used for better evaluation of short-range and medium-range forecast of soil drought in the Czech Republic. Detailed information and important results of this project were given at this report two years ago.

2   Use and application of products

2.1   Direct Use of ECMWF products

ECMWF products have become the main products to issue short-range and medium-range weather forecasts including severe weather for both the whole territory of the Czech Republic and particular regions of the Czech Republic. It consists both general weather forecasts for media and the public and special forecasts for aviation, winter maintenance of roads and motorways, energetics, gasworks etc.

The final medium-range forecasts produced by forecasters of CHMI are used in the general weather forecasting for the public and state authorities and in the national Warning and Alert Service. Warning system has become 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.

ECMWF deterministic temperature and precipitation forecasts serve also as optional input to hydrological model in cases when prolonged lead time is demanded (especially for the purpose of reservoir management).

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.

Only some products from ecCharts are used – e.g. precipitation state, precipitation probability.

Most of products of ECMWF are also used by the Weather Service of Army of the Czech Republic.

2.2   Other uses of ECMWF output

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.

2.2.1   Post processing

Objective statistical adaptation is used for 2 metre temperature prediction.

2.2.2   Derived fields

Derived fields are calculated to improve detection and prediction of severe weather, mainly severe thunderstorms with heavy rain, hail and severe wind gusts. They are calculated by weather station Visual Weather and they are depicted to tables, maps and diagrams by this weather station.

It is calculated instability of the atmosphere (CAPE, Lifted index, Showalter index, convective inhibition CIN, temperature gradient between 500 and 850 hPa), wind shear between different levels, SWEAT index, jet stream, low-level jet stream, mixing ratio and precipitable water. These parameters are used to improve prediction of thunderstorms and their dangerous events.

Other derived filds like type of precipitation, low level clouds and fogs, rime, snow drifts, ventilation index are used for prediction of other events.

Temperature, humidity, precipitation and wind speed predictions are also used for calculation of natural fire danger.

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.

2.2.3   Modelling

3   Verification of products

3.1   Objective verification

3.1.1   Direct ECMWF model output (both HRES and ENS), and other NWP models

CHMI carries out automatic evaluation of the main weather parameters (averages of minimum and maximum temperature, sunshine duration, precipitation total, percentage of region with precipitation, thunderstorms and fogs) of four numerical weather prediction models (Aladin, ECMWF, ICON, GFS) for both the whole Czech Republic and individual regions for five days ahead. The same method is used for evaluation of general forecasts issued by forecasters. Method is based on adapted Brádka's method of evaluation used by forecasters since the year 1958 and now uses new database system and computing capabilities.

3.1.2   Post-processed products and end products delivered to users

3.1.3   Monthly and Seasonal forecasts

3.2   Subjective verification

3.2.1   Subjective scores (including evaluation of confidence indices when available)
The seasonal and monthly forecast products ECMWF are considered as having some informative value.

3.2.2   Case studies

4   Requests for additional output

5   Feedback on ECMWF "forecast user" initiatives

6   <u>References to relevant publications</u>