Application and verification of ECMWF products 2018

National Meteorological Administration, Romania

1. Summary of major highlights

In the field of numerical model verification, the daily GRID_STAT method (from Metv5.2 http://www.dtcenter.org/met/users/index.php) was implemented for the following parameters: temperature, relative humidity at 2 m, wind speed at 10 m, low sea level pressure and total rainfall in 24 h.
MOS-ARPEGE and MOS_ECMWF equations were updated using a 4 years development data set..

2. Use and application of products

2.1 Post-processing of ECMWF model output

2.1.1 Statistical adaptation

The MOS statistical models have been in operational use since 2004. No major changes occurred in basic models from that moment until now. Starting with 2012 the discriminated analysis was replaced with logistic regression, for all MOS systems. The models provide twice a day, local forecasts up to 10 days, to 163 meteorological stations for the following main parameters: 2m temperatures, extreme temperatures, 10m wind speed and direction, total cloudiness (3 classes) and total precipitation (3 classes). The results are represented in map format, text format, and displayed on the web site. In 2014 a MOS version using HRES ECMWF model was developed and implemented on "ecgate".
Comparing the scores between MOS-HRES_CEP and Direct model, certain improvements in local forecasting should be expected.

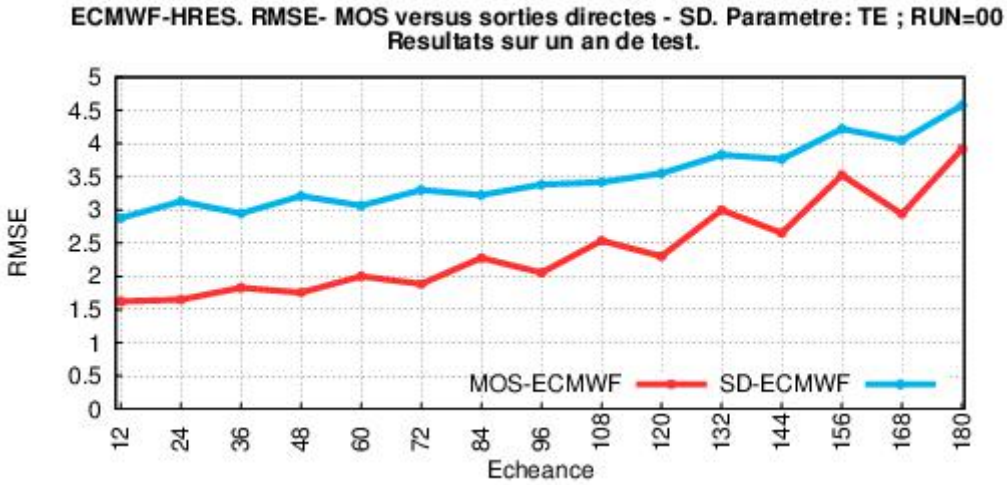


Fig.1 Comparison between MOS_ECMWF-HRES and Direct model – SD-ECMWF. Results for extreme temperature. All station included.

2.1.2 Physical adaptation

2.1.3 Derived fields

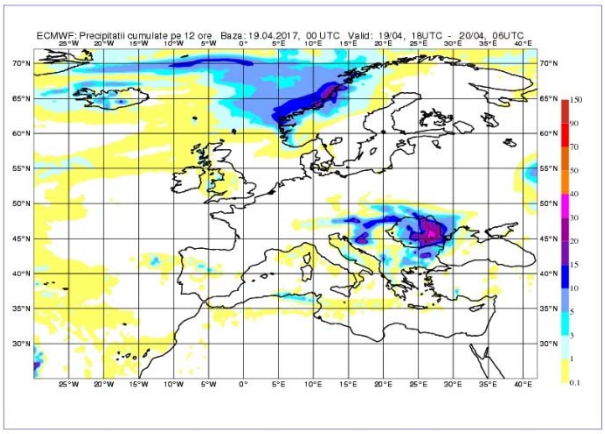
2.2 ECMWF products

2.2.1 Use of Products

The ECMWF products available at NMA are used for the short and medium range forecasts. These products are provided to forecasters (public, state authorities, national warning system) or to customers (more mass media) in different type format (graphical or grib data files).

The graphical products are available for the Weather Forecast Department, in real time, and are obtained using graphical packages developed at ECMWF: Metview and Magics.

Some examples of graphical products, which are available on a specific web site, are as follows:



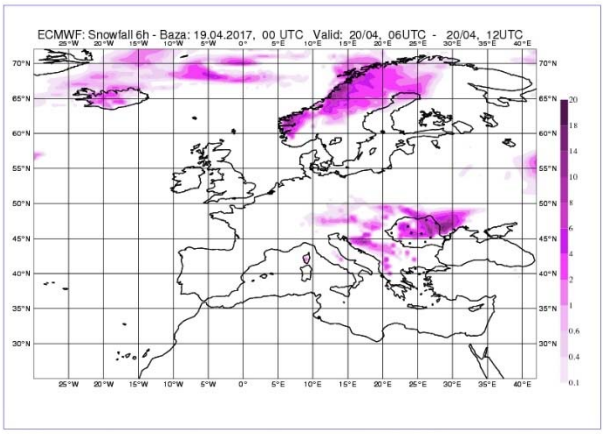
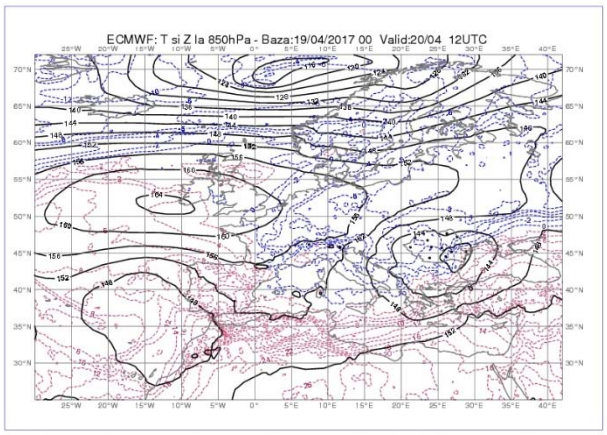


Fig.2 **left** – cumulated precipitation in 12 hours, Base: 19.04.2017, 00.00 GMT, Valid: 20.04.2017, 06 GMT – 20.04.2016, 18 GMT
right – cumulated precipitation in 06 hours, Base: Base: 19.04.2017, 00.00 GMT, Valid: 20.04.2017, 06 GMT – 20.04.2016, 12 GMT



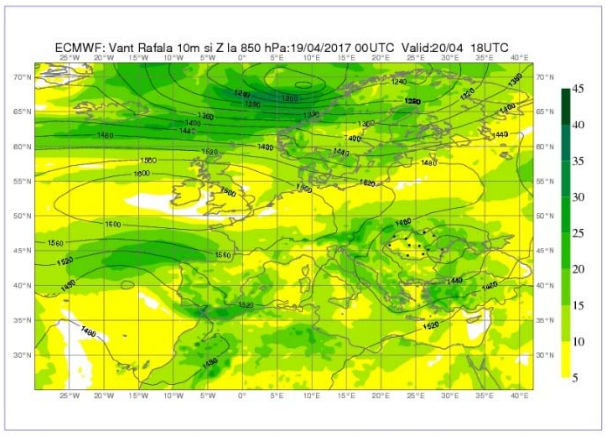
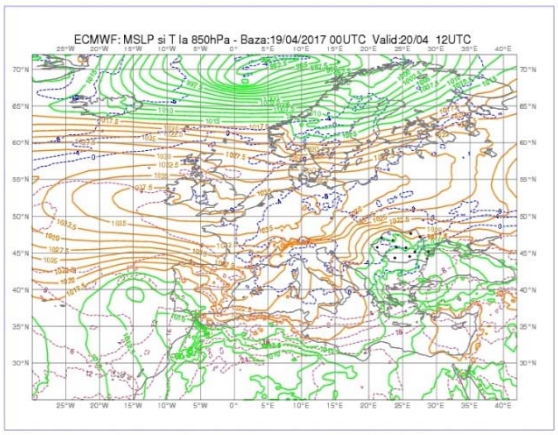


Fig.3 **left** – Temperature and geopotential at 850 hPa, Base: Base: 19.04.2017, 00.00 GMT, Valid: 20.04.2017, 12 GMT
right – Wind gust at 10 m and geopotential at 850 hPa, Base: 19.04.2017, 00.00 GMT, Valid: 20.04.2017, 12 GMT



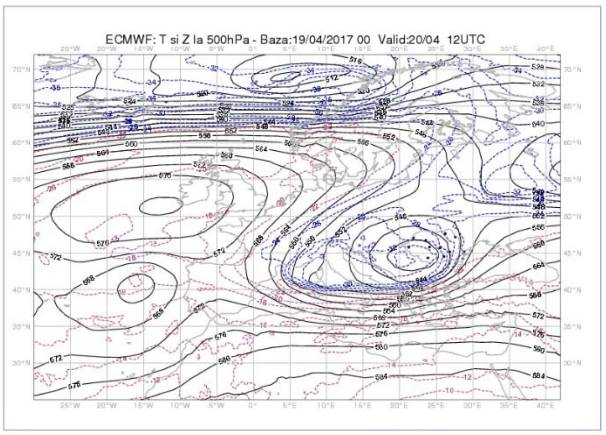


Fig.4 **left** – Mean see level pressure and temperature at 850 hPa, Base: 19.04.2017, 00.00 GMT, Valid: 20.04.2017, 12 GMT
right – Temperature and geopotential at 500 hPa, Base: 19.04.2017, 00.00 GMT, Valid: 20.04.2017, 12 GMT

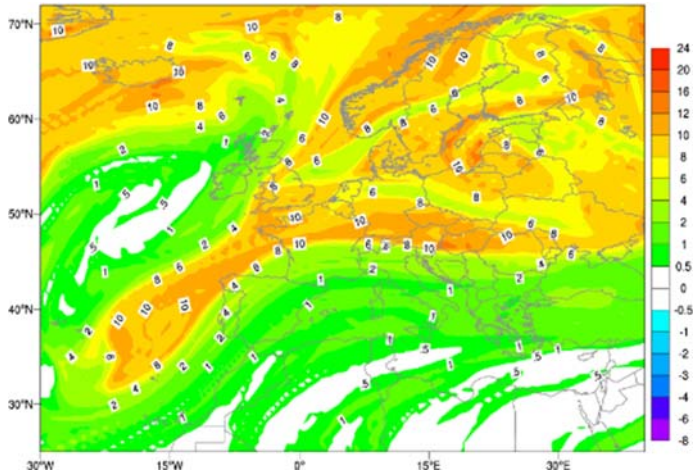


Fig.5 200 hPa potential vorticity

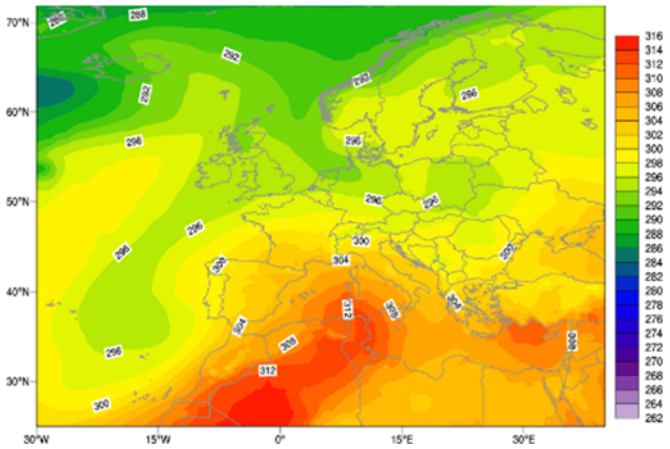


Fig.6 HGT 700 – 1000 hPa

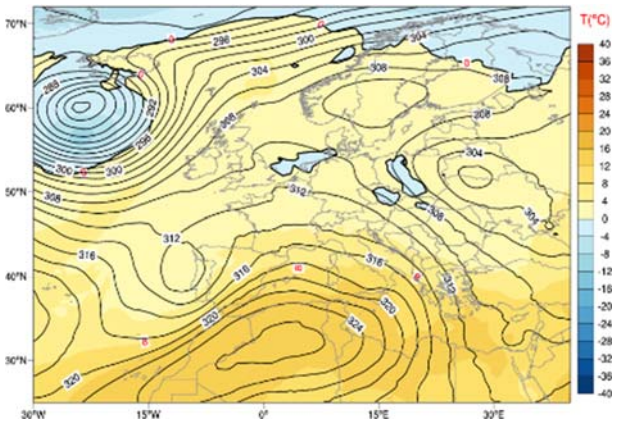


Fig.7 700 hPa temp & geop

Some other usefull products for the short and medium range forecasts, that NMA used daily during 2017, are provided by the ecCharts aplication and here are some examples that proved to be very useful in operational forecast activity:

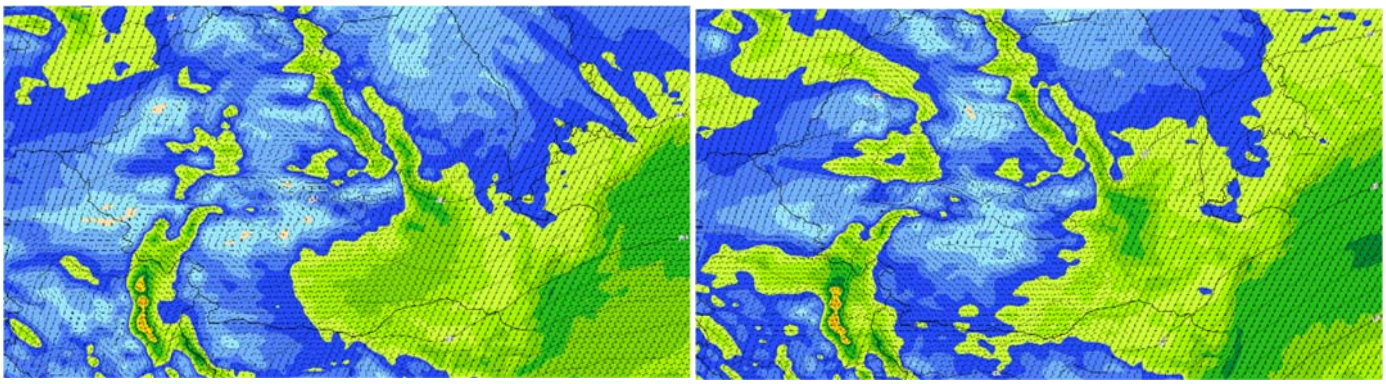


Fig.8 MSLP, WIND at 10 m and Wind Gust in the last 3 hour, Base: 17.01.2017, 00.00 GMT,
left – valid for 17.01.2017, 21.00 GMT; **right** – Valid for 18.01.2017, 12.00 GMT

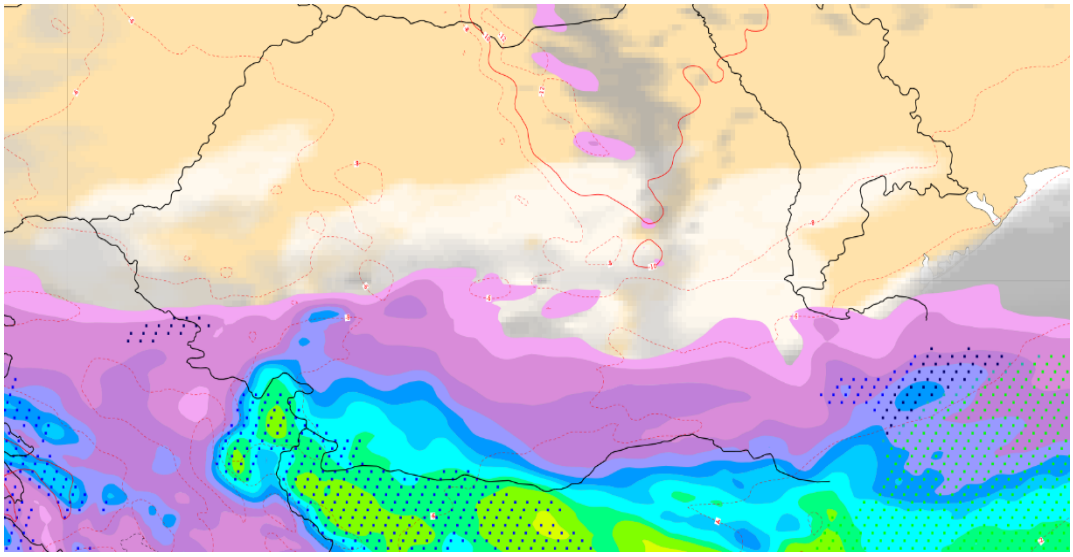


Fig.9 Base: 17.01.2017, 00.00 GMT, Overlay: Total precipitation over 24 hour, valid for: 17.01.2017, 12.00 GMT - 18.01.2017, 12.00 GMT; 850 hPa temperature valid for 18.01.2017, 12.00 GMT; Low, medium and high cloud cover valid for 18.01.2017, 12.00 GMT and Precipitation type valid for 18.01.2017, 12.00 GMT

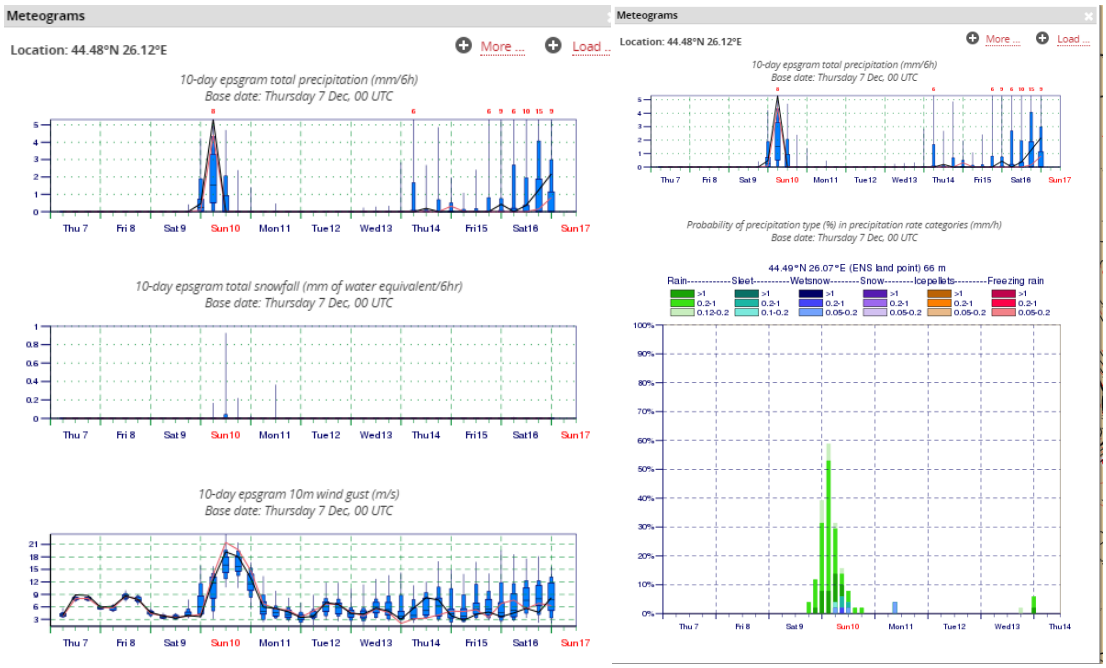


Fig.10 Meteogram for Bucharest, Base: 07.12.2017, 00.00 UTC – **left**: total precipitation (mm/6h), total snowfall (mm/6h)and 10 m wind gusts (m/s); **right**: total precipitation (mm/6h) and probability of precipitation type (%

2.2.2 Product requests

3. Verification of products

3.1 Objective verification

3.1.1 Direct ECMWF model output (both HRES and ENS)

The objective verification was continued in 2017 by using the VERMOD - an unitary system for objective verification of all models used operationally by the National Meteorological Administration (NMA): ECMWF, ARPEGE, ALADIN, ALARO COSMO_RO. A wide range of statistical verification measures are computed daily and monthly. The results are disseminated via dedicated statistical and verification web-site for different selections of stations.
The GRID_STAT procedure (based on METv5.2 verification tools from NCAR) was used in order to produce daily Verification of all models (surface parameters) used at NMA.
The results are daily disseminated on the dedicated statistical and verification website.

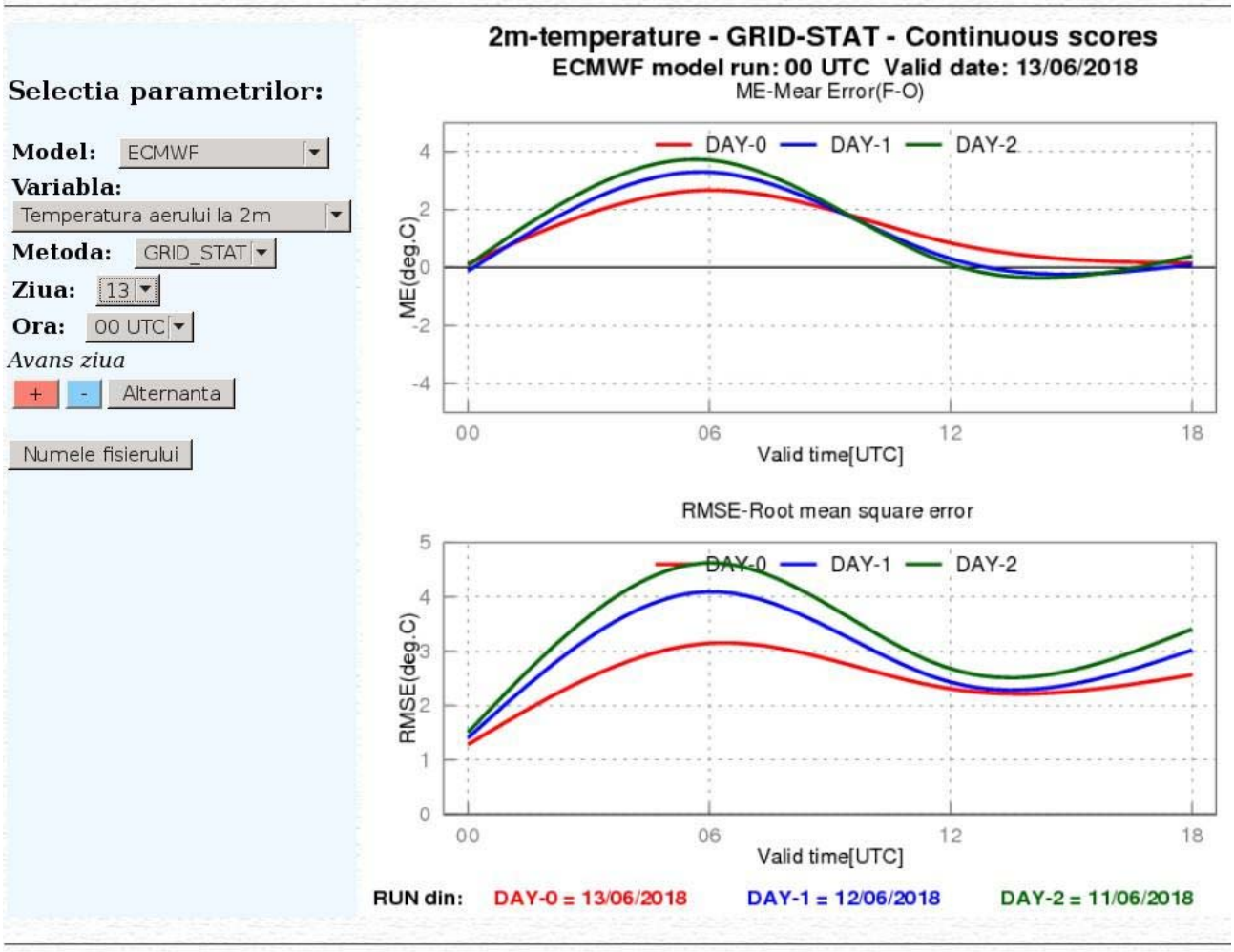


Fig. 11 Example of the web user interface to access the daily models verification scores

A special type of graph was created to plot the FSS score - Fraction Skill Score calculated with the GRID-STAT procedure of Metv5.2. The procedure is applied daily to verify the numerical model forecasts for the 24 hours cumulated precipitation (up to 78 hours). An example of the chart can be seen in the following figure.

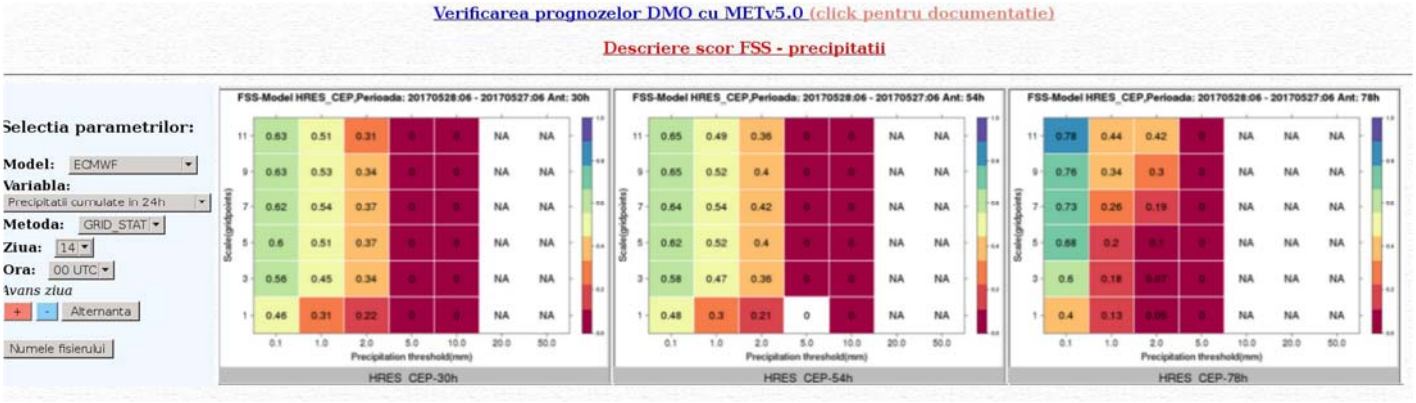


Fig. 12 Example of the web user interface to access the daily models verification score – FSS for HRES_CEP

3.1.2 ECMWF model output compared to other NWP models

Comparison of performance of ECMWF model to other NWP models used by NMA is performed daily and monthly, for the most important surface weather parameters: 2m temperature, 10m wind speed, total cloudiness, mean sea level pressure and 24 hours cumulated precipitation. Graphs of the main verification scores and an overview of the performances of the models for all year are available on the web-site.

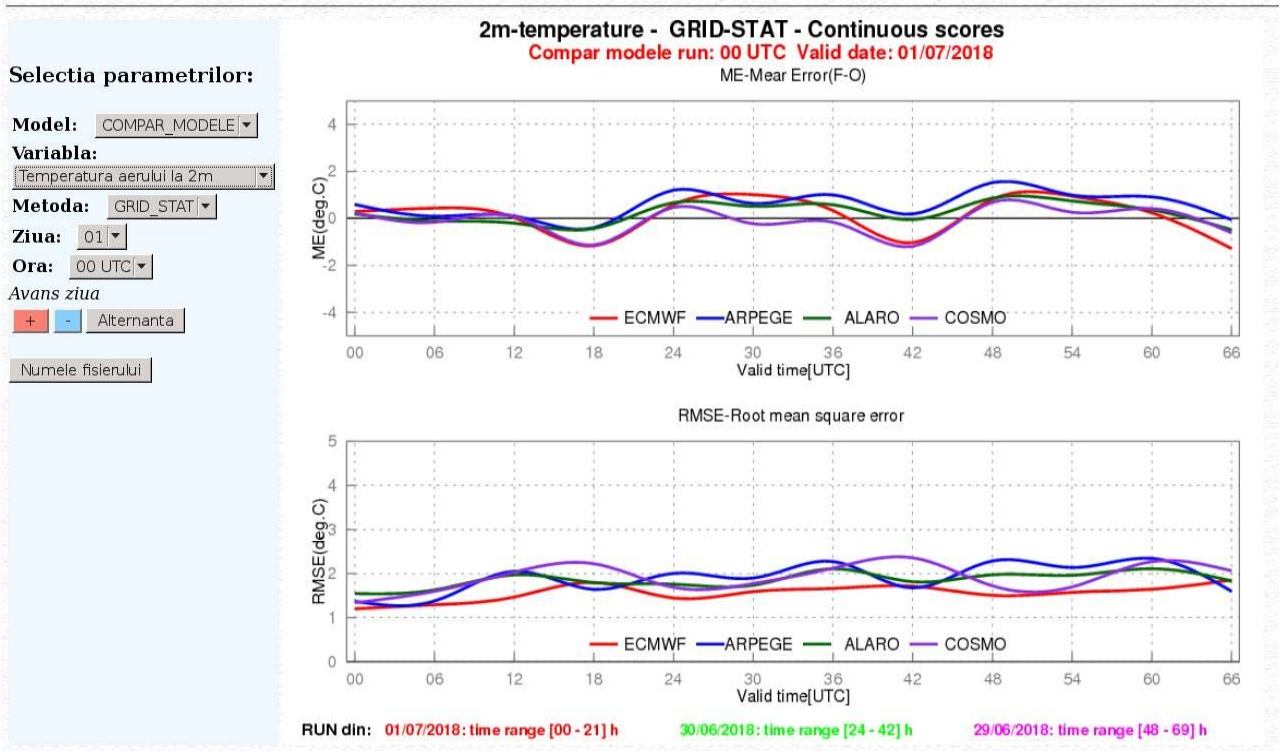


Fig. 13 Graphical example of daily comparison of numerical models scores

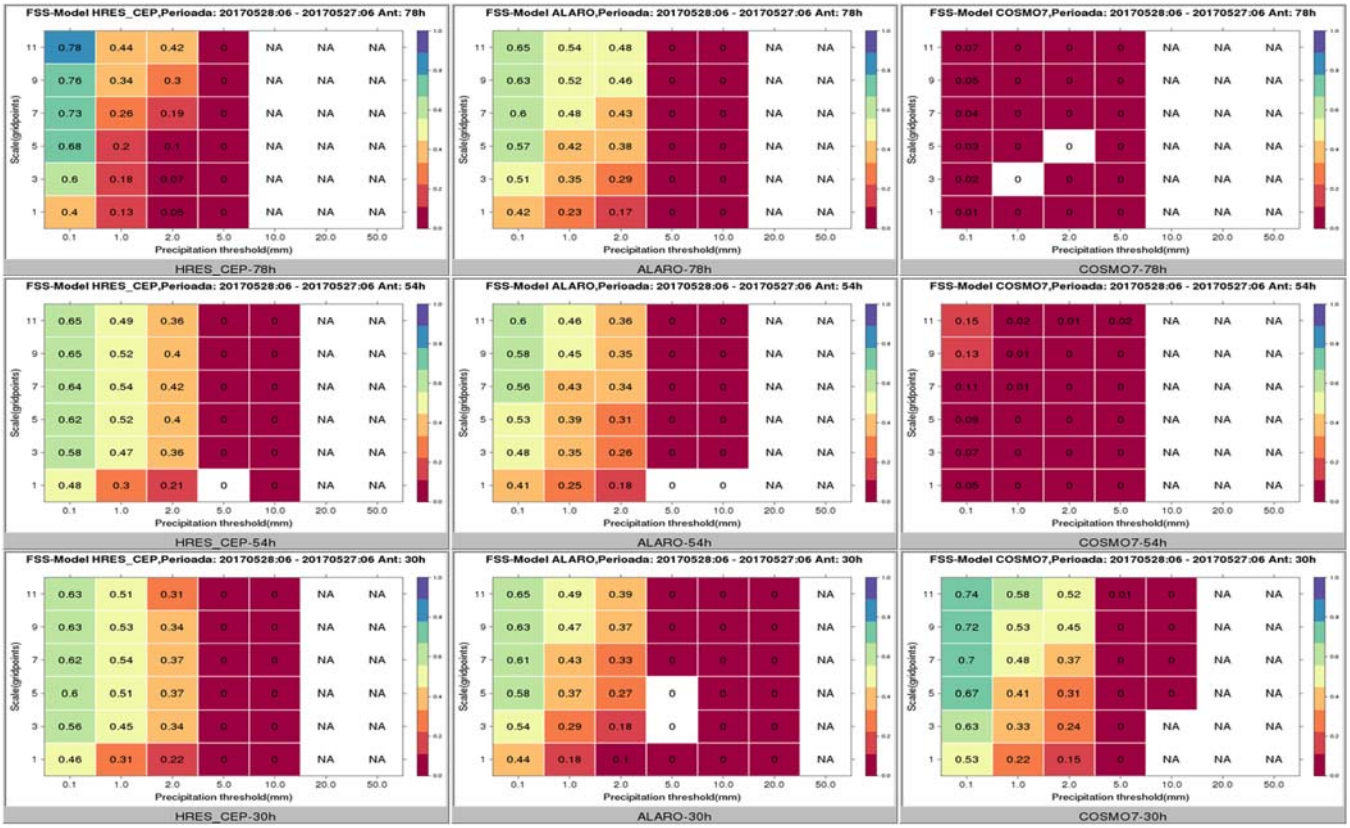


Fig. 14 Graphical example of daily comparison of numerical models score – FSS for 24 hours precipitation forecast

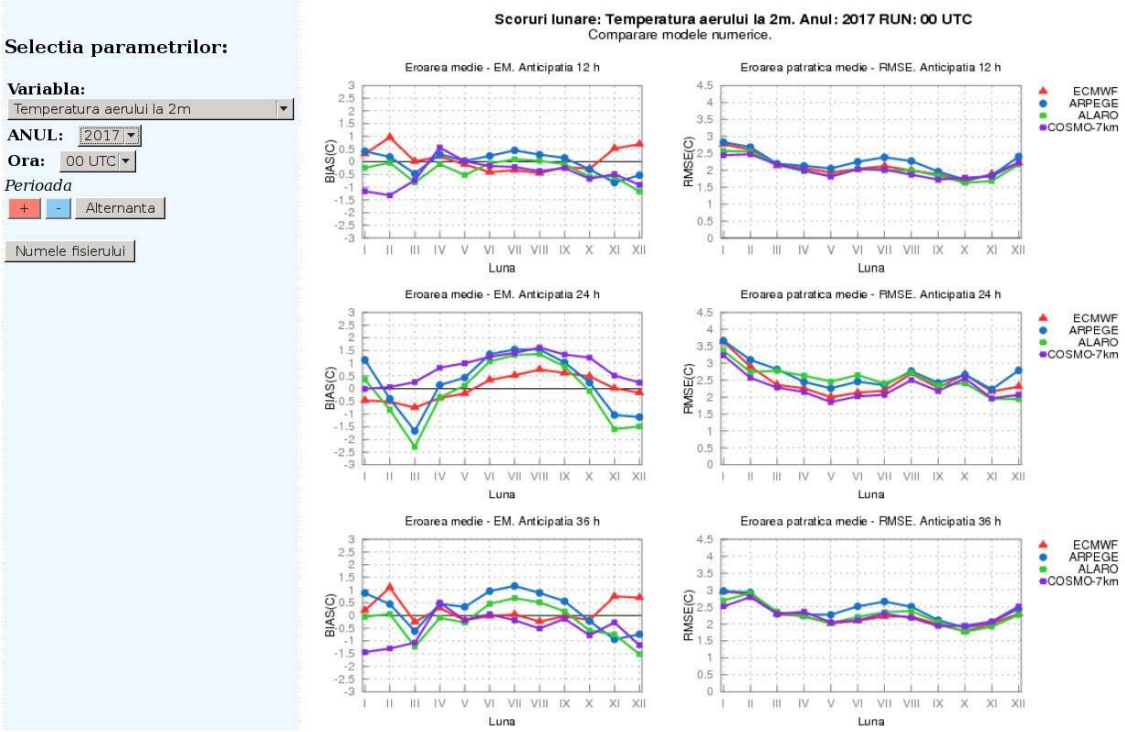


Fig. 15 *Web interface for the monthly scores.* 2mTemperature. BIAS and RMSE scores using all meteorological stations. Year – 2017

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)

3.2.2 Case studies

4. Feedback on ECMWF “forecast user” initiatives

5. References to relevant publications