

# Application and verification of ECMWF products 2016

National Meteorological Administration, Romania

## 1. Summary of major highlights

- Starting May 2015 HRES output model for a limited number of parameters and an area covering Romania were selected in automatic dissemination.
- In the field of numerical models verification graphic format for the presentation of comparative scores was diversified.
- Starting august 2015 some maps from EUROSIP and ECMWF seasonal model are plotted and used for seasonal forecast.

## 2. Use and application of products

Starting in May 2015, HRES output model for a limited number of parameters and an area covering Romania were selected in automatic dissemination. Various couplings maps were plotted and displayed on the web site (intranet) to be more easily understood by meteorologists. In the figures below are only two examples of maps of HRES model. Each map can be increase(zoom).

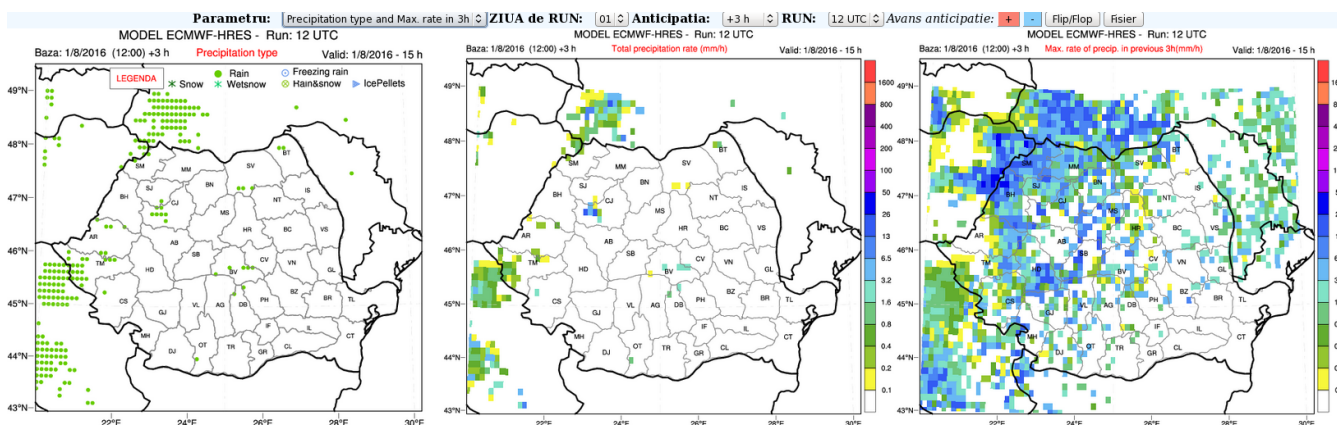


Fig 1. Example of Coupled maps of the Precipitation type, Total precipitation rate(mm/h) and Max. Rate of precipitation from HRES model

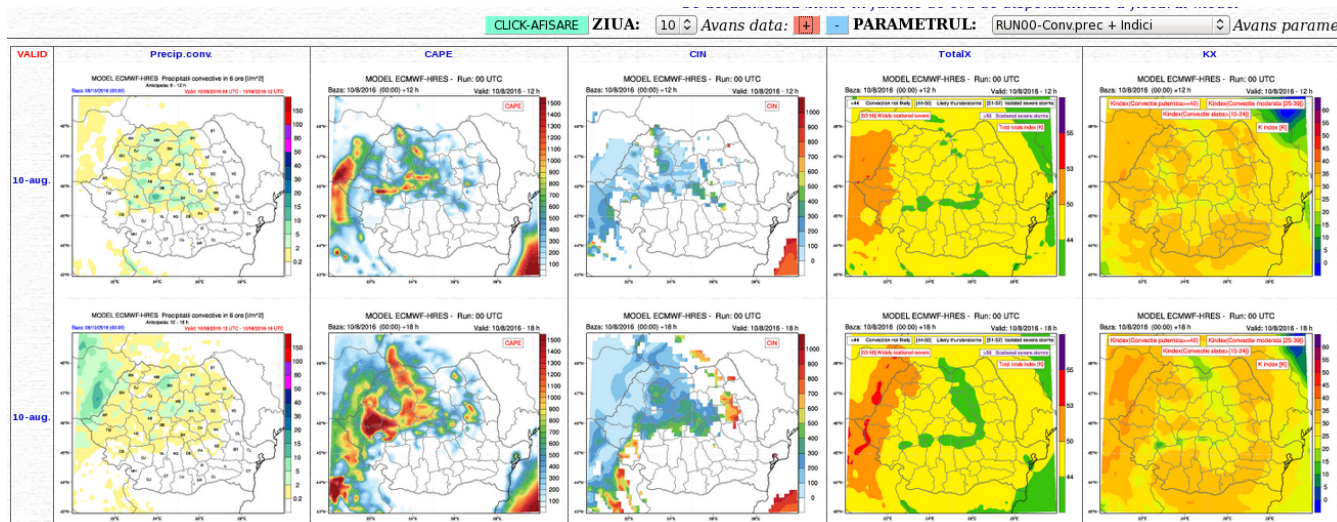


Fig 2. Example of Coupled maps of the Convective Precipitation, CAPE, CIN , TotalX and KX from HRES model

In the month of August 2015 we were set to release some products from EUROSIP and ECMWF models for seasonal forecast. Various maps over Europe and Northern Emisphere are plotted to be easily interpreted and used in the seasonal forecasts. Some examples in the figures below:

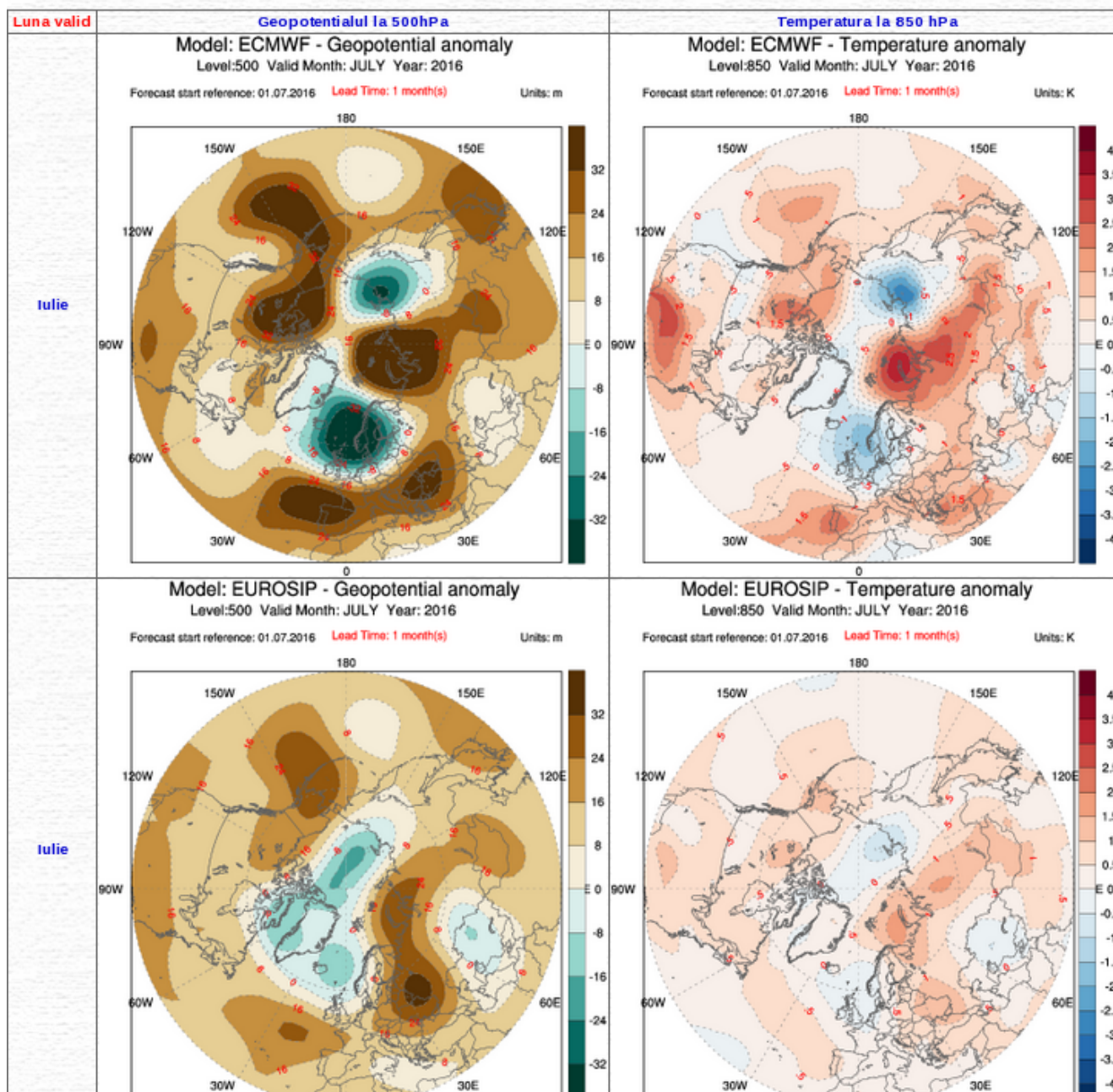


Fig 3. Example of Northern Hemisphere maps from EUROSIP and ECMWF model

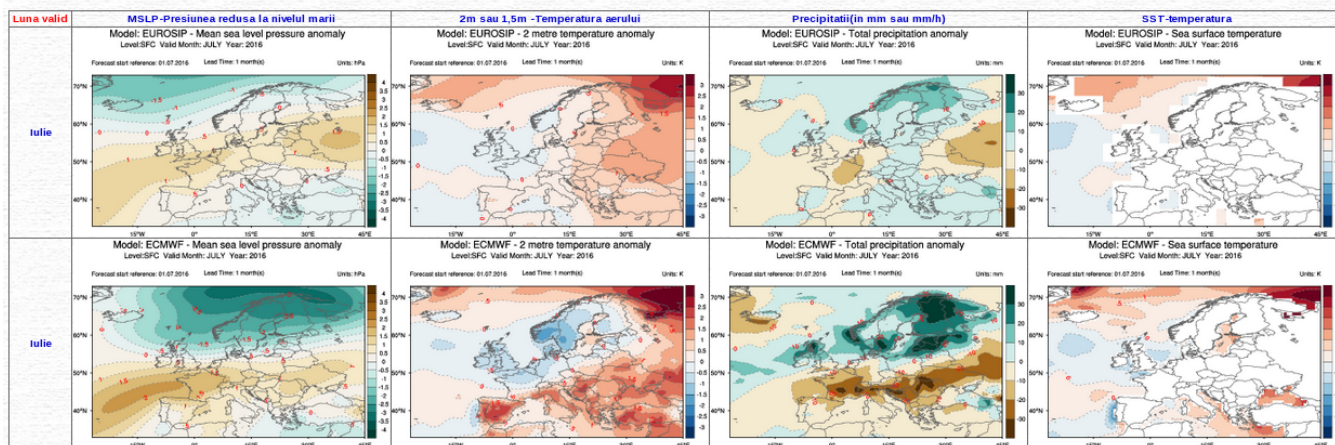


Fig 4. Example of the seasonal ECMWF coupled maps over Europe

At the end of each months a diagnosis maps are plotted to visual/subjective verification. One examples in Fig. 5

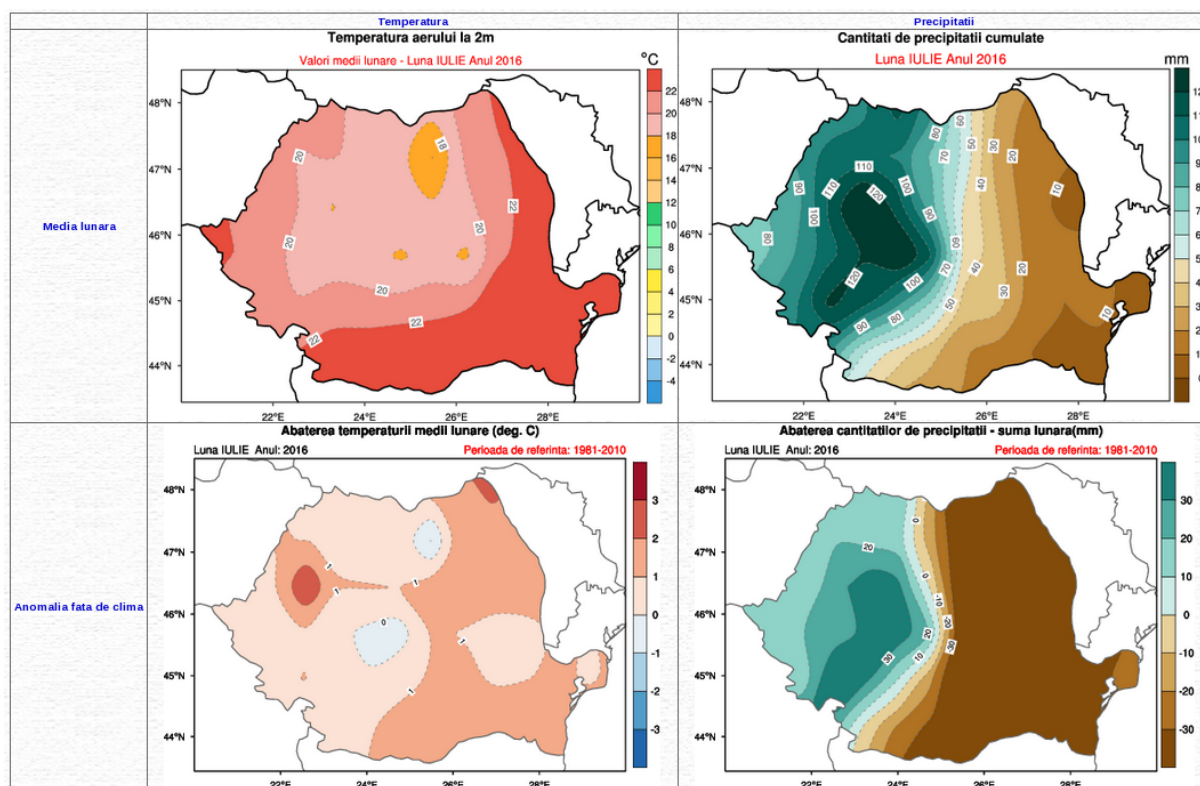


Fig 5. Monthly mean and monthly anomaly of temperature and precipitation for July 2016.

## 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 in basic models since that time. We have to notice that since 2012 the discriminant analysis was replaced with logistic regression, for all MOS systems. The models provide twice on 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 plotted in map forms, text format, and displayed on the web site. In 2014 a MOS version using HRES ECMWF model was developed and implemented on “ecgate”.

In 2015 a MOS version using ALARO model was developed and implemented in operational activity. The statistical models used follows the same architecture (described in the previous reports).

Comparing RMSE between MOS-ALARO and MOS-ALADIN Aladin, we can concluded that we expect a significant improvement in local forecasting using MOS-ALARO.

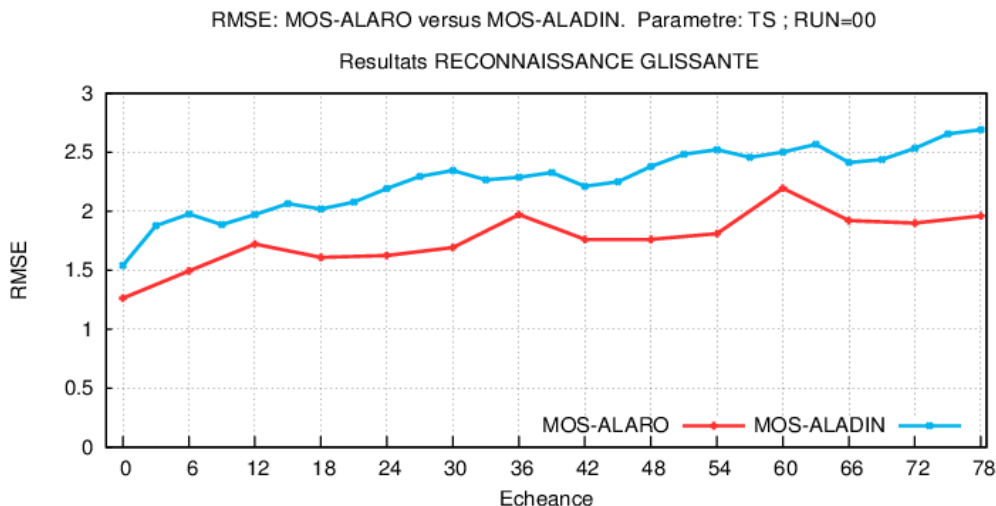


Fig 6. Comparative verification between MOS\_ALARO and MOS\_ALADIN.

2.1.2 Physical adaptation

2.1.3 Derived fields

2.2 Use of ECMWF products

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

Using graphical packages developed at ECMWF, Metview and Magics, the ECMWF products are available in real time for the Weather Forecast Department. Here are some examples of graphical products, which are available on an Intranet web site:

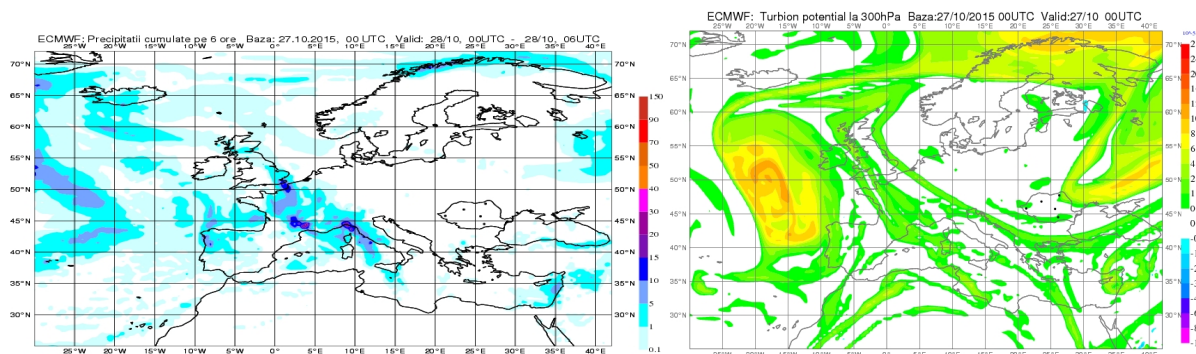


Fig 7. left – cumulated precipitation in 06 hours, Base: 27.10.2015, Valid: 28.10, 00UTC – 28.10, 06UTC  
 right – potential vorticity at 300 hPa, Base: 27.10.2015, 00 UTC, Valid: 27.10, 00UTC

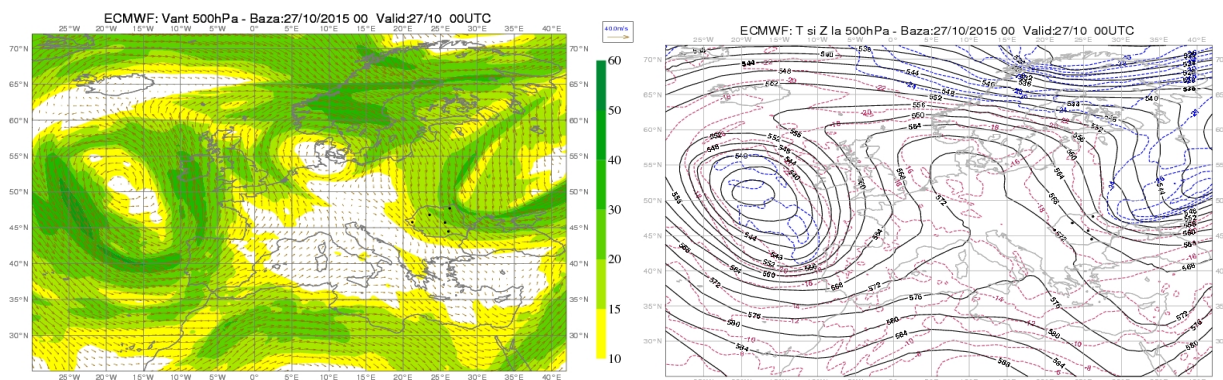


Fig 8. left - wind at 500 hPa Base:27.10.2015, 00 UTC, Valid: 27.10.2015, 00 UTC  
 right – Z&T 850hPa Base: 27.10.2015, 00 UTC, Valid: 27.10.2015, 00 UTC

Some other useful products for the short and medium range forecasts, that NMA used daily during 2015, are provided by the ecCharts application. The EFI products proved to be very useful in operational forecast activity (remarcable enhance of the signal concerning the temperature change):

### 3. Verification of products

#### 3.1 Objective verification

##### 3.1.1 Direct ECMWF model output (both HRES and ENS)

The objective verification has been continued in 2015, 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. A wide range of statistical verification measures are computed daily and monthly. The results are disseminated via dedicated *statistical and verification* web-site. The results are averaged over different stations selections.

A new procedure to daily verification of all models (surface parameters), used at NMA was implemented in 2015. This procedure use the **METv5.0** verification tools from **NCAR** ([http://www.dtcenter.org/met/users/support/online\\_tutorial/METv5.0/index.php](http://www.dtcenter.org/met/users/support/online_tutorial/METv5.0/index.php))

In 2016 we developed a new procedure for displaying comparative rainfall forecast (amount in 24 hours) of numerical models used in the NMA and measured in complex network of stations in Romania. This manner of presentation is very useful for meteorologist - subjective forecasts verification. (user can zoom each individual map)

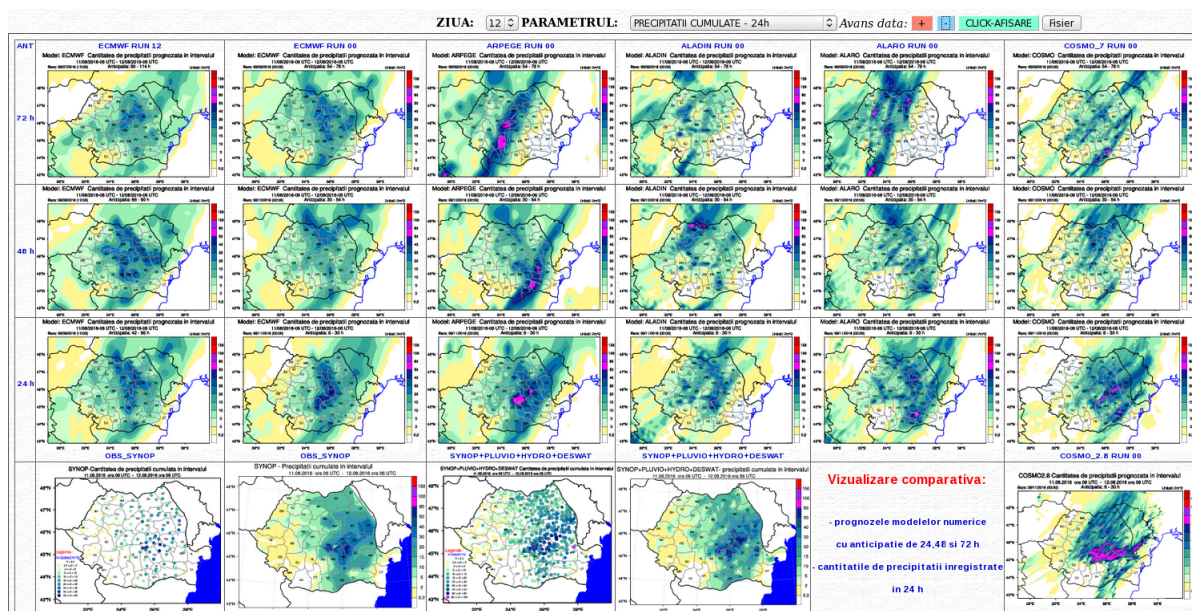


Fig 9. Precipitation forecasts comparative maps – subjective verification

3.1.2 ECMWF model output compared to other NWP models

Comparative scores are plotted each day( from GRID-STAT procedure), each month and over year(from **VERMOD** procedure) for the most important surface weather parameters: 2m temperature, 10m wind speed, total cloudiness, mslp pressure and 24 h total amount of precipitation. Graphs of the main verification scores are available on the web-site and also an overview of the performances of the models for all year.

All graphics and maps are displayed on statistical and verification web-site.

The monthly comparative BIAS and RMSE distribution for 2015 – 2m temperature- is shown in Fig 3.

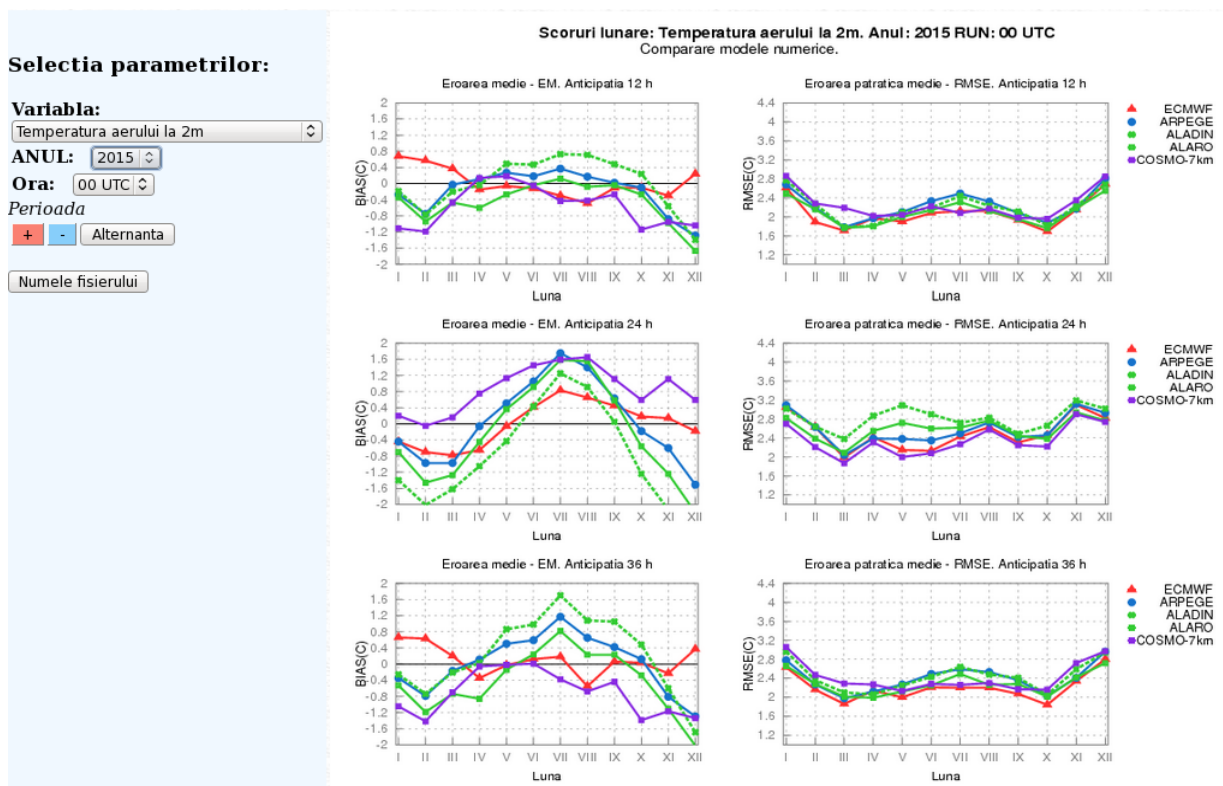


Fig 10. Web interface to acces on the monthly scores. Example: **2m Temperature**. Mean monthly BIAS and RMSE scores distribution using all meteorological stations.

Year – 2015

In 2015 we improved graphics display of the forecasts rainfall scores. An example of visualization Gilbert's Score in the figure below.

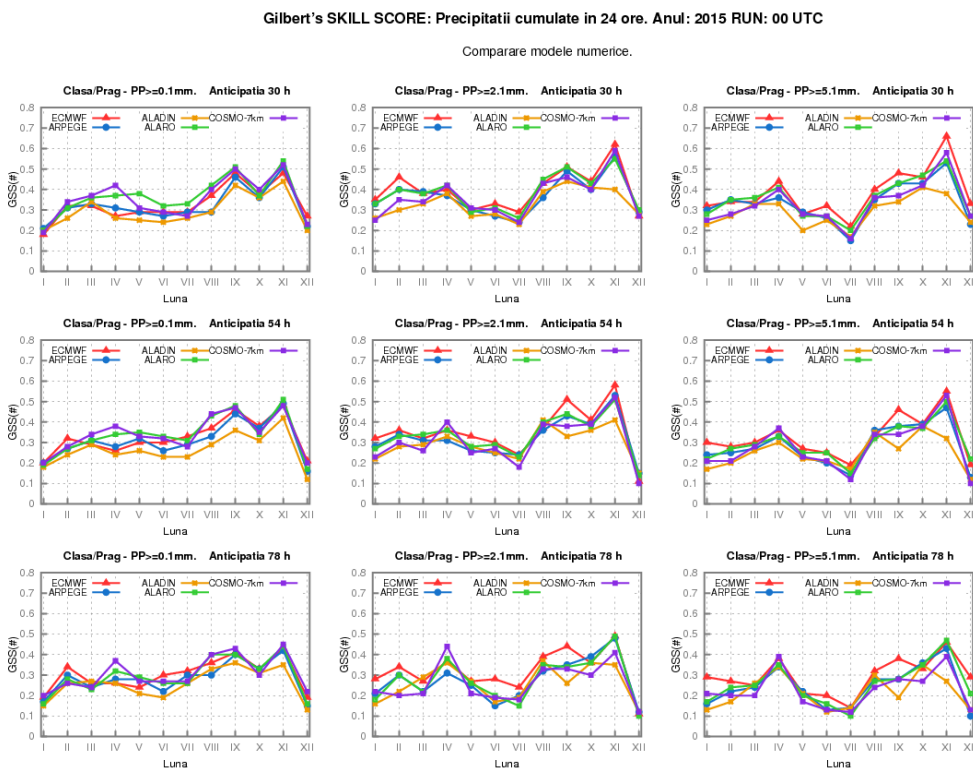


Fig 11. Gilbert SKILL SCORE – 24 h precipitation accumulation. Monthly score computed using observation from all meteorological stations.

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