Application and verification of ECMWF products 2009

DHMZ – Lovro Kalin

1. Summary of major highlights

At Croatian Meteorological Service, ECMWF products are the major source of information used in the operational weather forecast, particularly for medium- and long-range forecasts. For short range forecasts, ECMWF model is used along with Croatian version of ALADIN/ALARO model and DWD GME/LAM.

Regular verification is usually done by the point-to-point method, with synop data verified against nearest grid point of the model. However, other methods are occasionally also applied. This year a Verification section is founded inside the Forecasting department, in order to establish the operational verification of DMO output, and particularly department's end-forecasts.

2. Use and application of products

2.1 Post-processing of model output

2.1.1 Statistical adaptation

2.1.2 Physical adaptation

2.1.3 Derived fields

No significant improvement has been done in this area.

2.2 Use of products

ECMWF products are consulted regularly in operational duties. When it comes to severe weather, emphasis is put on the high resolution model (ALADIN). This year Croatian Meteorological Service joined METEOALARM project, but so far no extensive verification has been done for behaviour of ECMWF model in extreme weather cases in Croatia.

3. Verification of products

3.1 Objective verification

3.1.1 Direct ECMWF model output (both deterministic and EPS)

Figures 1. and 2. show decrease of skill of 2-m maximum temperature forecast with lead time. Raw ECMWF forecast (green) starts to spoil more rapidly after day 5, but still remains significantly better than climatology (red) and persistence (purple) forecasts. However, after day 7, combination of climatology and persistence forecast - so called damped persistence or CLI-PER (blue) - becomes better than ECMWF. This is even better visible in the second figure, where skill of the ECMWF forecast is calculated with reference to other three forecasts. ECMWF forecast is constantly better than persistence, and also better than climatology until the end of the forecasting range. However, after day 7 its skill becomes worse than CLI-PER forecast.

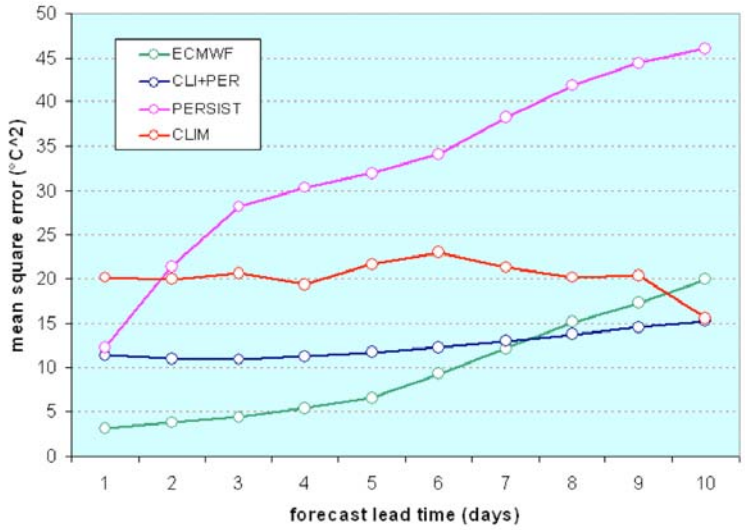

Fig. 1 Mean square error for 2m-maximum temperature forecast (Zagreb Maksimir, year 2008) against lead time. ECMWF forecast (green line) is compared to climatology forecast (red), persistence (purple) and so-called CLI-PER forecast (combination of climatology and persistence)

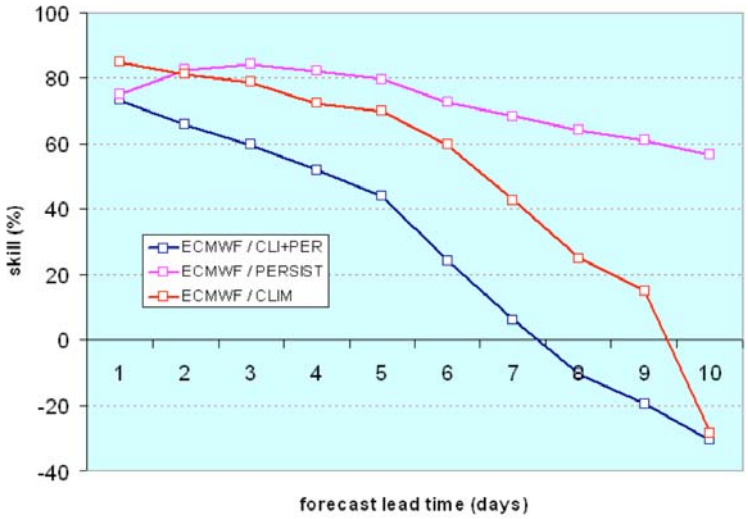

Fig. 2 Skill of ECMWF 2m-maximum temperature forecast (Zagreb Maksimir, year 2008) with reference to: climatology forecast (red), persistence (purple) and so-called CLI-PER forecast (combination of climatology and persistence)

Verification of precipitation forecasts generally exhibits significant overforecasting, that is visible in the Figure 3, for the accumulated 12-hour precipitation. Diurnal cycle of bias is also noticed (with exception for year 2005), where overestimating is more pronounced before noon than afternoon. Skill of 12-hour forecast usually drops bellow zero after day 7 or day 8 (not shown here, see previous reports).

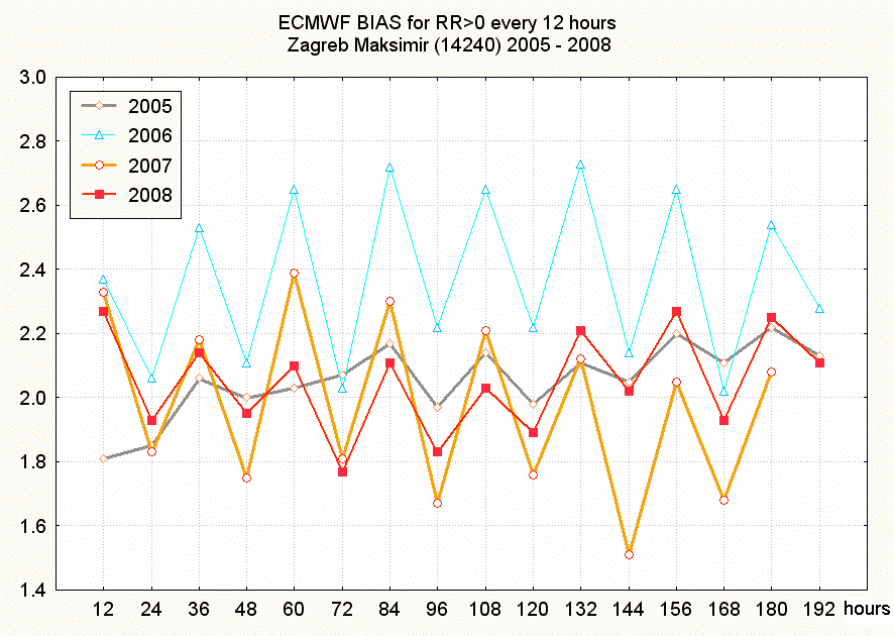

Fig. 3 Bias of 12-hour precipitation forecast for Zagreb Maksimir (14240) against forecast lead time

ECMWF monthly (4-week) forecast is consulted when issuing regular monthly forecast for 5 Croatian regions. This year a new version of this product will be introduced, and it will be derived directly from ECMWF 4-week forecast. However, no objective verification has been done on these forecasts.

Seasonal forecast are also widely used. A new product introduced to our service is the seasonal forecast for 6 months (temperature and precipitation anomaly). Figures 4. and 5. present verification of temperature anomaly forecast in year 2008 for Central Croatia region. A systematic underestimation of temperature anomaly is noticed, and constant through the whole forecasting range (6 months). A significant seasonal (semi-annual) variation is also present, with more intensive overestimation in the colder part of the year, and less intensive in the warmer part (Figure 5).

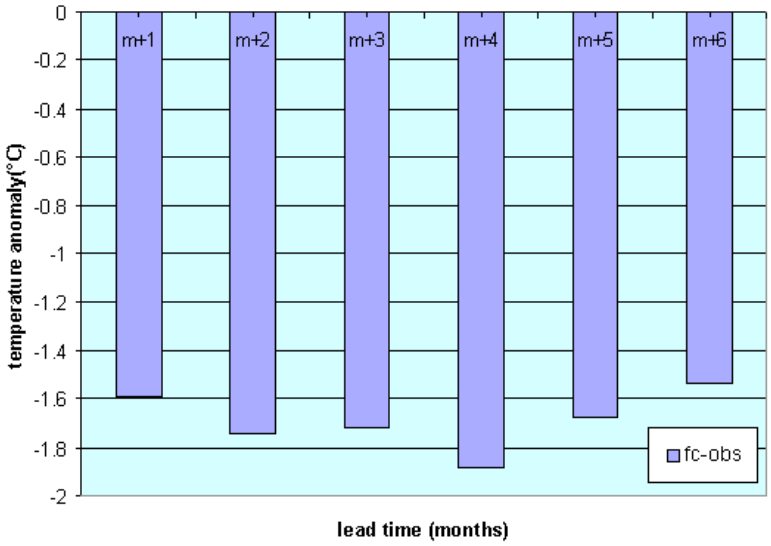

Fig. 4 Mean error of temperature anomaly forecast for ECMWF seasonal forecast against lead time (6 months) for Central Croatia region

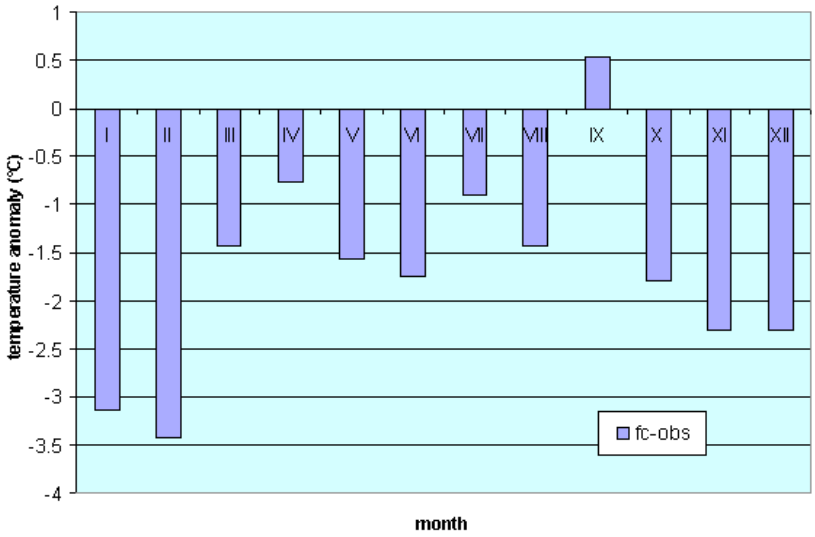

Fig. 5 Mean error of temperature anomaly forecast for ECMWF seasonal forecast (Central Croatia region)

Other parameters, such as cloudiness, wind etc. are verified only occasionally.

No extensive verification is being done for the ensemble products.

3.1.2 ECMWF model output compared to other NWP models

ECMWF is regularly verified against other models, usually against Aladin Croatia (ALARO). Skill of the ECMWF model over Croatia is generally found to be comparable to that of the Aladin model (see previous reports).

3.1.3 Post-processed products

None. Post-processing of ECMWF forecasts is still in development.

3.1.4 End products delivered to users

See verification of seasonal forecasts in section 3.1.1

3.2 Subjective verification

3.2.1 Subjective scores

3.2.2 Synoptic studies

Subjective verification of medium-range forecasts is done only occasionally, usually through case-studies, but no systematic verification has been done. Subjective remarks often refer to topics such as overestimated daily cycle of winter temperature (no low clouds present), underestimation of strong bora gusts at the Adriatic coast etc.

4. References to relevant publications