Application and verification of ECMWF products 2012

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1 Summary of major highlights

2 Use and application of products

2.1 Post-processing of model output

2.1.1 *Statistical adaptation*

ECMWF's System 4 Forecasting ensemble offers global seasonal forecasts for the coming seven months. MeteoSwiss makes operational use of these forecasts, both for commercial products and public duties. For many users absolute values and times series of daily resolution are gaining attention in order to derive application-specific climate indices. Therefore, MeteoSwiss is investigating methods to remove the model biases of seasonal forecasts to provide such data sets.

Figure 1 shows the bias of the temperature forecast of three monthly means for the lead time 2-4 months (DJF) over the period 1981-2011. The example is taken from the November initialization, hence Northern Hemispheric winter. Over most areas, especially the oceans, the bias is between -1 and +1°C. Over all, the forecasted temperature is too low, apart from the higher northern latitudes, which shows a large warm bias in several, but small regions. Other regions show a larger bias already for early lead times, in some cases this bias decreases towards the end of the forecast. Generally land areas are biased more than oceans and the bias changes spatially and temporally with increasing lead-time.

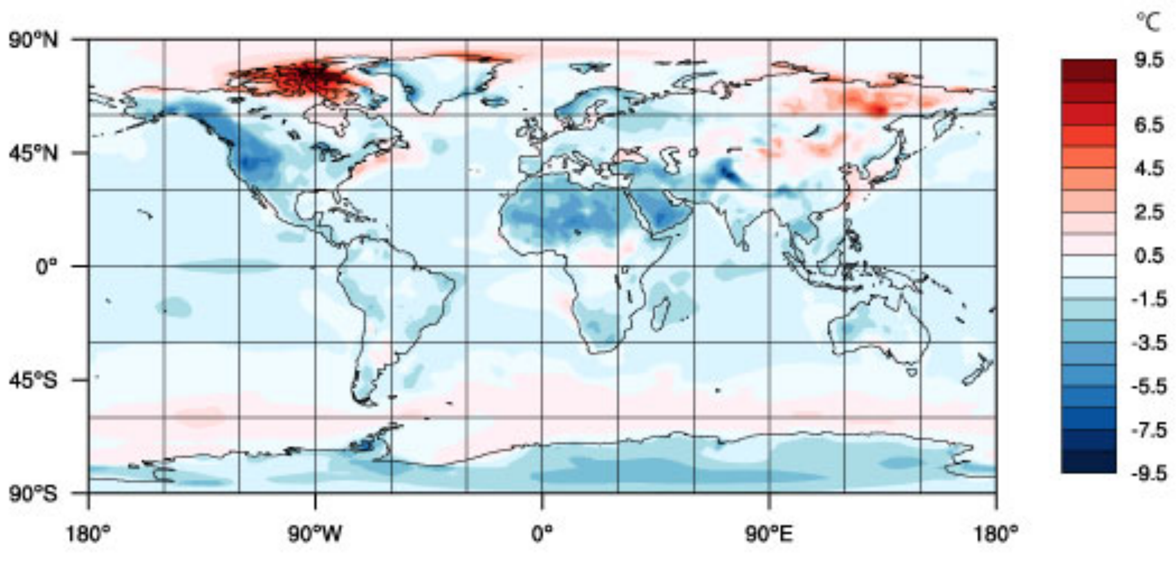

Figure 1 3-Monthly mean bias (DJF) of November initialization

Estimating biases of daily data becomes more difficult, as there are only about thirty years of observations and the sample size is too small to smooth out all of the daily variability as shown in Figure 2. Therefore a fit for the observed temperature was needed. Based on a spline function the observations were smoothed in order to obtain a more realistic daily climate of the observations.

The analysis confirms that biases of the seasonal forecast model have to be removed in dependence of location, start time, lead-time and aggregation. Special attention needs to be given to the estimation of the corresponding climate in the observations due to the small sample size.

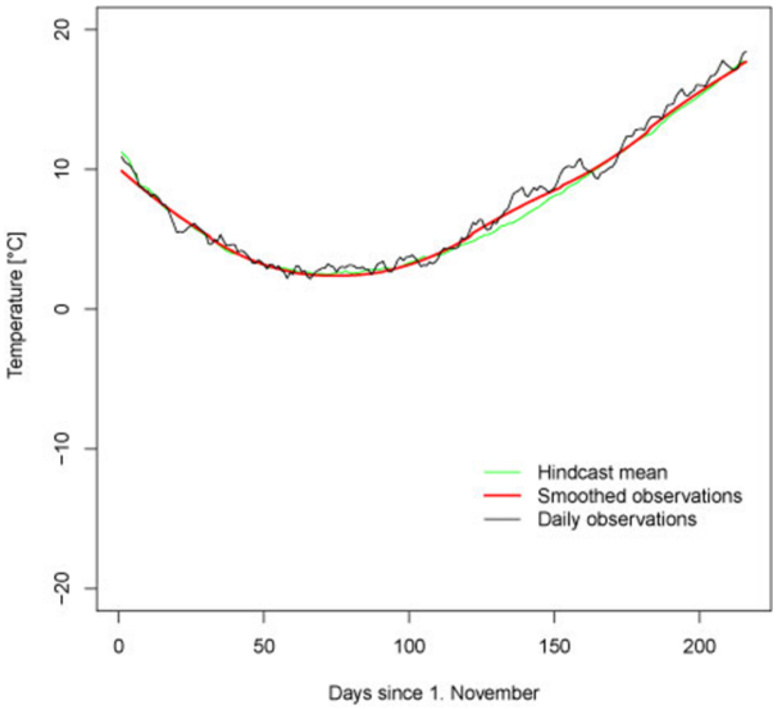

Figure 2 Example of the hindcast mean (green), the mean daily observations (black) and the fitted observations (red) for one specific grid cell in Western Europe for all lead times.

2.1.2 *Physical adaptation*

2.1.3 *Derived fields*

2.2 Use of products

Daily operational use

In the operational forecast office for MeteoSwiss the numerical predictions of ECMWF play an important role. On the one hand they provide the boundary conditions for the COSMO-7 model (and this again for COSMO-2). On the other hand the ECMWF predictions form an important base for the forecasters, who have to analyze and interpret the forecast fields and data to produce many different products for customers. The HRES is used for short range forecasts (in addition to COSMO-7/2) as well as mainly for medium range forecasts of course. The ENS we use to classify the HRES and to estimate the uncertainty of the forecast. The forecast uncertainty is then also communicate to the public. Most of the forecast fields can be visualized by the well-known Ninjo platform. It provides also the possibility to get a forecast sounding of any grid point, what is very helpful for the forecasters.

Severe weather situations

In the past years the ECMWF increased continuously the number of specific products for forecasting extreme weather situations. Our forecasters appreciate this and use these severe weather products more and more. While some years ago only predefined and pre-produced EFI-charts were available, today the forecasters can look at specific fields adapted to the weather situation.

At MeteoSwiss the forecasters like especially the EFI interactive chart, which gives a good first geographic overview of extreme weather. After that the forecasters can produce a meteogram or a CDF-diagram for an interesting location. It has shown that the CDF-diagrams provide very useful information, if a decision has to be made whether to send out a warning or not. In addition also ecCharts showed to be very helpful in warning situations. A popular feature in ecCharts is the possibility to produce probability charts of warning parameters (e.g. precipitation, gusts), where the threshold and the time interval can be defined by the forecaster. The threshold can be adapted to the warning limits of MeteoSwiss. These functionalities are appreciated very much by the forecasters.

Because MeteoSwiss uses already the powerful visualization system Ninjo, the mentioned tools developed and made available by ECMWF are applied mainly in severe weather situations, when forecasters need additional decision-making help.

3 Verification of products

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)*

In Locarno a subjective very simple point forecast verification has been conducted for a long period of time (since 1997). Following daily station parameter are considered: precipitation amount, relative sunshine duration and temperature deviation from the climatology. The forecast method and verification are quite consistent in time. For this reason the improvement of the forecast is essentially due to the improvements of the available numerical models, particularly in the medium range (i.e. ECMWF). **Error! Reference source not found.** shows that the score of 2012 was comparable with the mean values of the previous 5 years for all forecast lead times. Interesting is the improvement in the forecast day 3 / 7 compared to the mean values of the period 2002 – 2006. For the forecast day 8 / 10 the results apparently don't show an improvement of the accuracy of the forecast for Locarno in the last 10 years. We think that this is more due to the behaviour of the forecaster in the forecasting range 8 / 10 days, than in a lack of model improvements. The absolute values of the verifications are very specific to the verification method.

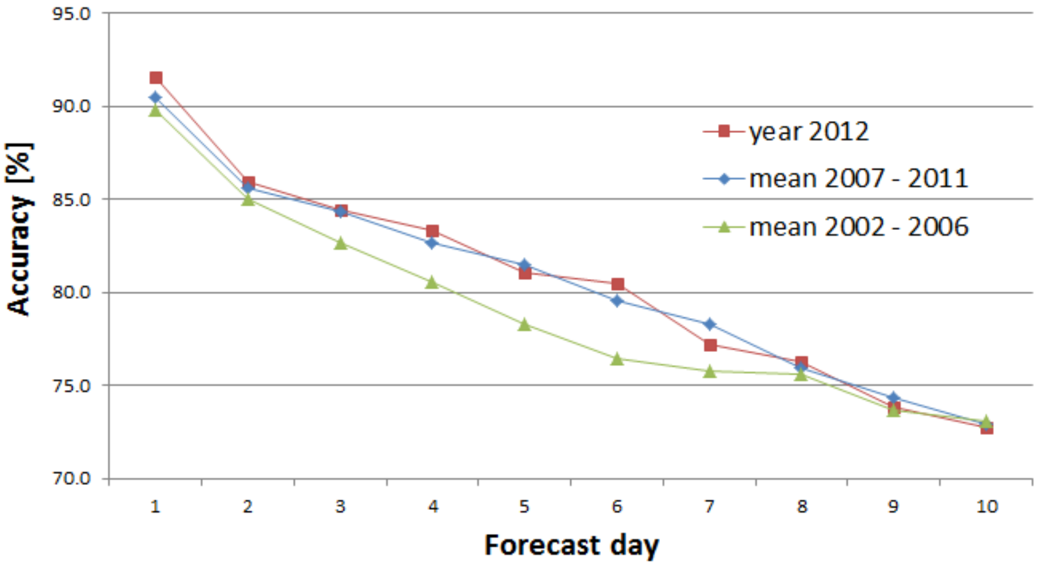

Figure 3 Forecast verification for Locarno. Results for year 2012 compared with the mean values of the previous 5 years and for the period 2002 – 2006, for all forecast lead-time

3.2.2 *Synoptic studies*

4 References to relevant publications