DWD's news in medium-range forecasting

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For a couple of years the general data base of DWD's medium-range forecasting has been - and still is - AFREG(MIX). This abbreviation stands for a statistical interpretation scheme based on PPM. The scheme interprets the most important near surface weather elements and, it is applied to both operational models, the ECMWF and the German global model GME. (MIX) means the mixture or averaging of both model interpretations. As a consequence the general data base is

$$F = AFREG(MIX) = (AFREG_{GME(run\ 00\ UTC\ today)} + AFREG_{ECM(run\ 12\ UTC\ yesterday)})/2.$$

It is well known that this simple averaging process proves to be a cost-effective approach to reduce both the error and the error variance, in particular in medium-range.
The near surface weather parameters interpreted by means of AFREG are: Tmin, Tmax, relative sunshine duration, PoP (yes/no and >5 mm/day), wind speed and direction, probability of fog and thunderstorm. For that reason the output is partly deterministic and partly probabilistic.

These elements are determined for several regions of Germany which are roughly defined according to their climatological background.

Since the EPS forecasts became available, a verification comparison has been carried out continuously. Up to now the simple interpreting and averaging strategy by means of AFREG(MIX) always verified better than the DMO of EPS mean. Consequently, it was decided to use the 'mixture F' of the two available operational models as the first data base in medium-range forecasting. (**and,**) Therefore the prognostic EPS information was not used primarily but only as additional information. Now we have reason to change this data base. Last year DWD started the verification of kalman-filtered EPS weather parameters based on the EPS mean. The latest results show that there is a considerable improvement of these EPS forecasts and, consequently, much of the advantage of skill of AFREG(MIX) has been lost recently. Some of these results are now published in the latest ECMWF's annual report on verification of ECMWF products. Therefore, the results will not be presented here. On the basis of this verification comparison we have now decided to introduce EPS mean, kalman-filtered, operationally because it is always obliged to use the best prognostic information available. This may be done in parallel to AFREG(MIX) for a certain period of time.

Automatically generated forecast text proposal

DWD intends to put the whole medium-range forecast activity (which is up to the regional centres so far) in one hand. This means a complete centralization of production. The most important reasons for that are

- to avoid huge and undesirable differences in the interpretation made by neighbouring regional centres or to harmonize (tune) the forecast content completely and
- to save resources.

From the scientific point of view, this would not be a problem considering the characteristic medium-range time and space scale compared with the area of Germany. But in practice it is indeed a serious problem because customers demands are far-reaching and very extensive today. As a consequence following the traditional way of forecast production in plain language, these extensive demands cannot be met by a single agent. This formed the basis for the idea of formulating coded standard text modules appropriate for an automatical text generation. For each forecast area a basic data matrix is automatically delivered by AFREG(MIX) (from EPS mean, kalman-filtered, in the near future) containing the forecast parameter needed. Each code of the text modules is connected to the data matrix. As a result the expert's responsibility will then be mainly reduced to the editing of the basic data matrices, whereby the focus lies in editing the columns containing the coded description of the ‚weather' as a combination of cloud coverage and precipitation (What kind of weather will occur). This procedure is now in a quasi operational stage.

A study on skill prediction
(very first and preliminary results)

ZEIT? Vergangenheit oder Gegenwart
By contract with Dr. C. Ziehmann, university of Potsdam, a study on skill prediction has been launched. In a first step simple possibilities were to be studied to predict the forecast error in order to estimate the prognostic skill potential of the EPS forecast. For that simple prediction models were defined. The data base consists of the weather parameter files available for German stations (EPS mean: N, ff, T2m, prec.). So, the consideration is primarily done on a local basis. The period choosen is May 97 - June 99 (n = 745).
The predictant of each prediction model tested is the error of the ensemble mean and, 3 spread measures are defined as predictors:

- standard deviation around the ensemble mean,
- maximum difference,
- absolute value of control forecast minus ensemble mean.

In this approach two simple reference prediction models were compared with two non-trivial prediction models at first. The procedure is as follows:

- define a learning set: Take 500 data pairs (consisting of the error of the ensemble mean and the spread measure) from the whole data set,
- test the performance of the prediction model applied to the learning set by comparing the performance taken from the remaining data pairs,
- repeat this procedure 10 times in order to simulate the inherent model uncertainty.

The (trivial) reference models are

- mean forecast error for each forecast step (+12,+24,...,+240 h) as obtained from the learning set,
- persistence of the forecast error as obtained from the learning set.

The tested (non-trivial) models are

- a linear model between the spread measure s and the error e which has an offset e_0 of the error:

$$e = f(s) = a*s + e_0$$

- a binned analogous model (for 3 classes of spread measure I_1, I_2, I_3 of equal probability the 3 corresponding error medians are taken). The constraint of prediction then is of the analog type

$$e = e_i \quad \text{if} \quad s \in I_i.$$

The performance of the models (applied to the learning sets) is simply expressed by the error of the predicted error.
Figure 1 shows one example of results obtained from the skill prediction models which were examined using the independent test sets.
The three skill predictors work in a quite comparable manner (not demonstrated here). It seems that the linear model produces the smallest error. It proves somewhat better than the binned analog model. Nevertheless, the advantage of the linear model over the trivial reference model > mean error < is nearly negligible. On the other hand, both non-trivial models perform better than the model of error persistence which could be considered a skill.

This station-based investigation of errors and spread measures may imply that the EPS local forecasts contain some predictive skill information but it is hardly more than that obtained from the simple reference model > mean error <. The relatively bad result concerning the trivial model > error persistence < is the only surprising fact.
The conclusion from this first investigation is that more experiments are needed and that perhaps more appropriate reference models should be tested.

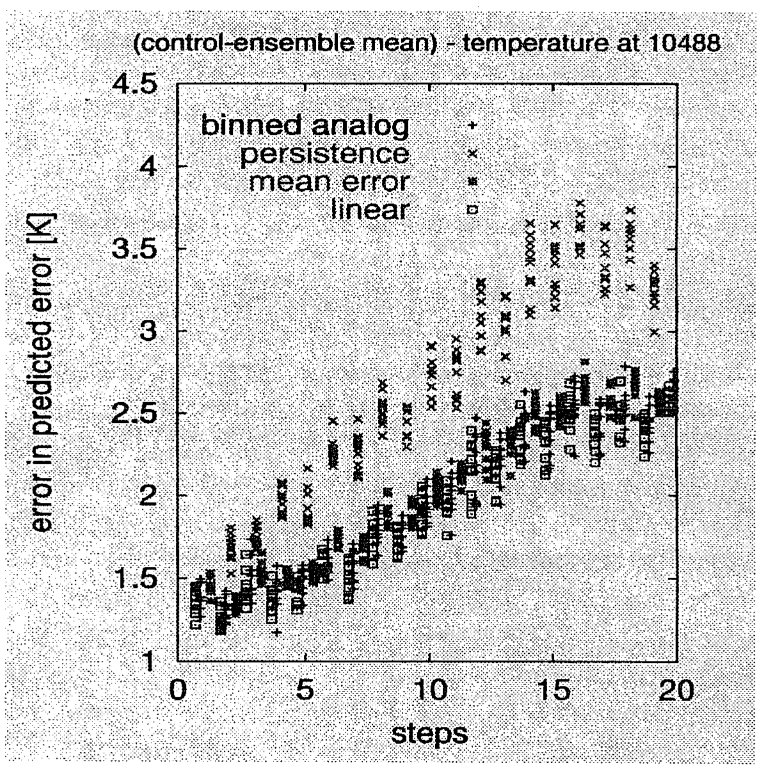

Figure 1: Error in predicted error of the ensemble mean by means of 4 prediction models using the difference (control – ensemble mean) as predictor 2m temperature, Dresden (10 488)