

**Development of an Editing, Production, and Monitoring System
to be used in Germany's SWIS**

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1. Introduction

Within the German Meteorological Service (DWD) nowcasting is understood as forecasting up to Δt hours. Given this time range a differentiated forecast with respect to space and time is in many cases possible, e.g. in the case of snowfall. There is an increasing number of customers who are interested in such detailed forecasts, especially with respect to severe weather warnings. The DWD has started to develop nowcasting tools, an editing, production and monitoring system, and is upgrading its communication system for the rapid dissemination of products. Similar work is under progress in Sweden as reported by Lindh and Nilsson (1997).

In this paper we will describe the editing, production and monitoring system for nowcasting products (termed as the EPM-system), which is being currently developed at the DWD. It is planned to use a first version operationally starting in spring 2000. The EPM-system will include road weather forecast products.

2. Previous experience

The DWD introduced a suite of forecast products for the German road weather information system (SWIS). The products are tailored to the needs of the road authorities. One of these products, a typical nowcasting product, is the so-called road weather advice. An advice is issued 2-3 hours before the onset of weather conditions (snow, freezing rain) leading suddenly to wide-spread slipperiness on roads. In the beginning the advice was valid for an entire federal state. However, regional aspects were mentioned in the text. Nevertheless, this procedure led to the problem, that customers

responsible for winter road maintenance in low lying areas were informed (or disturbed during the night) that a critical condition was expected only for the mountainous regions. As a first consequence, the procedure was changed, so that for each federal state road weather advices were issued to be valid for the lower or the higher grounds, respectively. However, the problem remained that a severe weather condition could affect the mountainous parts in the south of a state but not the mountains in the north.

In addition, these procedures required the dissemination (fax distribution) of many unnecessary products blocking the DWD's telephone lines.

In 1997/98 it was decided to issue advices on the basis of so-called forecast areas. Germany has been divided into about 150 forecast areas. These are climatic regions of similar temperature and precipitation regimes, sub-divided by 200 metre altitude intervals. Due to this decision the forecasters at each of the regional weather centres were forced many times to produce about 20-25 advices instead of one as in the first procedure. The production of so many individual advices is time consuming, and in some synoptic situations unnecessary. Therefore, the possibility was provided by the editing software to form groups of forecast areas, i.e. larger regions with expected similar weather conditions. The forecaster had to write only one advice for each group, copies were made automatically for the individual group members.

Yet another problem arose. The valid time of a road weather advice is limited to 6 hours. In a given synoptic situation, e.g. snowfall moving across a state, the requirements of lead time, regional aspects and valid time led to the problem that the forecaster ran into difficulties in monitoring the status of all their advices issued.

This experience and the DWD's decision to provide nowcasting products of all severe weather phenomena in a spatially and temporally detailed manner has initiated the development of an EPM-system.

3. Components of the EPM-system

The EPM-system is intended to fulfil the following requirements:

- fast and simple production of forecasts by the forecaster using pre-defined form sheets and graphical tools (the production may eventually occur automatically);
- production of a generic forecast by the forecaster which will lead to an automatic production of many individual forecast products tailored to the needs of a wide range of different customers;
- monitoring of forecast products issued.

Similar requirements have been formulated for a Swiss system by Pauli et al. (1997). These three requirements mentioned above lead to the main three components of the EPM-system: editing, production, and monitoring.

3.1 The editing component

Monitoring of actual weather and nowcasting may initiate the forecaster's wish to issue a generic forecast for a certain weather element. The forecaster has a graphical tool at her/his disposal. This tool presents all actual weather data (e.g. synop, satellite, radar), the results of nowcasting methods as well as a map of forecast areas. The selection of areas to be covered by the forecast is made just by mouse click, which transfers the information into a form sheet. For all relevant weather phenomena form sheets have been pre-defined. For the areas selected there will be a common valid time and a common forecast content. The editing component offers three possibilities how a generic forecast may be formulated:

- a) a standard (pre-defined) text (unchangeable) with forecast values to be edited;
- b) a pre-defined forecast table with time and forecast values to be edited;
- c) a free-worded text.

Depending on the customer's needs the forecaster may have to fill out one, two or all three possibilities. The number of form sheets and their content is defined locally at the regional weather centre.

3.2 The production component

After the forecaster has completed the form sheet a generic forecast will be created and stored containing the complete information. Based upon the generic forecast individual area forecasts for all forecast areas selected are generated automatically. There will be consistency checks, e.g. if there exists already a still valid product for a given forecast area, or if thresholds have been affected. The production component also utilizes a customer related data base in order to generate automatically products tailored to the individual needs of the customer based upon the area forecasts. This customer

related data base contains all information about the customers and their requirements with respect to forecast area, weather phenomena, and thresholds as well as individual product style (text, data). If the forecaster updates or even changes her/his forecast a different set of area forecasts and customer related forecasts will be generated. This new set of products will be compared with the already existing products. Depending on the requirements the customer will be informed about the

update. The production component hands over the products to the communication system which disseminates the products by various means to the customer.

3.3 The monitoring component

After the production component has generated the individual area forecasts the monitoring component transforms these forecasts into status monitoring data. This status monitoring data can be presented graphically in a geographical distribution or as time series. In addition, the status monitoring data is compared with the latest available actual weather data in order to verify the forecast. If significant deviations are found the forecaster will be informed and this might force her/him to update the generic forecast.

4. Problems to be solved

Providing an EPM-system is a necessary prerequisite for the production of detailed road weather advices. However, on the other hand the winter road maintenance organisations have to have means in order to react accordingly. The following problems have been identified:

- Road masters responsible for highways can be reached at any time and they are able to react immediately and do so because of existing federal regulations. However, organisations responsible for minor roads and city roads are not required to do winter road maintenance at any time. In many cases it is difficult to provide them with road weather advices after regular working hours and on weekends. During these times they may decide whether or not to start winter road maintenance.
- Winter road maintenance on highways can be initiated immediately because some staff is always present at the depot. With respect to minor roads and city roads a larger lead time is necessary because (in most cases) now crew is at stand-by.
- Once winter road maintenance is on its way it might be useful to receive regular updates of the road weather advice. Currently, there is controversial discussion how these updates can be used by the local road masters.

5. Summary

The EPM-system allows to produce a wide range of individual nowcasting products tailored to the needs of the customers with a high resolution in Space and time. On the other hand, the EPM-system supports the forecaster by requiring only the production of one generic forecast without knowledge

of the individual needs of the customers. In addition, monitoring of area forecasts is provided, which is essential for nowcasting with a high spatial and temporal resolution.

6. References

- Lindh, O. and S. Nilsson, 1997: RiPP; a development project for increased efficiency and automatization of the production process in Sweden. 3rd ECAM, Annalen der Meteorologie 35, pp. 123-125.
- Pauli, C., Matter, D. and P. Miiller, 1997: Production of nowcasting warnings based on the forecast product editor of the meteorological workstation project. 3rd ECAM, Annalen der Meteorologie 35, pp. 10-12.