New applications using real-time observations and ECMWF model data

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Summary

At Meteo Consult, part of MeteoGroup, ECMWF model data is pre- and post processed making extensive use of various observation types. Three applications will be shown.

(1) Precipitation nowcasts, including precipitation type nowcasts, based on a combination of radar and SYNOP observations and Model Output Statistics (MOS).

(2) Results of the Automatic Front Analysis and Automatic Forecast Text algorithms.

Finally,

(3) the combination of road surface observations and road model forecasts into a state-of-the-art Road Network Forecast.

Introduction

Data from several numerical models is processed and statistically combined within our Model Output Statistics (MOS) system. However, data from ECMWF is the most important source, as is shown in figure 1 (left). Currently we use, on average, 63 GB/day from ECMWF, the largest contribution is from the deterministic model but we also take a lot of data from the EPS (figure 1, right). The large volume can easily be explained: as we have customers all over the world our forecasts cover the entire world. This makes the transition to the new forecast system with a T1279 resolution (and EPS with T639) a real challenge, not only for our internal data processing system but also with respect to the current data transfer limit of 100 GB/day.

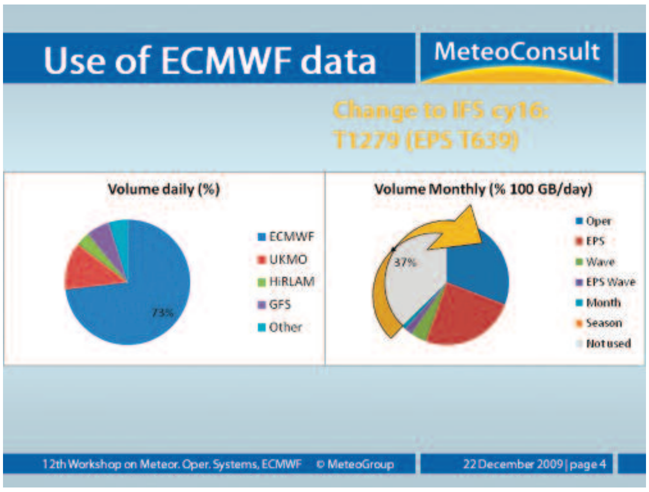

Fig. 1 Use of model data at Meteo Consult.

1. Precipitation nowcasts.

Despite their increasing resolution numerical models are still not able to reach the 1-3km scale of current precipitation radar systems. To calculate the most probable type of precipitation, especially in areas with a complex topography, sophisticated downscaling algorithms are needed.

We use downscaling based on 1hourly MOS forecasts and GTOPO data to get a forecast for the precipitation type. Actual surface observations are processed to update the MOS forecast in the nowcasting range (1-6 hour ahead) and a second interpolation in time enables us to label the actual radar pattern with the precipitation type (snow, sleet, rain, freezing rain, hail). An example is shown in figure 2. The left hand panel shows the precipitation mask, which is the precipitation type in case precipitation is observed. The panel to the right shows the final product, together with observed weather.

As most WMO stations do not report observed weather at a 1hourly interval (some do not report weather at all), spatial downscaling in itself also is a complex task which is briefly summarized in the upper panel of figure 2.

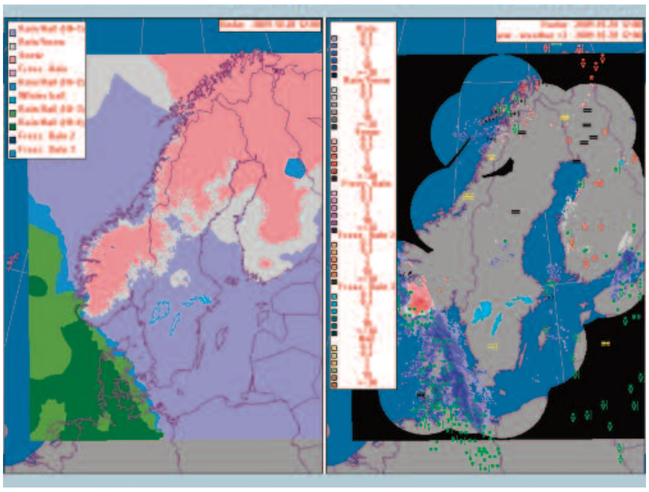

Fig. 2 Example of downscaling (left) resulting in actual radar precipitation type (right).

2. Automatic fronts and text.

As we deliver forecasts for many timesteps all over the world, automation of tasks becomes more and more important. Several applications are developed already.

Some professional markets still require fronts on their maps. Manual drawing of fronts is time consuming, and the result depends on the experience and interpretation of the forecaster. Here automation will help, and therefore we are developing automated fronts (example in figure 3). With the increasing resolution of numerical models their forecast fields resemble more and more the real atmosphere including all kinds of subsynoptic scale features. This is a challenge for automatic fronts, as they show a discontinuous behaviour in space and time. Current research is aimed of getting more consistency in the automatic fronts.

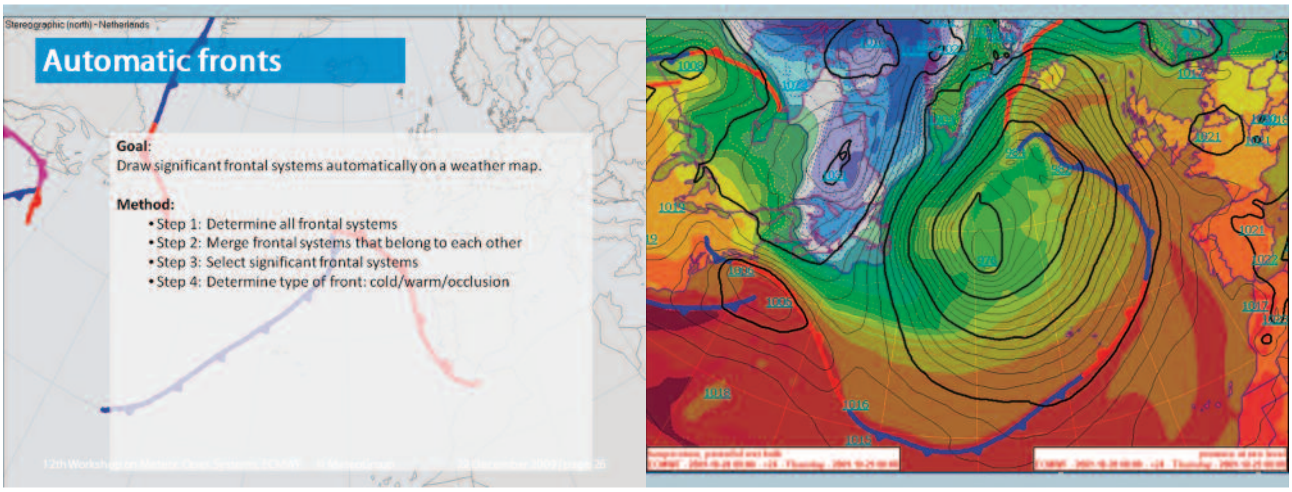

Fig. 3 Automatic fronts based on potential web bulb temperature and other parameters.

Another application is the development of autotext services, like automatic text forecasts for news papers and autotext for marine customers (example in figure 4). Every application starts with the raw model data (sometimes a mix of several models) or the raw MOS output. The forecaster has a tool to correct the automated products when needed.

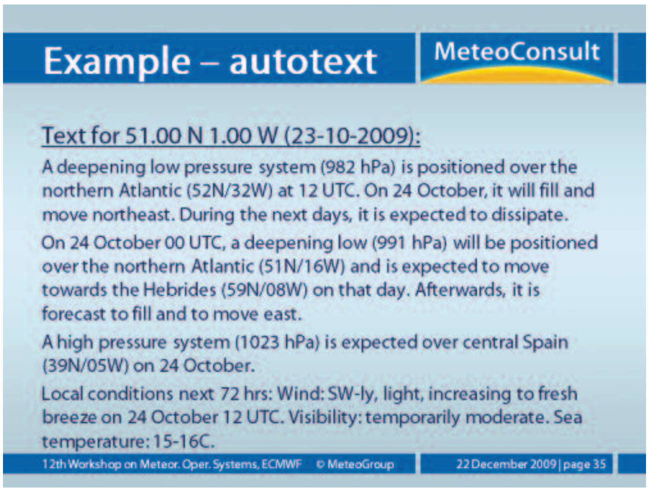

Fig. 4 Example of marine autotext.

3. Road network temperature forecast.

Road authorities require a detailed road surface temperature and road condition forecast. Measurements and MOS forecasts together are input for an energy balance model which produces a forecast for the road surface. Downscaled weather and road surface temperature enable a forecast for the road condition. This forecast is only valid for one site. Further downscaling, using GTOPO data, and detailed information about the radiation budget for the road (based on sky view and sun view measurements) are necessary to derive a route forecast (figure 5). In this case high quality of the effective cloudiness forecast is very important as well as a detailed description of a night time surface inversion layer.

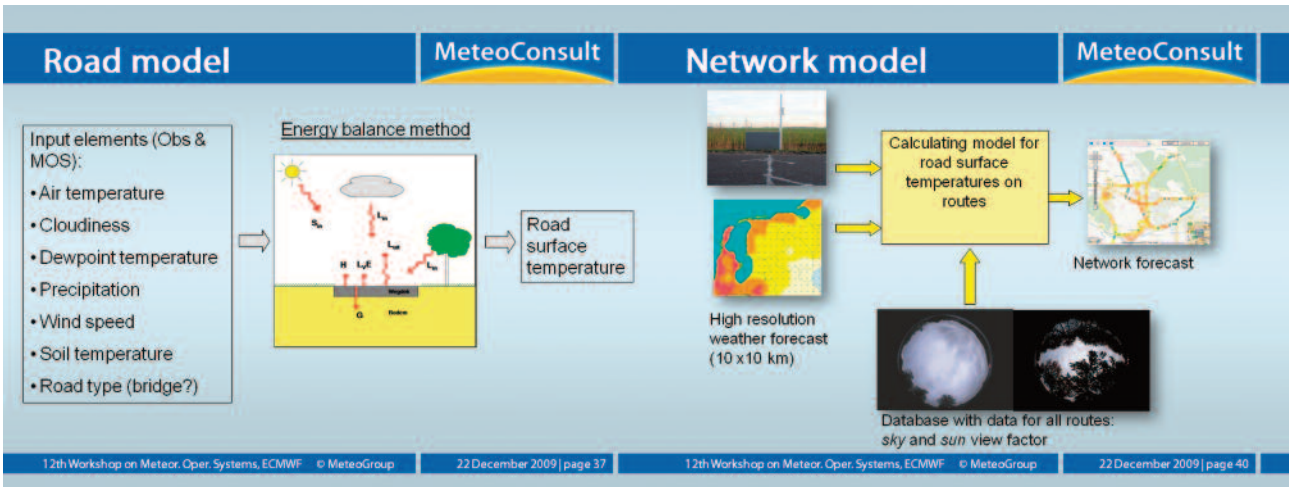

Fig. 5 Site specific road model downscaled to network forecast.