Valuing information from mesoscale forecasts

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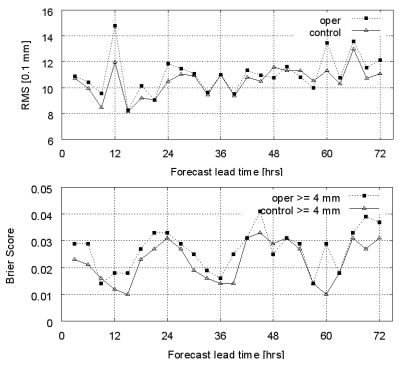
Traditional objective verification of deterministic model output fails to demonstrate the added value of high-resolution forecasts made by such models. It is generally accepted from subjective verification that these models nevertheless have a predictive potential for small-scale weather phenomena and extreme weather events.
The evaluation of the information in mesoscale forecasts should be essentially connected to the method that is used to extract this information from the direct model output. Given the probabilistic nature of small-scale weather, this can best be done some form of statistical post-processing. We use Model Output Statistics (MOS) incorporating concepts from fuzzy verification. The feasibility of the approach is shown in a comparative verification experiment.

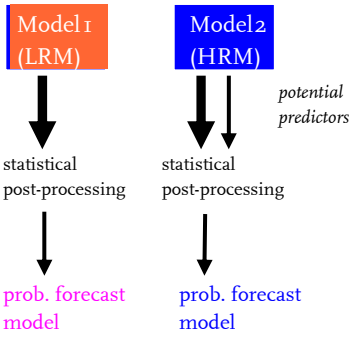
1.Verification of Direct Model Output / Double penalty

Traditional verification scores fail to recognize the added value of high resolution forecasts, mainly due to the double penalty. This is illustrated in the following figure where verification of the control and (higher resolution) operational ECMWF precipitation forecasts is shown for station De Bilt in the Netherlands. In the top panel the rms error of precipitation amount is given, in the bottom panel the exceedance probability of 4mm/3hr.



2.Design of the experiment

In the verification experiment we try to extract as much skilful information as possible from 2 models and compare that information. The models are the low resolution control (LRM) and the high resolution operational (HRM)

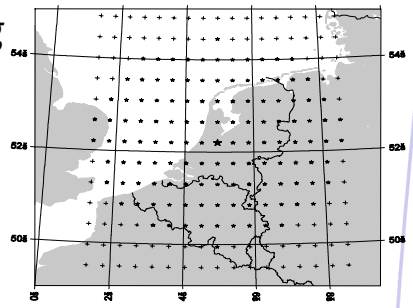


ECMWF model (Gaussian grids N200 and N4 resp.).
3-hourly precipitation forecasts up to +72 are considered. The investigated period is Feb 2006 until July 2007.

3. Extraction of probabilistic information for station De Bilt

The probabilistic information is derived from the two models by a statistical analysis of a set of potential predictors obtained from the predicted precipitation fields only. These predictors are chosen to resemble quantities used in fuzzy verification and are calculated on a grid shown below for the LRM. The grid of HRM is twice as fine. The potential predictors include
* the central grid box value (DMO).
* distance of predicted precipitation to station De Bilt, extent of the rain area, square root of the total amount of precipitation.

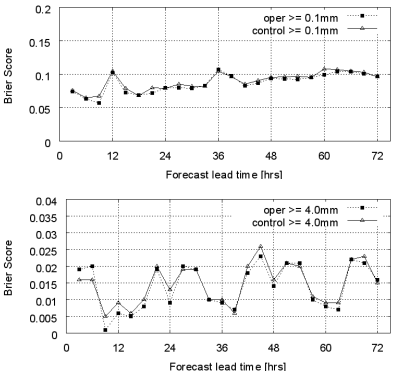
Low resolution Grid (LRM)



* a set of predictors defined on various circular neighborhoods, e.g. mean precipitation, square root of the maximum precipitation amount and the fraction of gridpoints with precipitation.
* a few extra predictors calculated only on the smallest HRM scale.
The MOS analysis showed that for both models the DMO is not an important factor for any lead time.

4. Verification of the post-processed model output

Verification of the resulting probabilistic forecast models shows that the HRM is at least as good as the LRM.



5. Conclusion

•Probabilistic interpretation is essential in mesoscale deterministic forecasting
•Statistical post-processing is a means to extract the probabilistic information
•Added value of high resolution over low resolution models can be shown
•Since it objectively weighs predicted flow characteristics the proposed approach is an essential extension to fuzzy verification

Reference Kok et al. Valuing Information from mesoscale forecasts. *Meteorol. Appl.* **15**, 103-111 (2008).

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