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Development of an ALADIN-MAROC verification system using MET package

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1. Introduction

The main purpose of this MET-based system of verification is to provide NWP developer or forecaster and any other user with various verification statistics which would give her/him an indication how the particular numerical forecast fits to the actual meteorological measurements.

The development of this system of verification has two important goals for evaluating the ALADIN MAROC model performance :

1. to provide objective evaluations of the experimental and operational forecasts,
2. to supplement and compare to subjective assessments of performance;

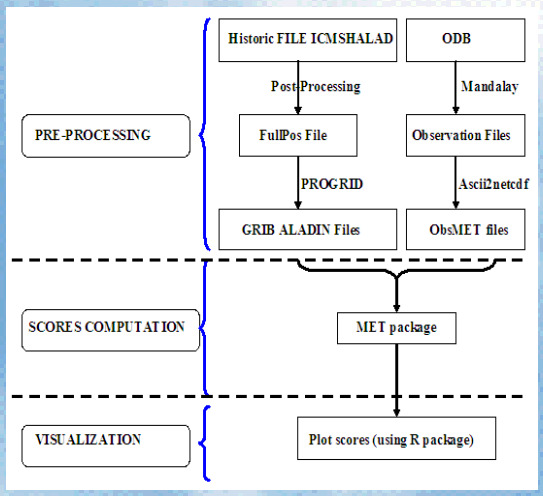
The statistical results may also aid researchers in selecting model configurations to use for their projects, and help operational forecasters understand model biases. In fact, the most important reason to verify forecasts is to monitor forecast quality over time.

2. Concept of the MET-based Verification System

The MET-based verification system were developed under Linux environment. It works on local PC. The main input of the verification system (GRIB ALADIN files and OBSERVATION files) are prepared on the HPC and then transferred via FTP to the local machine.

The source code of some binary executables of the MET package have been modified in order to take into account the evolution of the scores according to two configurations of one model or two models.

In addition, many new scripts for plotting the scores evolution up to 66 hours have been also developed.



3. MET package : Model Evaluation Tools

MET was developed by the National Center for Atmospheric Research (NCAR) Developmental Testbed Center (DTC) through the generous support of the U.S. Air Force Weather Agency (AFWA) and the National Oceanic and Atmospheric Administration (NOAA).

MET provides a variety of verification techniques, including:

- ✓ Standard verification scores comparing gridded model data to point-based observations
- ✓ Standard verification scores comparing gridded model data to gridded observations
- ✓ Spatial verification methods comparing gridded model data to gridded observations using neighborhood, object-based, and intensity-scale decomposition approaches
- ✓ Ensemble and probabilistic verification methods comparing gridded model data to point-based or gridded observations
- ✓ Aggregating the output of these verification methods through time and space

(more details about MET package at : http://www.dtcenter.org/met/users/index.php)

4. Products of The MET-based Verification System

The MET-based system of verification uses SYNOP, TEMP and PILOT reports from synoptic stations over the ALADIN domain (from 20°W to 7°E, and 20°N to 45°N).

At the moment, only the following standard meteorological parameters are considered : temperature at 2m, relative humidity at 2m and wind at 10m (zonal and meridian components) for land observations and temperature, wind and relative humidity for upper measurement at 850mb, 500mb, 700mb and 250mb.

The verification of the forecasts up to 66 hours, derived from the numerical forecast ALADIN MAROC model (10km resolution), is carried out in order to quantify the model prediction behaviour . The forecasts are initialized at 0000 UTC.

The matching approach between forecasts and relevant observations, used here is the bilinear interpolation using the 4 neighbourhoods grid points.

The most frequent statistical parameters used for model assessment are analysed : RMSE, ME, MAE.

✓ *The mean error (ME) measures the average difference between the forecast and observed values*

$$ME = \frac{1}{N}\sum_{i=1}^{N}(F_i - O_i) = \overline{F} - \overline{O}$$

✓ *The mean absolute error (MAE) measures the average magnitude of the error*

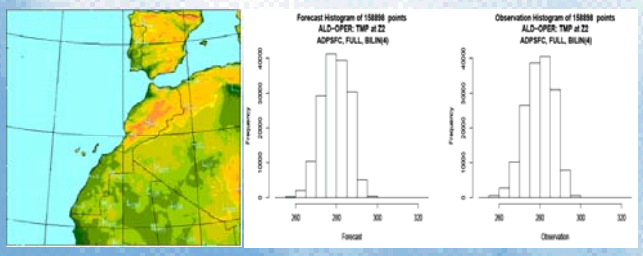
$$MAE = \frac{1}{N}\sum_{i=1}^{N}|F_i - O_i|$$

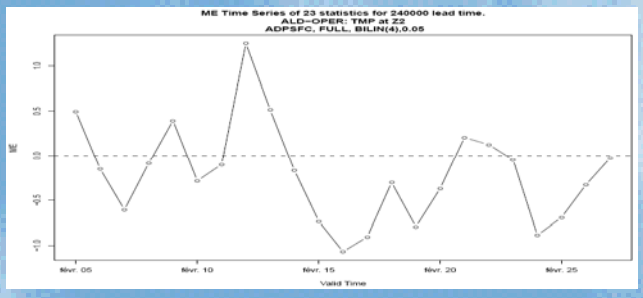
✓ *The root mean square error (RMSE) measures the average error magnitude but gives greater weight to larger errors*

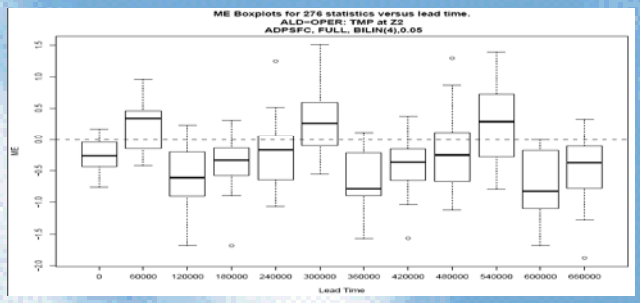
$$RMSE = \sqrt{\frac{1}{N}\sum_{i=1}^{N}(F_i - O_i)^2}$$

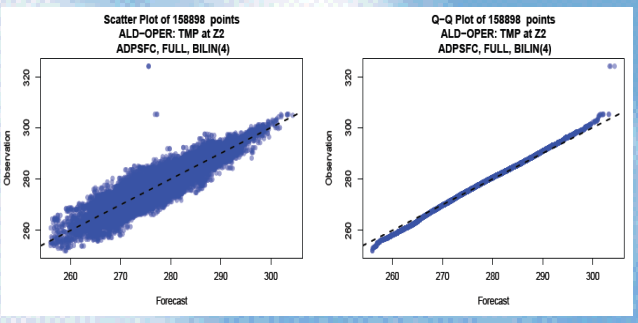
The main products of the verification system are :

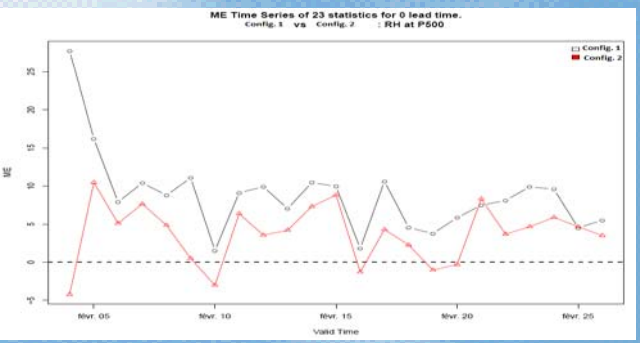
- ➢ *ASCII tables with RMSE, ME, MAE and total number of observations and forecasts pairs.*
- ➢ *Plot of the evolution of each score for different levels and forecast ranges*
- ➢ *Q-Q plots of observation versus forecasts*
- ➢ *Scatter plots of observation versus forecasts*
- ➢ *Evolution of the scores with the length of forecast for different levels*
- ➢ *Forecast and observation histograms*

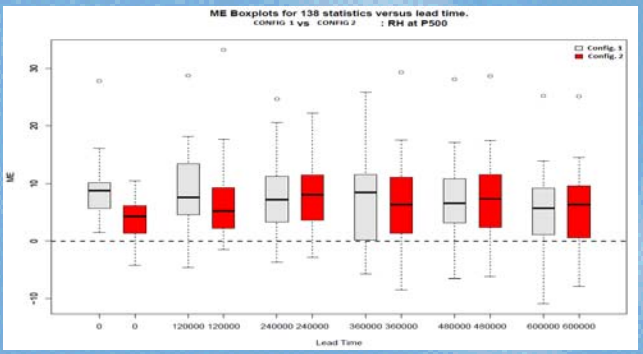












5. Summary and future work

- ❑ *The MET-based verification system is a new evaluation tool for assessing the ability of ALADIN-MAROC model to accurately predict some standard meteorological parameters*
- ❑ *Monitoring the quality of deterministic forecasts by plotting the time series of the well known set of verification scores*

Future work :

- ❑ *Compute the new scores developed for the extremes events*
- ❑ *Use of the feature-based measures (CRA, MODE)*