ITALIAN METEOROLOGICAL SERVICE

Conditional Verification: a new method verification of NWP forecast products

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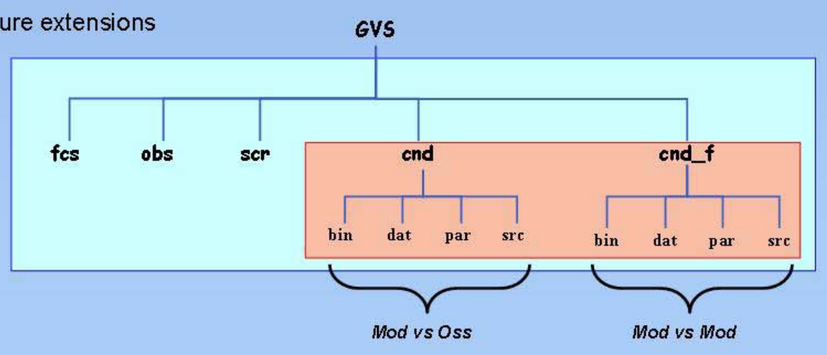
The classical verification of numerical weather products is generally based on the evaluation of single elements (e.g. T2m, RR) over specific domains in space and time. The resulting numbers, tables and plots present measures of the overall performance of the model with regard to the product considered. Potential interdependencies between various products are a priori ignored (e.g. cloud cover & near surface temperature).
The Italian Meteorological Service has developed a tool (integrated with the classical method) which formulate the verification of forecast products in conjunction with the existence of additional criteria, which are to be met, and that can be considered as ‚conditional verification' (CV). The prime purpose of CV is the systematic evaluation of model performance in order to reveal typical shortcomings and the reasons behind them. Applied in a routine mode, it have the potential to provide information with regard to the situation and product dependent model reliability (e.g. typical clear sky forecast errors for T2M in contrast to cloudy sky condition errors). The typical approach to CV consist of the selection of one or several forecast products and one or several ‚mask variables', which are used to define thresholds for the product verification (e.g. verification of T2M for grid points with zero cloud cover in model and/or observations). Special features and different model behaviours appear in comparison with the non-conditional verification.

CVS - CV Common Verification Suite – Conditional Verification

The new tool developed is totally integrated in the classical tool used and it is:

- ✓ Flexible
- ✓ Customizable
- ✓ Possible create Automatic Procedure to verify generic data-set and to create statistic index (Mod-Obs and Mod-Mod)
- ✓ Possible allow future extensions

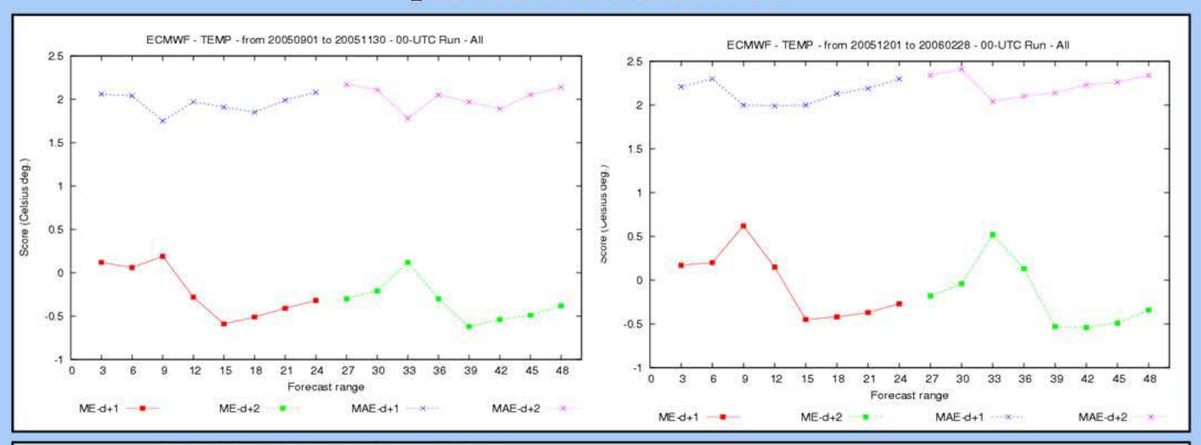


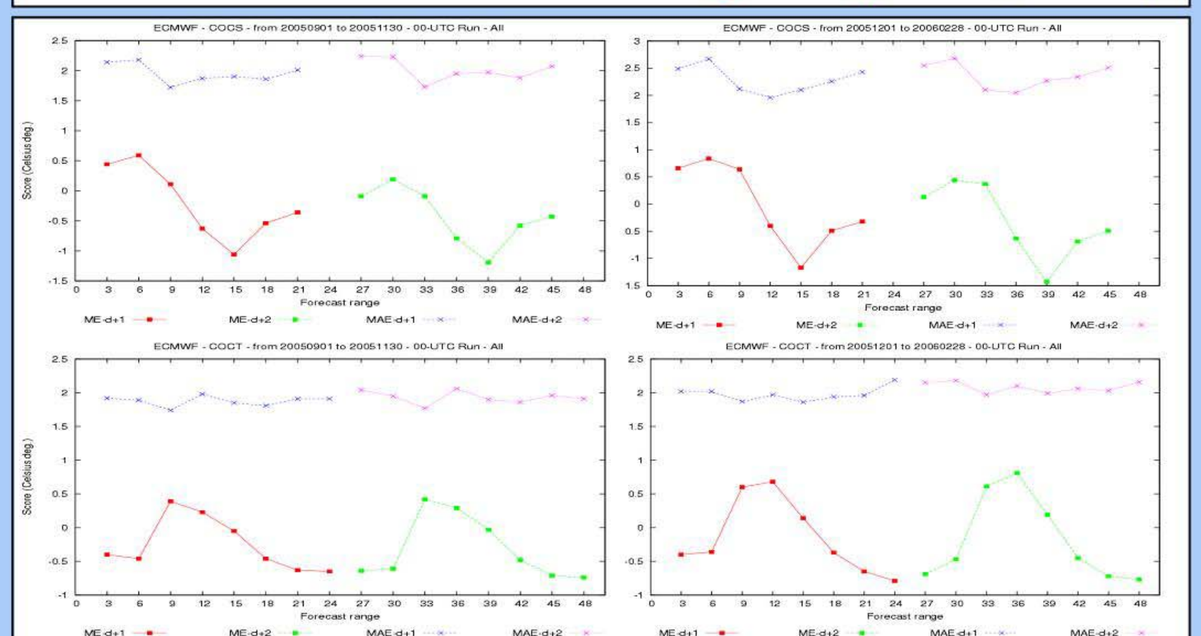
Parameters

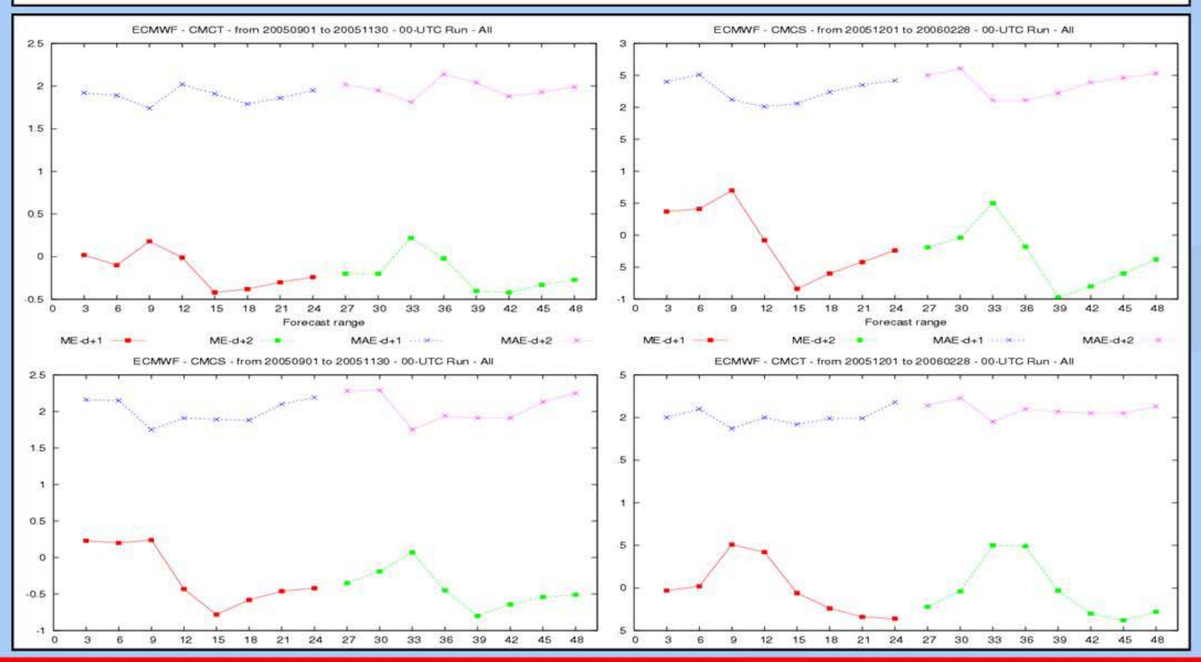
Verified variable	Mask variable(s)	Criteria	Remarks
T_{2m}	CLC(t); local time	lower & upper thresholds in CLC; local time slots	cloud cover thresholds should be applied over the time period preceding the verification time and both to model and observations
T_{2m}	W_{soil}	lower & upper thresholds in (relative to field capacity) soil moisture	soil moisture is a multi-layer variable and it may be useful to compute an ‚effective' soil moisture as average over several layers
CLC(L)	vertical stability index	"stable" vs unstable situations	differences in temperatures at various pressure levels may be used as a stability index; the distinction with regard to stability may be considered as an example for situation dependent masking, e.g. to focus on low level stratus or convective regimes
RR	as above	as above	regime dependent precipitation verification
T2m	U10m	upper threshold in wind speed	exclude advection dominated situations in temperature verification
Td2m	Wsoil	lower & upper thresholds in (relative to field capacity) soil moisture	determine the error of dew point temperatures in the case of dry soils versus wet soils
T2m	Wsnow	No snow/ broken snow/ snow	The temperature error is likely to depend on snow cover yes/no, a broken snow deck might be an indicator for melting snow
...	...	...	...

The aim of project is analyze and compare data set with / without condition, Mod vs Mod, Mod vs Obs. In our graphics we use the following classification to compare the results.

Some Results







BUFR and GRIB from several NWP can be compared:

- ECMWF (00- run; 12- run)
- LAMI (00- run; 12- run)
- EURO LM (00 - run ; 12- run)
- HRM (00- run; 12- run)
- EURO HRM (00 - run)

For MSLP, TEMP, PREC, UWND, VWND, TDEW, CLCT

The tool is developed on Unix/Linux OS with F90 applications.
A more flexible way to perform a selection of forecasts and observations data is the selection of a number of conditions from an"ad hoc database", planned and designed for this purpose, where the mask or filter could be simply or complex SQL statements.
CNMCA - Verification Section is implementing such a DB system, including portability, user-friendliness and easy-to-install features.

Future Improvement

- Study of the obtained results
- Validation of the correlations already identified
- Definition of further correlations
- Creation of a Data-warehouse
- Realization of a Graphical User Interface

COCT - Model vs Obs. Temp. when Cloud Cover > 5/8
COCS - Model vs Obs. Temp. when Cloud Cover < 3/8
COWD - Model vs Obs. dTemp. when Wmod is < 2 m/s
COWT - Model vs Obs. Temp. when Wmod < 2 m/s
CMCT - Model vs Model Temp. when Cloud Cover > 5/8
CMCS - Model vs Model Temp. when Cloud Cover < 3/8
CMWD - Model vs Model dTemp. when Wmod is < 2 m/s
CMWT - Model vs Model Temp. when Wmod < 2 m/s

Scores Production

Continues Variable :

- ***ME = Mean Error***
- ***MAE = Mean Abs. Error***
- ***MSE = Mean squared Error***
- ***RMSE = $(MSE)^{1/2}$***

Dicotomic Variable :

- ***FBI = Frequency Bias***
- ***POD = Probability of detection***
- ***FAR = False Alarm Ratio***
- ***F = False Alarm rate***
- ***KSS = Kuipers Skill Score***
- ***TS = Threat Score***
- ***ETS = Equitable Trheat Score***