

5 Working Group on Verification and Case Studies

1 Group Activities

The activities of this group focus on an administrative point of view, in order to have an objective measure of how well LM forecasts are performing, and on a scientific one, in order to have a detailed assessment of the strengths and weaknesses of the model. Thus at the moment the main activities of the working group deal with the following issues:

- Verification of operational model forecast.
- Verification with feedback on the physics parameterization (verification of new predefined LM versions on predefined set of test cases).
- The development of new verification methods and diagnostic tools.
- LM case studies and collection.

The Working Group was coordinated from September 2004 to September 2005 by Patrizio Emiliani (CNMCA-Italy), and now by Adriano Raspanti (CNMCA-Italy). The main activities for the period Oct 2004 - Sep 2005 covered the following points:

- Operational verification of surface parameters, using Synop stations and also regional high resolution networks. Results are summarised in verification reports which are distributed on quarterly basis on the COSMO web site.
- Operational verification of upper-air parameters, using TEMP stations, with results summarised again in quarterly reports distributed on the COSMO web site.
- Exchange of LM maps (24hrs cumulated precipitation, and MSLP), of each operational LM running, on the COSMO web site.
- High resolution verification of precipitation, using available high resolution dense non-GTS surface data. Consolidation of a common high resolution data set of non-GTS daily precipitation.
- Daily cloudiness verification at 12 UTC with the Meteosat VIS channel.
- Verification of integrated water vapour content using GPS data.
- Validation of near-surface boundary layer processes and radiation budget from operational weather prediction runs (LM, GME, aLMo) at selected observatory measurement sites with different land surface properties.
- Weather regime type verification of vertical profiles and precipitation using Radar composite network.
- Verification of precipitation forecast using radar composite network.
- Realization of a common Verification Package.
- Verification of runoff over river basins.

A WG3/WG5 workshop was held on March 2005 in Langen. Besides usual presentations of recent developments and results and the status of the common verification package at ECMWF, the main topic of this joint workshop was dedicated to the problem concerning the needs of so-called *Conditional Verification*. In particular, it has been clarified that this is the best verification technique that can be used for the peculiar needs of WG3, in order to find and solve problems or to optimize the variables parameterization. For this purpose WG3 provided, around mid 2005, a list of criteria to use for conditional verification and a draft of this new project was also discussed at the second WG Coordinator meeting held in Bologna (September 2005).

Finally, during the COSMO general meeting 2005 held in Zürich, the new WG5 Priority Project *Conditional Verification Tool* was presented to the COSMO community and approved by the Steering Committee.

Further, the plan for 2005-2006 includes verification on high resolution verification for precipitation, weather regime verification of surface and upper-air data, verification of near surface boundary layer processes (operational at MeteoSwiss), complete delivery of the Common Verification Suite package and a WG 5 workshop on March 2006 in Langen, pointed on Conditional Verification Tool.

2 Results and Methods of Model Verification

The operational verification results for the LM forecasts at various COSMO meteorological centres, both for near-surface and upper-air parameters, are summarized in this section. More detailed verification results are presented on a quarterly basis at the COSMO web-site.

Also included are contributions related to the development and test of new methods of model verification, including the use of high-resolution non-GTS data and weather situation-dependent verification using radar composite data. Most of the papers are write-ups from the COSMO annual meeting 2005 in Zürich.

Of course, thanks to all of you who provided contributions for the present issue of the Newsletter. The numbering of equations and figures in this section refers to each paper.

Before continuing with the contributions, it can be useful to summarize briefly some conclusions on model deficiencies from the recent verification results as well as from diagnostic evaluations and from case studies.

Model Deficiencies

From the verification results for 2004-2005, we can summarize some basic problems:

- The cloud cover cycle is not well reproduced, generally the high cloud cover is overestimated, with a different behaviour in summer depending on the area and the thresholds; it is better in winter.
- The mean daily cycle of precipitation is not well represented, generally overestimated, with a signal increase with terrain height.
- During summer the model shows a strong phase shift of precipitation maxima in the daily cycle (maxima occur too early in the forecasts), probably this is linked to the fact that also the diurnal cycle of 2m-temperature still shows too rapid increase during the early morning and too rapid decrease in the afternoon

- Also low precipitation amounts appear to be overestimated by the model. Over regions with complex orography (especially over the Alps and Appenini), the precipitation patterns are still not very satisfactory and show great precipitation amounts upwind and an underestimation of rainfall downwind (reported also by forecasters in their subjective evaluations).
- During evening and night-time, the 2m-temperature has a quite large cold bias, especially during winter, while in summer it shows a low absolute accuracy (strong positive mae) around midday.
- The diurnal cycle phase of the 2m-dewpoint-temperature is relatively well captured by the model even if the diurnal wave amplitude is not so good, it is clear an overestimation.
- 10-m winds generally appear to be underestimated on mountain stations and overestimated, especially during the night, for low stations as well as there is a constant overestimation of wind gusts (also the small ones).
- The temperature vertical profiles (as verified with TEMP soundings) show a cold bias in the boundary layer during summer season and in the whole atmosphere during winter. Small positive above 500 hPa in summer.

There are some interesting first results in verifications of LMK test runs:

- It shows an enhanced forecast accuracy for gusts probably due to finer grid resolution.
- For precipitation the results of the smaller scale model lead to partly better verification results than the LM routine forecast.
- In general it leads to higher accuracy for some parameters, but other parameters may be affected negatively.

During the last COSMO meeting, held in Zürich in September 2005, the new concept of *Priority Projects* has been introduced. In this frame, WG5 people have proposed a sort of extension of the Common Verification Suite into a new Priority Project named *Conditional Verification Tool*. This will be the main topic of discussion and the main work duty of WG5 for the next 2-3 years.