STATUS OF PT NWP

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GOAL

- Build up a software environment to perform carefully-controlled and rigorous testing

  ➔ calculation of verification statistics for any COSMO model test – version

- Offer necessary information on the model forecasting performance

- Provide the COSMO community with standards against which the impacts of new developments in the model should be evaluated

- Benchmark to monitor the progress of mesoscale forecast improvement (periodic testing as COSMO evolves)

Task 1: COSMO Model Installation and Implementation
A. Montani, R.C. Dumitrache

1.1 Development of the Test Suite

ECMWF resources – special project SPITRASP (submitted by A. Raspanti)

Computer resources	2013		2014		2015
	Allocated	Used	Allocated	Used	Allocated
HPC Facility (units)	400 000	11.91	1 000 000	358 875.34	1 000 000
Data storage capacity (GB)	80	1	180	20	180

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➔**COSMO-4.26** & **COSMO-5.0** (7km) used as prototypes

➔New version of the COSMO model & INT2LM compiled by DWD

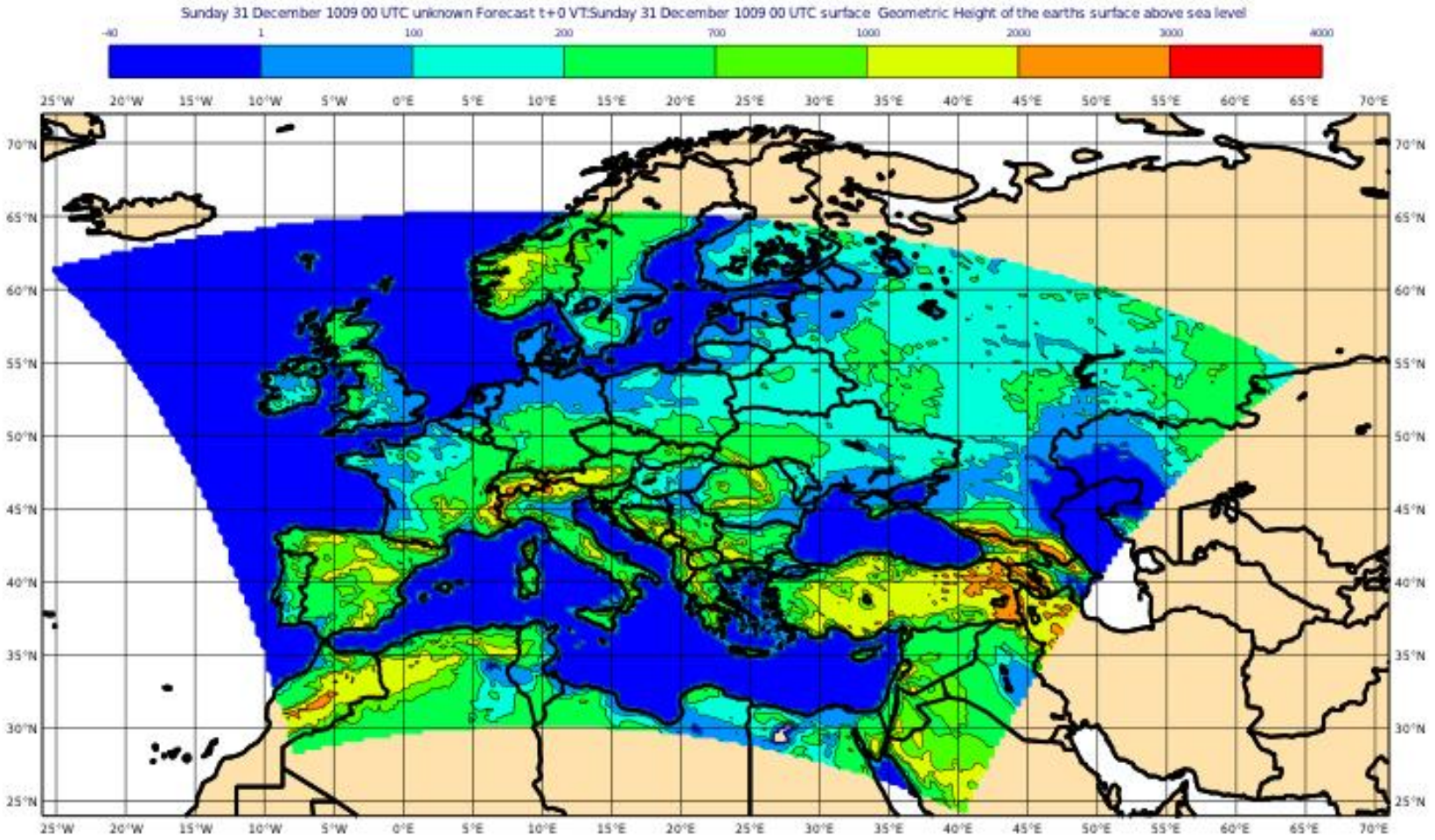
STEPS:

- compilation of necessary external libraries and tools for file managing (grib, grib2, netcdf, cdo, nco, fieldextra)
- compilation of **INT2LM-2.0** for current tests
- compilation of each COSMO version tested (4.26 and 5.00)
- availability of external parameter files (topography, lakes, land use, etc.)
- set-up of namelists

STEPS:

- directory structure and the archiving procedures were set
- after each testing procedure is completed, model output is transferred to the VERSUS machine for the statistical analysis
- model output stored locally in the ECFS system
- arrangements are made for space availability according to needs

Task 1: COSMO Model Installation and Implementation
1.2 Model Implementation and Set-up of Appropriate Tests



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TESTS:

- 72 hours run
- one daily cycle based on 00UTC initializing data
- ECMWF initial and LBC (11.6Gb)
- Runs for January 2013 and July 2013 (62 days total)

COSTS:

- Interpolation for **COSMO-4.26**: **~ 80.0 BU** per run (takes ~ 8 min)
- Interpolation for **COSMO-5.0**: **~ 81.5 BU** per run (takes ~ 8 min)
- **COSMO-4.26**: **~ 2434 BU** per run (takes ~ 30 min)
- **COSMO-5.0**: **~ 2350 BU** per run (takes ~ 29 min)
- **!!!!! COSMO-5.1: ~ 2284 BU per run (takes ~ 28 min) !!!!!**
- total_tasks = 64 and node = 1 for **int2lm**
- total_tasks = 512 and node = 8 for **COSMO**

TECHNICAL SPECIFICATIONS:

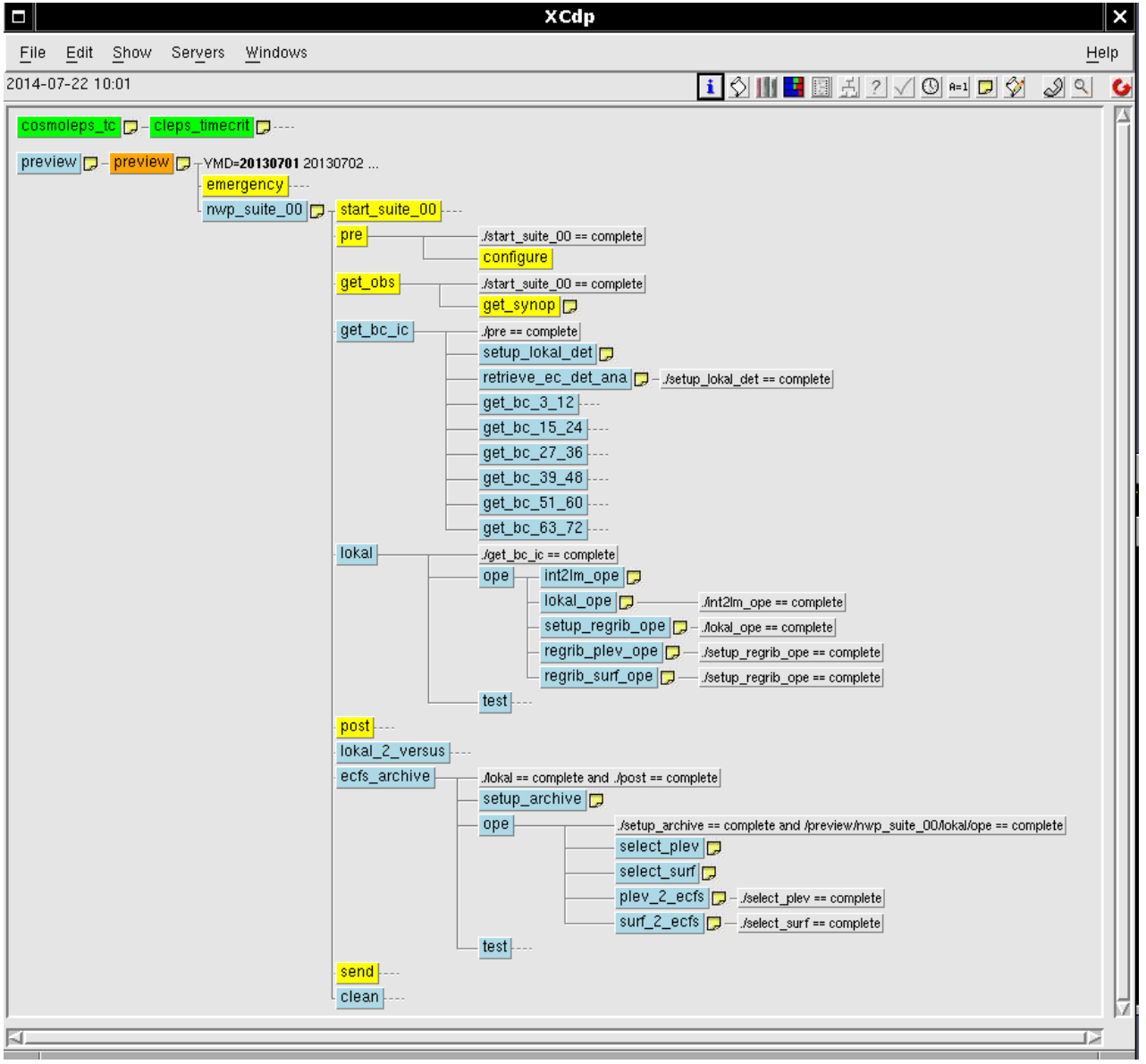
- several tasks with interdependencies between them
- work flow organized and maintained through an **xcdp/sms** suite

(X Control Display Manager/Supervisor Monitoring Scheduler - ECMWF's monitoring and scheduling software)

- **xcdp/sms** suite runs under **ecaccess** and **IBM**
- work in progress for the migration from IBM to Cray

  (end of September 2014)

More detailed information in the Final Report submitted to the STC.



Screenshot of the suite with its main families/tasks

TROUBLESHOOTING:

- We experienced, especially in May and June 2014, some problems with the network every now and then.
- This made it more difficult to work remotely on the ECMWF machines.
- **Problems solved by ECMWF in July 2014**

Task 2: Model Output Verification

A. Raspanti, F. Gofa

2.1 Installation of VERSUS software

VERSUS software installed at ECMWF

➔ **virtual machine** based on the ECGATE linux system

ECMWF personnel - no prior experience in hosting external software

➔ technical and security issues

➔ main software, accompanying software (R language, grib_api, SWING, BufrDC) installed and appropriately configured

Final product -> remote access of each user to the virtual machine and execution of the verification suite through the **web graphic interface

VIRTUAL MACHINE SCPECIFICATIONS:

- 2 CPU's and a total RAM of 8Gb
- tests show performance is satisfactory
  - ➔ stability & speed of system
- ECMWF requested tests with 4Gb RAM setup
  - ➔ to be performed later on
  - ➔ could result in a general slowdown of the system performance

More detailed information in the Final Report submitted to the STC.

LOGIN to the VERSUS MACHINE (ms-versus) [I]

- Login to **ecgate**
- ssh –X **versus@ms-versus** to connect to the virtual machine
- open **Firefox** to have the webgui at **localhost** with VERSUS web access
- The user will be asked to choose their own Firefox profile or create a new one
  - ➔ allows multiple GUI users
  - ➔ other connections to VERSUS virtual machine can be established using "ssh **versus@ms-versus**"

LOGIN to the VERSUS MACHINE (ms-versus) [II]

*at the moment only the "**versus**" user has access to the machine*

- root available only for ECMWF
- accessible from the **ecgate** cluster only by the users that at the moment are allowed without any password
- other users need password (at the moment only for ECMWF)
- Current users:
  - cn9: Adriano Raspanti
  - emo: Flora Gofa
  - roz: Amalia Iriza
  - itm: Andrea Montani
- Other users can be added by ECMWF Users support personnel after request.

TROUBLESHOOTING (VERSUS installation):

- restricted rights to some directories and configuration files where certain components of VERSUS are installed
- setup of the virtual machine on ECGATE (actually 8Gb and 2 CPU's)
- remote web access issues and problems with connection to the virtual machine
- very slow connection with the GUI (fixed using NoMachine)
- First time ECMWF was hosting on their machine external software with such requirements **->** delays in resolving each issue, but it was an important experience for both sides

- First approach - grid-to-point comparisons:

gridded surface and upper-air model data to point observations

- **Setup of station stratification**

  ➔ area covering - 25/24/65/65 (W/S/E/N) selected from the world-wide WMO flatfile

- **Suspect observations values**

Parameter	|Fcst-Obs| < Value
FF_10m	50 m/s
MSLP	2500 Pa
PS	2500 Pa
TD_2m	30 deg. C
T_2m	30 deg. C

Task 2: Model Output Verification
2.2 Configuration of the System for Semi-Automatic Production of Statistical Results

Setup of COSMO models

- each model version registered with the version number
- currently COSMO 4.26 & 5.0
- same grid characteristics / **different model id** (software prerequisite)
- each new model registered:
  - ➔ the same topography file
  - ➔ **new model-id code**
  - ➔ assigned during the model run

Forecast Model

Report

Model Type	
Type	COSMO 4.26
Topography	/versus/VERSUS/data/lsm_oro/oro_lsm_test.grb
Grib Codify	Standard
Model Process	
Process ID	131
Center	80
Description	COSMO 4.26
Feature	deterministic features

Forecast Model

Report

Model Type	
Type	COSMO 5.0
Topography	/versus/VERSUS/data/lsm_oro/oro_lsm_test.grb
Grib Codify	Standard
Model Process	
Process ID	101
Center	80
Description	COSMO 5.0
Feature	deterministic features

Back

Task 2: Model Output Verification
2.2 Configuration of the System for Semi-Automatic Production of Statistical Results

Ingestion of data

- split original grib model outputs in smaller files
- data transferred through **sftp** protocol in the dedicated Fes
- separate frontends (FE)
  - ➔ 3 for surface data (depending on selection method)
  - ➔ 1 upper air

Task 2: Model Output Verification
2.2 Configuration of the System for Semi-Automatic Production of Statistical Results

Registration of Verifications and Batch Execution

For each test:

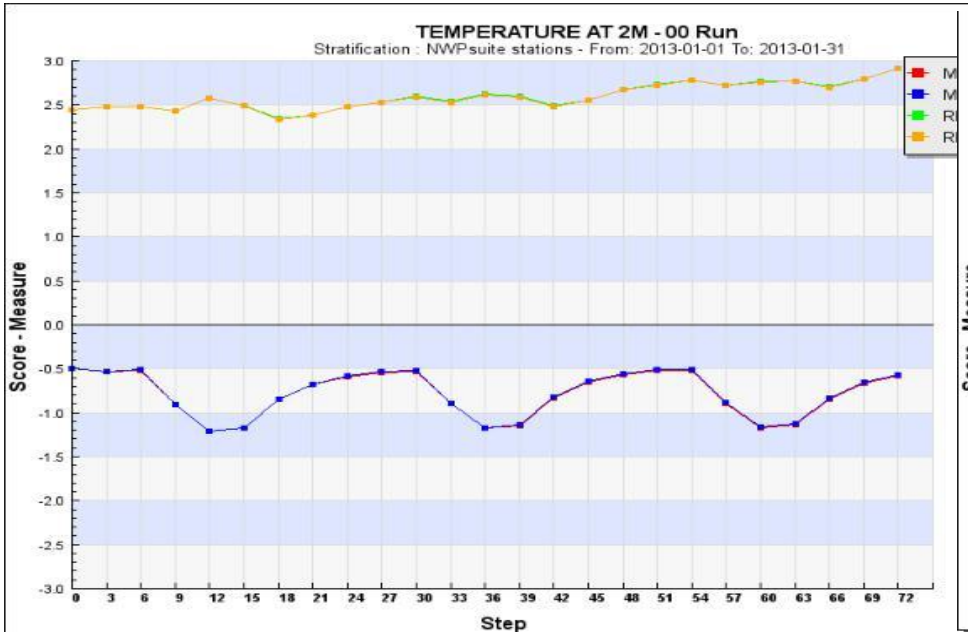
- **COSMO 4.26 & COSMO 5.00, CROSS Model – Surface:**
  - ➔ **2mTD, MSLP, 2mT, WS**
  - ➔ **TCC**
  - ➔ **6h/12h/24h precipitation**
- **COSMO 4.26 & COSMO 5.00, CROSS Model – Upper air:**
  - ➔ **T, WS, RH**

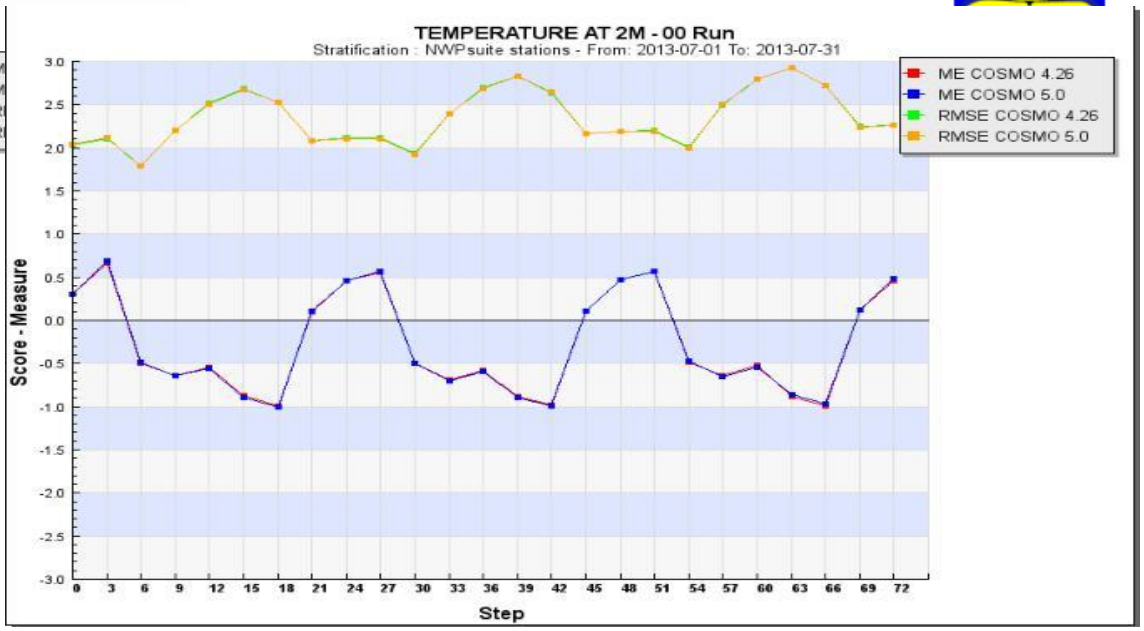
Task 2: Model Output Verification
2.2 Configuration of the System for Semi-Automatic Production of Statistical Results

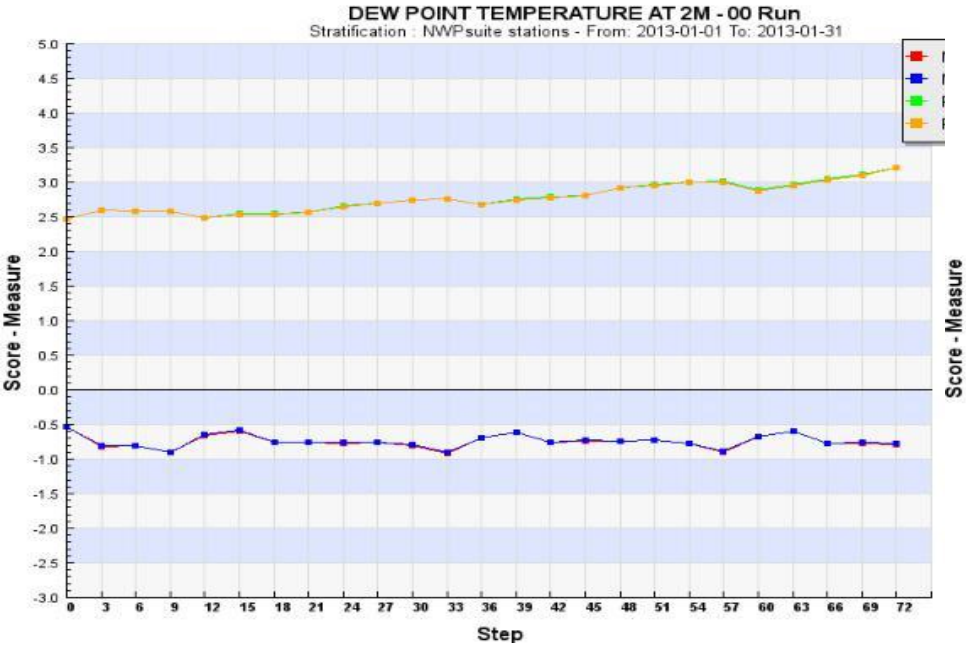
TROUBLESHOOTING (model output verification):

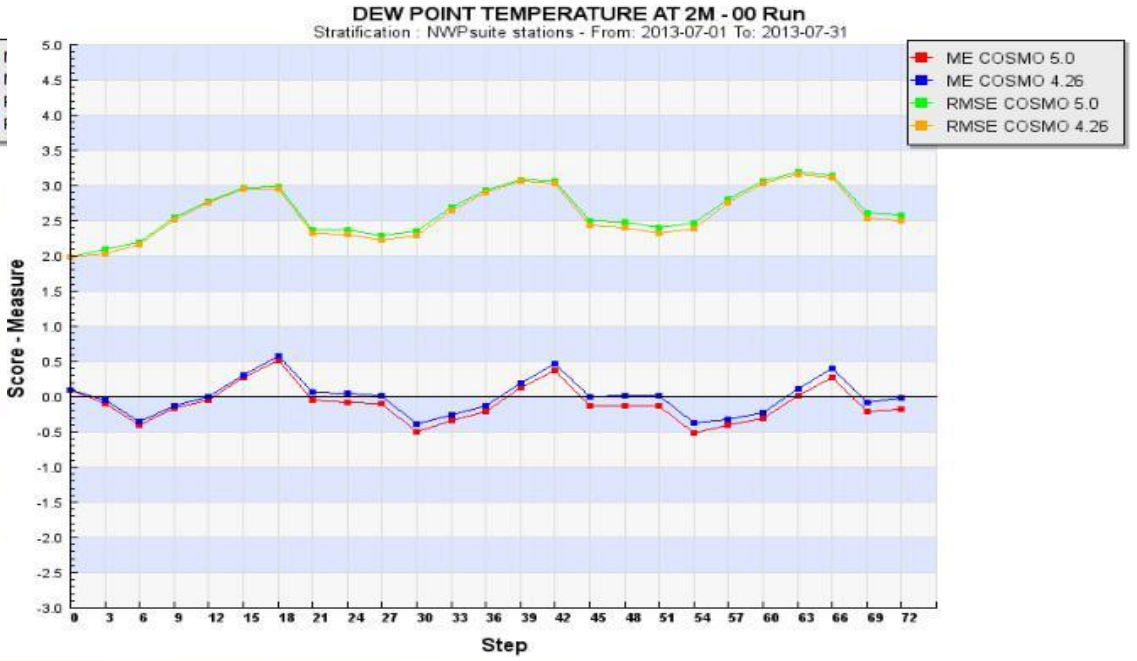
- restricted rights to some directories and configuration files where certain components of VERSUS are installed
- installation of Firefox for multiple users
- problems with the registration of the (3600) stations stratification
- memory allocation of some important variables for VERSUS performance
- size of grib files (need for splitting in smaller units)
- allocation of data (and log files) on another file system than the VERSUS one (use of symbolic links)

Verification results COSMO 4.26 versus COSMO 5.00

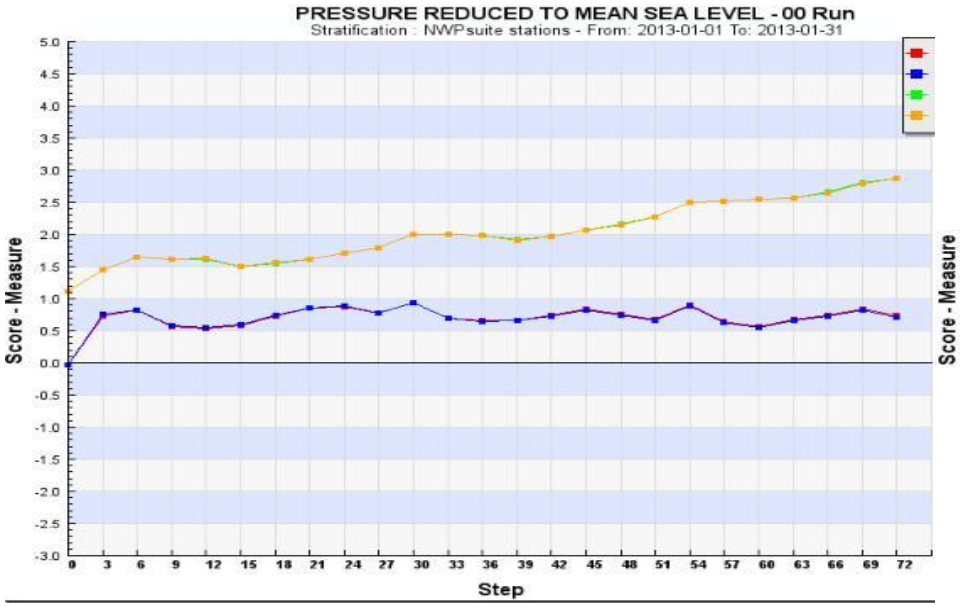


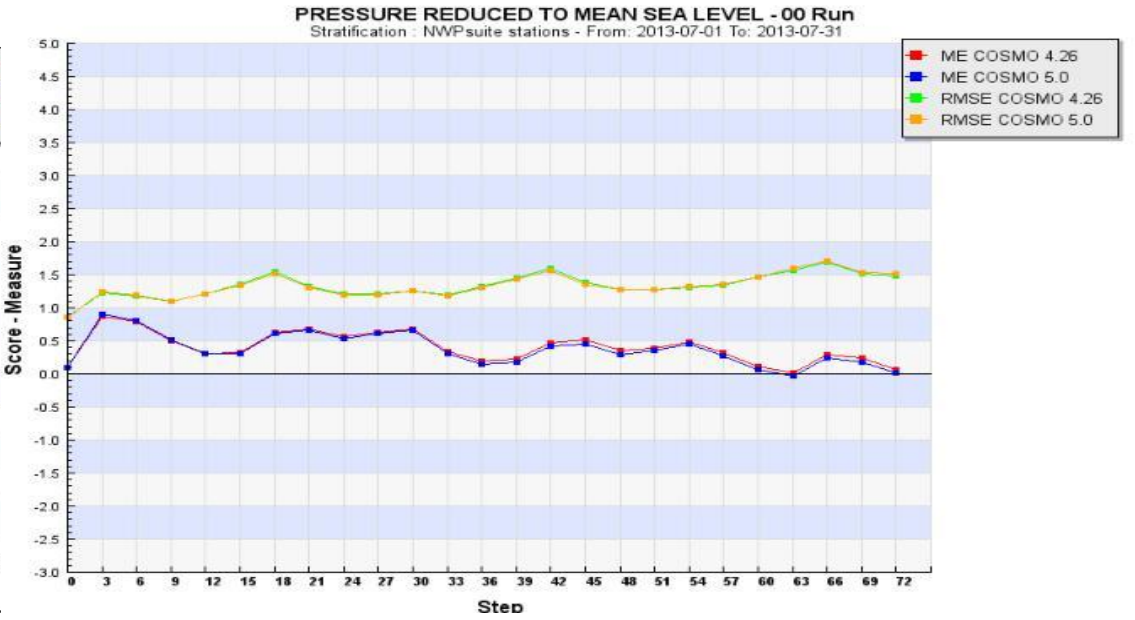


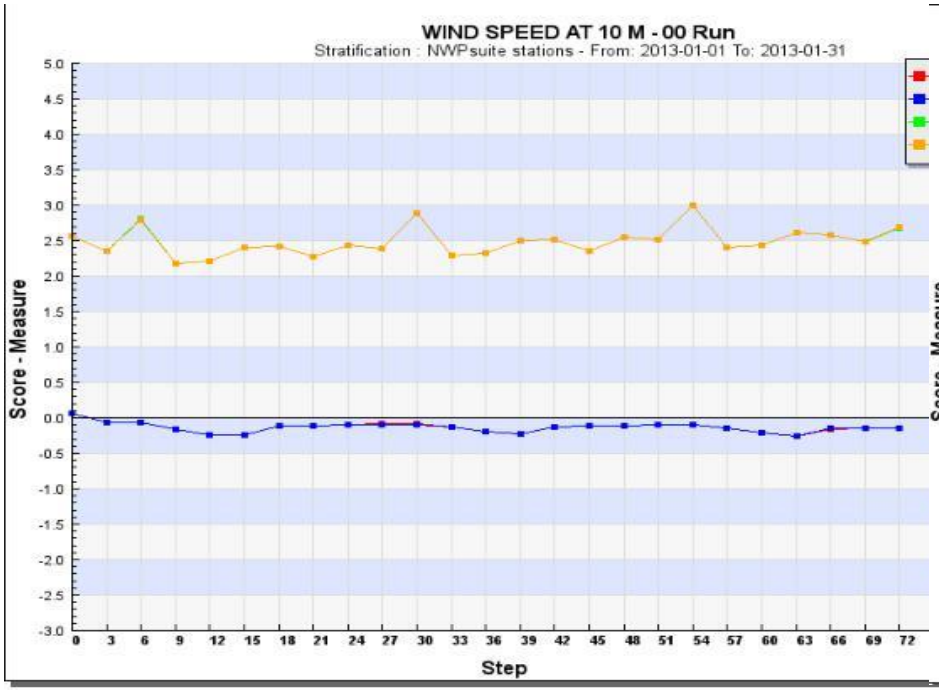


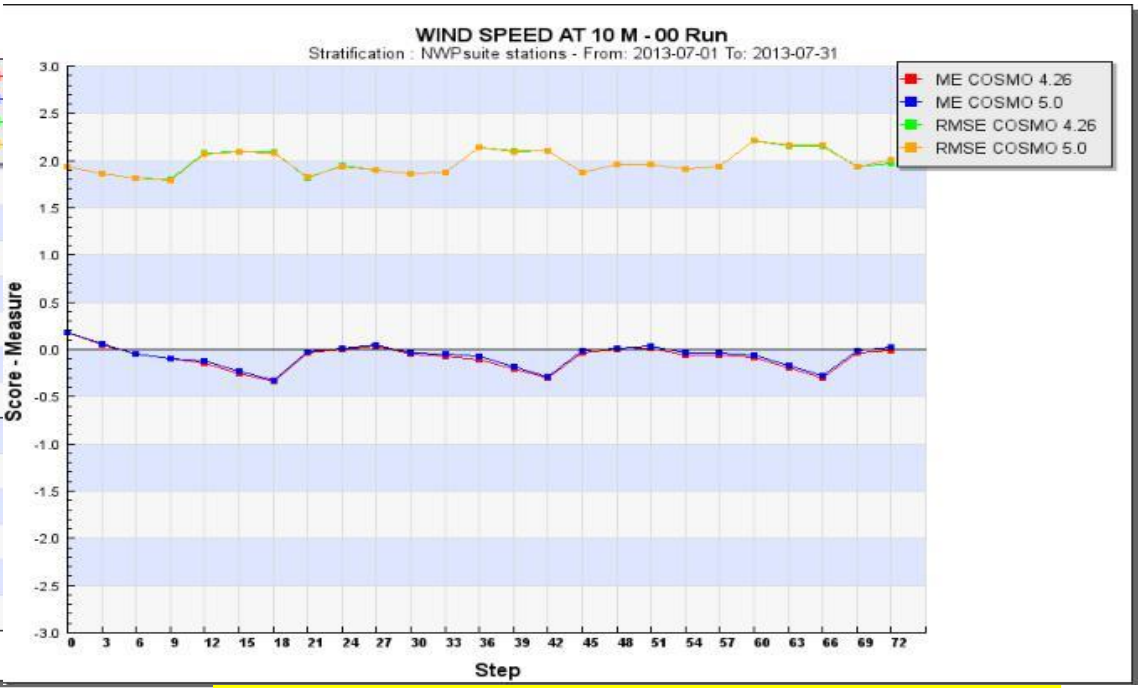


Verification results COSMO 4.26 versus COSMO 5.00

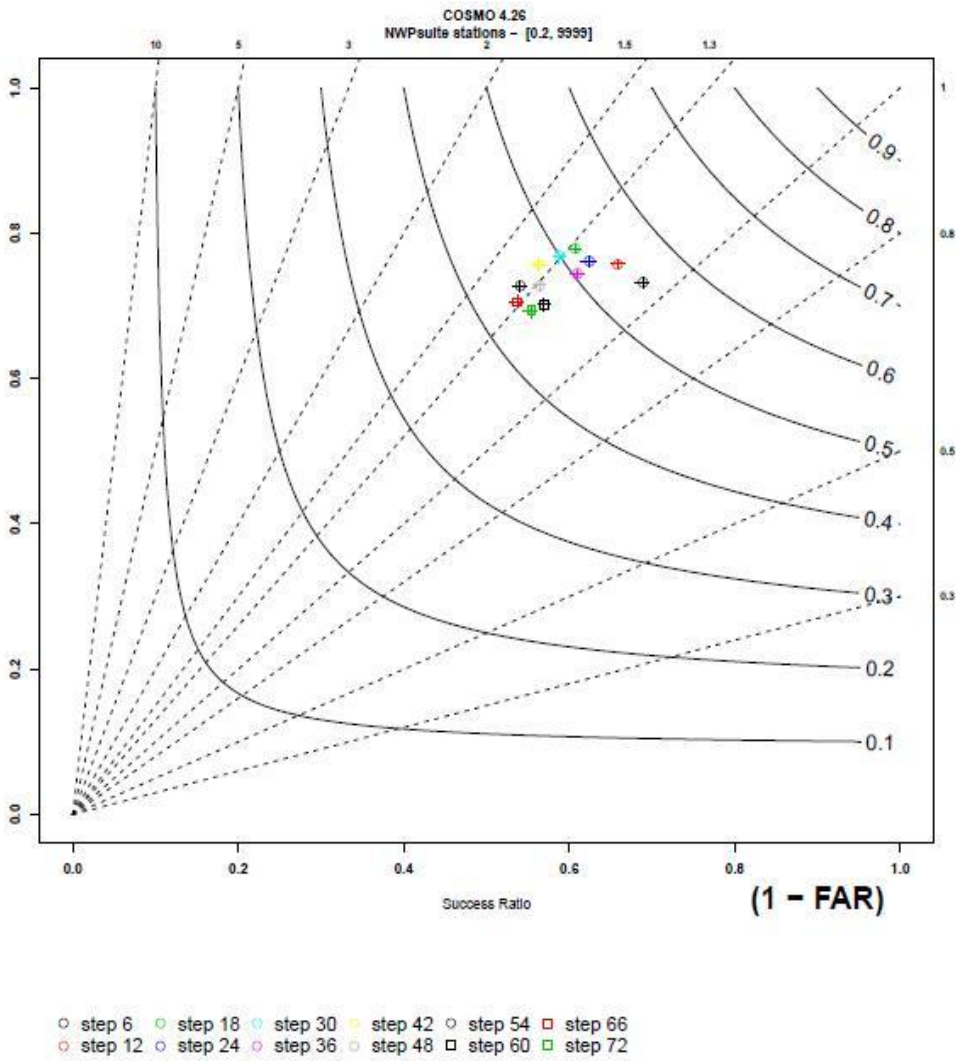


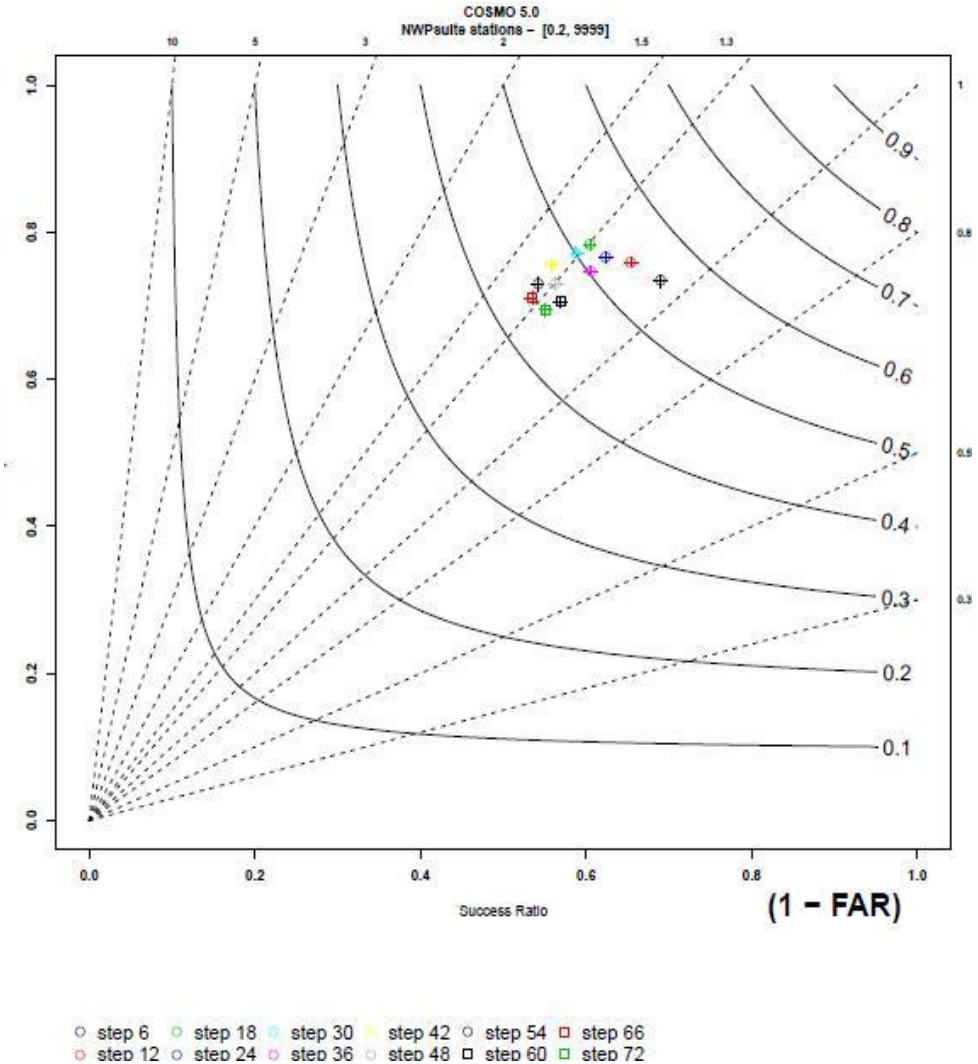






Verification results COSMO 4.26 versus COSMO 5.00





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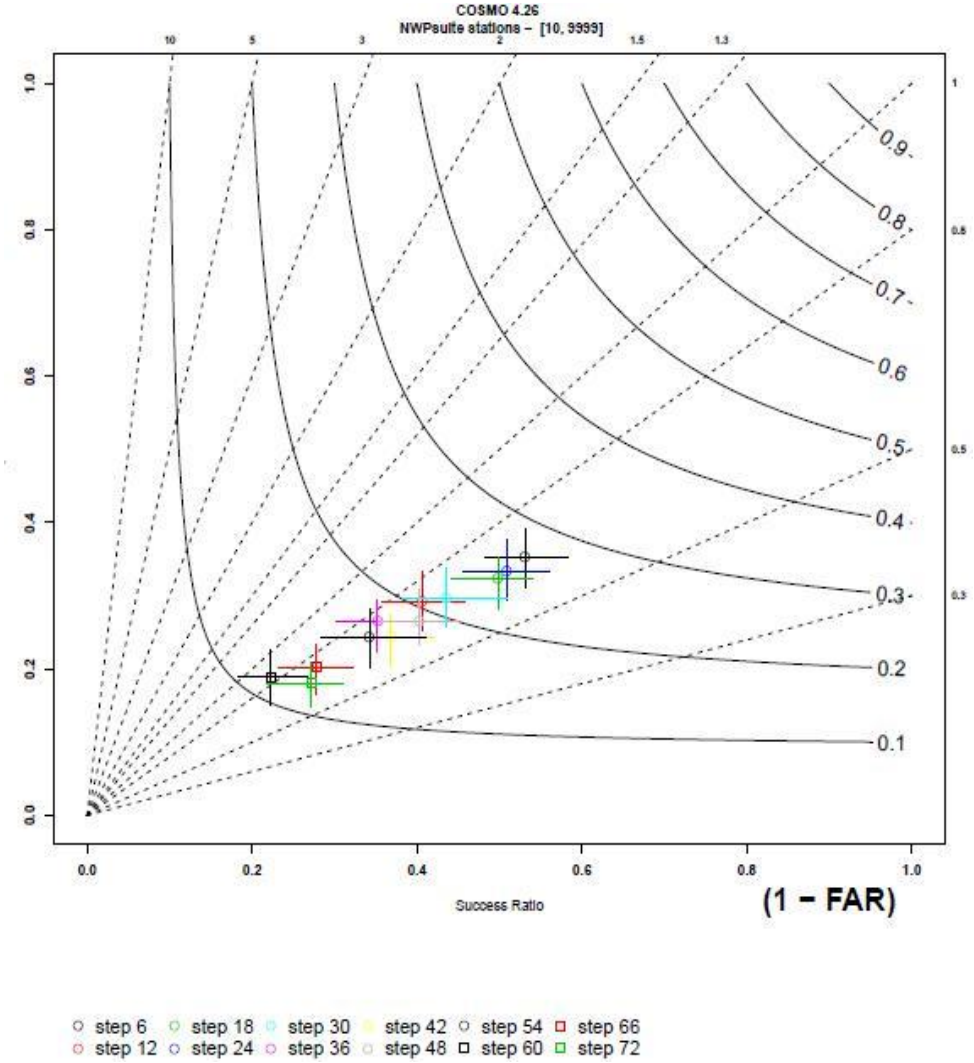
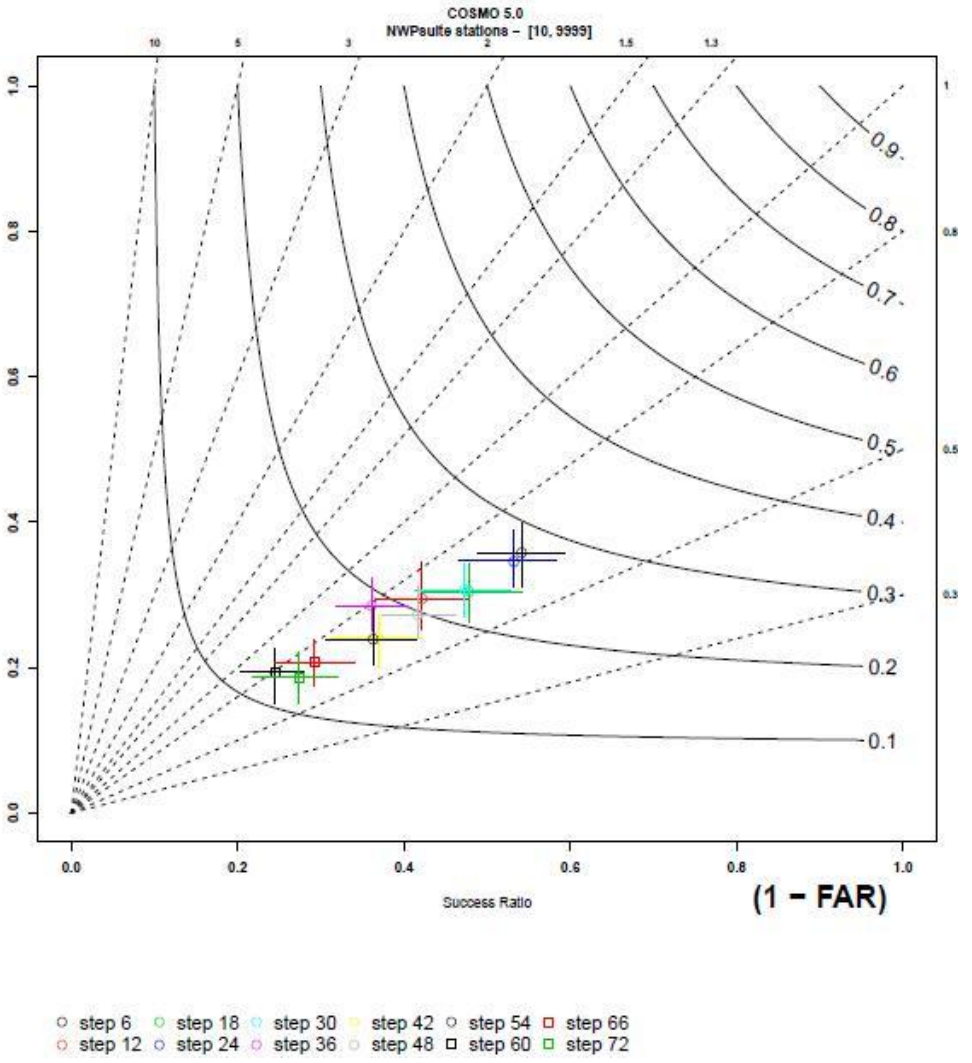
Verification results COSMO 4.26 versus COSMO 5.00





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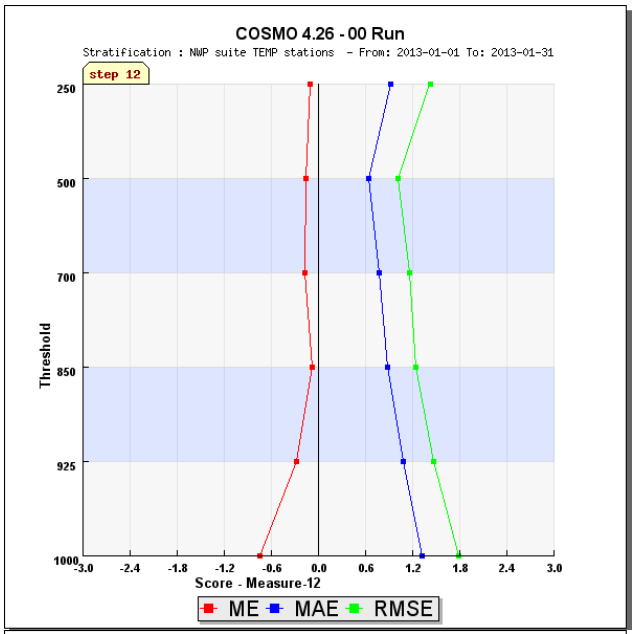
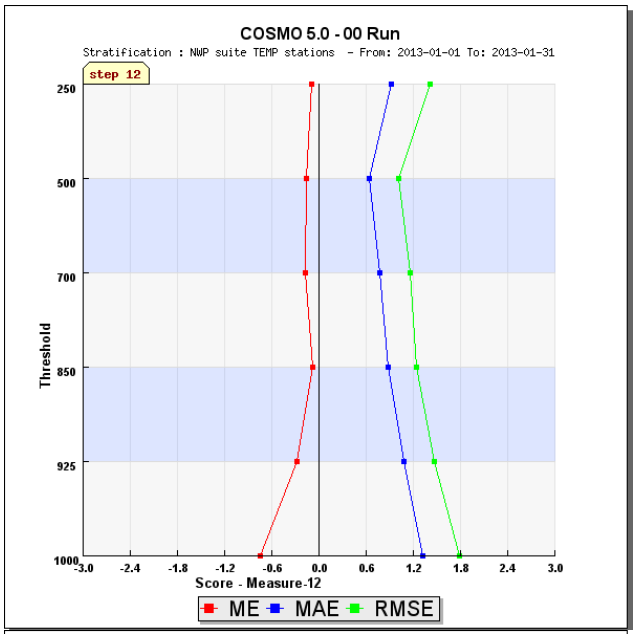
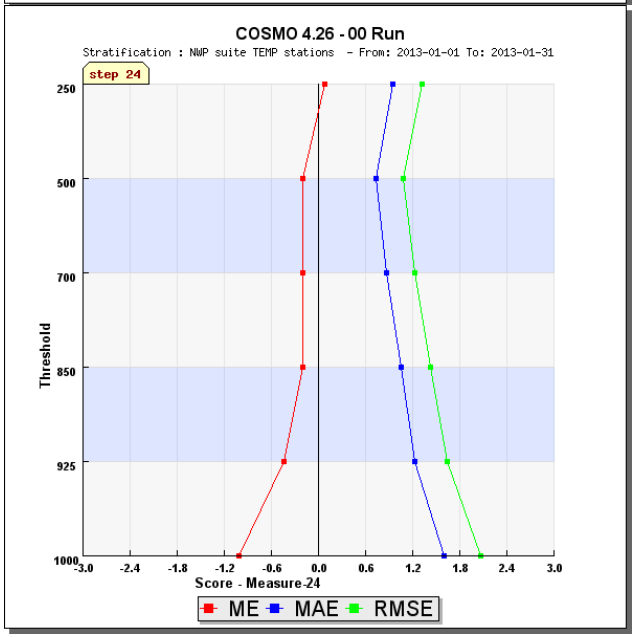
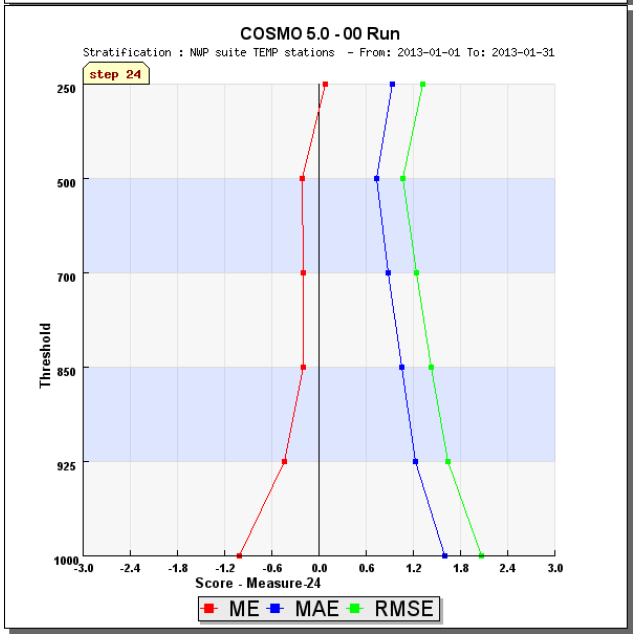
Verification results COSMO 4.26 versus COSMO 5.00









Upper air verification
January 2013
Temperature

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Final Report - complete documentation regarding the proper use and execution of each NWP test using this platform

Completed meteorological test -> report prepared (by the responsible person for this Task)

- main comparisons (**graphs**) of the **two model versions** (old & new)
- summary of **main verification results** & **suggestions** regarding advantages/disadvantages associated with the latest model version
- section for **discussion** & **evaluation** of the statistical analysis and main findings - **neutral/positive/negative benefit** to the performance of the model resulted from the new implementation

Responsible person of running the suite & **WG5 coordinator** include in the report a paragraph with a recommendation to be submitted to the SMC - whether the new version tested is eligible to become a release version according to SCM standards.

Future Plans – Maintenance activities

1. Maintenance of the Test Suite - A. Montani (for the next 3 years)

- ECMWF migration from IBM to Cray computing platform
- necessity to reevaluate computing costs
- future versions of the model to be installed

BREAKING NEWS:
COSMO 5.1 started running on 6 September

The initial Task Plan involved the setting up of a Version Control System: is it necessary?

2. Maintenance of Versus – (VERSUS SCA and PL – A. Celozzi)

- installation of future VERSUS releases

Future Plans – Maintenance activities

3. Running of test suite – NMA with help from A. Montani

- running of the test suite for further versions of the model
- model evaluation for further versions of the model using VERSUS
- evaluation report for the SMC

  (NMA with consultation with WG5 coordinator)

A set amount of FTEs is decided by the STC (including the performance of the annual Tasks for maintaining and executing the NWP test suite for each new model version aprox. 2 complete tests/ year)

4. Closer look at methods for model evaluation

- verification techniques to be adjusted / additional features to be added (acc. to results and advanced in the model code)

The need for further expansion will be evaluated after the first year of use of the current NWP suite setup.

THANKS TO

Umberto MODIGLIANI and the ECMWF staff

.... the PT Team for the work and involvement in the project:

ANDREA Montani
FLORA Gofa
ADRIANO Raspanti
RODICA Dumitrache

THANK YOU FOR YOUR ATTENTION !