

LATE REQUEST FOR A SPECIAL PROJECT 2013–2015

MEMBER STATE: Germany, Greece, Italy

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**Project Title:** NWP Meteorological Test Suite

Would you accept support for 1 year only, if necessary?	YES <input type="checkbox"/>	NO <input checked="" type="checkbox"/>
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Computer resources required for 2013-2015: (The project duration is limited to a maximum of 3 years, agreed at the beginning of the project. For late requests the project will start in the current year.)	2013	2014	2015
	High Performance Computing Facility (units)	400.000	1.000.000
Data storage capacity (total archive volume) (gigabytes)	80	180	180

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<sup>1</sup> The Principal Investigator will act as contact person for this Special Project and, in particular, will be asked to register the project, provide an annual progress report of the project's activities, etc.

Principal Investigator: Aurelia Lupascu, Adriano Raspanti

Project Title: NWP Meteorological Test Suite

## **Introduction**

The aim of the project NWP Meteorological Test Suite is to build up a software environment to perform carefully-controlled and rigorous testing, including the calculation of verification statistics, for any COSMO model test-version. COSMO (Consortium for Small-scale Modeling) is a European group for numerical weather prediction with participating meteorological services from Germany (DWD), Greece (HNMS), Italy (USAM), Switzerland (MeteoSwiss), Poland (IMGW), Romania (NMA) and Russia (RHM). The general goal of the consortium is to develop, improve and maintain a non-hydrostatic limited area modelling system to be used for both operational and research applications by the members of COSMO.

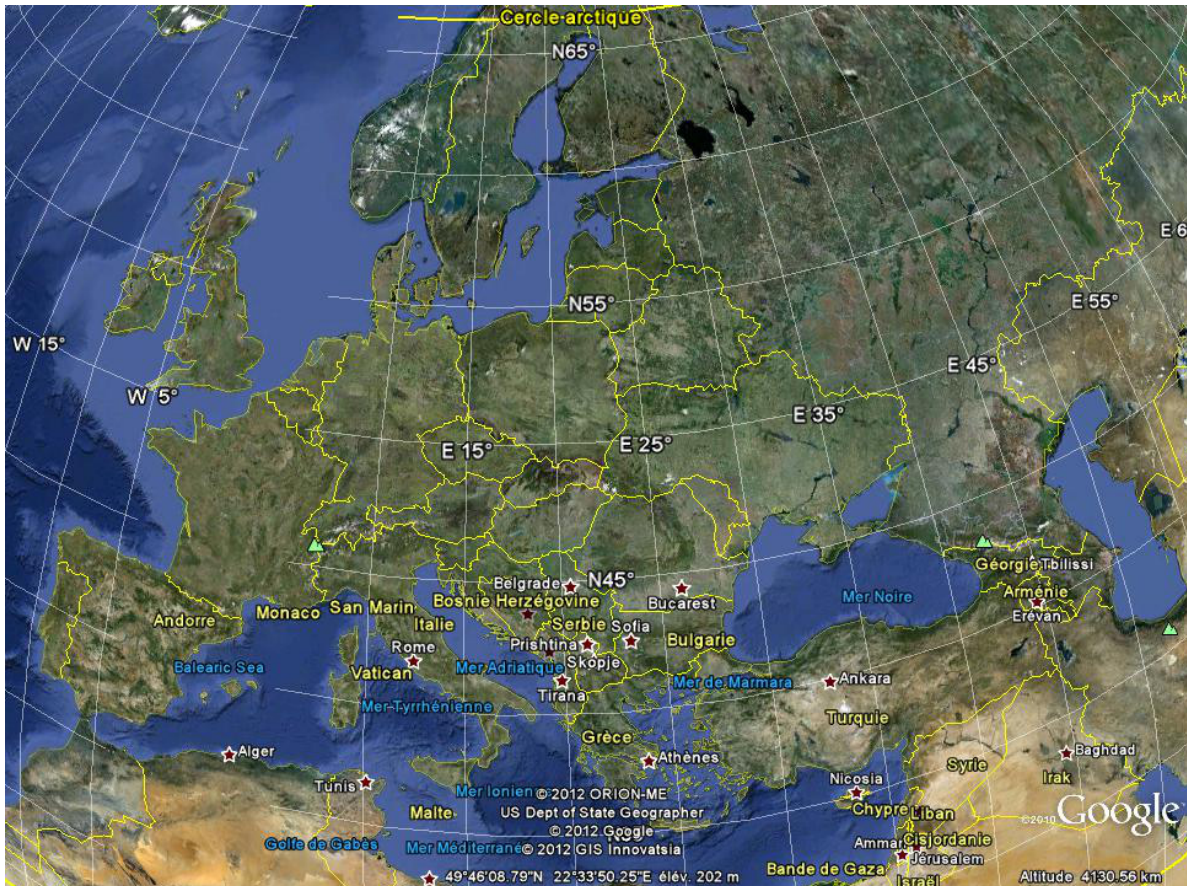
## **Scientific Plan**

In the framework of NWP Meteorological Test Suite, a platform will be developed, on which present and future versions of the COSMO model will be tested for their forecasting performance, within a well-defined framework. This platform will be the tool to be used for performing the tests that will upgrade a model test-version to a new release, but it will also provide a tool available and accessible to each COSMO member for testing in a standardised way each released model version. The NWP meteorological test suite platform will provide the COSMO community with standards against which the impacts of new developments in the model should be evaluated.

The test suite only addresses the statistical quality of a COSMO version in comparison with the previous one. The statistical measures will be defined within the task itself; this concerns not only the type of scores to be used but also the array of parameters (e.g. 500 hPa geopotential, precipitation, 2m temperature). The comparison of the model versions for validation will be carried out only on a common domain, but the results will be stored in such a way that each country will be able to extract verification results for its own region of interest. It is then left open to each country to adopt or not the new version, as the verification results could be also affected by the assimilation of different data or the use of other boundary conditions. A new version of the model will be considered validated or accepted if the set of verification results show a positive impact on the common domain or if the results are neutral.

## **Phase I- Model set-up**

The 7km version of the COSMO model will be used for these tests, following the operational resolution in most meteorological services. The domain involved in calculation will cover the COSMO countries (with some extension to the west) and a good part of European Russia. The total number of grid points is  $(NX \times NY \times NZ) \sim 750 \times 460 \times 40 = 13.800.000$ ,



Main activities of this phase include the preparation of model installation. Therefore it is crucial to build up a linux/unix environment with a fortran compiler, a debug tool, standard protocols of file transfer (scp, ftp), ssh protocol for connection, etc.

Regarding the model installation, the necessary steps are the following:

- compilation all the necessary external libraries and tools for file managing (grib, grib2, netcdf, cdo, nco, fieldextra)
- availability of all the necessary external parameters files (topography, lakes, land use, land-sea mask...)
- availability of the various namelists
- compilation of interpolation program INT2LM
- compilation of each COSMO version to be tested

## Phase II: Configuration of test runs

The 7km version of the COSMO model will be used for these tests, following the operational resolution in most meteorological services. The forecast period of each daily run will be 72 hours, on one daily cycle based on the 00UTC initializing data. The simulation period for each test is one month for summer and one month for winter season (two months total), depending on the code changes that will be implemented in each model version and on the expected impact on model performance. The initial and boundary data will be provided by the ECMWF IFS system.

## Phase III: Model Output Verification

The model verification will be generated using VERification System Unified Survey (VERSUS) software. VERSUS is LAMP open source software. **LAMP** is an acronym referring to the first letters of Linux (operating system), Apache HTTP Server, MySQL (database software) and PHP, principal components to build a viable general purpose web server.

For this software is necessary to have a linux virtual machine or a new linux cluster with administration profile for an easier installation of the packages used by VERSUS like MySql, PHP, R, Jpgraph etc. This implies the use of a separate machine than the one used for the COSMO model execution, but the two systems need to have direct connection for the data transfer.

#### **Phase IV: Additional steps**

After the initial phases are completed, the testing methods will be extended to include:

- run the model at higher horizontal resolutions;
- use data assimilation cycle;
- set-up a wider simulation area;
- perform additional verification activities;

#### **Use of ECMWF computer resources, software and data infrastructure**

The computer resources will be used for running the COSMO model and for model verification using VERSUS software. netcdf, grib\_api and R utilities will be necessary for this project. The data (model outputs) obtained from the experiments will be stored locally in the ECFS system. Arrangements will be made for space availability.

Also, to set-up and properly run the VERSUS software, **a dedicated machine at ECMWF** or the new linux cluster that will replace the actual ECGATE (preferred option) is required in order to activate the **necessary platform for web services** (like APACHE, Web Browser, PHP typical of a LAMP system) even if "for internal use only" (no need of Internet surfing).

Because not all the consortium members are also ECMWF participating countries, during this project the special access rights should be provided to them, restricted to the activities connected with the project tasks as they were described above.

#### **Technical characteristics of the codes**

In the framework of this special project, the following F90 codes will be used:

- “INT2LM”, an interpolation program which performs the interpolation from coarse grid model data to COSMO initial and/or boundary data. The ECMWF IFS files will be used as LBC data.
- “COSMO”, the code performing the actual numerical weather prediction with the non-hydrostatic limited-area atmospheric prediction model COSMO. This code has been designed for both operational forecasts and various scientific applications on the meso-beta (from 5 to 50 km) and meso-gamma (from 500 m to 5 km) scale. COSMO model is based on the primitive thermo-hydrodynamical equations describing compressible flow in a moist atmosphere. The model equations are formulated in rotated geographical coordinates and a generalized terrain following height coordinate. A variety of physical processes are taken into account by parameterisation schemes.
- The VERSUS software installation will follow the specifications of the available machine. Together with the main software, all the necessary accompanied software (R language, grib\_api, SWING, BufrDC) will also be installed and appropriately configured.

#### **Deliverables:**

Detailed guidelines for the proper use and execution of each NWP test using this platform, will be prepared. A detailed description of all steps will be included, from the compilation of a new COSMO model testing version to the final production of the graphics of the statistical scores extracted.