Contribution ID: **31** Type: **Oral**

Weather multi-model and multi-analysis ensemble forecasting on the Grid

Wednesday 4 March 2009 14:00 (20 minutes)

A common problem in weather forecasting derives from the uncertainty related to the atmosphere's chaotic behaviour. A well-known approach to deal with this is to base the final forecast not only on the predictions of one model (deterministic forecast) but on an ensemble of forecasts that is produced by running an individual model using a range of perturbed initial conditions (multi-analysis forecasting) or by running multiple models using the same initial conditions (multi-model forecasting).

Impact

The ability to run ensemble forecasts based on four different weather models and multiple initial conditions would be extremely difficult without the Grid. REFS will require daily ˜500 CPUs in order to produce timely results. Developing a production level application of this type is challenging for two reasons: the external dependency on NCEP servers and the inherent weakness of current grid infrastructure to support strict deadline applications with relatively high CPU requirements. In order to facilitate the execution and monitoring of the above models and their workflows, various generic support tools are being developed by the project. In many cases external high level software like GANGA is also used for job execution to increase the robustness and reliability of the system. The final toolset will potentially be beneficial for similar meteorological applications running for different regions, based on alternative models and utilizing variable initial and boundary data sources.

URL for further information

http://wiki.egee-see.org/index.php/SG_Meteo_VO

Conclusions and Future Work

The four models are currently pilot-tested on the grid performing multi-analysis ensemble forecasting. The next step will be the combination of all results to produce also multi-model weather forecasts. The final product of the application aims at assessing the probability of a particular weather event to occur and to provide this information to the authorities, the general public, etc, in order to help them make the necessary decisions based on this probabilistic information.

Keywords

meteorological models, ensemble forecasting, MM5, BOLAM, NCEP/ETA, NCEP/NMM

Detailed analysis

In the frame of the SEE-GRID-SCI EU funded project, we are developing the Regional scale Multi-model, Multi-analysis ensemble forecasting system (REFS). This system exploits four different numerical weather prediction models (multi-model system), namely BOLAM, MM5, NCEP/Eta, and NCEP/ NMM which are currently being ported on the Grid. The models will run for the same region many times, each initialized with various initial conditions (multi-analysis system). Among the models, BOLAM is a serial code whereas MM5, NMM and Eta

are parallelized with MPI.
The Grid is used to coordinate, collect and analyze the outputs from all models for the generation of probabilistic forecasts over the area of central and eastern Mediterranean. Initial and boundary data (atmospheric and sea conditions) are fetched daily from the National Center for Environmental Prediction (NCEP) in USA, where a global ensemble forecasting system runs daily.

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Session Classification: Earth Sciences

Track Classification: Planned or on-going scientific work using the grid