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Grid implementation and application of the WRF-ARW prognostic model

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In this work the implementation and deploying of the Advanced Weather Research and Forecasting (WRF-ARW) model on the SEEGRID-SCI grid infrastructure is presented. The goal of porting the model to the grid is to get more accurate and detailed forecast with operational speed-up on high-resolution model grids. The results and the application of the WRF model will be shown through the examples of the operational weather forecast, foehn effects over Banja Luka in Bosna and Hercegovina (BIH) and bora winds simulations over the Adriatic coast in Croatia.

Detailed analysis

The numerical weather prediction models, like WRF-ARW model, demand large execution time and resource allocation; therefore we need large parallel computation facilities, like the grid systems, in order to execute them. The idea of deploying the WRF-ARW model to the grid is that all of the model data, binaries and results, are stored on the grid storage elements while the submission and data manipulation scripts are installed on the grid user interface node. In order to store huge amount of data on the grid, we have created the storage scheme to store files and folders required or produced by the model. The storage scheme is implemented in the LFC catalogue, so that the data retrieving is independent of the storage where the data physically resides. All grid execution is controlled by the scripts responsible for model data collection, generating jdl files, submitting jobs and results collecting. These scripts integrate the glite tools for job submission and output retrieving and hide the grid complexity from the end users as much as possible. The biggest issues are to avoid jobs remaining in the queuing system and the copying time for large model data.

Conclusions and Future Work

We have achieved a great success in porting WRF-ARW model to the grid and improvements gained through deployment of the model increases the support and feasibility of new projects in the area of the SEE-GRID-SCI infrastructure and Earth Science community. Implementation of the WRF-ARW model on the grid infrastructure, increasing scientific research in regional scale particularly in the field of ecology. Some improvements in the model execution on the grid is to be done. In the plan are some new projects on this subject which will extend the model functionality and increase efficiency.

Impact

We have achieved significant progress in accelerating the model execution and simplicity of starting jobs on the grid. The weather forecast is now more accurate due to the increased grid resolution, while the execution time is significantly smaller than before. In our examples we have found that the benefits are not only in the reduced execution time (up to 30% for large enough number of CPUs) but also in the simultaneous runs of the same model. This is especially important in research activities when many similar jobs can be executed simultaneously on different grid CE that results in enormous speedup. For research purposes, the WRF model was used to show the increase of air temperature due to the Foehn effect, and to study the reasons of the

failure of the weather forecast for a local extreme situation, like a thunderstorm or hailstorm, which occurred in Banja Luka this summer without a clear weather forecast outputs. Also, the model was used for very accurate and detailed simulations of the bora wind over the north Adriatic. For the forecast purposes, the model is used for the daily weather prediction over BIH.

Keywords

Grid, meteorology, WRF/ARW, foehn effect, bora winds, weather research, SEEGRID-SCI

URL for further information

http://wiki.egee-see.org/index.php/WRF-ARW

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