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Long range air pollution transport over Europe, studied on the Grid

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The Danish Eulerian Model (DEM) is a powerful air pollution model, designed to calculate the concentrations of various dangerous species over a large geographical region (e.g. Europe). This is a huge computational task and requires significant resources of storage and CPU time. Parallel computing is essential for the efficient practical use of the model. However, it is not sufficient when a large number of experiments have to be done. A number of experiments for one year period were necessary to carry out in order to detect the set of the most important parameters, which have influence on certain specific pollutant (e.g. the ozone). The computational grid was used for this purpose. Promising results have been obtained within a reasonable time by using EGEE infrastructure. Overview of these results will be presented in this talk.

3. Impact

The most powerful supercomputers have been used in the past decade for the development and test runs of DEM. Both MPI and OpenMP standard tools have been used in order to achieve highest parallel efficiency without loosing portability. Parallel computing was the only possible technique in order to get real data results in real time, even for the simplest 35-species chemical scheme. With the development of the more sophisticated chemistry submodels (with 56 and 168 different chemical species respectively), it was no longer possible to obtain sufficient affordable parallel resources for all our experiments. That is why we have to use Grid technology as well. It allows us running several long experiments (for one year period) simultaneously on several EGEE cites. Parallelism via MPI was also used in these experiments.

4. Conclusions / Future plans

The Grid technology set up new horizons for use and further development of the Danish Eulerian Model. We consider it as very attractive and affordable, especially for the countries from Eastern Europe. Results show that parallel computing on the Grid is one of the most promising computing techniques, that could deal efficiently with such tasks.

Provide a set of generic keywords that define your contribution (e.g. Data Management, Workflows, High Energy Physics)

Environmental Model, Air Pollution, DEM, EGEE, Parallel Computing, MPI

1. Short overview

Large-scale environmental models are powerful tools, designed to meet the increasing demand in various environmental studies. The pollutants and other chemical species actively interact with each other and can be moved in a very long distance. All relevant processes should be taken into account. This makes the air pollution modeling a difficult computational task. The huge demand of computational resources has always been a limitation factor in the development and practical use of such models.

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