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Increased Computational Requirement of Meteorological and Crisis Applications

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Authors:Ladislav Hluchy, Ivana Bartokova, Juraj Bartok

We present application from domain of meteorology and crisis management we developed. Particularly, the IMS Model Suite - a complex software system designed to address the needs of accurate forecast of weather and hazardous weather phenomena, environmental pollution assessment and prediction of consequences of an accident. We discuss requirements on computational means and our experiences how to meet them by high performance computing. The process of a weather related hazard assessment and prediction of its consequences results in complex data-flows and work-flows among databases, models and simulation tools. A regional sandstorm pollution assessment and prediction requires building of dust source and strength database, running of 3D meteorological model as well as running of the dispersion model performing the simulation of the release transport and deposition of the pollutant with respect to the numerical weather prediction data, released material description, topography, land use description and user defined simulation scenario. Several post-processing options can be selected according to particular situation. Sandstorm modelling requires both high resolution and large scale meteorological modeling. High resolution enables to model precise wind in sand/dust uplift areas (local conditions) while large scale of simulation is needed to capture sand transport, which can be thousands of kilometers in a few days.

Wider impact and conclusions

This results in the model parameters optimization and more accurate simulation outputs. Having taken into account that the simulations are used for the aviation, road traffic and crisis management, even small improvement in accuracy of predictions may result in significant improvement of safety as well as cost reduction.

URL(s) for further info

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Description of work

The architecture of given application and its computational complexity makes is well suited for high performance computing.

We present useful and practical applications of technologies of high performance computing. The use of grid technology provides access to much higher computation power not only for modeling and simulation, but also for the model parameterization and validation. This results in the model parameters optimization and more accurate simulation outputs. Having taken into account that the simulations are used for the aviation, road traffic and crisis management, even small improvement in accuracy of predictions may result in significant improvement of safety as well as cost reduction.

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Primary author: Prof. HLUCHY, Ladislav (Institute of Informatics SAS, Bratislava)

Co-authors: Dr BARTOKOVA, Ivana (Insttute of Informatics SAS, Bratislava); Mr BARTOK, Juray (Institute of Informatics SAS, Bratislava)

Presenter: Prof. HLUCHY, Ladislav (Institute of Informatics SAS, Bratislava)

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