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Earth Science applications on Grid –advantages and limitations

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The civil society at large has addressed to the Earth Science community many strong requirements related in particular to natural and industrial risks, climate changes, new energies.... Our total knowledge about the complex Earth system is contained in models and measurements, how we put them together has to be managed cleverly... The technical challenge is to put together databases and computing resources to answer the ES challenges.
The main critical point is that on one hand the civil society and all public ask for certainties i.e. precise values with small error range as it concerns prediction at short, medium and long term in all domains; on the other hand Science can mainly answer only in terms of probability of occurrence. To improve the answer or/and decrease the uncertainties, (1) new observational networks have been deployed in order to have a better geographical coverage and more accurate measurements have been carried out in key locations and aboard satellites, (2) new algorithms and methodologies have been developed using new technologies and compute resources.
Numerous applications in atmospheric chemistry, meteorology, seismology, hydrology, pollution, climate and biodiversity were deployed successfully on Grid. In order to fulfill requirements of risk management, several prototype applications have been deployed using OGC (Open geospatial Consortium) components with Grid middleware. The Grid has permitted to decrease uncertainties by increasing the probability of occurrence via a larger number of runs. Some limitations are related to the combination of databases-outside the grid infrastructure- and grid compute resources; and to real-time applications that need resource reservation in order to insure results at given time.
As a matter of fact ES scientists use different compute resources according to the phase of their application are used to work in large projects and share their results. They need a service-oriented architecture and a platform of services and tools across Data, Grid, cloud and HPC infrastructures
The major lesson we learnt with Grid is the impact of e-collaboration among various scientific domains on the development of ES research in Europe.