

Overview of Earth Science activity in EGEE and Seismic applications

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Induction Tutorial

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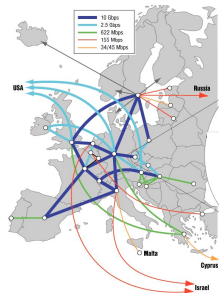
Earth Science in EGEE

Activities in **EGEE**:

Specific Service (SA), Joint Research (JRA) and Networking (NA).

Application Identification and Support (NA4):

- ▶ Pilot applications: High Energy Physics and Biomedical
- ▶ **Other applications:**
 - ▶ **Earth Science**
 - ▶ Academic: **ESR VO**
 - ▶ Industrial: **EGEODE VO**
 - ▶ Astrophysics: Magic, Plank, Antares, Nemo
 - ▶ Fusion
 - ▶ Digital libraries
 - ▶ Computational Chemistry
 - ▶ ...



Available resources

To make a clear distinction between resources and data available to industrial / academic partners, 2 distinct VOs have been created.

- ▶ 40 ESR members from
ESA/ESRIN, CRS4 (IT), DUTCHSPACE, KNMI (NL), IPSL/CNRS (FR), IPGP/CNRS (FR), IGUASSU (CZ), UNINE (CH), IISAS (SK), DKRZ, SCAI (DE), BAS (BG), GCRAS (RU).
- ▶ Computational resources
 - ▶ RB (WMS): 17 LCG + 2 gLite
 - ▶ > 510 To on SEs
 - ▶ \simeq 3845 CPUs on 30 sites

Earth Science Applications

- ▶ Earth Observations by Satellite (IT, NL, FR)
- ▶ Hydrology: SWIMED (IT, CH, TU, FR) and Flood (SK)
- ▶ Climate (DE)
- ▶ Pollution (BG)
- ▶ Meteorology and Space weather (RU)
- ▶ Mars Atmosphere (FR)
- ▶ Seismology (FR)
- ▶ Geosciences (EGEODE)

Earth Observations by Satellite

Ozone

ESA (IT), KNMI (NL), IPSL (FR), UTV (IT)

Atmospheric ozone chemistry by satellite observation and validation by the Lidar instrument.

Goal: Feasibility study for generic processing tools of satellite data. Validation of 7 years data of GNOME.

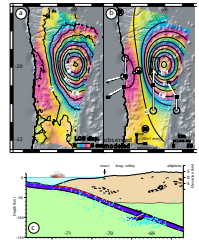


SAR satellite data

IGUASSU (CZ), ESA (IT)

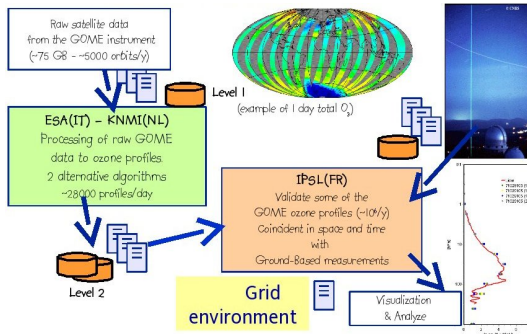
Distributed processing of large satellite images of Earth through ESA Web portal.

Goal: To port on the Grid existing Earth Observation (EO) processing tools of ESR/SAR and Envisat/ASAR satellite data for on demand higher information level products.



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Ozone Processing and Validation



Goal: Compute Ozone profiles from satellite observations (GOME/ESR), and validation of the profiles using Lidar data.

Challenge: Complex Algorithms, NNO (Neural networks), OPERA (Inversion), and large number of relatively small distributed data files.

Seismological Applications

Anelastic Wave Propagation – IPGP, UNIVERSITÉ DE PAU (FR)

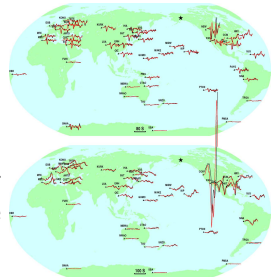
Computation of the propagation and attenuation of seismic waves from a fault rupture to a target site.

Goal: Compute synthetic broadband seismograms, integration into distributed seismological databases (Orpheus, Geoscope, Iris); prediction of site amplification for seismic risk assessment.

Earthquake source mechanisms – IPGP (FR)

Rapid computation of CMT solutions of major earthquakes from global seismic networks of the FDSN (IRIS, Geoscope, Geofon).

Goal: Provide source parameters of major earthquakes, integration in information systems.



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Anelastic Wave Propagation

Regional and Global wave propagation in 3D earth models using the Spectral Element Method (SEM) and point or extended earthquake sources.

Specifications: SpecFem3D ([D. Komatitsch](#)) has been parallelized using MPI and ported on the EGEE Grid using asynchronous communications.
I/O intensive: parallel I/O + local temporary storage on WNs.



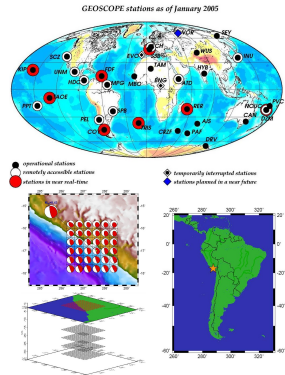
Challenge: on demand mobilization of a large number of CPU nodes on the Grid.

Earthquake source mechanism

Challenge: Solution in few hours after the earthquake; fast retrieval of seismological data from global permanent networks.

Specifications: Independant non linear inversion on a spatial 3D grid, statistical post processing analysis of the solutions.

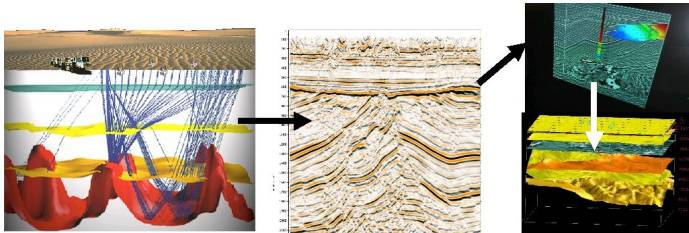
Note: Experimented on the EGEE Grid for various older data and now used for every occurrence of a major earthquake.



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Geosciences

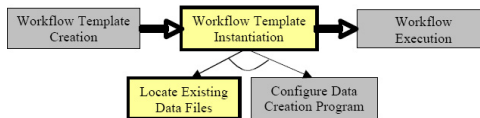
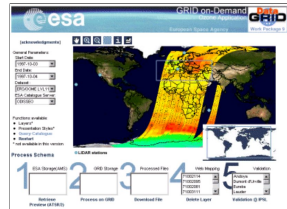
- ▶ Geocluster: Industrial application (400 modules) ported on the EGEE Grid Production Service (CGG).



- ▶ **EGEODE** VO (Expanding GEOsciences on DEmand): dedicated to industrial R&D in Geosciences and academic laboratories. License server and accounting.

Grid Integration with ES Web services and Workflow management

- ▶ Use Web services and Portal technologies to improve the workflow construction and submission processes in order to hide Grid complexity for ES users.
- ▶ Improve the ability to retrieve (Metadata search capabilities) and prepare observations stored on international distributed databases (Seismology, Geodesy, ...) for use in the workflow construction process.



Related Project: **DEGREE**

Dissemination and Exploitation of GRids in Earth science

Specific Support Action (SSA) project which aims to promote Grid thru a wide ES community, in order to increase the awareness and uptake of Grid technology and infrastructure.

Institute of Informatics, Slovak Academy of Sciences, Slovakia - IISAS

Centre National de la Recherche Scientifique, France - CNRS

Royal Netherlands Meteorological Institute, The Netherlands - KNMI

Université de Neuchâtel, Switzerland - UNINE

Center for Advanced Studies, Research and Development in Sardinia, Italy - CRS4

Fraunhofer Institute, Germany - SCAI

Geophysical Center Russian Academic Science, Russia - GCRAS

European Space Agency, Italy - ESA-ESRIN

Compagnie Générale de Géophysique, France - CGG

Dutch Space, The Netherlands - DUTCHSPACE

DEGREE: Some Challenges

Requirements of ES complex applications

- ▶ Global, regional, local applications
- ▶ Large historical distributed archives
- ▶ Near real-time access to data
- ▶ Intensive processing facilities for long term trends and forecast generation
- ▶ Integrate different data sources and types

Dissemination of Grid technologies

- ▶ Promote integration of Grid middleware with ES tools
- ▶ Evaluate technologies under development
- ▶ Fill the gap between scientific users and Grid technologies
- ▶ Enable ontology-based Metadata search and translation

Foster collaborations with Latin America (EELA)

Promote e-collaboration, exchange and sharing of distributed data, applications, algorithms, and processing tools.

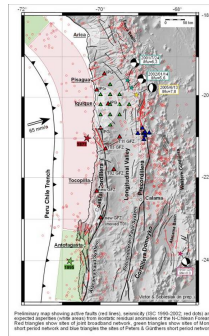
Information for technology research in Earthquake Science

- ▶ Earthquake monitoring and alert systems
- ▶ Rupture dynamics and anelastic wave model
- ▶ Site response and Earthquake mitigation
- ▶ Distributed databases; real-time information systems

Ongoing collaborations

- ▶ Chili: CNRS / Universidad de Chile (Santiago)
- ▶ Mexico: CNRS / UNAM (Mexico city)
- ▶ Venezuela: MAE / FUNVISIS (Caracas)

⇒ Extension to atmospheric sciences.



More Information

- ▶ EGEE: <http://public.eu-egee.org>
- ▶ ESR wiki: <http://esr.knmi.nl/twiki/bin/view/ESR>
- ▶ ESR VOMS:
<https://mu4.matrix.sara.nl:8443/voms/esr>
- ▶ DEGREE: <http://www.eu-degree.org>
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VO Manager



Merci de votre attention!!