NEW DEVELOPMENTS OF THE GEOSCOPE PROGRAM

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The GEOSCOPE Observatory

The GEOSCOPE Observatory was launched in 1982. It consists of a global seismic network and a data center. The 31 GEOSCOPE stations are installed in 19 countries, across all continents and on islands throughout the oceans. They are equipped with three component very broadband seismometers (STS1 or STS2) and 24 or 26 bit digitizers, as required by the Federation of Seismic Digital Network (FDSN). In most stations, a pressure gauge and a thermometer are also installed. In 2010, RER station has been upgraded to new STS1 standard and a new station – RODM – has been installed in Rodrigues Island in the Republic of Mauritius in the Indian Ocean.

Currently, 21 stations send data in real or near real time to the GEOSCOPE Data Center. Continuous data of all stations are collected in real time or with a delay by the GEOSCOPE Data Center in Paris where they are validated, stored and made available to the international scientific community. Real time data are also made accessible to earthquake detection centers and tsunami warning centers using seedlink protocol. GEOSCOPE Data Center is networked to the French virtual data center, FOSFORE/RESIF, in order to give unique access to French seismological data. In Europe, GEOSCOPE Data Center is one of the 4 primary nodes of EIDA (European Integrated waveform Data Archive) which consists of a distributed archive and database for all continuous digital waveform recordings of the Euro-Med region (NERIES project).

GEOSCOPE Broadband Seismological Network

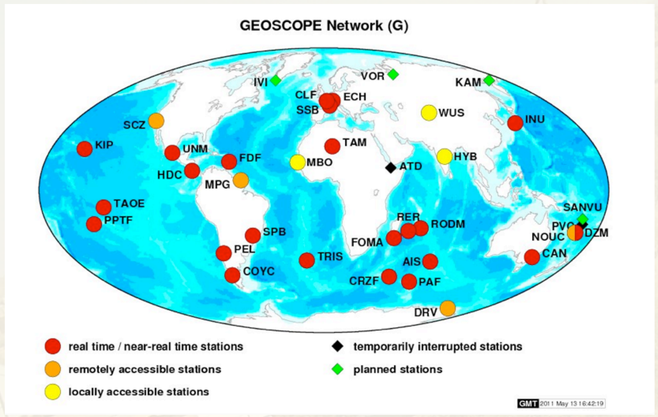


***Figure 1**: GEOSCOPE network configuration. In 2010, RER was upgraded and RODM was installed. Upgrades have started for COYC, PEL, ATD.*

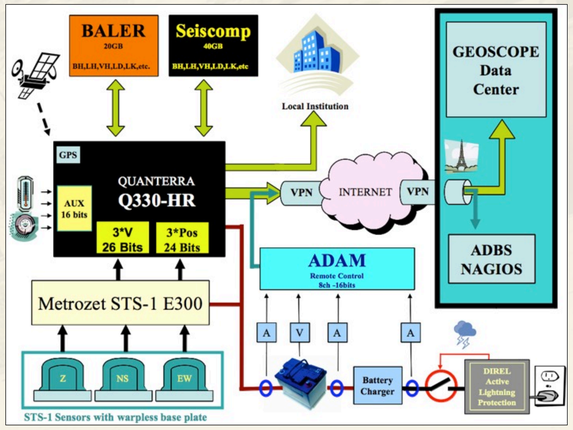


***Figure 2**: Seismic signals of the 3 STS-1 sensors are digitized with the Q330HR, recorded locally on a SeisComP Box and/or a baler and sent in real time to the GEOSCOPE Data Center via seedlink protocol.*

RER Upgrade

In September 2010, RER station on La Réunion Island in the Indian Ocean was upgraded to GEOSCOPE new STS1 standard : Metrozet E300 electronics and warpless base plates. The orientation of the station was also checked with a gyrocompass.
Two months of noise analysis have shown thatt he long period noise on the horizontal components is decreased by 5 to 10db.

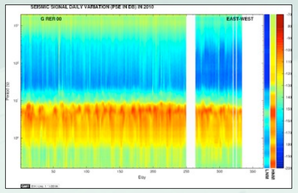


***Figure 9**: Effect of the upgrade on the station noise variation for year 2010 on the East component*

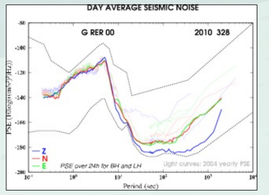
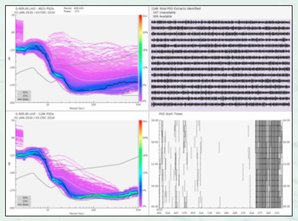


***Figure 10**: Noise spectra for day 328 (after upgrade)*



The vertical component has also been improved and the Low Noise Model is almost reached every day for periods from 20s to 1000s

***Figure 11**: PQLX analysis of year 2010 on the vertical component: selection of low noise long period PSDs matches post upgrade traces.*

New Website – http://geoscope.ipgp.fr

The GEOSCOPE website was completely redesigned in 2009 and was opened in December 2009. It was developed with CMS Joomla.

Features :
- Station information (Google Maps, instrumental responses, Seed comments, data continuity, daily and yearly noise plots, pictures …)
- News (station interventions, earthquakes)
- Data availability: real-time data, earthquake data, continuous and validated data, metadata, statistics
- Data access tools: NetDC request form, BQI and GOAT (Bud Query Interface and Gap/Overlap Analysis Tool, provided by IRIS DMC), Dataless query
- Observatory information (contacts, team, history)

Future developments :
- Improvement of the access to earthquake related data: development of a map/form based search interface
- Implementation of SeismiQuery for GEOSCOPE database (based on IRIS DMC SeismiQuery)
- Implementation of PQLX (PASSCAL Quick Look eXtended)

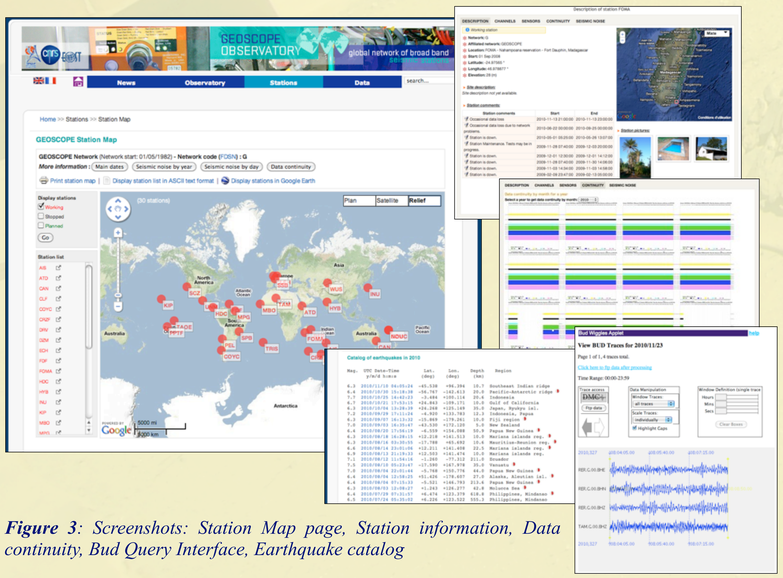


***Figure 3**: Screenshots: Station Map page, Station information, Data continuity, Bud Query Interface, Earthquake catalog*

Seismic Noise

Average seismic noise level per day computed using the European Grid Infrastructure. Data consists of 24 hours of signal x 365 days x 27 years (1982 to 2010) x 31 stations x 2 channels x 3 components.

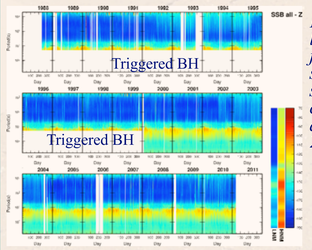


***Figure 4:** Seismic noise level as a function of julian day and period since 1988 for SSB station. Noise PSE is not computed for triggered data (BH channel before 2000).*

Seismic signal robust power spectra estimate is automatically computed every day (at D+3) for the real time stations and whenever data are available for the other stations. Plots are visible on http://geoscope.ipgp.fr.

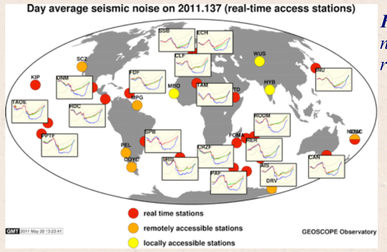


***Figure 5**: Daily noise variations for real time data*

Data Center

The GEOSCOPE Data Center receives, validates, archives and distributes data from the GEOSCOPE broadband seismological network. Users have free and open access to data in real/near real time, to validated continuous waveforms and meta data and to a selection of seismograms corresponding to large earthquakes.

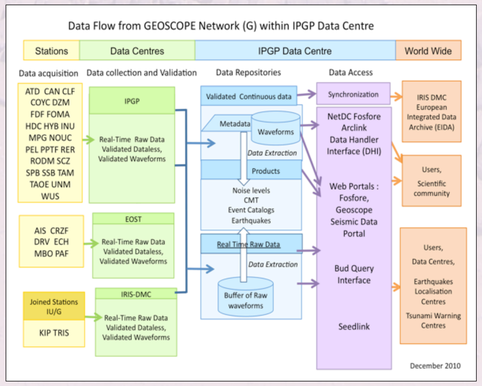


***Figure 6:** Data Flow from GEOSCOPE Network*

28 years of continuous validated data are available at the GEOSCOPE/IPGP Data Center. Most stations transmit data in real/near real time using the seedlink protocol from SeisComP (developed at GEOFON/GFZ, Germany). Real time data are automatically available from a seedlink public server.
The GEOSCOPE Data Center is one of four primary archiving data nodes of EIDA (European Integrated waveform Data Archive) which consists of a single distributed database for all continuous broadband seismic data in Europe. All data are available through the Seismic Data Portal (http://www.seismicportal.eu)

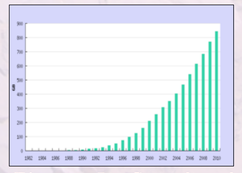


***Figure 7:** Cumulated GEOSCOPE data archive*

***Figure 8:** GEOSCOPE data distribution*

Warpless Base Plate New Design for STS1

***Figure 12**: Set of 3 warpless base plates with aluminum jar*

GEOSCOPE design of the STS1 warpless base plates has evolved : the old unsafe glass bell is now replaced with aluminum jar of 1cm thickness sealed by an O-ring gasket. Vacuum can be set as low as 10mbars, improving thermal insulation as well as reducing moisture and thus, corrosion risk. Dimensions and connectors placements have been modified to improve assembly and test.

New Station : Rodrigues Island - RODM

In November 2010, a new station was installed in Rodrigues Island, Republic of Mauritius, in the Indian Ocean.
The station is equipped with:
- STS2 on a granite plate with a cooking pot and thermal insulation (*Stuttgart* shielding)
- Q330HR + Baler + SeisComP PC + remote monitoring
- Active Lightning protection and backup power on batteries
- VPN box and ADSL link (Satellite link from the Island to Internet)

***Figure 13**: Station insulated door and STS2 with the granite plate on the pier, before final insulation*

Current Projects

Several upgrades and two new installations are planned for 2011:
- Chile stations COYC and PEL will be upgraded to the new STS1 standard
- Djibouti ATD station will be upgraded
- Brazil station SPB is now repaired (fiber optic destroyed by rock fall) and will be upgraded with new STS1 standard
- A new STS2 station is under construction in Vanuatu and will replace PVC station destroyed by fire
- GEOSCOPE is part of the GLISN project and will install a STS1 station in Greenland.