The GEOSCOPE Program
State of the art as of July 2007

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I - HISTORY

The GEOSCOPE program led by the Institute of Physics of the Earth of Paris (IPGP) was launched in 1982 by the National Institute of Sciences of Universe (INSU), a department of the French National Center of Scientific Research (CNRS). The purpose was the installation of about 25 seismic stations well distributed worldwide (in particular in the southern hemisphere), in the standard configuration defined by the FDSN (very broad-band 24 bit, continuous recording at 20 sps).

II - STATIONS

The GEOSCOPE program is operating 28 *digital 3-component very-broadband* stations (figure 1).
In terms of site locations, the aim of the GEOSCOPE program is almost fulfilled. We re-installed the Chinese station WUS with modern equipment in October 2004. We plan to install two sites in Russia, to install a new station at high latitude in Vorkuta and to move and upgrade the SEY station to north of Kamchatka (KAM). Our challenge is to get data in real-time.

III – GEOSCOPE and the real-time: in 2007 eleven stations in real-time and two in near real-time

Data from large events are teletransmitted from some stations (via dial-up phone line or through Internet) and become available to public within one day. Eleven stations provide data in real-time (RT <1minute) and two stations in near real-time (NRT <2h).
The installation of new 24bit dataloggers (Q4128, Q330-6, DASE datalogger) allows us to receive data in real time from the following stations:

- DZM Dzumac, New Caledonia, a joint DASE/CTBTO/GEOSCOPE station (NRT)
- FDF Fort de France, French West Indies (RT)
- SSB St Sauveur-Badole and ECH Echery in France (RT)
- KIP Kipapa, Hawaï and TRIS Tristan da Cunha, joint GSN/IRIS/USGS/GEOSCOPE stations (RT)
- RER La Réunion and PAF Kerguelen in the Indian Ocean (RT)
- TAOE Marquesas Islands, a joint DASE/GEOSCOPE station (NRT)
- ATD Djibouti, a joint CTBTO/CERD/G station (RT)
- SPB Sao Paulo, Brazil (RT)
- CAN Canberra, Australia, a joint ANU/GA/G station (RT)
- TAM Tamnarasset in Algeria (RT)

The data are now available in near real-time in the Data Center in Paris and can be downloaded from: http://geoscope.ipgp.jussieu.fr/BUD_QUERY/bud_stuff/bud/bud_start.pl

The GEOSCOPE data of the real-time stations are included into the real-time stations of the FDSN and available as well at the IRIS Data Center .

IV- DATA AVAILABILITY

The GEOSCOPE Data Center has been completely reorganized around RAID disks system in 2000, where data from the period 1982-2005 are stored after data quality control. There are three main different media, 36 CD-Roms for the data between 1982 and 1992, local disks for recently teletransmitted data, and RAID disks for all data from 1982 up to now. The most recent data (RT and NRT) are stored before quality control (Raw Data) and are accessible. The GEOSCOPE data can be obtained through following ways:

A) GEOSCOPE AutoDRM: the NetDC procedure (Networked Data Centers)

The necessity of distribution of large datasets to the seismic community leads to a new form of shared cooperative environment between different Data Centers. The NetDC idea makes the access to data transparent to users who should not bother about where the data are actually located. The routing of data requests is solved by the coordination of the Data Centers.

Some Data Centers are currently networked (IRIS, GEOSCOPE, NCEDC (UC Berkeley) and ORFEUS) with the NetDC device. You can send a request (netdc@ipgp.jussieu.fr) and download the INVentory, the instrumental RESPonses and the DATA directly on your computer.

B) Anonymous ftp for recent events

Remote accessibility is possible from 15 teletransmitted stations by telephone line or through Internet link. You can get data for all recent events with magnitude Ms > 6.3 or with particular scientific interest (location, focal depth) within 1-2 days.

C) CDROM production (for data from 1982 to 1992)

All data from March 1982 (82.061) to July 1992 (92.189) are written on CD-Roms in old SEED format and the whole collection (37 CD-Roms) has been distributed worldwide without charge to about 200 users in the period range 1992-1996. In 1997, the CD-Rom production has been stopped because of the dominance of Internet as the data exchange tool.

V - OTHER PRODUCTS

A- THE GEOSCOPE STATION BOOK

The updated version of the station-book is available on the web site. It references the technical details for each station (http://geoscope.ipgp.jussieu.fr). The history of each station is described with information about the parent organization, the network affiliation, the vault conditions, the site description, the instrumentation, the sensors, the primary and auxiliary channels such as microbarometers and thermometers, the dates of upgrade, and the sensitivities in the flat part of the band-pass of the instrumental responses. The corresponding plots can be easily downloaded.

B -GEOSCOPE CMT DETERMINATION

An inversion method for the fundamental mode Rayleigh wave spectra has made possible the quick determination of the mechanism and the seismic moments. It's been proved that a correct CMT can be retrieved using few stations (GEOSCOPE and IRIS). This determination is done for all events with Ms > 6.5 from the GEOSCOPE stations data available within one day.
(http://geoscope.ipgp.jussieu.fr/CMT/cmt.html).

C- THE SEISMIC NOISE LEVEL PLOTS of all GEOSCOPE stations

The estimate Power Spectral Density plots have been computed for the years 1995 and 2004. They are available on the Web site, for the 3 channels VH, LH and BH, and the 3 components.
The average seismic noise level per day is computed for every GEOSCOPE station every day for the date J-8. The procedure is ***fully automatic*** and can be used for any seismic data in SEED format. It is also used to check the data continuity and accessibility. For the non real time stations, daily seismic noise estimate is computed whenever data are available. The plots are visible at the Web site:
http://geoscope.ipgp.jussieu.fr/STATIONS/bruit.html

VI – PRESENT DEVELOPMENTS

A – REAL TIME TRANSMISSION OF CONTINUOUS DATA

In order to be ready for the next step which will consist in gathering data towards our Data Center in real-time, we have been replacing old Streckeisen digitizers with new Quanterras (Q330HR). Main goal is to link the maximum number of stations to the Data Center for real time and continuous transmission of data in few years. We are able to upgrade 3 or 4 stations per year, giving priority to those with an easy permanent link to Paris.

B - GEOSCOPE AND THE DEVELOPMENT OF MULTIPARAMETERS STATIONS

We plan to equip all our stations with microthermometers, microbarometers, in order to clean the seismic signal and to study potential correlations between the seismic signal and these environmental parameters. Some of our stations have long seismic time series. Removing the atmospheric pressure effect is absolutely necessary for scientists using low frequency free oscillation modes.

C – GEOSCOPE and the STS1 seismometers

Most GEOSCOPE stations are equipped with STS1 seismometers, only a few ones with STS2 seismometers. Because we plan to move some stations from the northern hemisphere to the southern one, in order to fill a geographical instrumental gap, we are fixing or upgrading a lot of STS1 seismometers. We plan also to re-install 3 STS1 at BNG (Bangui, Republic Centrafrican).

D - GEOSCOPE AND THE CTBTO

In the framework of the CTBTO (Comprehensive Test Ban Treaty Organization) and the IMS (International Monitoring System), two GEOSCOPE stations have been chosen, as auxiliary stations, and upgraded in cooperation with GEOSCOPE.
DZM (Dzumac in New Caledonia) and ATD (Arta Tunnel, Djibouti) are providing data in real time http://geoscope.ipgp.jussieu.fr/BUD_QUERY/bud_stuff/bud/bud_start.pl

E – GEOSCOPE AND TSUNAMI WARNING

As part of a new French initiative CNATOI (Centre National d'Alerte aux Tsunamis dans l'Océan Indien), GEOSCOPE is planning to use continuous real time data from 7 stations in the Indian Ocean (5 existing stations and two additional sites) to monitor the seismic activity in this region with a purpose to incorporate this information in the future tsunami warning system. Presently the data are made available for the Tsunami Warning Centers PTWC (Pacific Tsunami Warning Center) in Hawaï and JMA (Japan meteorological Agency) in Japan, GITEWS (German-Indonesian Tsunami Early Warning System) and ATWS (Australian tsunami Warning System).

VII – The GEOSCOPE Group

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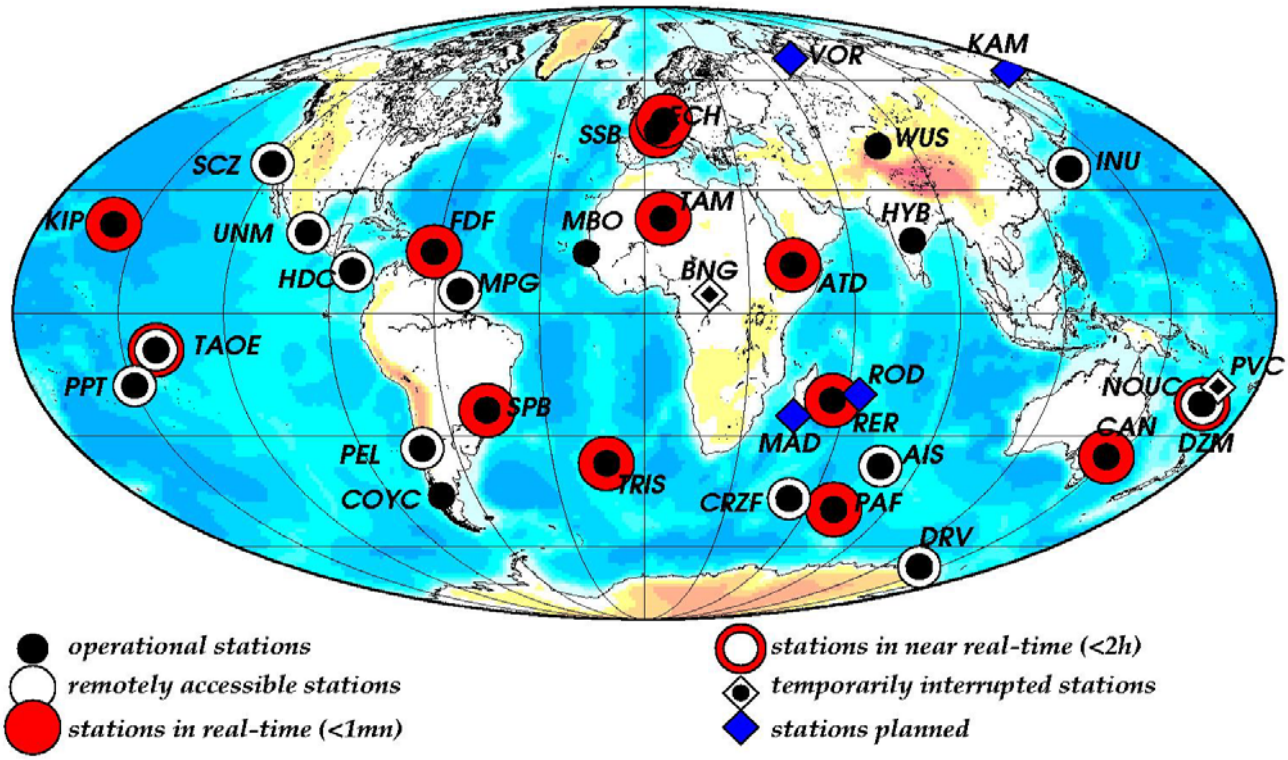
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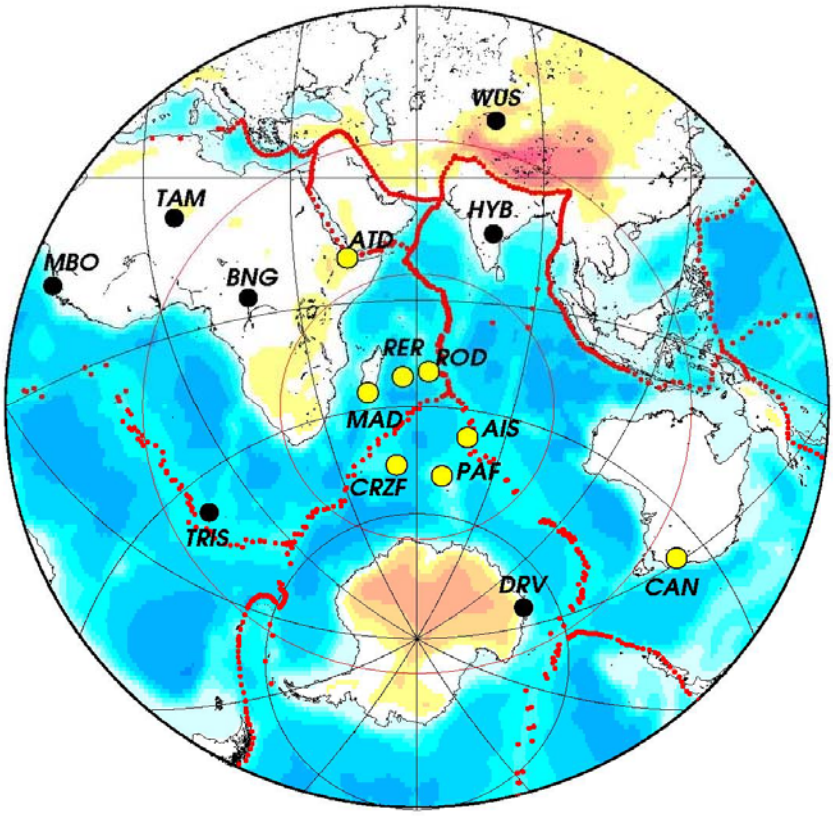
MAD
PEL
AIS
TRIS
COYC
CRZF
PAF
DRV
operational stations
remotely accessible stations
stations in real-time (<1mn)
stations in near real-time (<2h)
temporarily interrupted stations
stations planned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GEOSCOPE stations as of July 2007

	Station	Location	Latitude	Longitude	Elevat of sensor m	STARTED VH m/s^2	VH - MH m/s^2 m/s	BH – VH m/s	Station
	AIS	Amsterdam Island	37.797 S	77.569 E	35.9		25 Dec 1993	7 Jan 1999	AIS
RT	ATD	Arta tunnel, Djibouti	11.530 N	42.847 E	610.0			7 Jul 1993	ATD
RT	CAN	Canberra, Australia	35.321 S	148.999 E	650.0			27 Nov 1987	CAN
I	COYC	Cohyaique, Chile	45.573 S	72.081 W				20 Dec 2004	COYC
	CRZF	Port Alfred, Crozet Islands	46.430 S	51.861 E	140.0	13 Mar 1986	27 Jul 1988	28 Nov 1993	CRZF
	DRV	Dumont D'Urville, Antarctica	66.665 S	140.010 E	40.0	1 Feb 1986	1 Feb 1988	25 Jan 1991	DRV
NRT	DZM	Dzumac, New Caledonia	22.072 S	166.444 E	878.0			1 Sep 2003	DZM
RT	ECH	Echery, France	48.216 N	7.158 E	580.0			8 Nov 1990	ECH
RT	FDF	Fort de France, West Indies	14.735 N	61.143 W	467.0			25 Nov 1998	FDF
I	HDC	Heredia, Costa Rica	10.000 N	84.112 W	1150.0			8 Mar 1997	HDC
	HYB	Hyderabad, India	17.417 N	78.553 E	510.0			15 Jan 1989	HYB
RA	INU	Inuyama, Japan	35.350 N	137.029 E	132.3			4 Mar 1987	INU
RT	KIP	Kipapa, Hawaii, USA	21.423 N	158.015 W	70.0		17 Apr 1986	26 May 1988	KIP
	MBO	Mbour, Senegal	14.391 N	16.955 W	3.0	1 Sep 1985	30 Nov 1987	05 Nov 2002	MBO
RA	MPG	Montagne des Pères, French Guiana	5.110 N	52.644 W	147.0			3 Jul 2000	MPG
RA	NOUC	Port Laguerre, New Caledonia	22.101 S	166.303 E	112.3	21 Mar 1988	8 May 1989	2 Nov 1992	NOUC
RT	PAF	Port aux Français, Kerguelen	49.351.S	70.213 E	17.0	1 Jan 1983	28 Jan 1988	28 Dec 1992	PAF
I	PEL	Peldehue, Chile	33.146 S	70.675 W	660.0			4 Oct 1995	PEL
RA	PPT	Papeete, Tahiti	17.569 S	149.576 W	340.0	31 May 1986	24 Nov 1986	5 Oct 1991	PPT
No Data	PVC	Port Vila, Vanuatu islands	17.740 S	168.312E	40.0		1 Jun 1994	23 Mar 1995	PVC
RT	RER	Rivière de l'Est, La Réunion isl.	21.159 S	55.746 E	834.0		10 Feb 1986	4 Jul 1990	RER
I	SCZ	Santa Cruz, California, USA	36.598 N	121.403 W	261.0	11 Jun 1986	27 Sep 1987	27 Sep 1991	SCZ
No Data	SEY	Seymchan, Russie	62.933 N	152.373 E	206.0			21 Sep 1990	SEY
RT	SPB	Sao Paulo, Brazil	23.592 S	47.432 W	85.0			17 Jun 1996	SPB
RT	SSB	Saint Sauveur Badol, France	45.279 N	4.542 E	700.0	2 May 1982	14 Jan 1985	22 Apr 1987	SSB
RT	TAM	Tamanrasset, Algeria	22.791 N	5.527 E	1377.0	16 Nov 1983		11 Mar 1990	TAM
NRT	TAOE	Marquesas I., France	8.855 S	140.148 W	800.0			30 Oct 2005	TAOE
RT	TRIS	Tristan Da Cunha, UK	37.068 S	12.315 W	55.0			3 Mar 2004	TRIS
I	UNM	Unam, Mexico city, Mexico	19.329 N	99.178 W	2280.0			6 Jun 1990	UNM
	WUS	Wushi, Xinjiang, China	41.199 N	79.218 E	1457.0			31 Oct 1988	WUS

RT = Real-Time <1mn NRT = Near Real-Time <2h RA = Remotely accessible (phone line) I = Internet

Tableau 1

Previous GEOSCOPE stations

					STARTED			
Station	Location	Latitude	Longitude	Elevat.	VH m/s/s	VH - MH m/s/s – m/s	BH – VH m/s – m/s	STOPPED
AGD	Arta Grotte, Djibouti	11.529 N	42.824 E	450.0	9 Mar 1985	6 Aug 1987		9 Dec 1990
BNG	Bangui, Centrafrica	4.435 N	18.547 E	378.0	11 Dec 1987	12 Sep 1988		31 Dec 2000
CAY	Cayenne, French Guiana	4.948 N	52.317 W	25.0	22 Jul 1985	9 Dec 1985		28 Sep 1991
EVOP	Evora, Portugal	38.532 N	8.013 W	0.0			7 Feb 1996	30 Jun 1997
GRC	Garchy, France	47.295 N	3.074 E	191.0			21 Jun 2000	19 Dec 2002
HDC2	Heredia, Costa Rica	10.027 N	84.117 W	1253.2		25 Sep 1987		1 Mar 1989
KOG	Kourou, French Guiana	5.207 N	52.732 W	10.0			2 Jul 1994	19 Dec 2000
NOC	Noumea, New Caledonia	22.284 S	166.432 E	5.0	8 Dec 1985			27 Oct 1987
PCR	Plaine des Cafres, La Réunion	21.196 S	55.578 E	1520.0	25 Jul 1982			9 Feb 1986
SEY	Seymchan, Russie	62.933 N	152.373 E	206.0			21 Sep 1990	2 Feb 1994
WFM	Westford, Massachussetts, USA	42.611 N	71.491 W	87.5	17 May 1984	9 Apr 1986		27 Apr 1994

Planned stations

Station	Location	Latitude	Longitude	Year
VOR	Vorkuta, Russia	67.0 N	75.0 E	2007
KAM	Kamchatka	~67.0 N	~160.0 E	2007

Tableau 1