



NERIES
JRA4

TASK A: SITE SELECTION

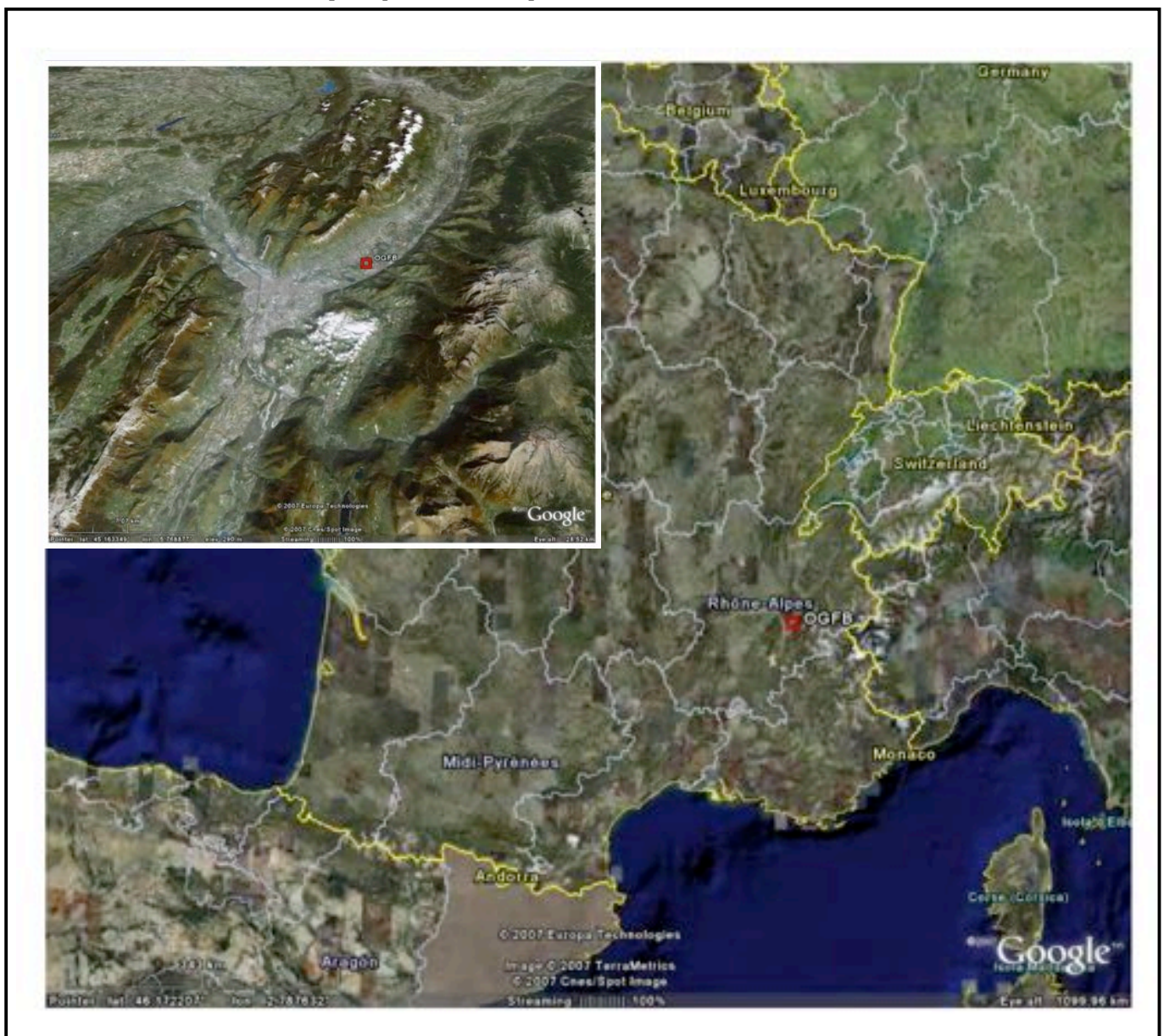
Monograph of the station
(Montbonnot Borehole)

Station code
(OGFH)

General Site Information

Code if the station code is less than 5 char. use "underscore"	OGFH
Site Name-Location	Montbonnot – Grenoble (38)
Surface Geology [Rock, Stiff, Soft] = [Rk/St/Sf]	St

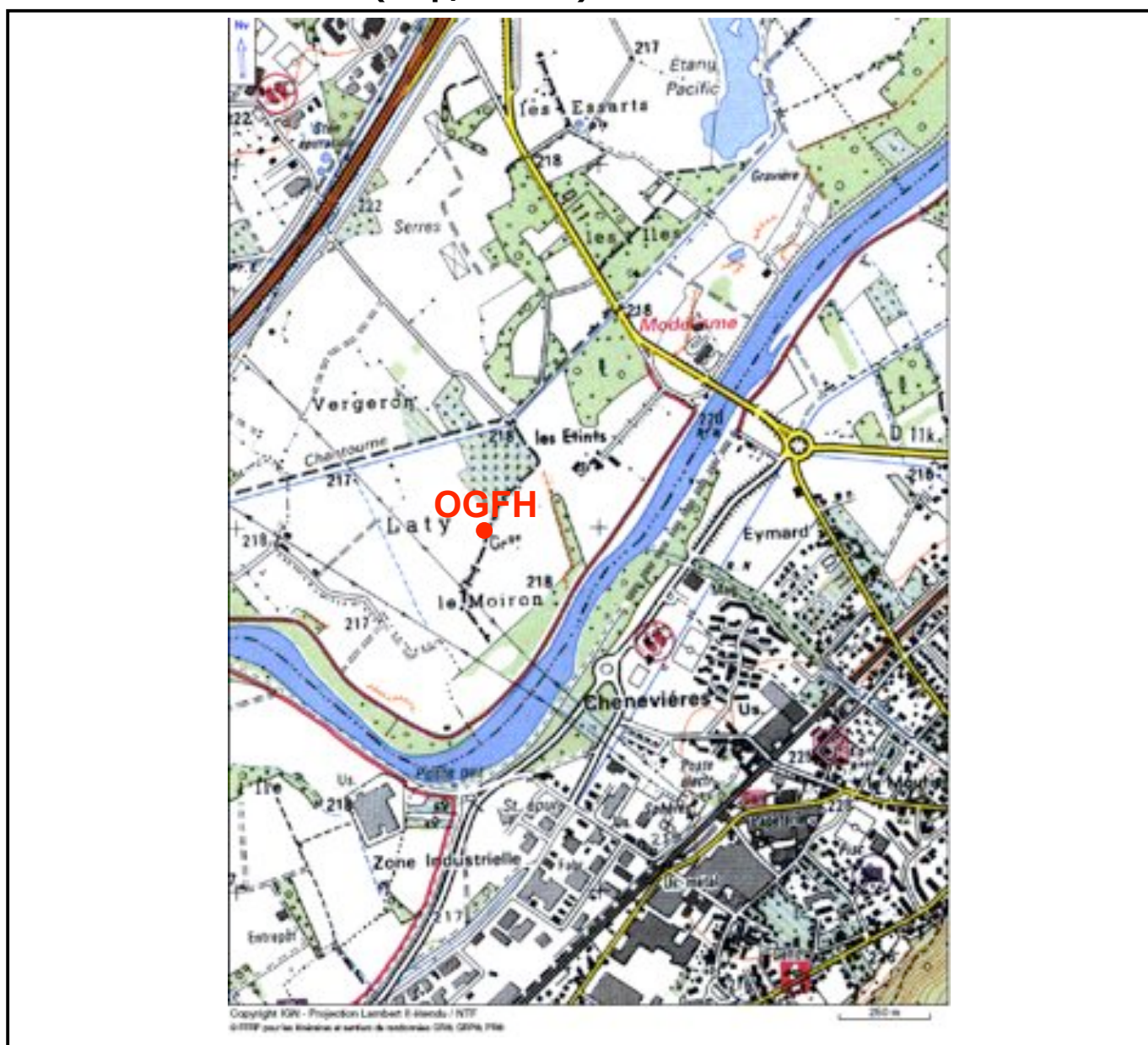
Location of the site (Map/Picture)



Geographical Data

Latitude	45.2088
Longitude	5.8210
Altitude (m)	220

Location of the station (Map/Picture)



Site Description – Housing

Picture Picture (aerial,satellite, photo, etc.) availability [Y/N]	Y
Free Field [Y/N]	Y
Type of network [Permanent network, Temporary Network] = [Per/Tem]	Per
Instrument location to fill only if Free Field=N [Building, Dam, Bridge, Other] = [Bu/Da/Br/Ot]	
Orientation [NS, WE, or azimuth in degrees from N]	0
Address	La Chantourne, Montbonnot

Housing of the station (photo)



Earthquake Recordings

Type of Instrument [Analogic/Digital] = [A/D]	D
Present Condition [Active/Removed] = [Act/Rem]	Act
Date of activation (AAAA/MM/GG)	2000/12/19
Date of deactivation (AAAA/MM/GG)	
Strong Motion Records [Y/N]	Y
<i>number of records with $PGA < 0.1$</i>	294
<i>number of records with $PGA \geq 0.1$</i>	0
<i>maximum recorded PGA (g)</i>	0.005
Date of Max PGA recorded	2004/04/26
Source	ReNaSS

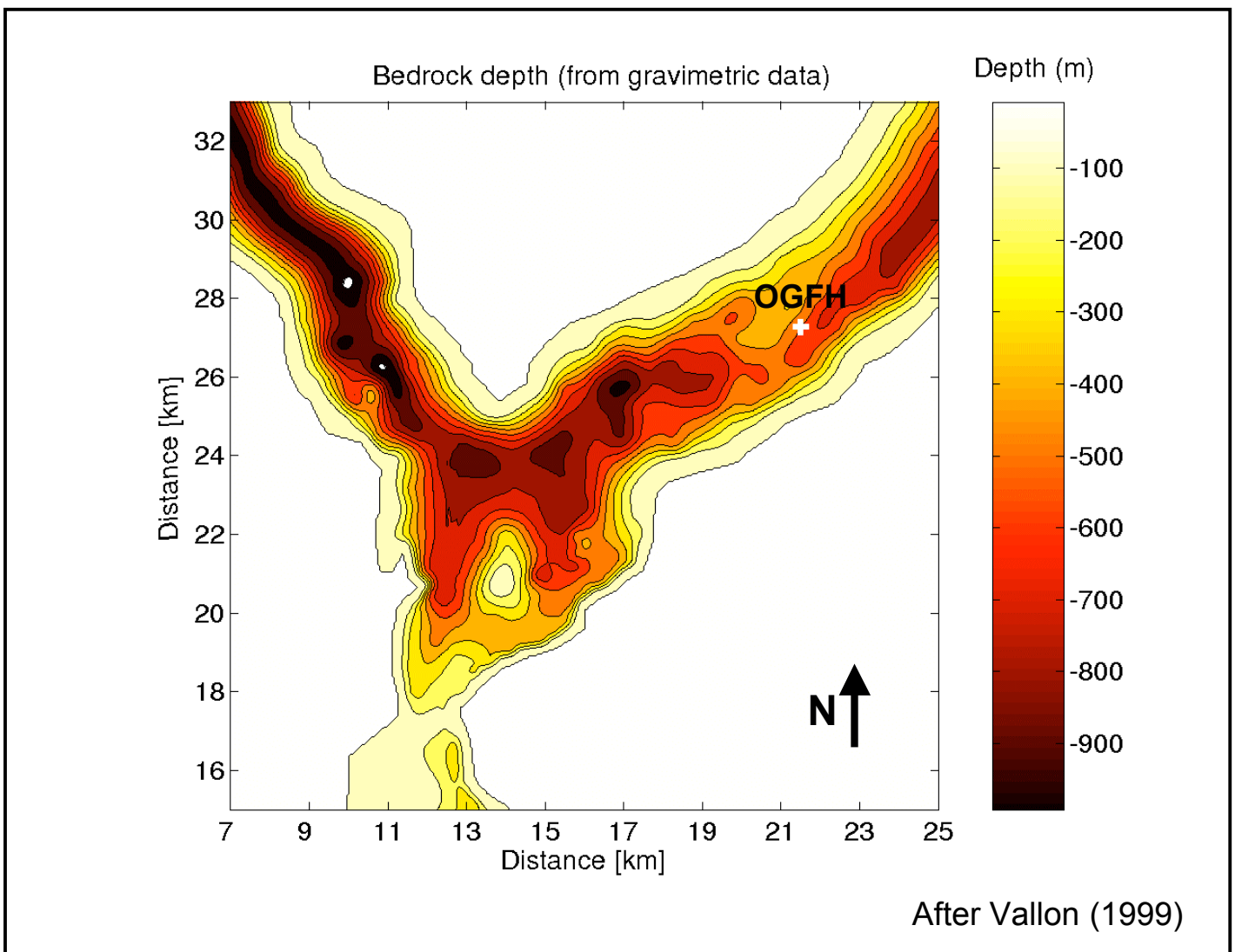
Earthquake information (Map/table for epicenters, focal mechanisms, ...)

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Morphological Data

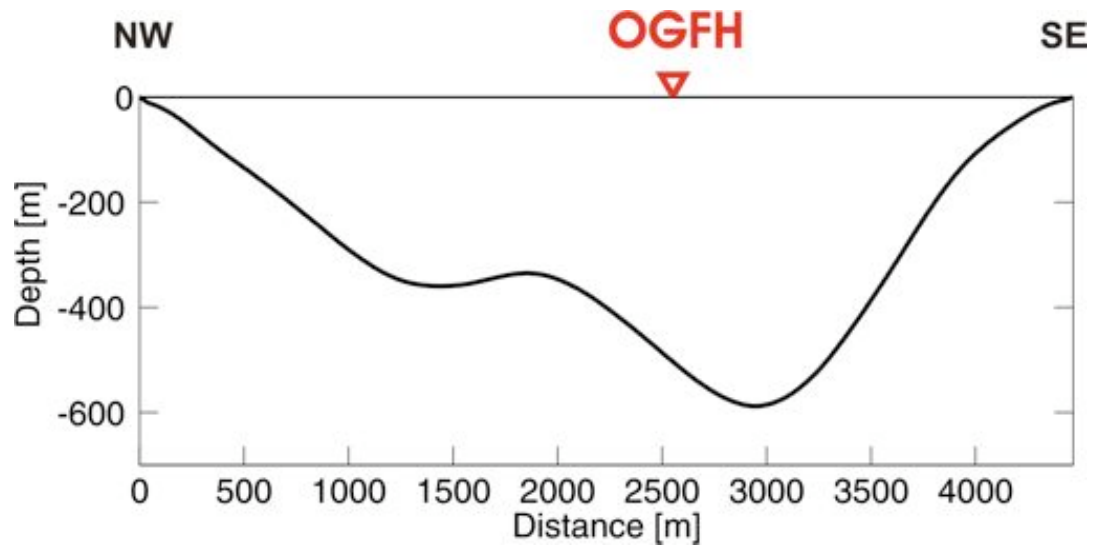
Morphology [slope/ridge/valley/top/saddle/plain] = [SL/RD/VA/TP/SA/PL]	VA
Basin Geometry [Y/N] - to fill only if Morphology = VA	Y
<i>Width (Km)</i>	4.5
<i>Depth (Km)</i>	0.6
<i>Length (Km)</i>	
<i>Closest Distance from Edge (Km)</i>	1.6

View of the area



View of the area

Bedrock depth (from gravimetric data)



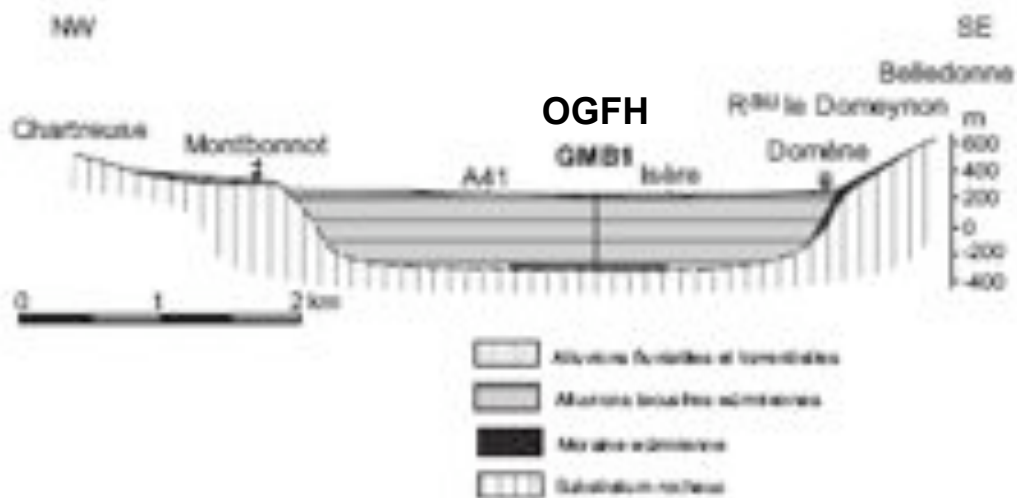
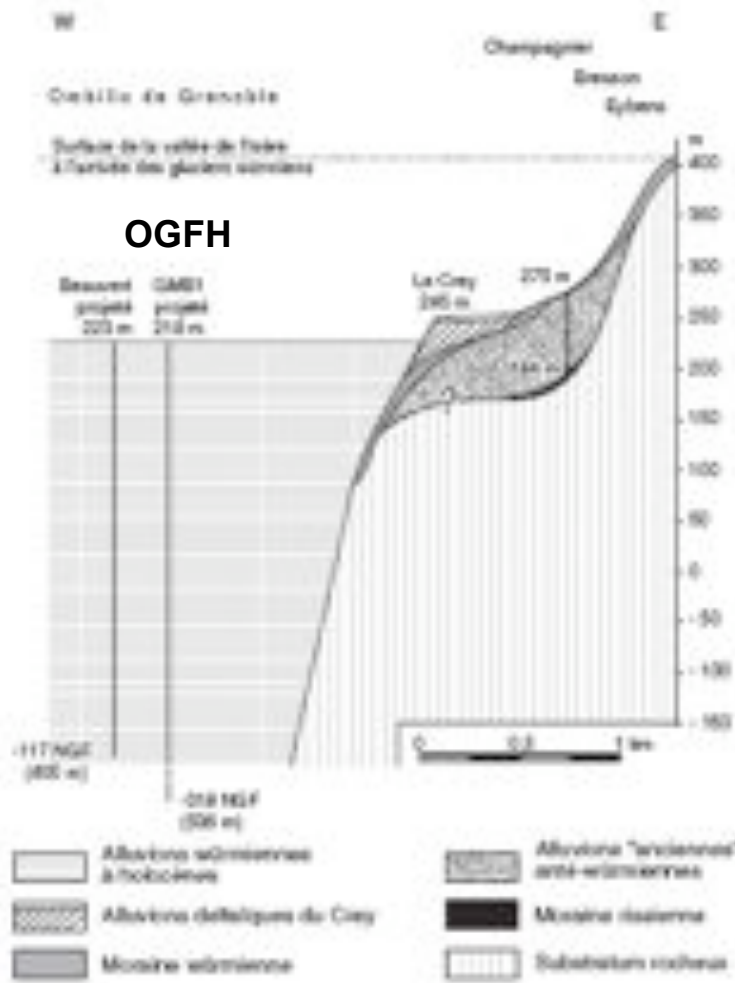
After Vallon (1999)

Geological Data

Geological map [Y/N]	Y
Stratigraphy & Lithology [Y/N]	Y
Bedrock Depth (m)	535 m
Ground water table [Y/N]	N
<i>Water table depth</i> <i>to fill only if Ground water table = Y</i>	

Piezometric measurements

Geological map & Geological sketch

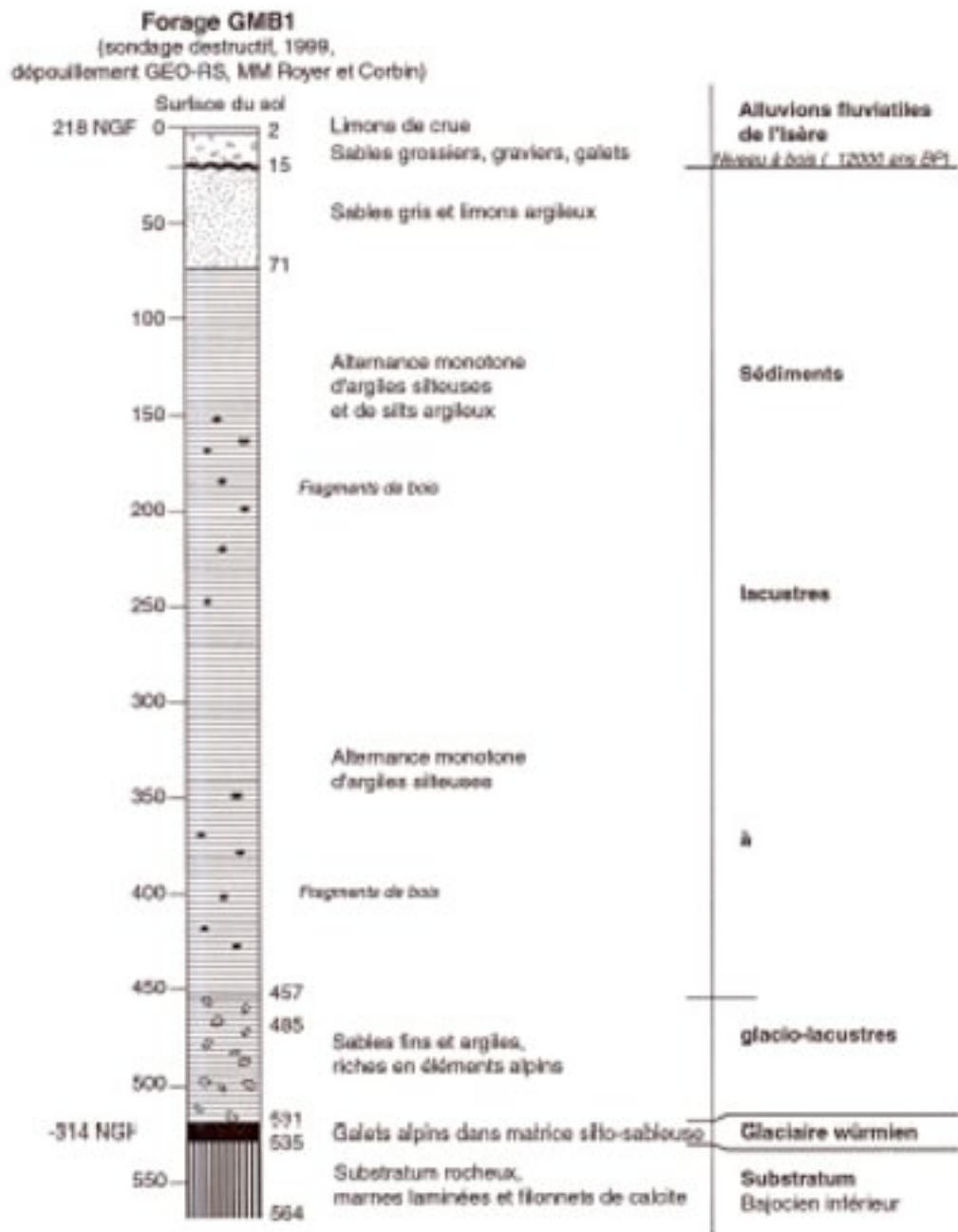


After Nicoud et al. (2002)

Geognostic Investigation

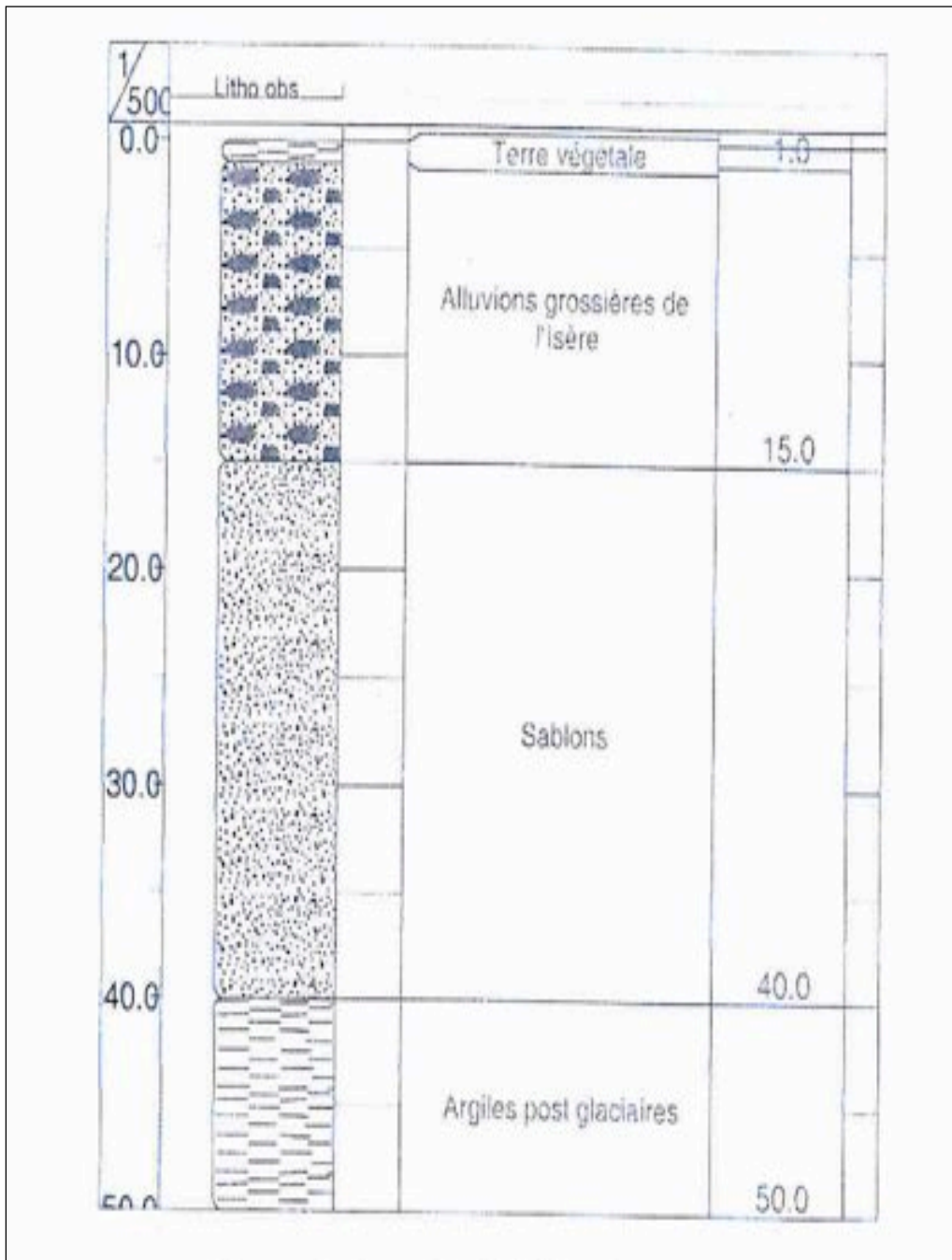
In-Situ Test [Y/N] - to fill the following field only if Y here	Y
Survey's Year	2000
Borehole stratigraphy [Y/N]	Y
SPT [Y/N]	Y
<i>SPT-number</i> to fill only if SPT = Y	1
<i>SPT-max. depth</i> to fill only if SPT = Y	40 m
CPT [Y/N]	Y
<i>CPT-number</i> to fill only if CPT = Y	1
<i>CPT-max. depth</i> to fill only if CPT = Y	40 m
Survey's closest distance from station (m)	2 m
Raw data availability [Y/N]	N
Type of raw data [Digital, Analog] = [D/A]	
References Location of surveys map	<p>Vallon, M. (1999), Estimation de l'épaisseur d'alluvions et sédiments quaternaires dans la région grenobloise par inversion des anomalies gravimétriques, IRSN/CNRS Internal Report, 34 pp</p> <p>Lemeille, F. (2002). Forage de Montbonnot 2 (GMB 2): Organisation et suivi géologique du forage (NT n°02-55). Fontenay-aux-Roses, IRSN: 19 pp.</p> <p>Nicoud, G., G. Royer, C. Corbin, F. Lemeille, A. Paillet (2002). "Creusement et remplissage de la vallée de l'Isère au Quaternaire récent." Géologie de la France n°4: pp 39-49.</p> <p>Guéguen, P., C. Cornou, S. Garambois and J. Banton. 2007. On the limitation of the H/V spectral ratio using seismic noise as an exploration tool: Application to the Grenoble valley (France), a small apex ratio basin, <i>PAGEOPH</i>, 164(1), 115-134.</p>

Borehole stratigraphy



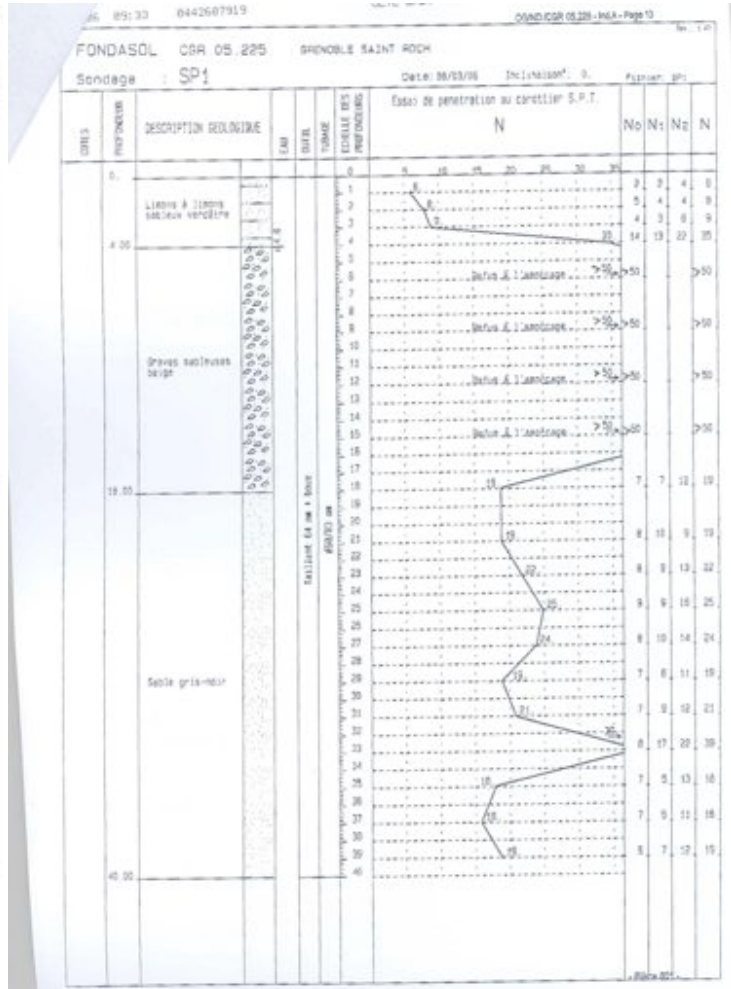
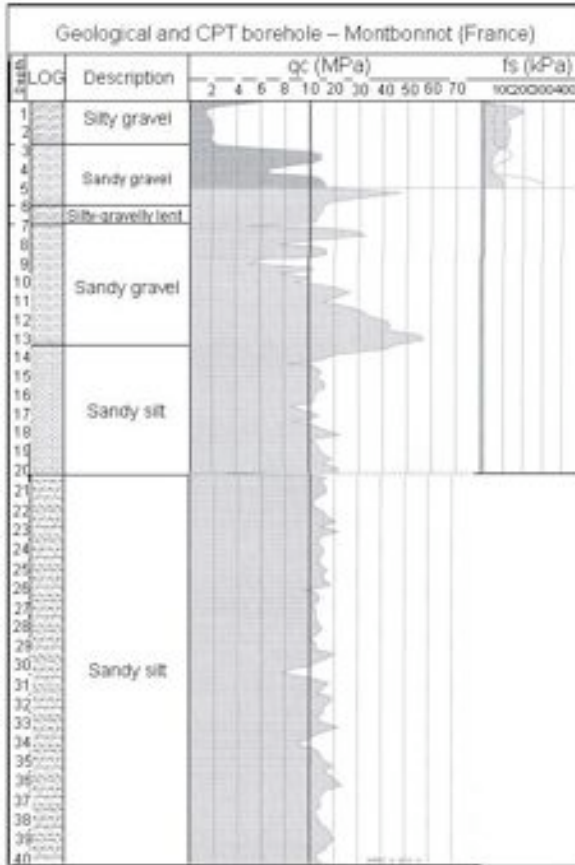
Simplified lithology – borehole log (after Nicoud et al., 2002)

Borehole stratigraphy



Simplified lithology – borehole log (after Lemeille, 2002)

Geognostic Investigation (SPT/CPT, ..)

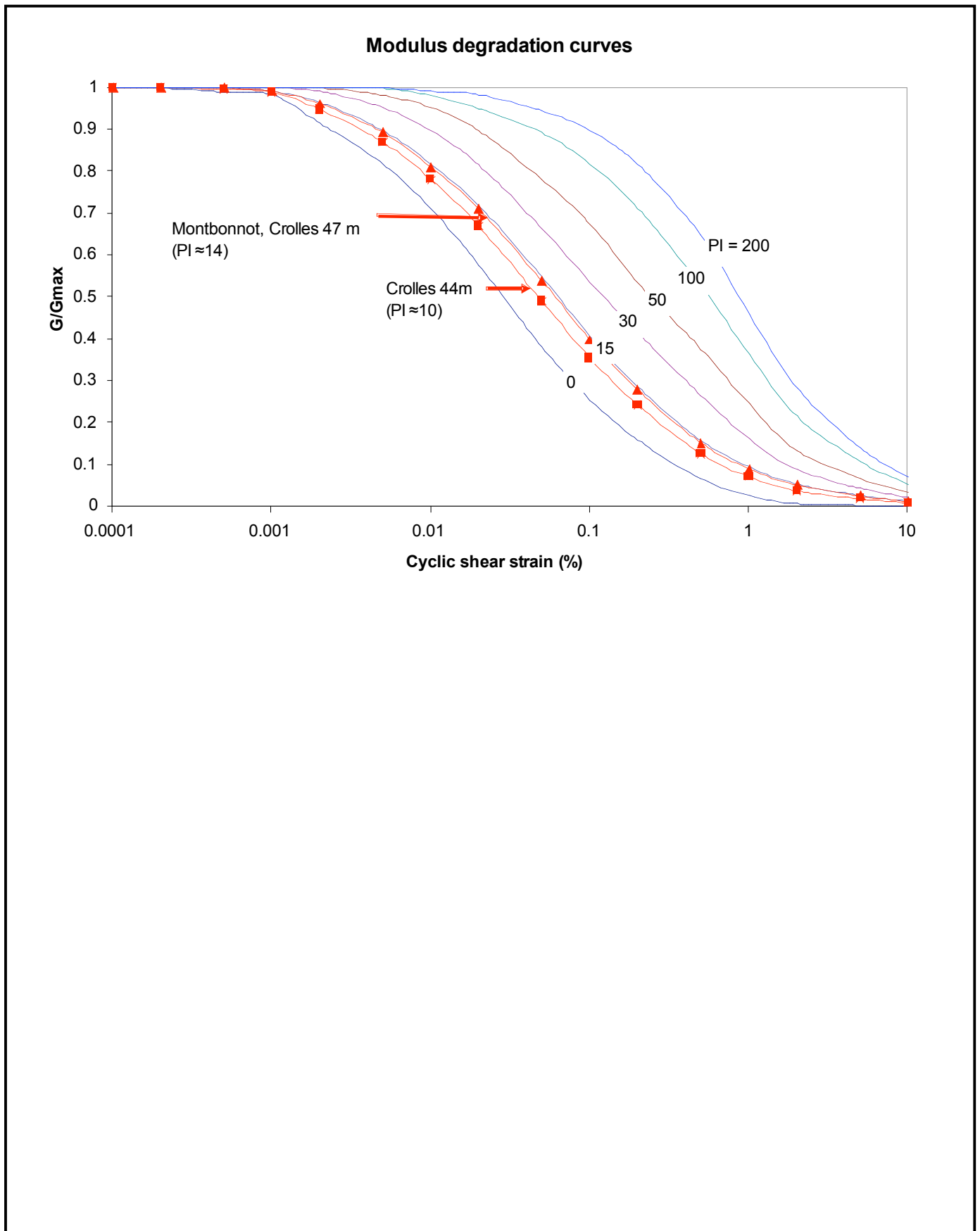


After Guéguen et al (2007)

Geotechnical Laboratory Analysis

Lab. Test [Y/N] - to fill the following field only if Y here	Y
Survey's Year	2005
γ [Y/N]	
Resonant Column Test (G-g-D curves) [Y/N]	
Torsional Shear Test [Y/N]	
Triaxial Cyclic Loading Test [Y/N]	
Survey's closest distance from station (m)	
Raw data availability [Y/N]	N
Type of raw data [Digital, Analog] = [D/A]	
References	Jerram et al., ESG, 2006

Geotechnical Laboratory Analysis (G-g-D curves, ..)



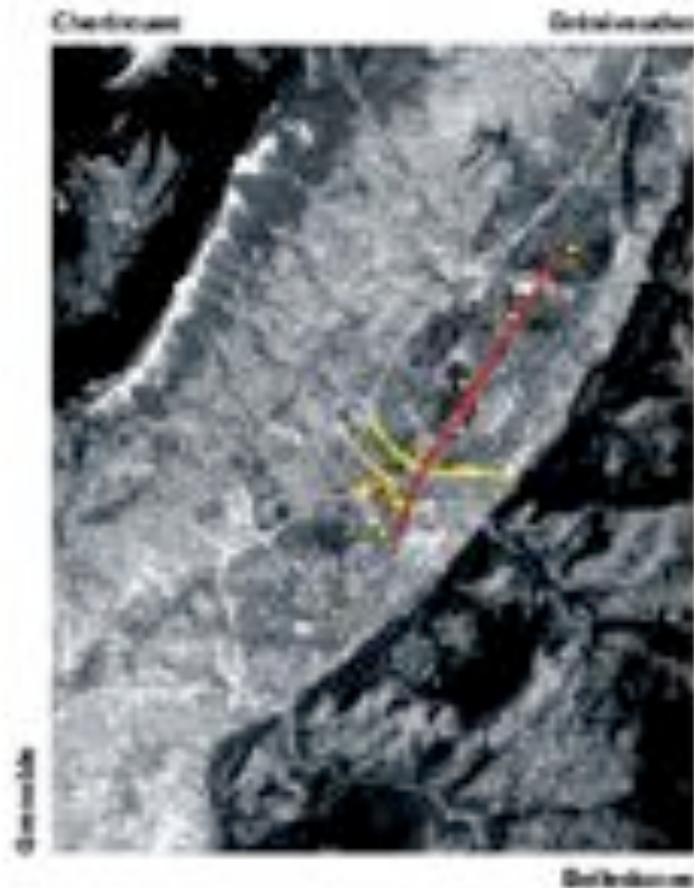
Geophysical Data

In-Situ Test [Y/N] - to fill the following field only if Y here	Y
Survey's Year	1999-2006
P-wave velocity [Y/N]	Y
<i>P-depth</i> to fill only if P-wave velocity = Y	554 m
<i>P-method</i> [CH, DH, Refr, Other]	DH (VSP) + Refr
S-wave velocity [Y/N]	Y
<i>S-depth</i> to fill only if S-wave velocity = Y	554 m
<i>S-method</i> [CH, DH, Refr, MASW, SASW, Other]	DH (VSO), Refr
Qp [Y/N]	Y
<i>Qp-depth</i> to fill only if Qp = Y	554
<i>Qp-method</i> [CH, DH, Refr, MASW, SASW, Other]	DH (VSP)
Qs [Y/N]	Y
<i>Qs-depth</i> to fill only if Qs = Y	554
<i>Qs-method</i> [CH, DH, Refr, MASW, SASW, Other]	DH (VSO)
Survey's closest distance from station (m)	2 m
Raw data availability [Y/N]	N
Type of raw data [Digital, Analog] = [D/A]	D
EC8_Code EC8 classification = [A/B/C/D/E/S1/S2]	B-C
References	Cornou, C., 2002. Traitement d'antenne et imagerie sismique dans l'agglomération grenobloise (Alpes françaises) : implications pour les effets de site, thèse de doctorat de l'université Joseph Fourier, Grenoble, 261 pages.

References	<p>Dietrich, M., C., Cornou, G. Ménard, F. Lemeille, F. Guyoton and R. Guiguet, 2006. Seismic profiling and borehole measurements in the Isère valley near Grenoble, France: 1- Data acquisition and processing, <i>Third International Symposium on the Effects of Surface Geology on Seismic Motion</i>, P.-Y. Bard, E. Chaljub, C. Cornou, F. Cotton, P. Guéguen Eds, Grenoble, France, 30 August - 1 September 2006.</p> <p>Ménard, G., M. Dietrich, M. Vallon, S. Tadenuma, C. Bordes, O. Meric, F. Lemeille, 2006. Seismic profiling and borehole measurements in the Isère valley near Grenoble, France: 1- Interpretation, <i>Third International Symposium on the Effects of Surface Geology on Seismic Motion</i>, P.-Y. Bard, E. Chaljub, C. Cornou, F. Cotton, P. Guéguen Eds, Grenoble, France, 30 August - 1 September 2006.</p> <p>Guéguen, P., C. Cornou, S. Garambois and J. Banton. 2007. On the limitation of the H/V spectral ratio using seismic noise as an exploration tool: Application to the Grenoble valley (France), a small apex ratio basin, <i>PAGEOPH</i>, 164(1), 1 1 5 - 1 3 4 .</p>
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V_s and V_p profiles (CH, DH, ...)

Location map of seismic data acquisition at the borehole site
(after Cornou., 2002)

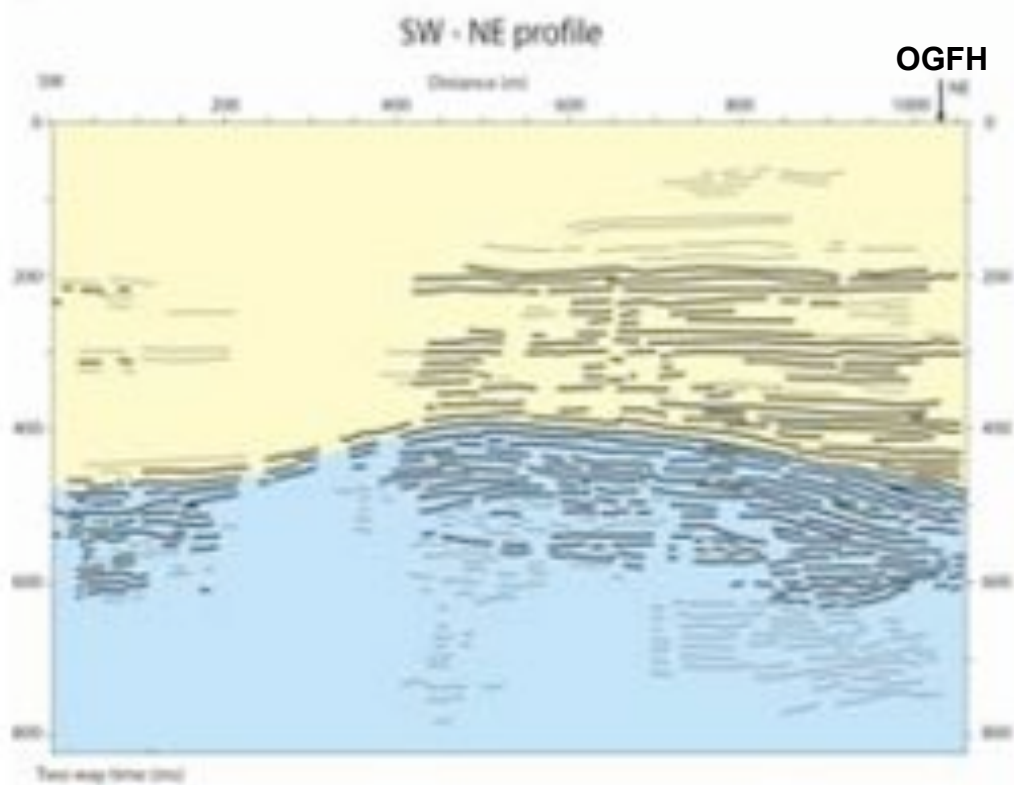
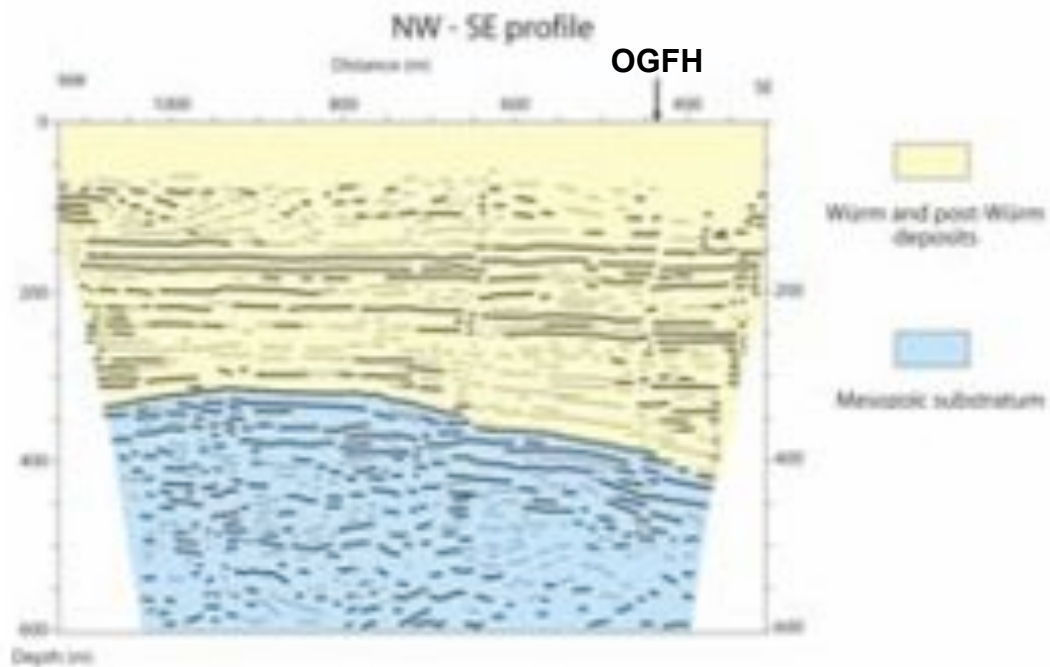


Campagne Vibroseis 2001 LGIT Grenoble

- | | |
|--|---|
| 1)  Profil sismique vertical
Forage de Mazonville - 100 m
30 sites - 2 points vibros | Diffus Sismique passif
(2 vibrosés points) |
| 2)  Profil de sismique réflexion
30 stations sismologiques sur 6 km
7 points vibros | Sismique réflexion profil
(30 stations stations, length 6 km
7 vibrosés points) |
| 3)  Profil de sismique réflexion
60 sites à 10 m d'intervalle
370 points vibros à 10 m d'intervalle | Sismique réflexion profil |
| 4)  Profil de sismique réflexion, de 100 m
20 sites à 10 m d'intervalle
30 points de 10 à 10 m d'intervalle | Sismique réflexion profil |
|  LGIT | |

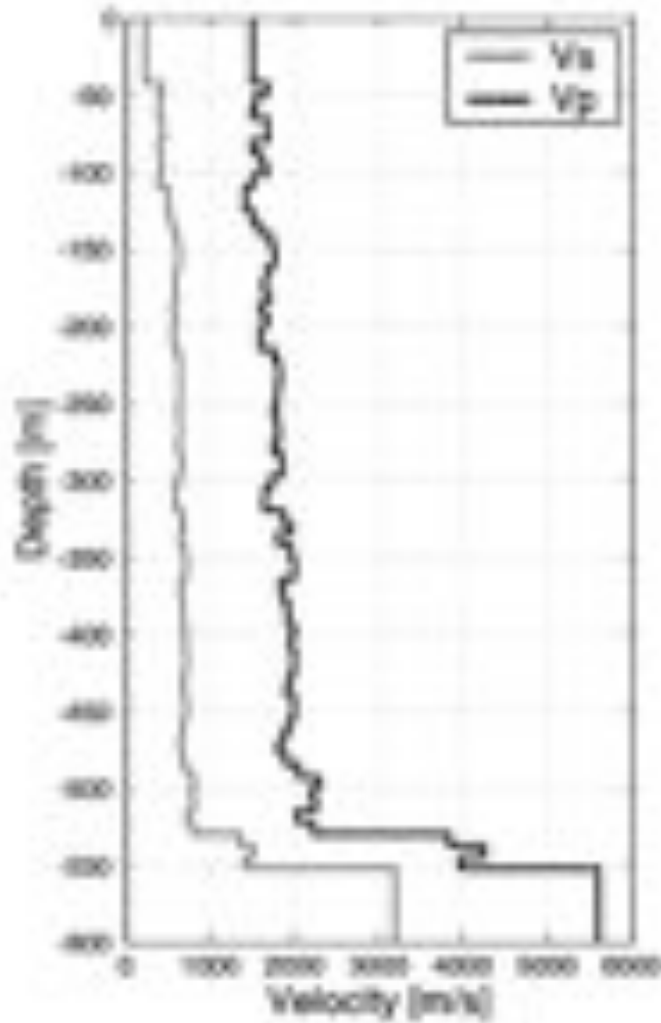
V_s and V_p profiles (CH, DH, ...)

Seismic reflection profiles nearby borehole location - After Ménard et al. (2006)



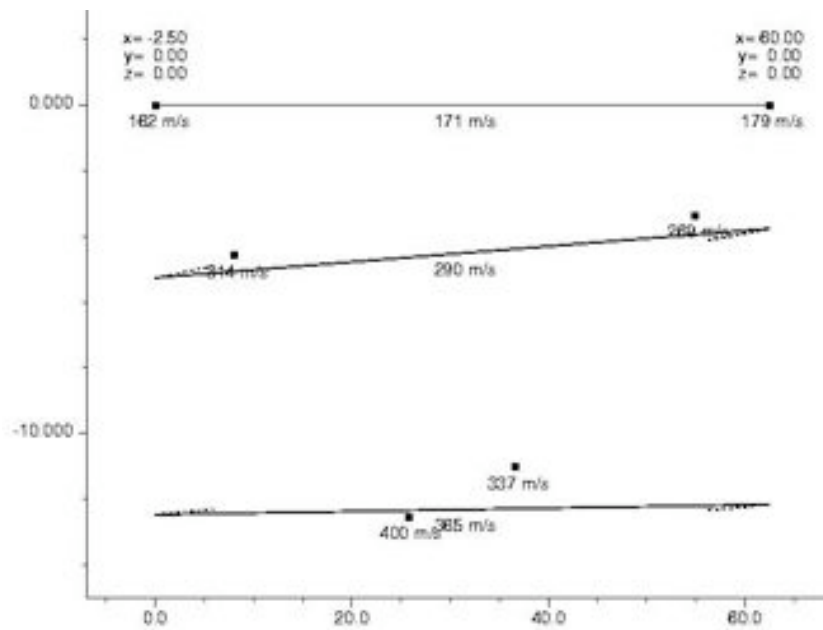
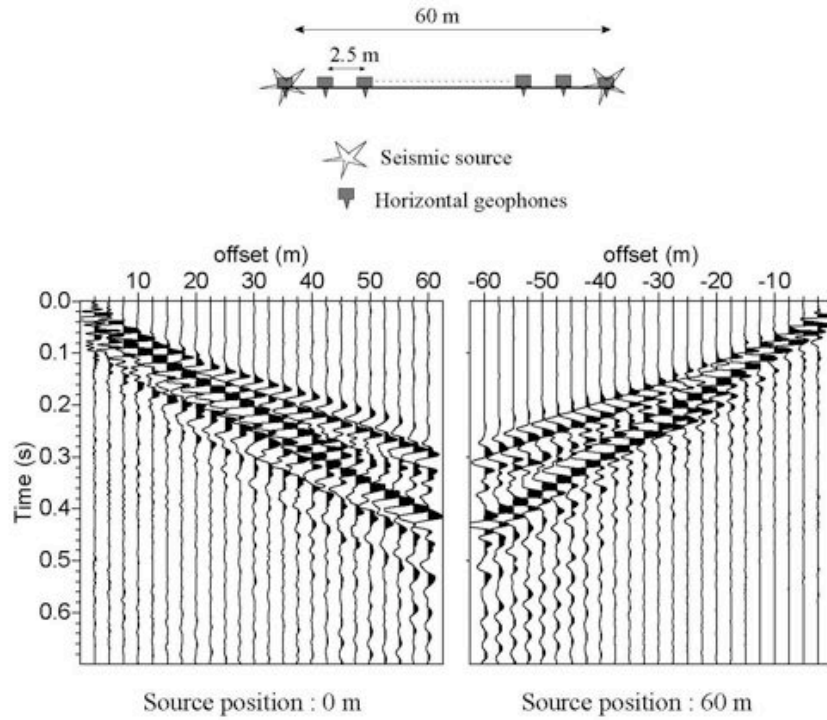
V_s and V_p profiles (CH, DH, ...)

V_p and V_s profiles (interval velocity) derived from VSP and VSO profiles
(after Cornou, 2002)



V_s and V_p profiles (CH, DH, ...)

Shallow V_s profiles derived from active seismics (SH waves) nearby borehole location - After Guéguen et al (2007)



Noise Recordings

In-Situ Test [Y/N] - to fill the following field only if Y here	Y
Survey's Year	1999-2006
Single station measurements [Y/N]	Y
<i>duration of measurements</i>	at least 15'
<i>Raw data availability [Y/N]</i>	Y
Array measurements [Y/N]	Y
<i>duration of measurements in central station</i>	at least 30'
<i>Raw data availability [Y/N]</i>	Y
References	<p>Scherbaum, F., J. Riepl, B. Bettig, M. Ohrnberger, C. Cornou, F. Cotton, P.-Y. Bard, 1999. Dense array measurements of ambient vibrations in the Grenoble basin to study local site effects, AGU Fall meeting, San Francisco, December 1999.</p> <p>Bettig B., P.-Y. Bard, F. Sherbaum, J. Riepl, F. Cotton, C. Cornou, D. Hatzfeld, 2001. Analysis of dense array measurements using the modified spatial auto-correlation method (SPAC). Application to Grenoble area., <i>Boletín de Geofísica Teoría e Aplicada</i>, 42, 3-4, 281-304.</p> <p>Cornou C. and the SESAME team, SESAME Deliverable D11.10 & D17.10. Simulation for real sites: set of noise synthetics for H/V and array studies from simulation of real sites and comparison for test sites. SESAME EVG1-CT 2000-00026 project, 62 pages, 2004.</p> <p>Guéguen, P., C. Cornou, S. Garambois and J. Banton. 2007. On the limitation of the H/V spectral ratio using seismic noise as an exploration tool: Application to the Grenoble valley (France), a small apex ratio basin, <i>PAGEOPH</i>, 164(1), 115-134.</p>

Single station/Array Analysis

Approximative location of array noise measurements (central receiver)

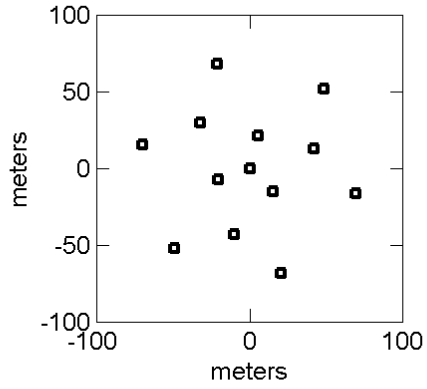


- Scherbaum et al., 1999
- Bettig et al., 2001
- Kudo K. (2000) + LGIT measurements (2002-)

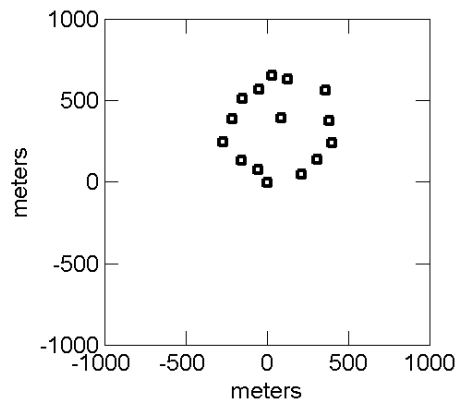
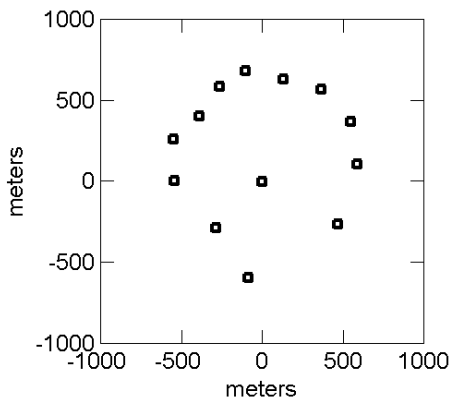
Single station/Array Analysis

Array layout

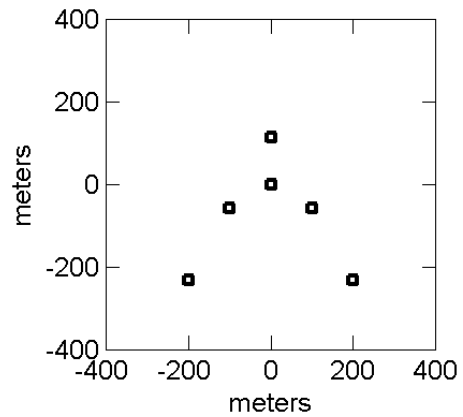
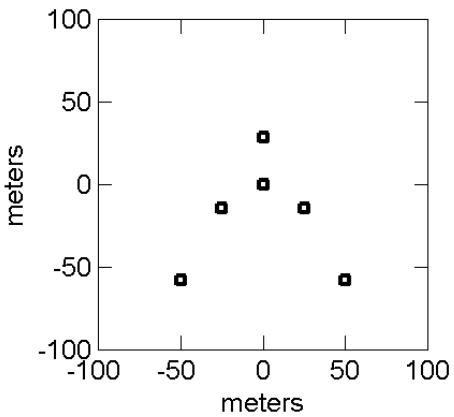
Scherbaum et al., 1999



Bettig et al., 2001



Kudo K. (2000)

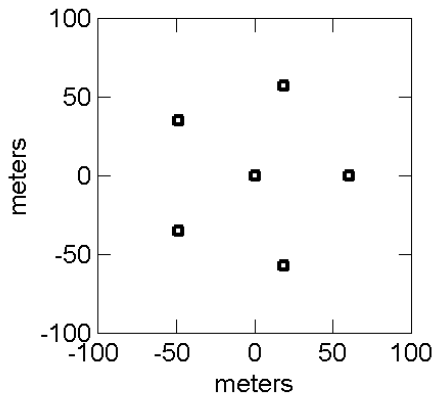
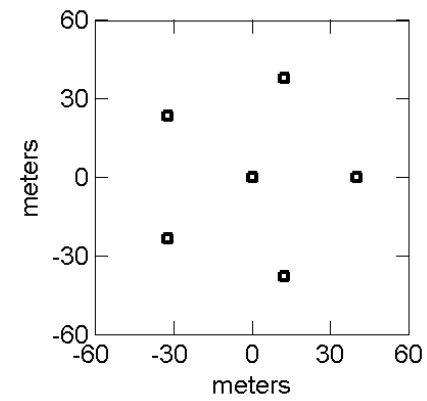
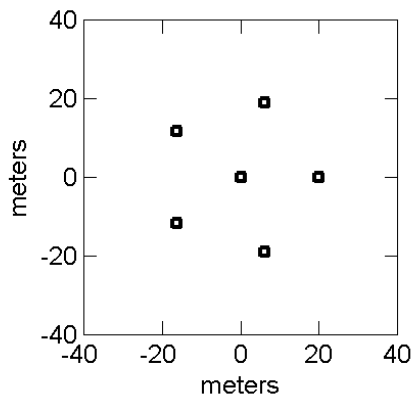
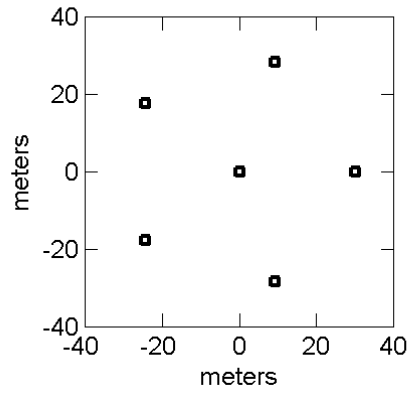
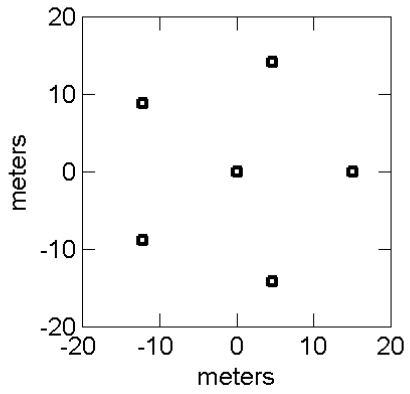


Single station/Array Analysis

Array layout

LGIT measurements (2002-2005)

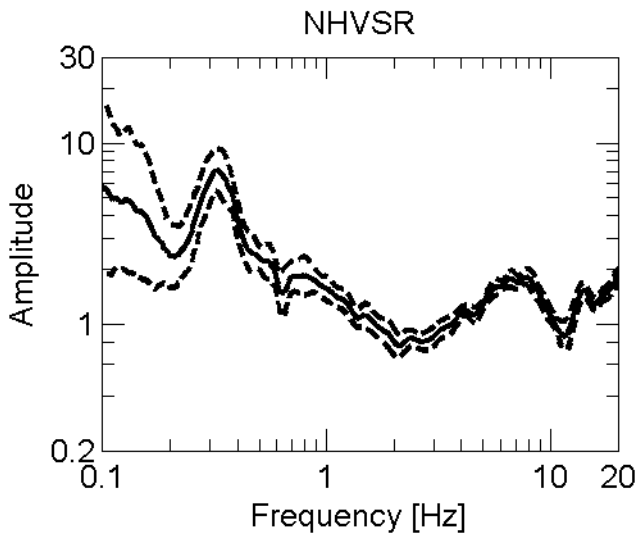
Acquisition performed by S. Bonnefoy-Claudet and H. Cadet



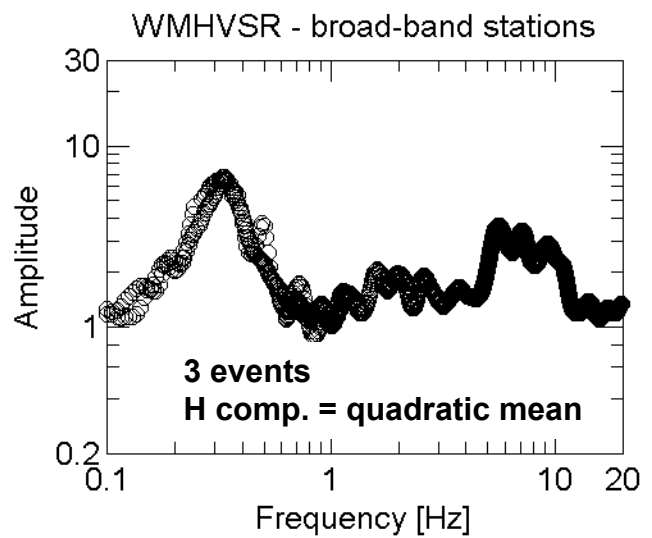
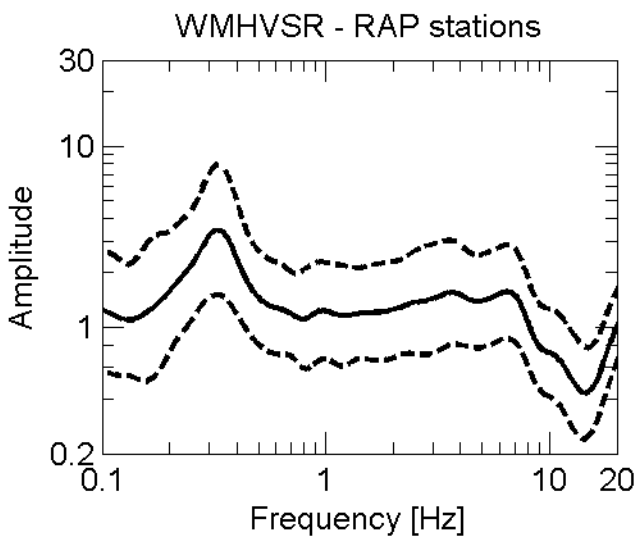
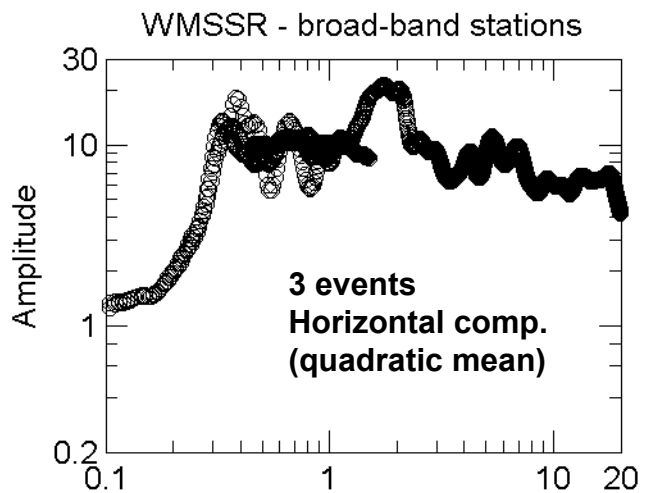
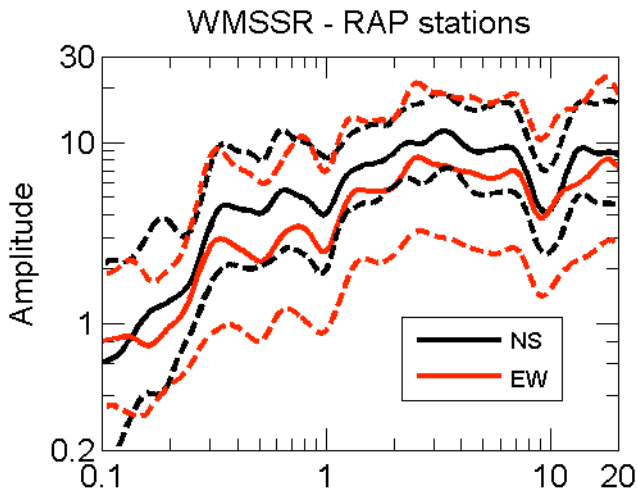
Site Response

Site Response Analysis [Y/N] - to fill the following field only if Y here	Y
Survey's Year	2000-2006
Experimental Studies Earthquake Records [Y/N]	Y
Experimental Studies Ambient Noise Records [Y/N]	Y
Theoretical Studies 1D [Y/N]	Y
Theoretical Studies 2D [Y/N]	Y
Theoretical Studies 3D [Y/N]	Y
References	<p>Bard, P.-Y., E. Chaljub, C. Cornou, F. Cotton, Ph. Guéguen, M. Kham, 2005. Spectres sismiques en surface pour le site "sobegal" a Domène (38). Etude réalisée pour le compte d'Antea, 19 pages, 11 figures.</p> <p>Chaljub, E., C. Cornou, J. Verbeke, J. Converset, C. Voisin, L. Stehly, J.-R. Grasso, P. Guéguen, S. Roussel, P. Roux, S. Hatton and M. Campillo. 2006. Measurement and variability study of site effects in the 3D glacial valley of Grenoble, French Alps, in Proc. 3rd Int. Symp. on the Effects of Surface Geology on Seismic Motion, Grenoble, 29 August - 01 September, 2006, Bard, P.Y., Chaljub, E., Cornou, C., Cotton, F. and Guéguen, P. Editors, LCPC Editions, paper# 154</p> <p>Tsuno, T., Chaljub, E., P.-Y. Bard, 2006. Grenoble simulation benchmark: comparison of results and learnings, in <i>Proc. 3rd Int. Symp. on the Effects of Surface Geology on Seismic Motion</i>, Grenoble, 29 August - 01 September, 2006, Bard, P.Y., Chaljub, E., Cornou, C., Cotton, F. and Guéguen, P. Editors, LCPC Editions.</p> <p>Guéguen, P., C. Cornou, S. Garambois and J. Banton. 2007. On the limitation of the H/V spectral ratio using seismic noise as an exploration tool: Application to the Grenoble valley (France), a small apex ratio basin, <i>PAGEOPH</i>, 164(1), 115-134.</p>

Site Response Analysis



NHVSR = H/V from microtremors
 WMHVSr = H/V from weak motion
 WMSSR = standard spectral ratio from weak motion



Site Transfer Function

Survey's Year	
Type of site transfer function determination GIT = generalized inversion technique NHVSR = H/V from microtremors SMHVSR = H/V from strong motion WMHVSR = H/V from weak motion SMSSR = standard spectral ratio from strong motion WMSSR = standard spectral ratio from weak motion	NHVSR, WMHVSR, WMSSR
References	<p>Chaljub, E., C. Cornou, J. Verbeke, J. Converset, C. Voisin, L. Stehly, J.-R. Grasso, P. Guéguen, S. Roussel, P. Roux, S. Hatton and M. Campillo. 2006. Measurement and variability study of site effects in the 3D glacial valley of Grenoble, French Alps, in Proc. 3rd Int. Symp. on the Effects of Surface Geology on Seismic Motion, Grenoble, 29 August - 01 September, 2006, Bard, P.Y., Chaljub, E., Cornou, C., Cotton, F. and Guéguen, P. Editors, LCPC Editions, paper# 154</p> <p>Guéguen, P., C. Cornou, S. Garambois and J. Banton. 2007. On the limitation of the H/V spectral ratio using seismic noise as an exploration tool: Application to the Grenoble valley (France), a small apex ratio basin, <i>PAGEOPH</i>, 164(1), 115-134. Guéguen and Garambois, 2007</p>

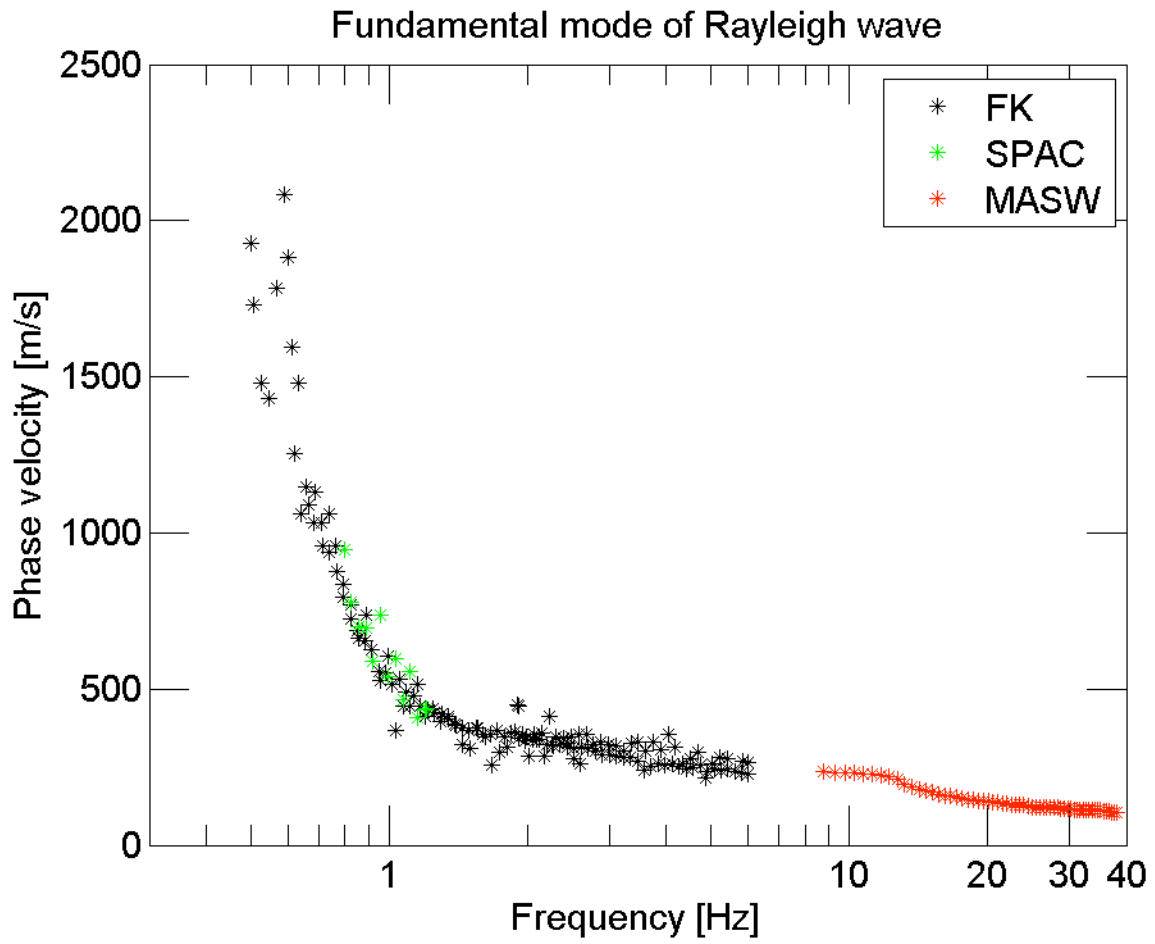
Site Transfer Function values

Frequency [Hz]	Amplitude	Standard deviation
0.1		
0.125		
0.16		
0.2		
0.25		
0.3		
0.4		
0.5		
0.65		
0.8		
1		
1.25		
1.6		
2		
2.5		
3.2		
4		
5		
6.3		
8		
10		
20		

Dispersion Curve Information

Survey's Year	1999 - 2004
Rayleigh waves [Y/N]	Y
Method of recordings [Active/Passive]	A/P
Method of analysis - active recordings [SASW, MASW]	MASW
Method of analysis - passive recordings [SPAC, FK, ReMi]	SPAC, FK
Love waves [Y/N]	N
Method of recordings [Active/Passive]	
Method of analysis - active recordings [SASW, MASW]	
Method of analysis - passive recordings [SPAC, FK]	
References	<p>Scherbaum, F., J. Riepl, B. Bettig, M. Ohrnberger, C. Cornou, F. Cotton, P.-Y. Bard, 1999. Dense array measurements of ambient vibrations in the Grenoble basin to study local site effects, AGU Fall meeting, San Francisco, December 1999.</p> <p>Bettig B., P.-Y. Bard, F. Sherbaum, J. Riepl, F. Cotton, C. Cornou, D. Hatzfeld, 2001. Analysis of dense array measurements using the modified spatial auto-correlation method (SPAC). Application to Grenoble area., <i>Boletin de Geofisica Teoria e Aplicata</i>, 42, 3-4, 281-304.</p> <p>Cornou C. and the SESAME team, SESAME Deliverable D11.10 & D17.10. Simulation for real sites: set of noise synthetics for H/V and array studies from simulation of real sites and comparison for test sites. SESAME EVG1-CT 2000-00026 project, 62 pages, 2004.</p>

Dispersion curve



Dispersion Curve values

Frequency (Hz)	Rayleigh wave velocity (m/s)	Standard deviation (m/s)
0.50	1928.51	157.55
0.65	1091.93	308.53
0.80	876.59	156.69
1.00	536.40	87.32
1.25	424.33	32.18
1.60	355.74	23.81
2.00	336.40	32.26
2.50	313.05	22.38
3.20	284.07	22.45
4.00	258.26	22.05
5.00	240.28	11.83
6.30	232.65	18.50
8.00	233.57	5.86
10.00	230.00	0.00
11.00	226.94	0.00
12.00	219.70	0.00
13.00	202.02	0.00
14.00	180.97	0.00
15.00	170.68	0.00
16.00	159.16	0.00
17.00	154.37	0.00
18.00	147.54	0.00
19.00	142.18	0.00
20.00	140.04	0.00

Frequency (Hz)	Rayleigh wave velocity (m/s)	Standard deviation (m/s)
21.00	135.98	0.00
22.00	131.94	0.00
23.00	130.90	0.00
24.00	127.70	0.00
25.00	122.80	0.00
26.00	121.00	0.00
27.00	120.70	0.00
28.00	120.00	0.00
29.00	116.61	0.00
30.00	115.00	0.00
31.00	112.54	0.00
32.00	111.00	0.00
33.00	111.00	0.00
34.00	111.00	0.00
35.00	111.00	0.00
36.00	110.00	0.00
37.00	106.12	0.00
38.00	106.00	0.00
39.00	105.48	0.00
40.00	104.91	0.00

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