

Welcome words

Sesarray course: who are we ?

Marc Wathelet **LGIT/IRD** **Grenoble**
main developer of SESARRAY software
inversion, geophysics, site effects

Matthias Ohrnberger **IGUP** **Potsdam**
array algorithms, seismology, site effects

Cécile Cornou **LGIT/IRD** **Grenoble**
site effects, earthquake seismology

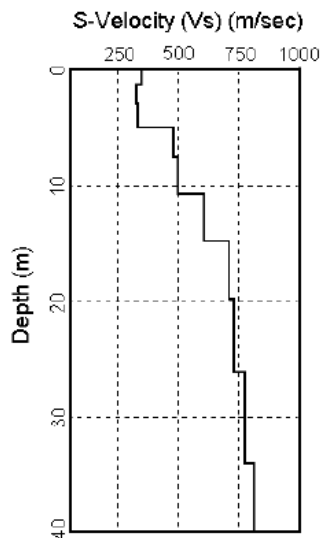
Bertrand Guillier **LGIT/IRD** **Grenoble**
geology, site effects, building vulnerability

Alekos Savaiidis **ITSAK** **Thessaloniki**
geophysics, geomagnetics, site effects

Héloïse Cadet **ITSAK** **Thessaloniki**
site effects, earthquake engineering

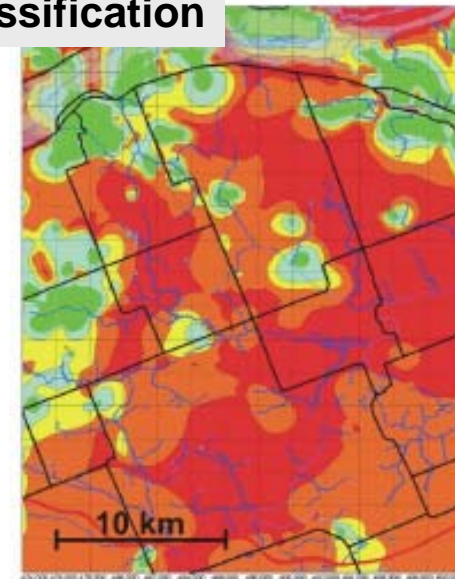
Who are you ?

For what **scientific** reasons are we interested in ambient vibration ?

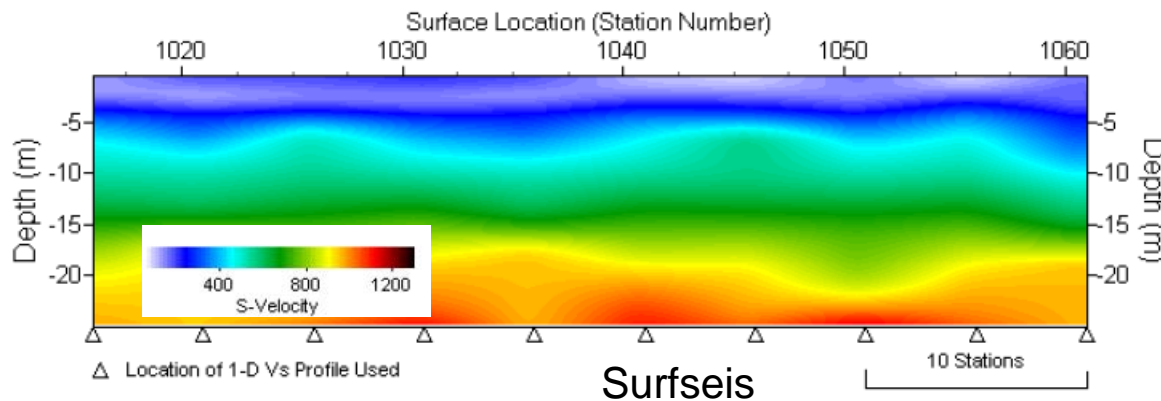


Site response
 GMPE
 Microzoning
 1D Modelling

Microzoning
 EC8 classification



Subsurface imaging
 2D/3D modelling



NEHRP Classification	$V_{s_{30}}$
E	$V_{s_{30}} < 180$ m/s
D	$180 < V_{s_{30}} < 360$ m/s
C	$360 < V_{s_{30}} < 760$ m/s
B	$760 < V_{s_{30}} < 1500$ m/s
A	$V_{s_{30}} > 1500$ m/s

Benjuema, 2006

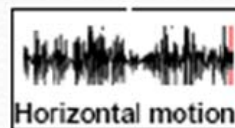
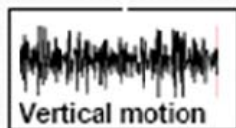
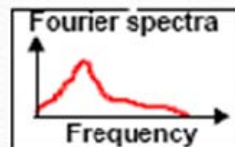
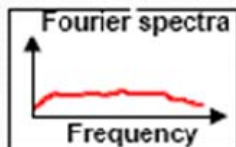
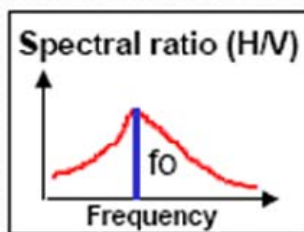
For what **economical** reasons are we interested in ambient vibration ?

S wave velocity

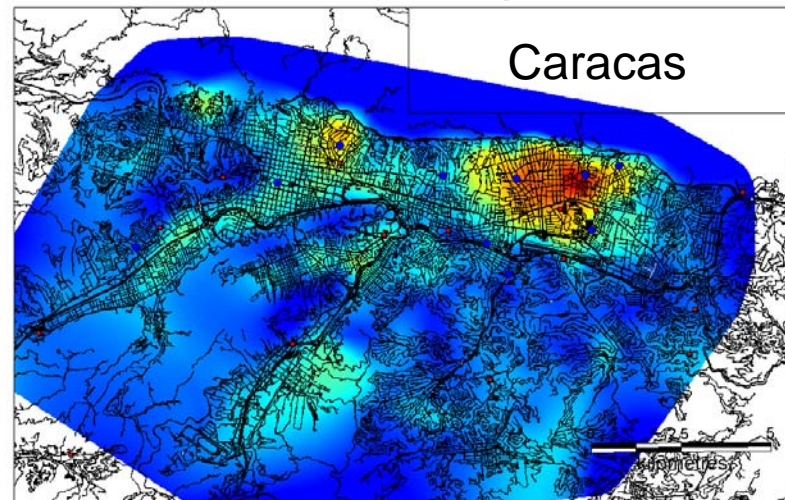
	Method	Investigation depth Surface / Deep	Source Active / Passive	Cost Low-cost/ Expensive	Use easyness Easy / Standard / Non standard	Precision / Reliability Very high / Satisfactory / Unsatisfactory
Within Borehole	Cross-Hole	S	A	E	S	V
	Down-Hole	S, D	A	E	S	S
From the surface	Refraction	S, D	A	LC, E	S	S
	Reflexion	S, D	A	E	NS	S
	SASW	S	A	LC	S	S
	Microtremor, Array	S, D	P	LC	NS	S
Correlations	(SPT, Cu,)	S	-	LC	E	U

What do we get by using ambient vibrations ?

H/V



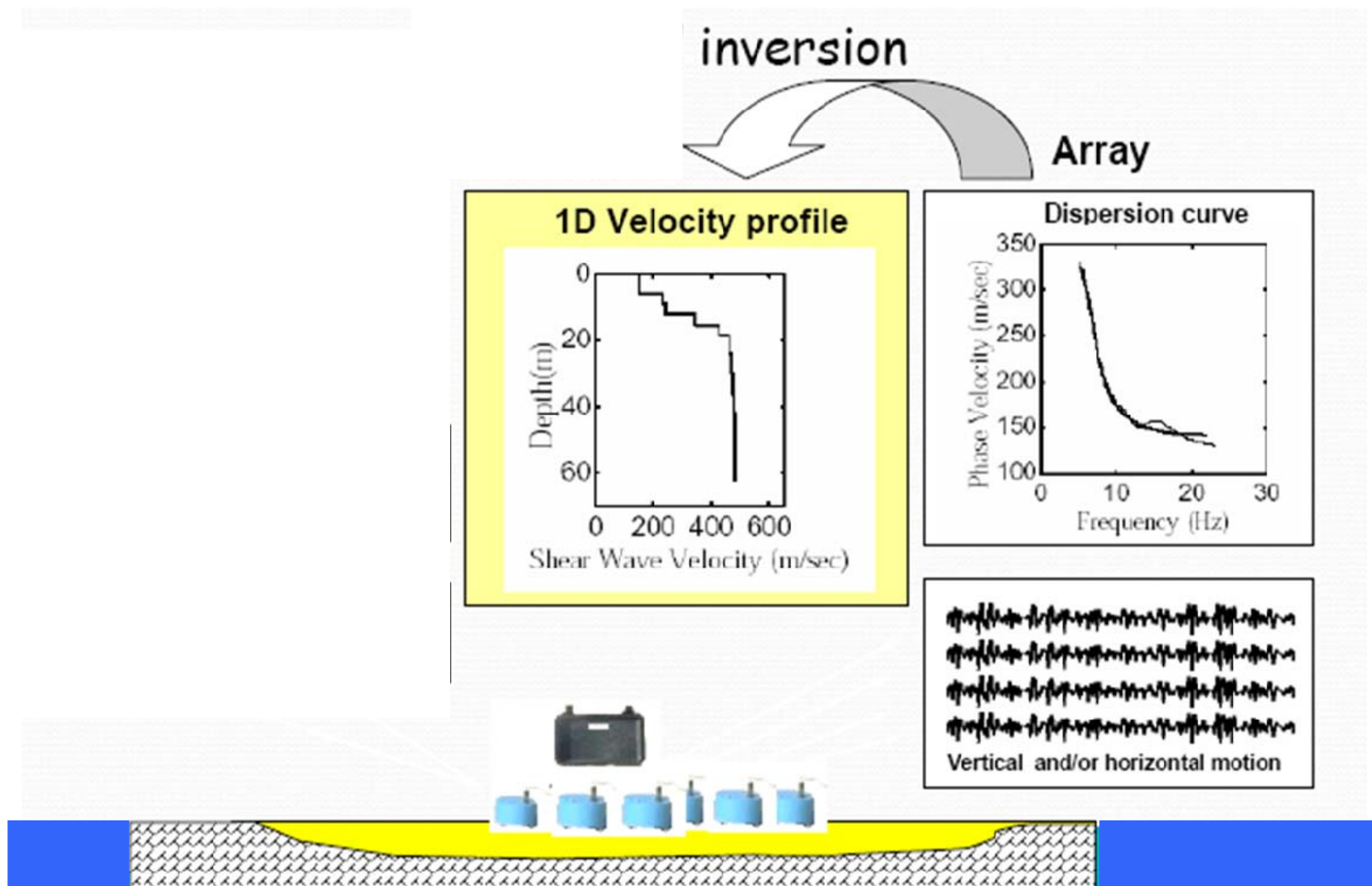
Resonance frequencies



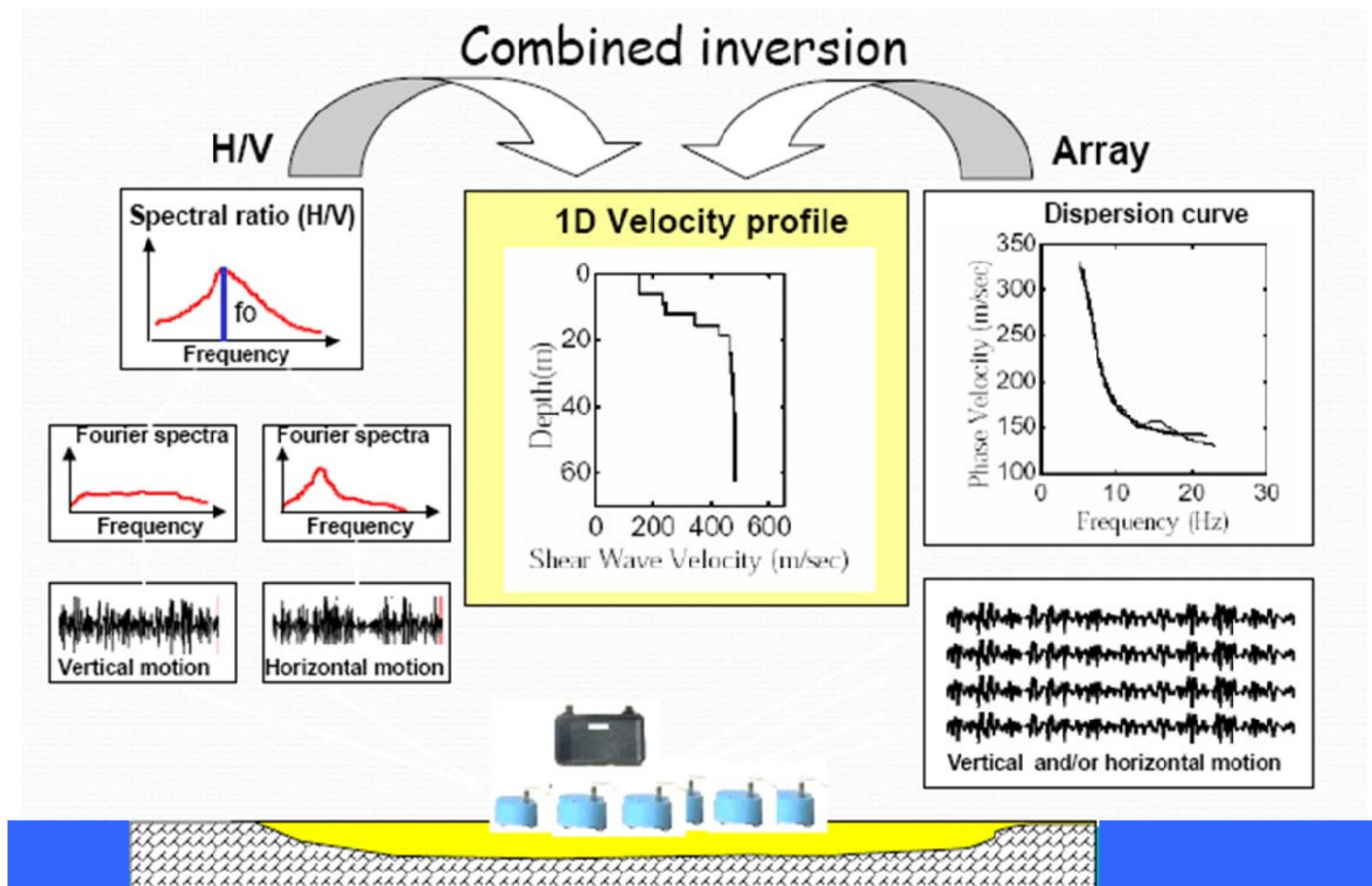
Courtesy of V. Rocabado



What do we get by using ambient vibrations ?



What do we get by using ambient vibrations ?



Is it new to use ambient vibrations ? Is it reliable ?

- use of microtremors for deriving velocity structures exist for more than 20 years in Japan
- calibration of these techniques at borehole sites (especially in Japan)
- recent increase of these techniques world wide for deriving Vs30 or site response (especially at sites with moderate seismicity or developed countries)
- recent increase of new techniques (dispersion curves, inversion, ...)

Main issues (our personal viewpoint in 2004):

- no real comparison of techniques (except at peculiar sites)
- blind application : no (few) data to check reliability of estimates !

Since then ...

- Boore (2006) in California: one site, several methods
- Cornou et al. (2006): one site, several methods
- Renalier et al. (2009): several sites, several methods
- Moss (2008): several sites, several methods

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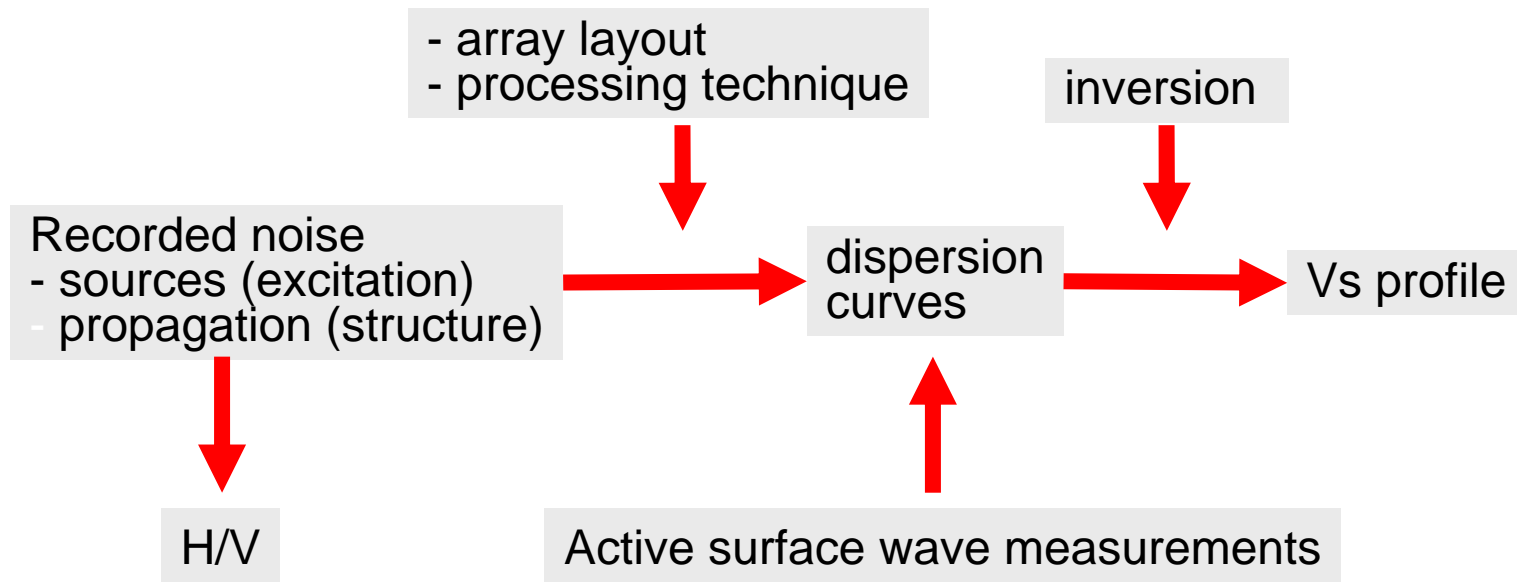
- no real comparison of techniques (except at peculiar sites)
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Since then ...

- Boore (2006) in California: several methods
- Cornou et al. (2007) in France: several methods
- Ren et al. (2007) in China: several sites, several methods
- Moss et al. (2007) in New Zealand: several sites, several methods

SUMMARY NEXT SUNDAY

What are the different steps involved in array noise processing ?



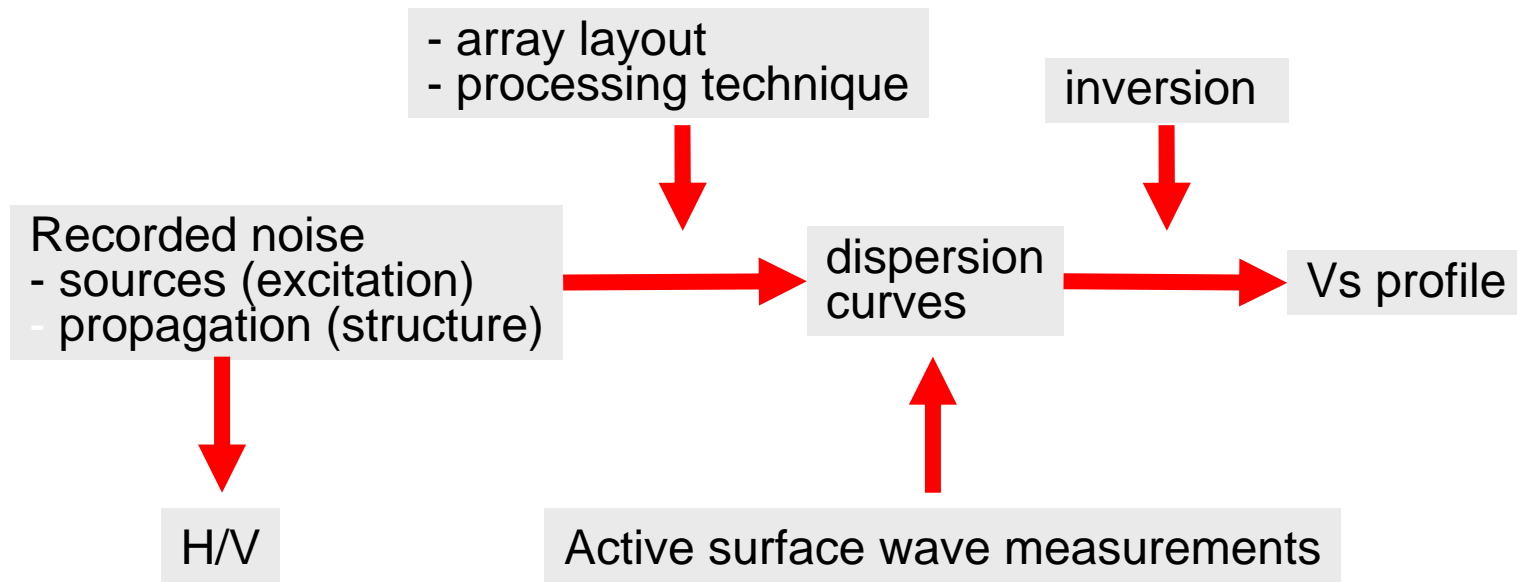
Different techniques to extract the dispersion curves:

- FK, HRFK, SPAC, Correlation, MASW, SASW, REMI

Different techniques to invert dispersion curves

- Linearized inversion, Monte Carlo, Genetic algorithm

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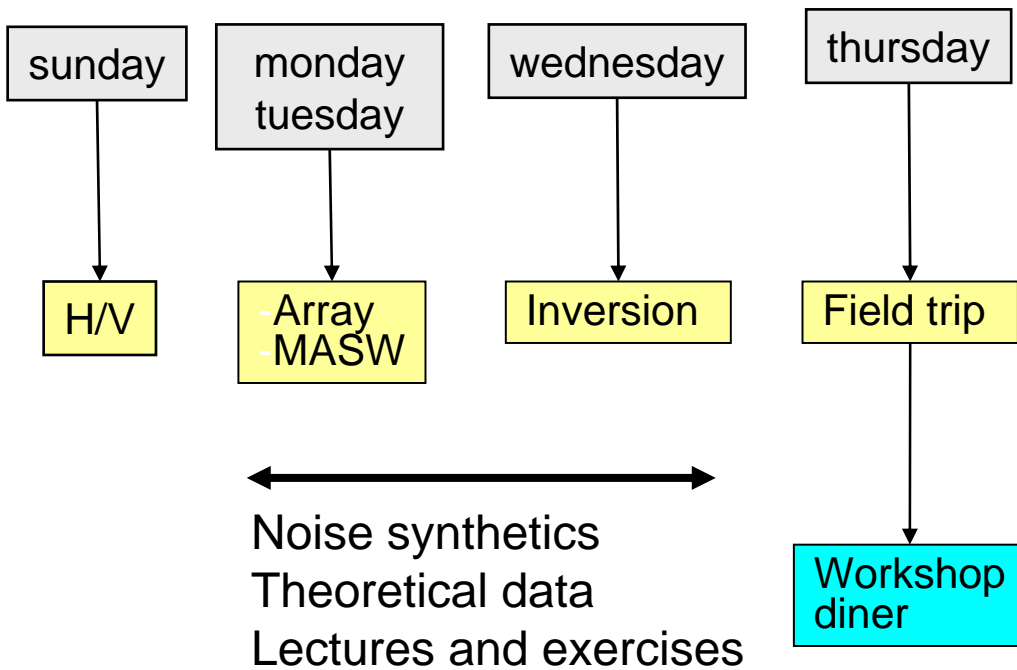
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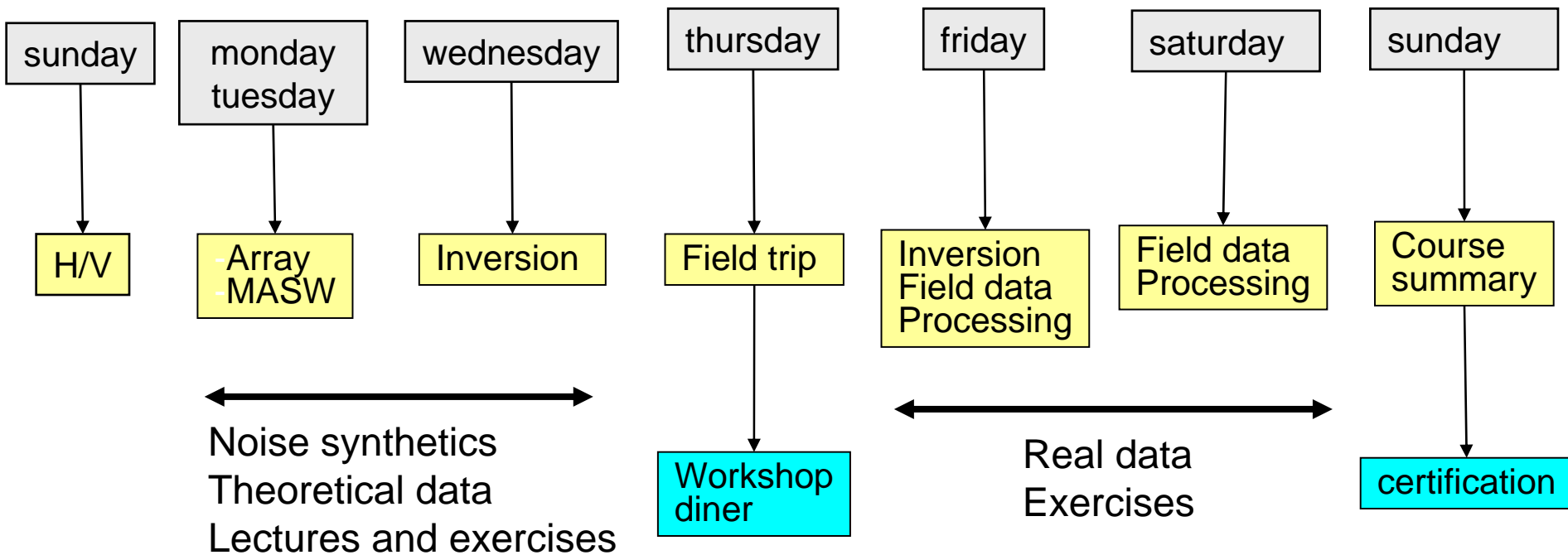
Different techniques to invert dispersion curves

- Linearized inversion, Monte Carlo, **Genetic algorithm**

Organisation of the course



Organisation of the course



For all administrative issues (invoices, etc.) => ask to Alexandros

History of SESARRAY package: The SESAME project

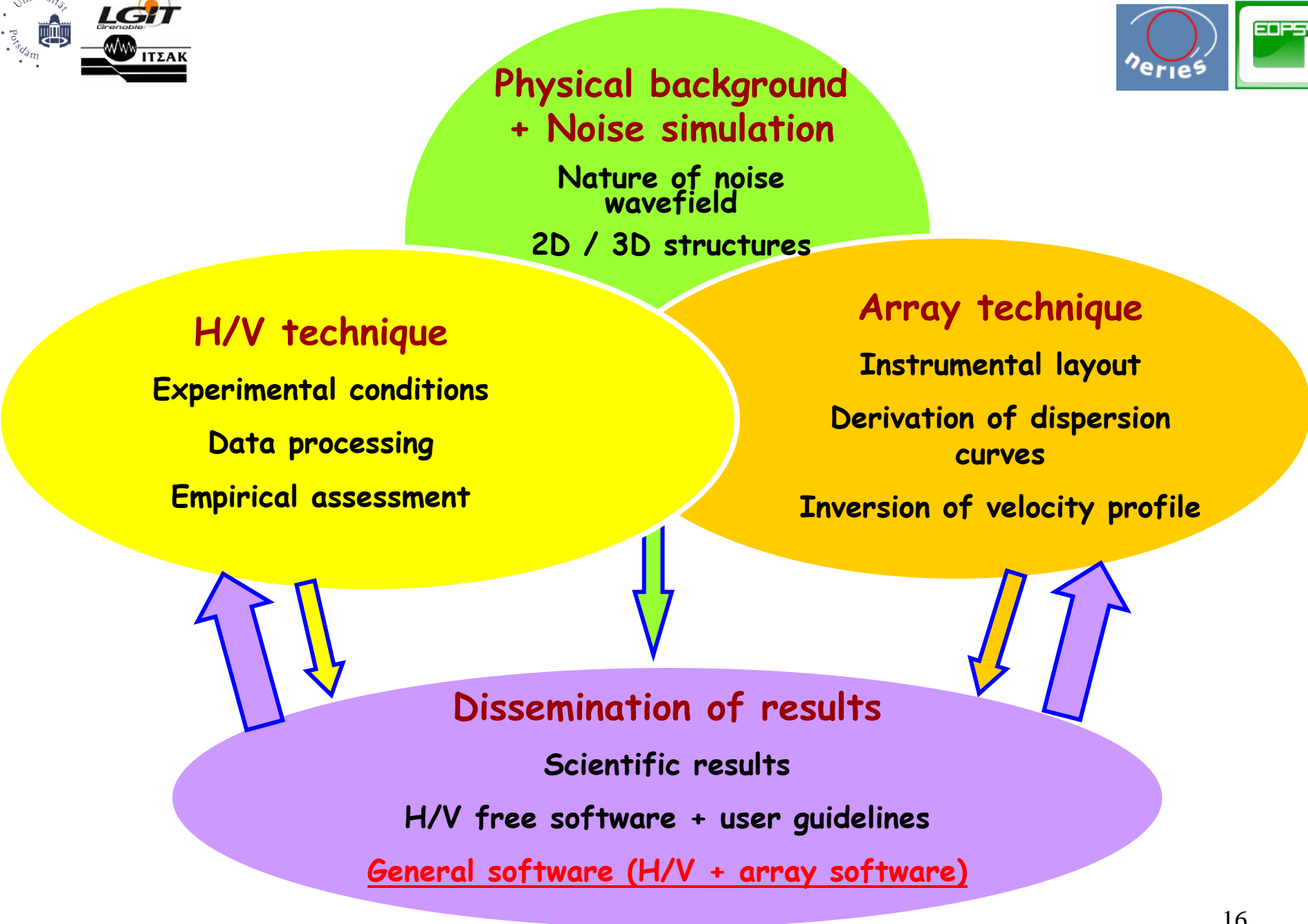
Site Effects aSsessment using
AMbient Excitations

An EC / ESD project
(May 1, 2001 – October 31, 2004)

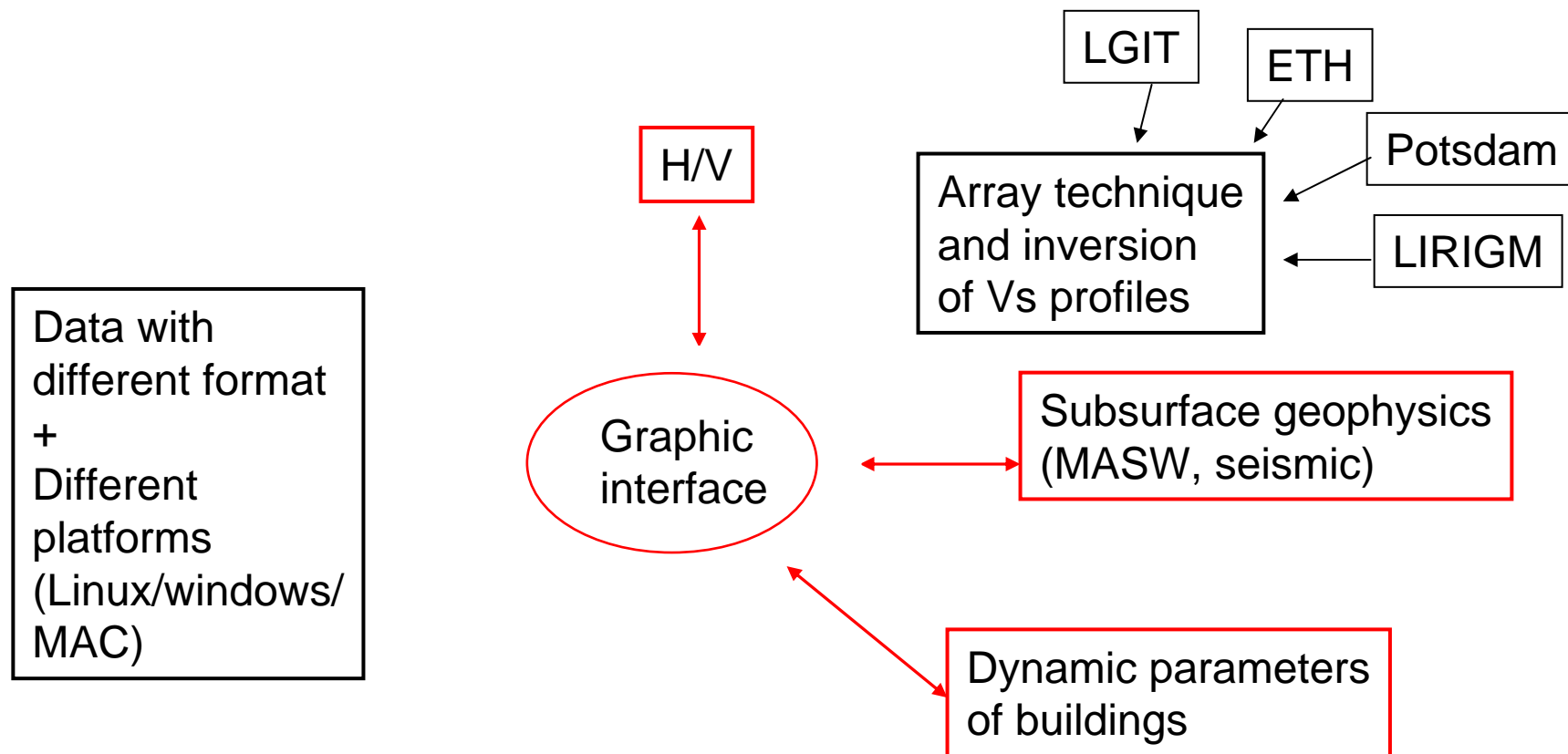


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Institute of Geophysics Bratislava
Resonance Geneva
LGIT Grenoble
University Liège / LIRIGM
Grenoble
University Lisboa
CNR Milano
CETE Nice
University Potsdam
INGV Roma
ITSAK Thessaloniki
ETH Zürich

<http://SESAME-FP5.obs.ujf-grenoble.fr>



History of the sesarray package



Contributions to the software

Fundings

- NERIES EU-project 2006-2010
- SESAME EU-project 2001-2004
- SISMOVALP EU-project 2003-2006
- Participation fees of previous courses (Grenoble 2005, Potsdam 2006)

Development/improvement of the software

- Participants from the EU projects
- Feed-back from users