

The logo for EMS (Earth and Atmospheric Sciences) features the letters 'EMS' in a white, stylized, cursive font on a blue background. To the right of the text is a dark blue, multi-faceted geometric shape resembling a crystal or a molecular structure.

CENTRE NATIONAL
DE LA RECHERCHE
SCIENTIFIQUE

A large, yellow arrow with a blue outline, pointing from the EMS logo towards the text below.A large, yellow arrow with a blue outline, pointing from the CNRS logo towards the text below.

Earth and Atmospheric Science department

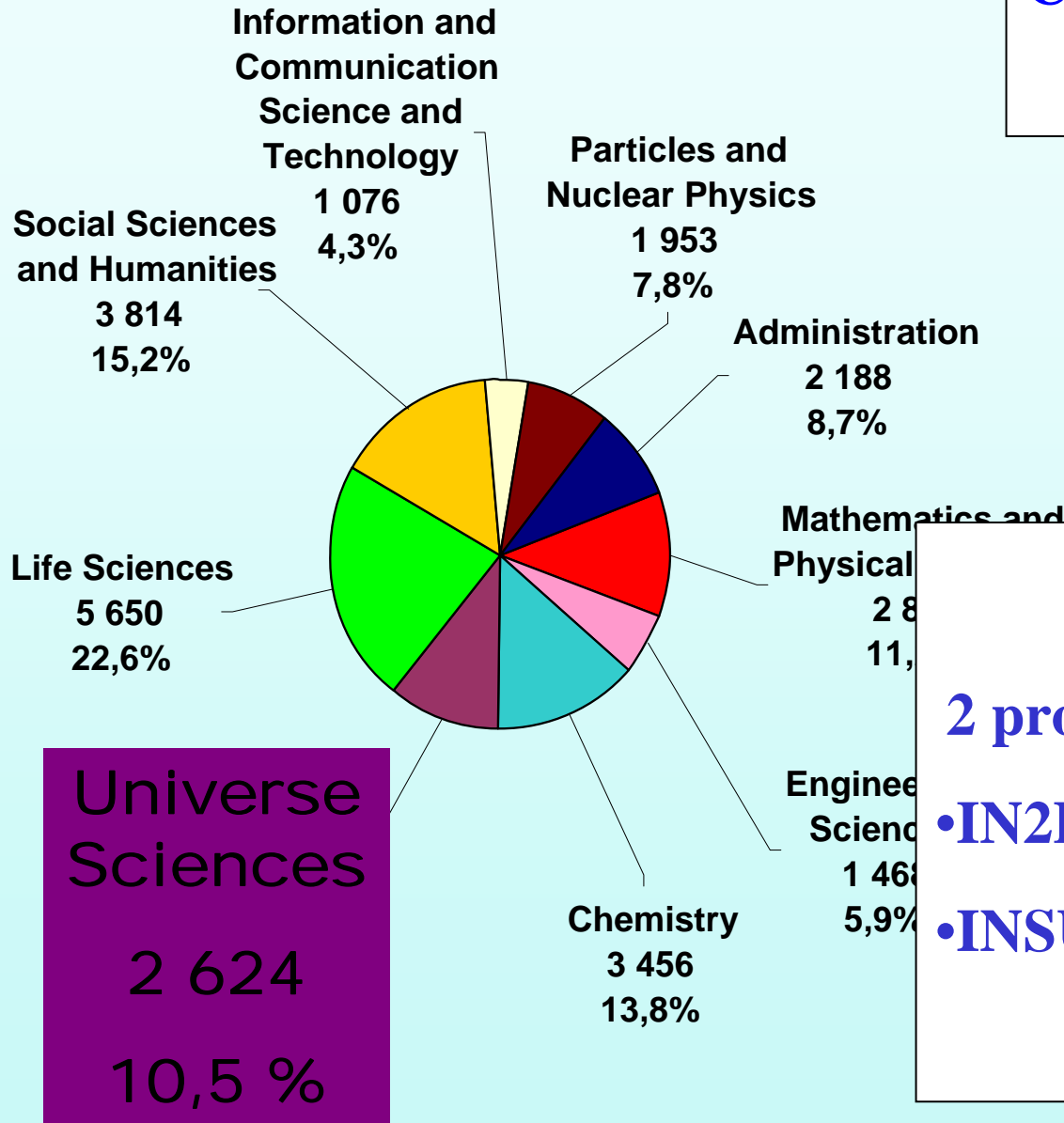
Laboratory of Geology

at ENS, PARIS, FRANCE

CNRS Key Figures

- CNRS stands for “**N**ational **C**enter for **S**cientific **R**esearch”
- A total budget of **2.44** billion Euros including 275 ME in contract funds (essentially with industry, European Union)
- **1,236** CNRS laboratories : own (13%) or associated (87%)
- **25,283** agents : researchers (11,349), engineers (6134), technical (6962) and administrative (807) staff
- **5,000** visiting foreign researchers
- **300** CNRS researchers on leave of absence in foreign laboratories

**CNRS is divided in :
8 departments**



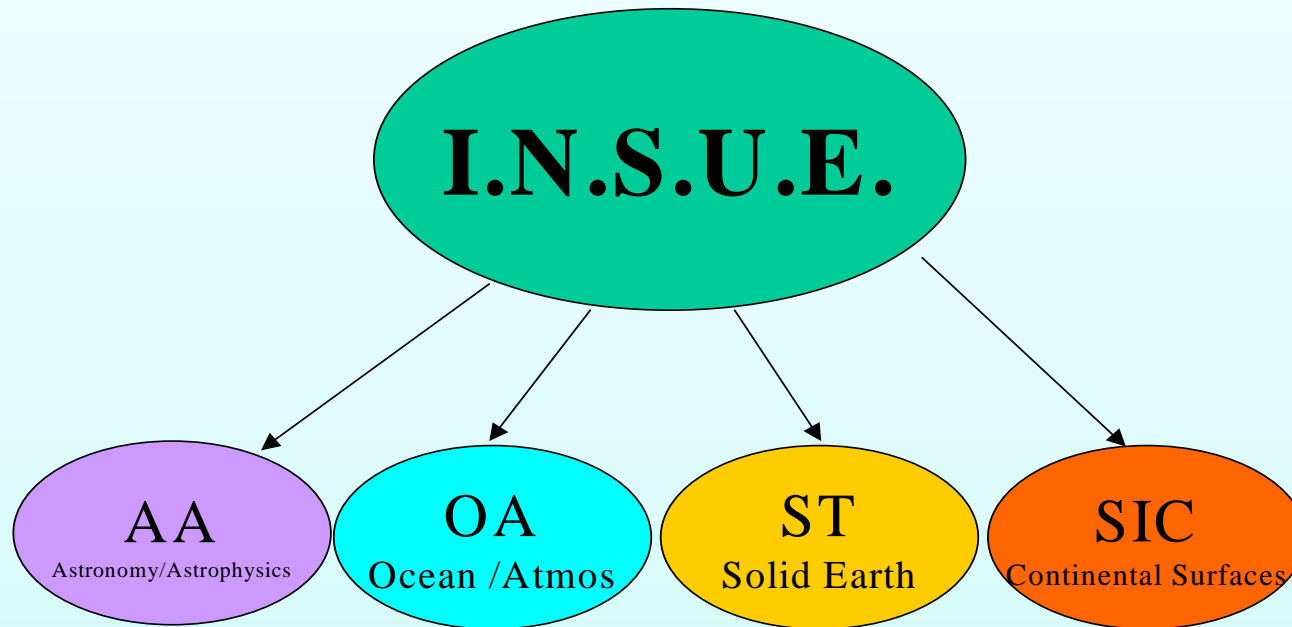
+

2 programming agencies

- **IN2P3** (Nuclear physics)
- **INSU** (Universe Science)

+ Environment

INSUE Structure and Missions



- Expertise
- Prospective
- Programming and funding
- National equipments (aircrafts, boats, telescope, chemical analysis, gravimeter, super computer ...)
- Observatories (Volcanoes, magnetic, seismologic, ...)
- Relations with other agencies (government and private)

Astronomy/Astrophysics

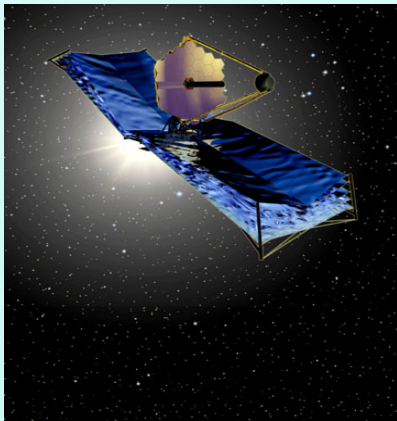


Priorities

- Origin of the Universe
- Exploration of Mars
- Extrasolar Planets

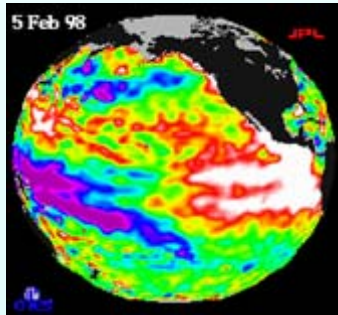
New Generation of Space (visible/IR) and ground (radio) Telescope

- stars and galaxies
- formation of planetary systems



Ocean / Atmosphere / Climate

Ocean



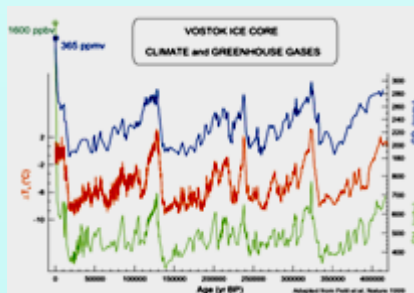
- Ocean Contribution to climate variability
- Ocean-atmosphere exchanges
- Effect of biological processes on the chemistry of oceans
- Evolution of coastal zones

Atmosphere



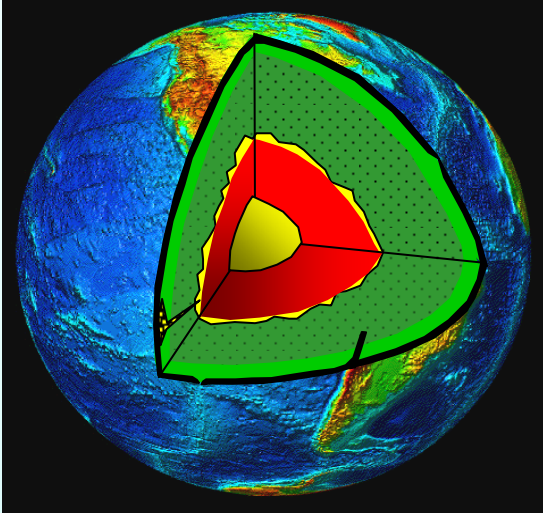
- Increase model prevision capabilities
- Role of clouds in the radiation budget
- Chemical reaction in the atmosphere
- Air pollution in cities

Climate



- Collecting long-term data from space and on the ground
- Establishing and understanding the state of climate before the industrial era
- Increase the quality of climate models (ice, biosphere)

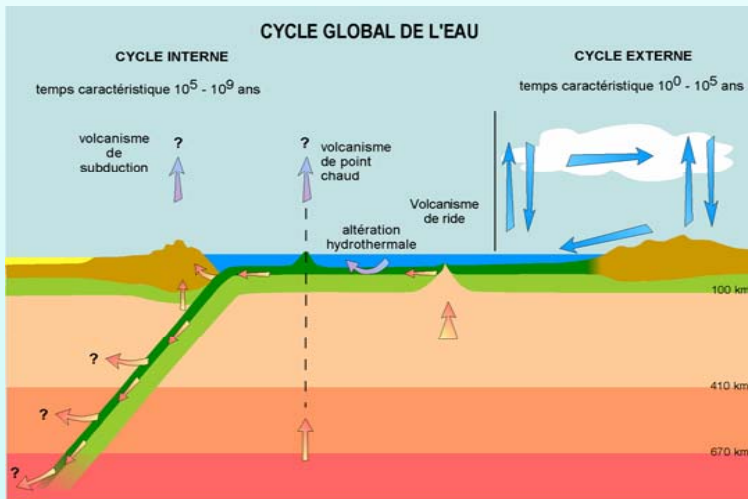
Solid Earth



- **The Earth system : interactions and coupling between inner and outer reservoirs**
- **Geochemical cycles**
- **Dynamics of the Earth interior (core and mantle) and surface**
- **Natural hazards : earthquakes, volcanoes, land slides, floods, tsunami, ...**

Continental Surfaces

Soils and Biosphere



- climate (C sinks)
- water cycle
- Waste storage
- Sustainable development

Observation networks / Observatories

- DYFAMED Temporal Variability of the Mediterranean water column
- SOMLIT Coastal Waters Monitoring Network
- OISO Carbon Oxide Sea/Air exchanges
- ROSAME Sea Level Monitoring Network
- NDSC Stratosphere Composition Monitoring Network
- MOZAIC Atmospheric composition Monitoring (com. airplanes)
- RAMCES Atmosphere «Green House » Gaz contains monitoring
- GEOSCOPE Global Seismological network
- Volcanic Observatories (Guadeloupe, Martinique, La Réunion, Djibouti)
- LITHOSCOPE Portable Seismological network (80 stations)
- GPS portable GPS network (40 stations)

National Programs

PROGRAMMES Operations	INSU	ADEME	BRGM	CEA	CEMAGREF	CIRAD	CNRS SC	CNRS SDV	CNRS SHS	CNRS SPI	CNRS SPM	CNES	EDF	ELF	IFREMER	IFRTP	IGN	INRA	IRD	LCPC	
ASPS	2300											205									
ASRHA	275																				
Clipper	125											170									
DORSALES	350							300							300						
Intérieur Terre	4800																				
Mercator	1000																				
OCEAN	1250																				
PATOM	1500											500	100								
PCMI	1000			150			120				400	208									
PNC	950			200																	
PNCA	2015	800					100				200	1450	100	100				200			
PNEC	1700		140									220		250	3500					850	
PNEDC	1500											850								400	
PNP	1500											1500									
PNRH	1700		140		200	100				30		200						600	400	100	
PNRN	1900		140	200	200							100								100	
PNSE	1850		160				180	200											800	500	
PNST	1550											310									
PNTS	350		100		0	50			100			1300					50	300	100		
Pomme	1600																				
PROOF	1400											300		300	100					100	
Woce	250											80									
	30865	800	680	550	400	150	400	500	100	30	600	7393	200	650	3900	0	50	1900	2450	100	

ENS Key Figures

- ENS stands for “**E**cole **N**ormale **S**upérieure”
- It is a school with more teachers than students :
 - About **200** professors and assistant professors
 - **190** students enter every year through a **very** competitive exam
- **14** departments covering literature history and science (no medical nor law)
- Students become university professors, researchers, administration directors ... And prime ministers.

ENS DEPARTMENTS

(14)

- HISTORY AND PHILOSOPHY OF SCIENCE
- COGNITION
- LITERATURE AND LANGUAGES
- HISTORY
- ANTIQUITY
- PHILOSOPHY
- GEOGRAPHY
- SOCIAL SCIENCES
- COMPUTER SCIENCES
- BIOLOGY
- CHEMISTRY
- MATHEMATICS
- PHYSICS
- EARTH-ATMOSPHERE-OCEAN

EARTH and ATMOSPHERIC Dpt. (TAO)



2 labs :

- Dynamical meteorology lab (LMD)
- Geological lab (LG)

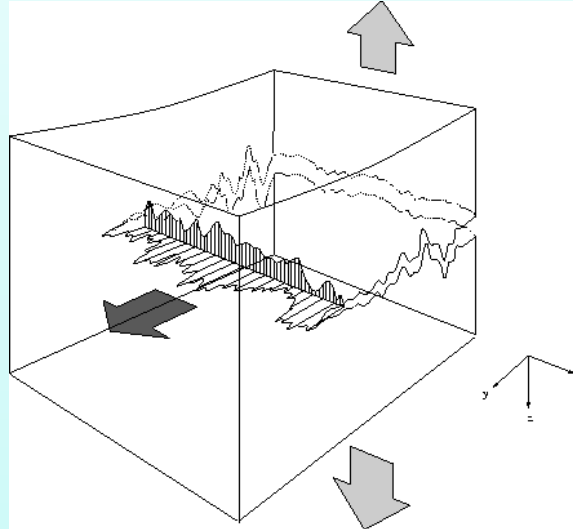
Laboratoire de GEOLOGIE

2 teams

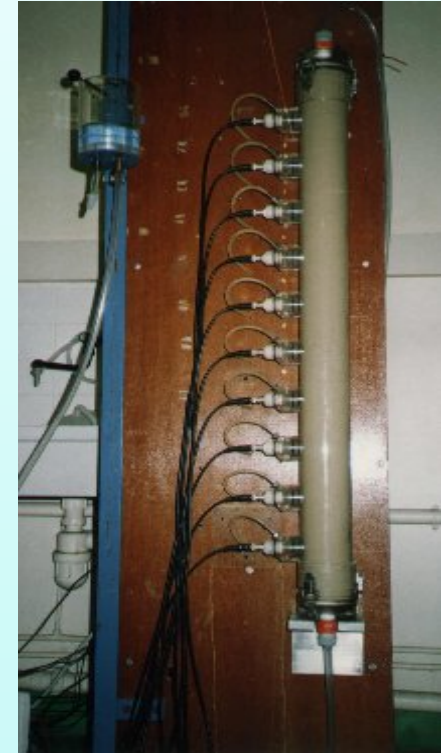
- Rock mechanics and electric properties



High pressure cell



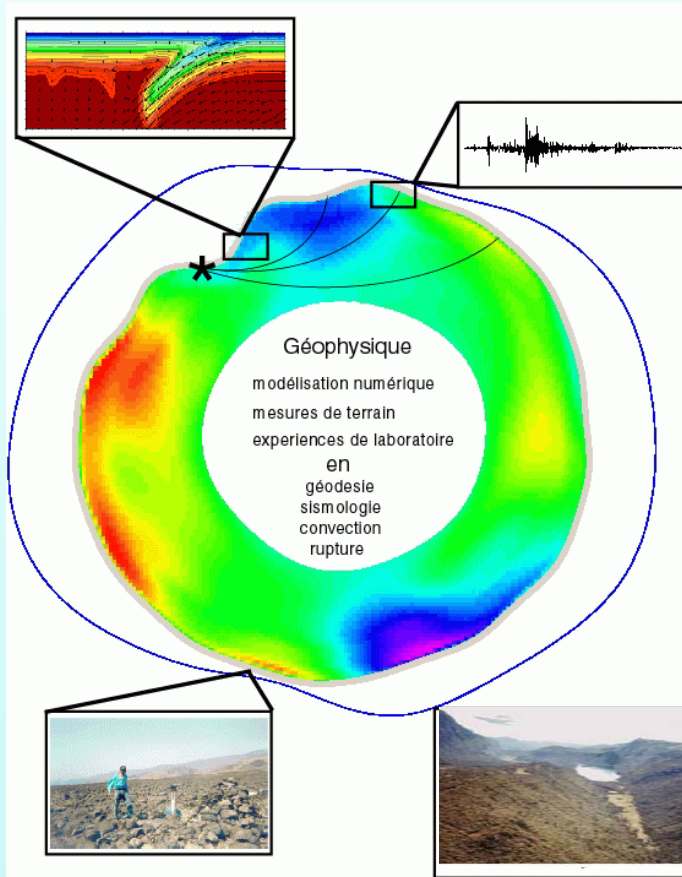
Rock fracture
experiment



Electro-magnetic filtration

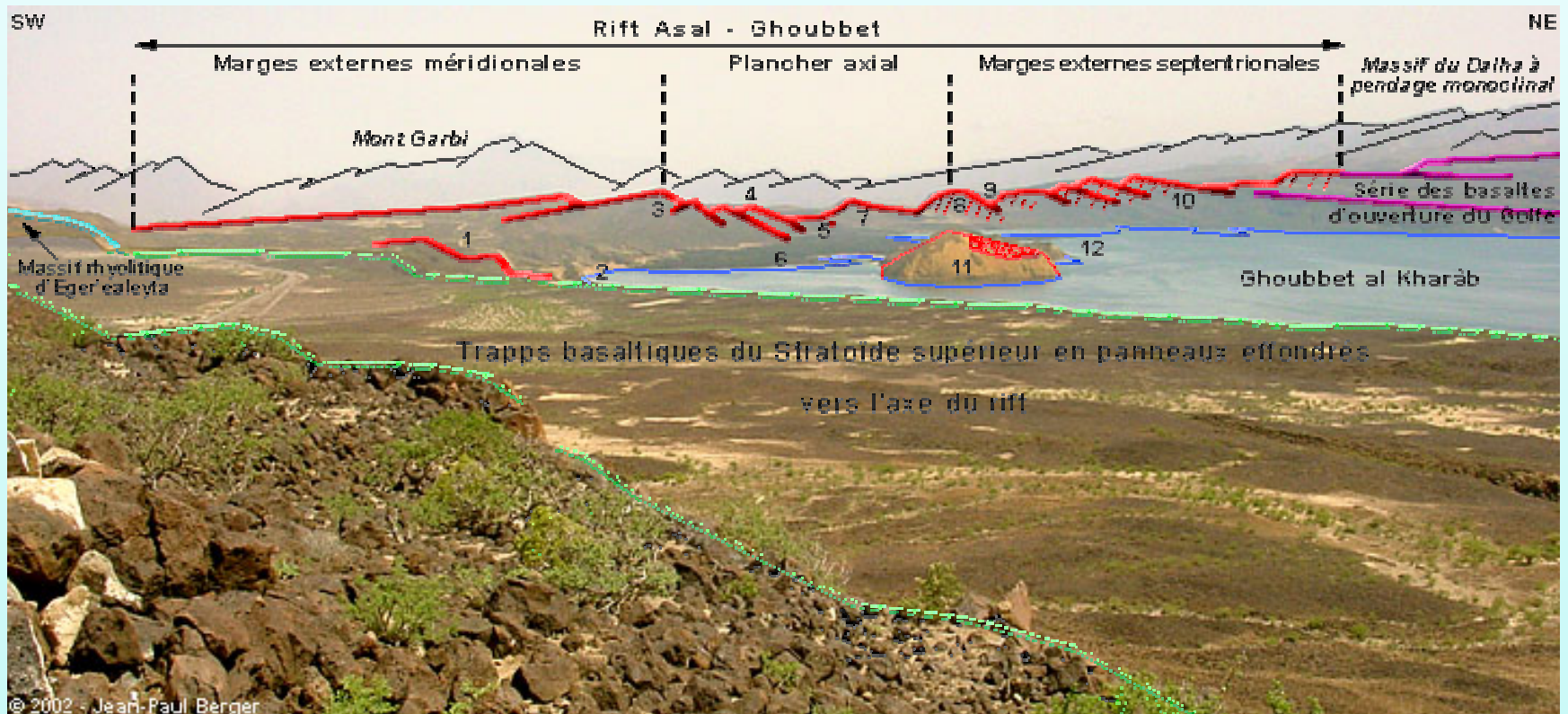
Laboratoire de GEOLOGIE

- Geophysics and Geodynamics (13 researchers : 5 ENS + 8 CNRS)



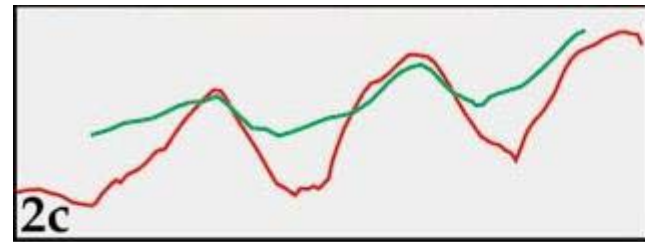
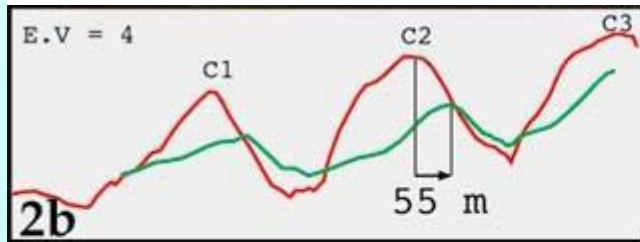
- Structural Geology and Tectonics
- Numerical modelling of the Earth mantle
- Sismology
 - Imagery of the lithosphere
 - Earthquake source study
- Geodesy : GPS and INSAR

Asal rift, Djibouti

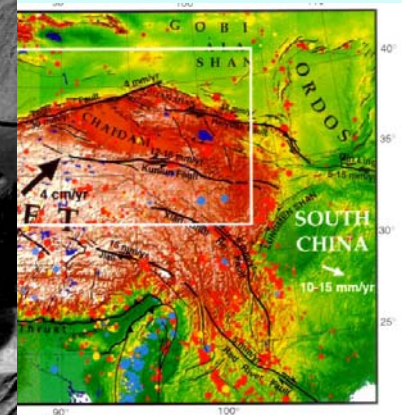
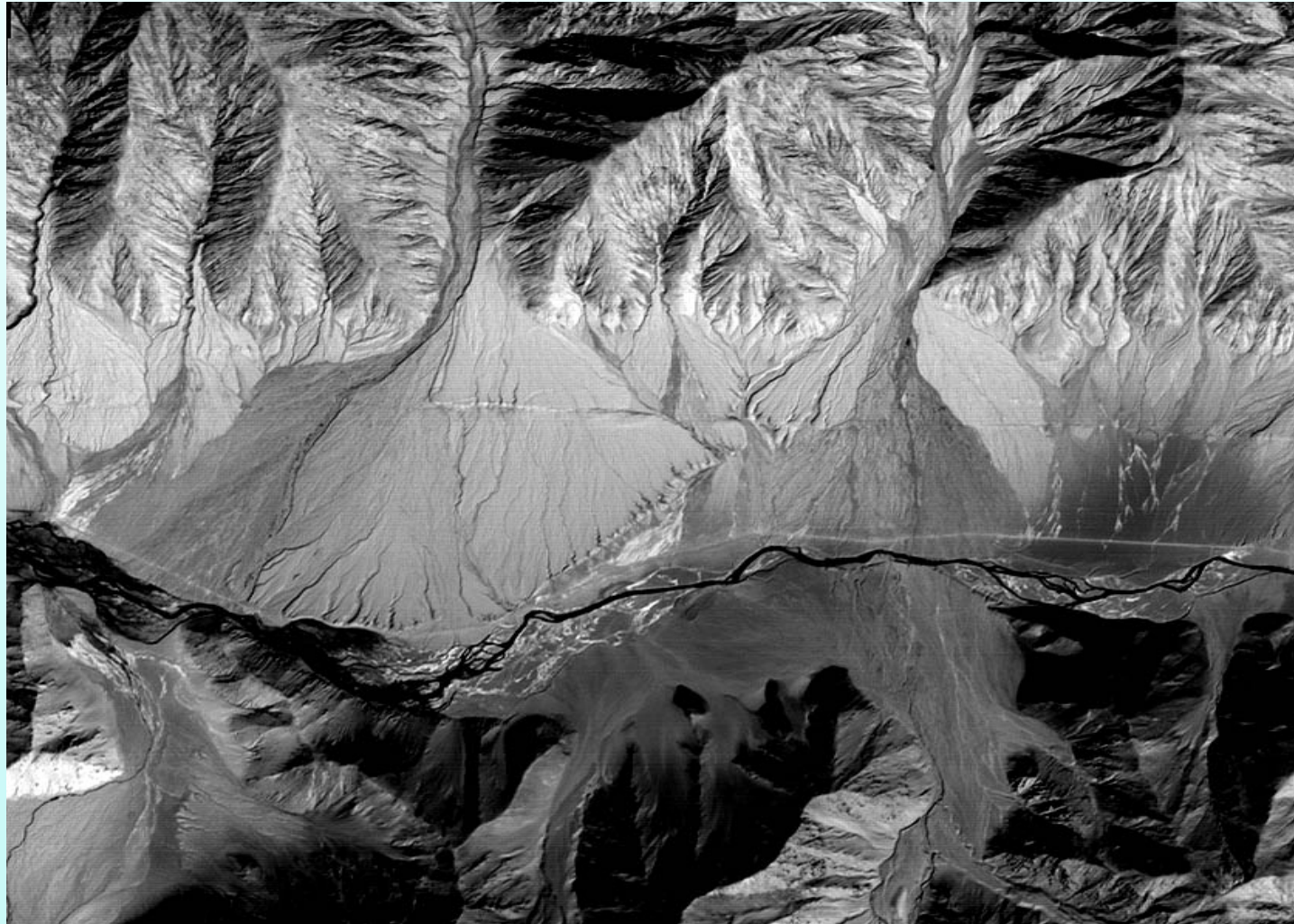


Quantification of a fault

Chang Ma fault, China



Satellite imagery



Seismicity from 1902-1994
Only earthquakes with known depth
(different than 0 and 33 km).
SSB (1902-1984), USGS (1984-1994).

SEAMERGES - Bangkok
3-5 March 2004

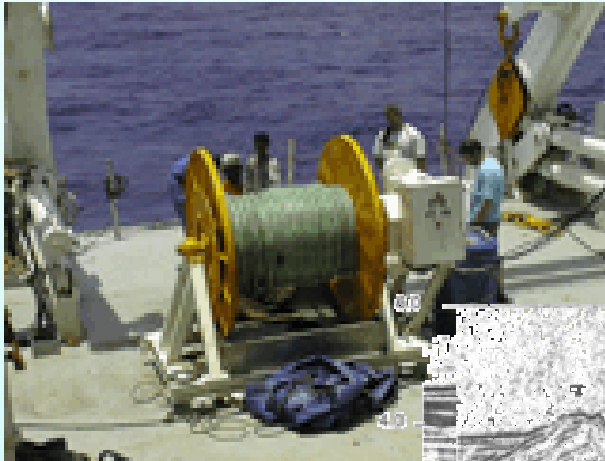
Marine Geophysics



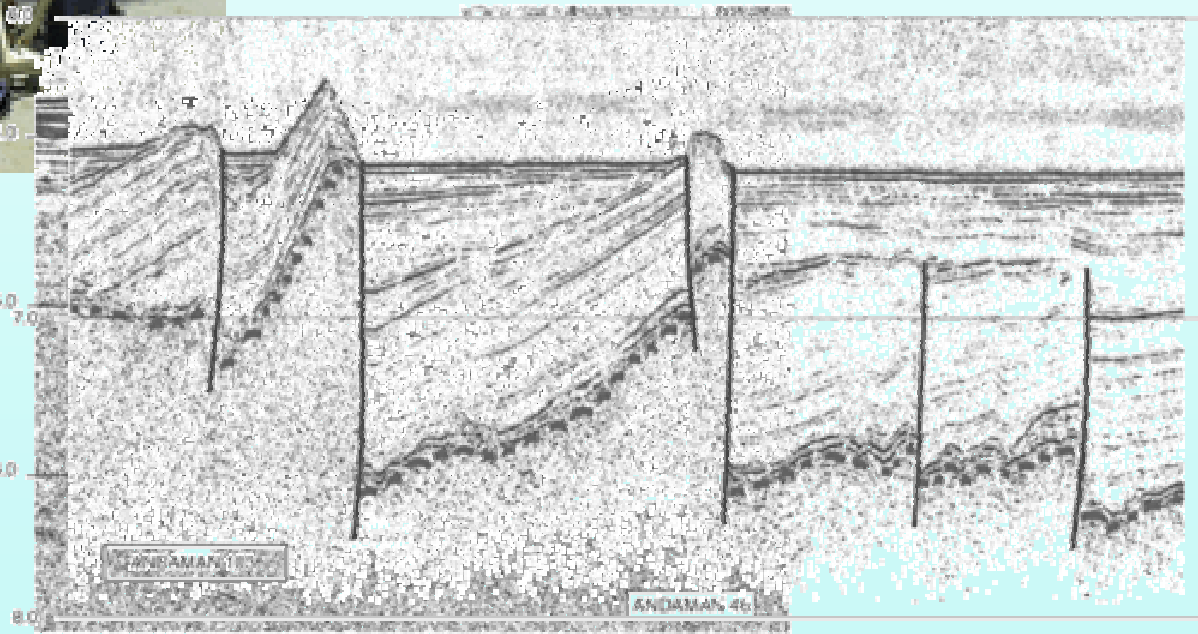
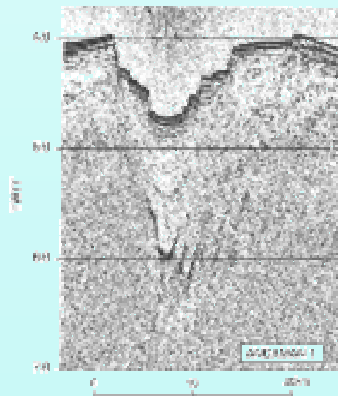
Le Marion Dufresne, INSU oceanographic vessel

SEAMERGES - Bangkok
3-5 March 2004

Reflective Sismic prospection

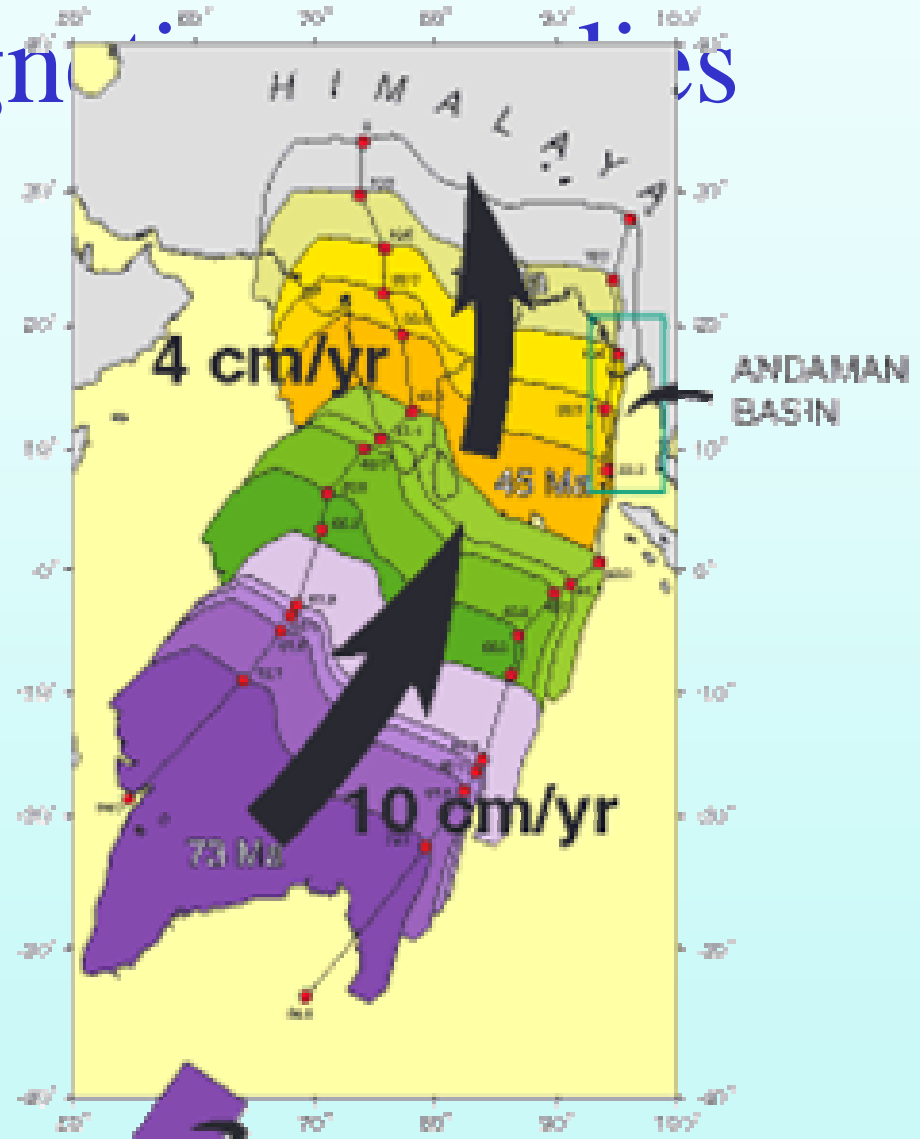
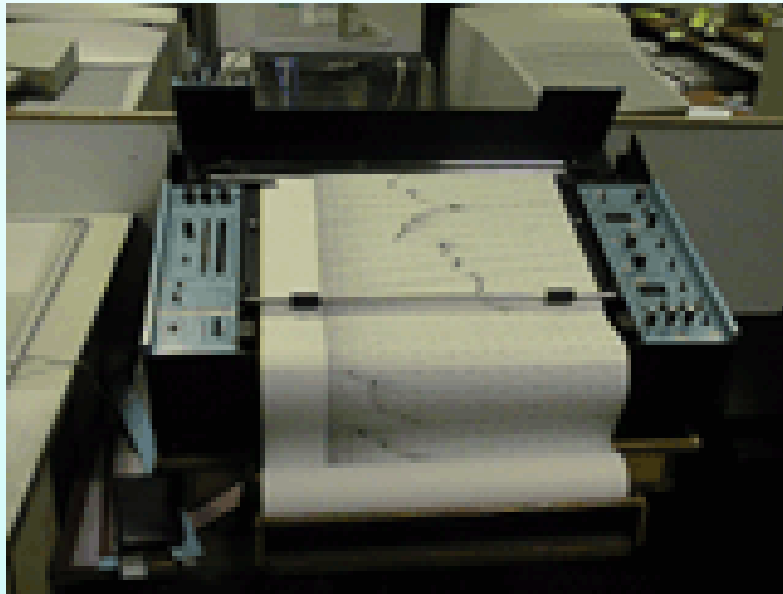


Flute sismique



MD116 - ANDAMAN
Marion Dufresne - May 2000

Sea bottom magnetics



SEAMERGES - Ban
3-5 March 200

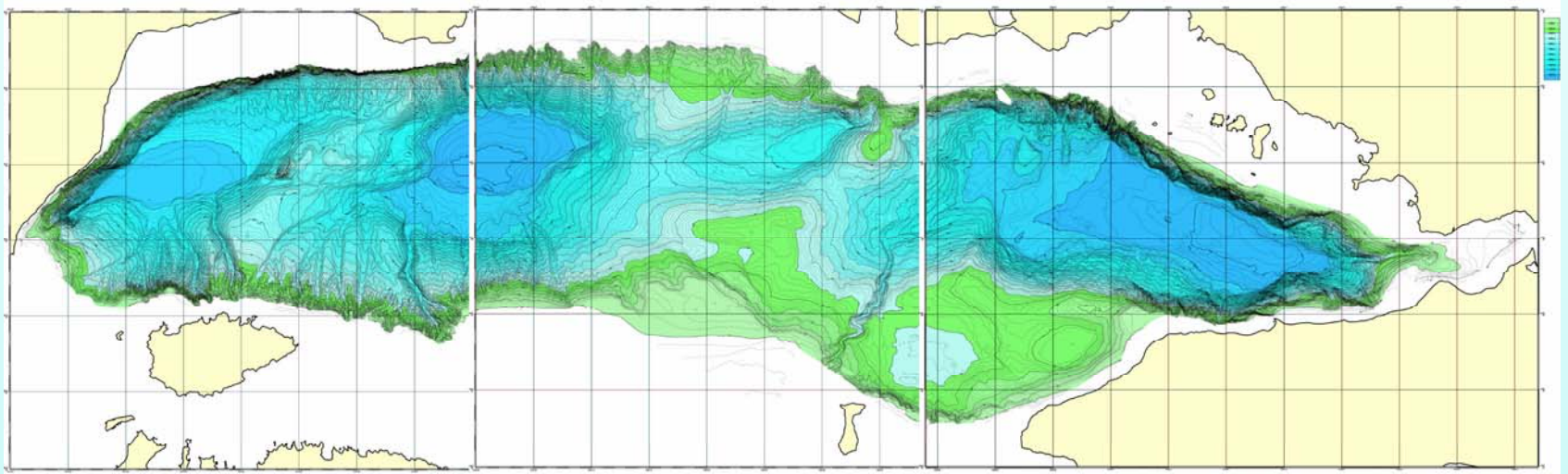
Under Sea Bathymétry



SAR : towed Accou

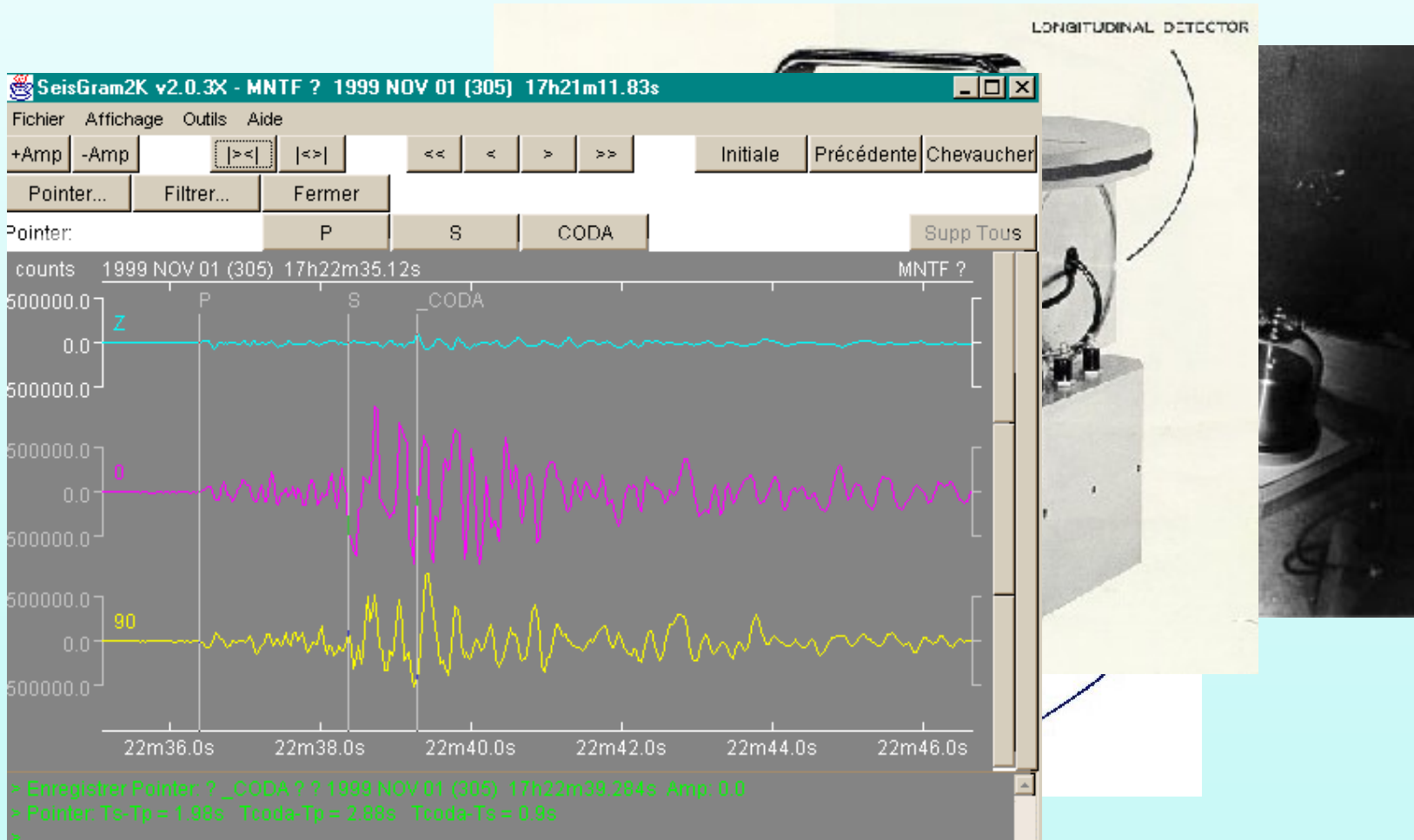


Sea of Marmara



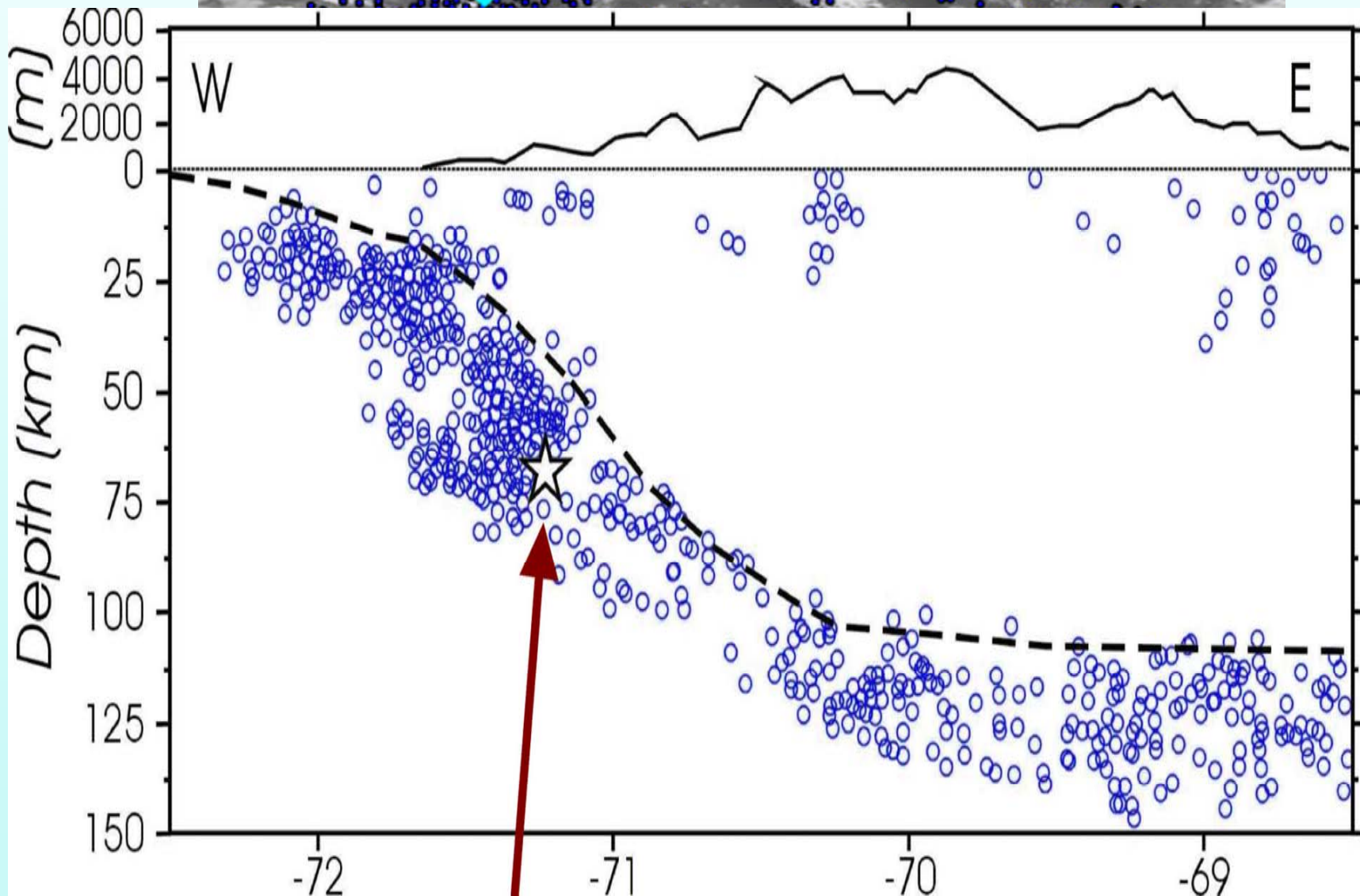
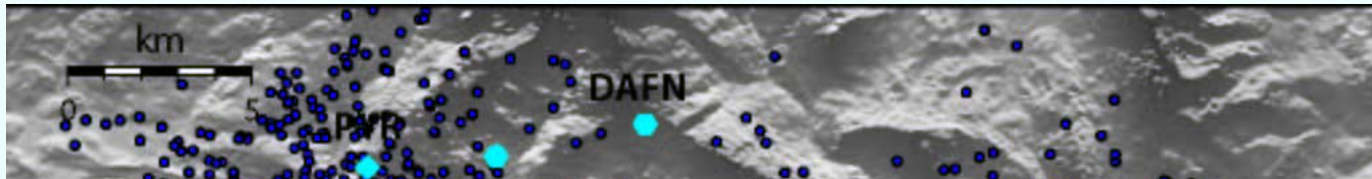
SEAMERGES - Bangkok
3-5 March 2004

Sismology



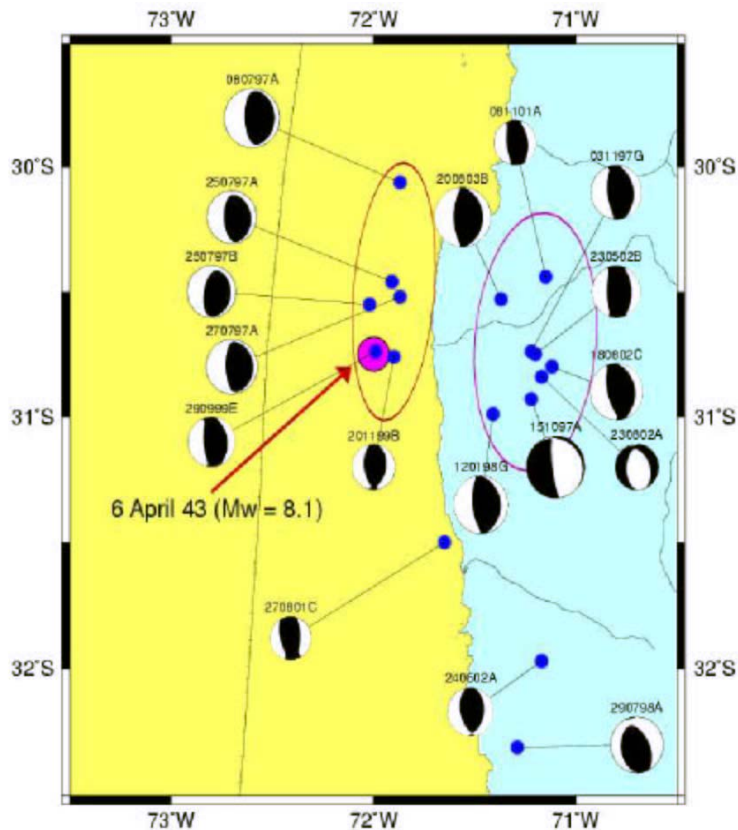
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3-5 March 2004



Illapel Seismic gap, Chile

Seismicity 4a Region 1992-2003



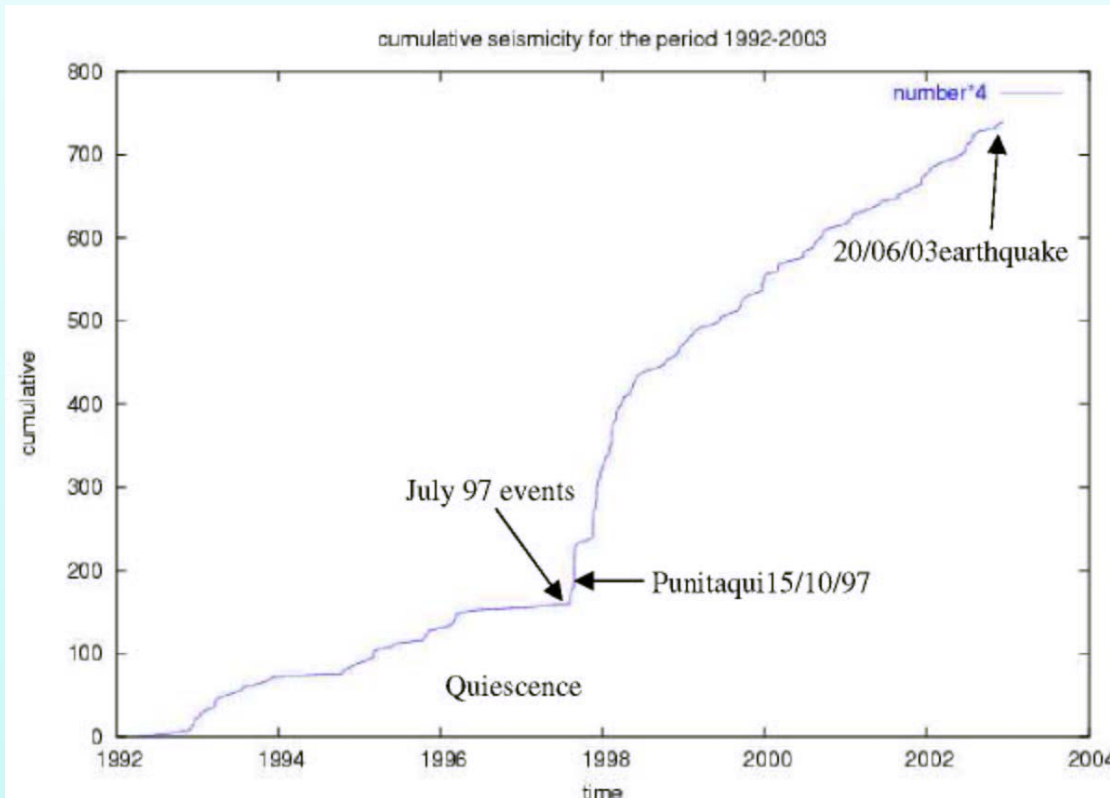
Locations from NEIC. Mechanisms from Harvard CMT.
14 $M > 6$ earthquakes occurred in two zones

2 areas of activity

1. Blue area between July 97 and November 99

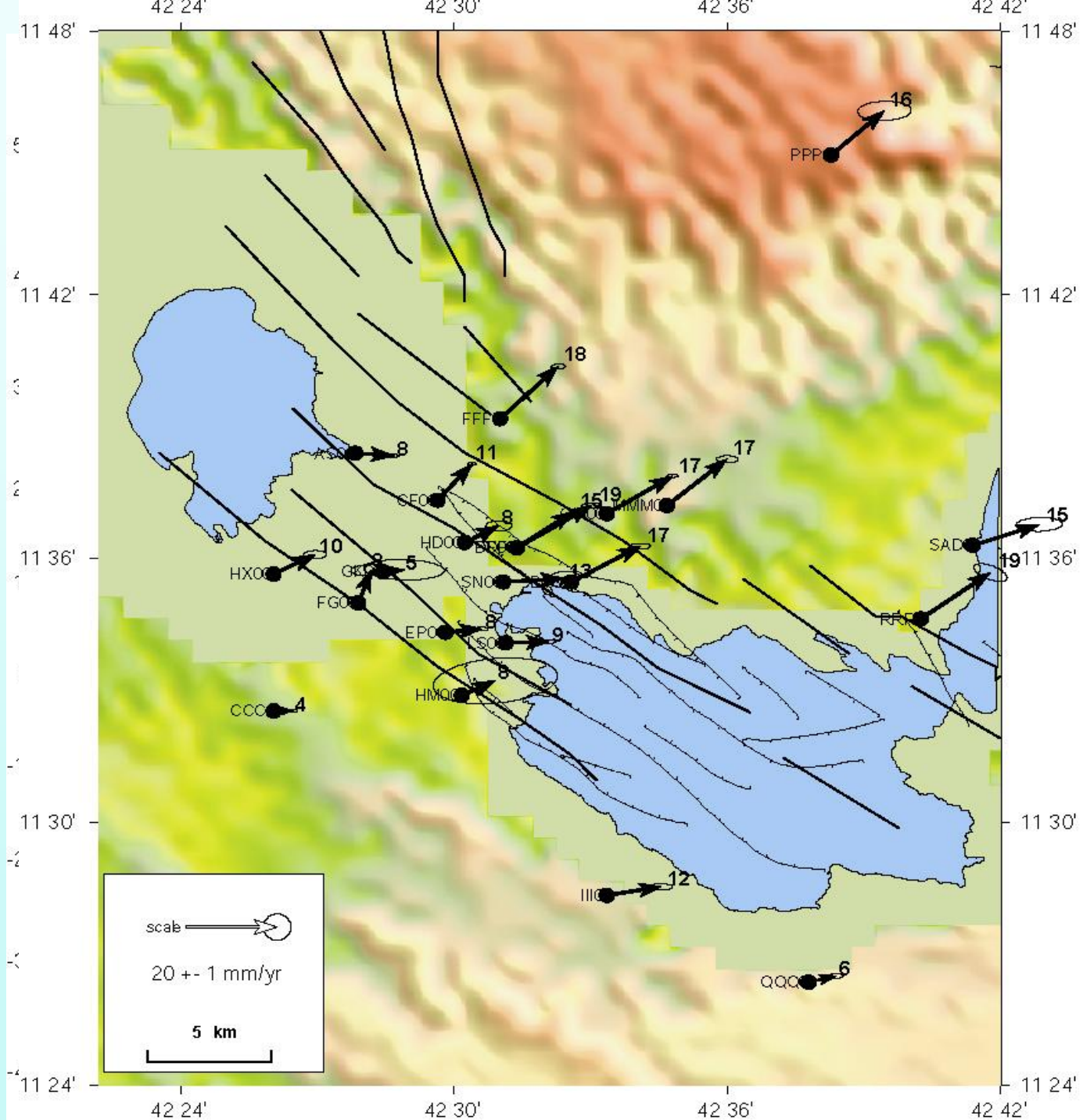
2. Violet area since Punitaqui earthquake October 97

Cumulated number of Earthquakes



3 distinct periods :

1. « normal » until 1996
2. Quiescence between 96 and 97
3. Intense since Punitaqui , end 97



Geodesy : INSAR

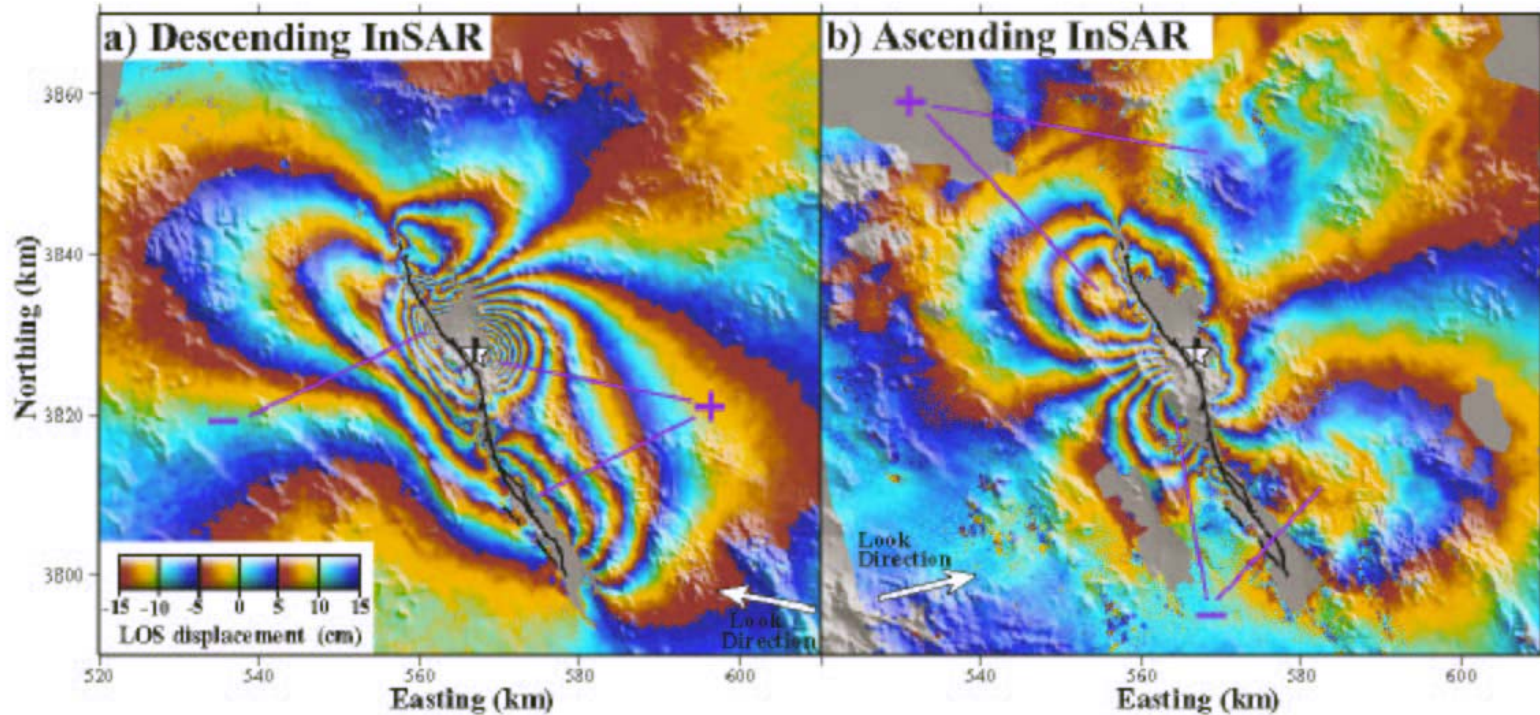


Figure 2: (a) Descending and (b) ascending interferograms showing the deformation of the Hector Mine earthquake. Each color cycle represents 10 cm of line-of-sight (LOS) displacement toward (yellow-red-blue) or away from (yellow-blue-red) the satellite. Arrows show the horizontal component of the look direction from the radar satellites. Purple + and - signs point to areas of positive and negative LOS displacement. The mapped fault trace is shown as thick line and the epicenter is denoted with a star. Coordinates are universal transverse Mercator (UTM) coordinates (zone 11S) in kilometers.