I mostly use GPS to study how the Earth changes. I study plate tectonics, volcanoes, and earthquakes.

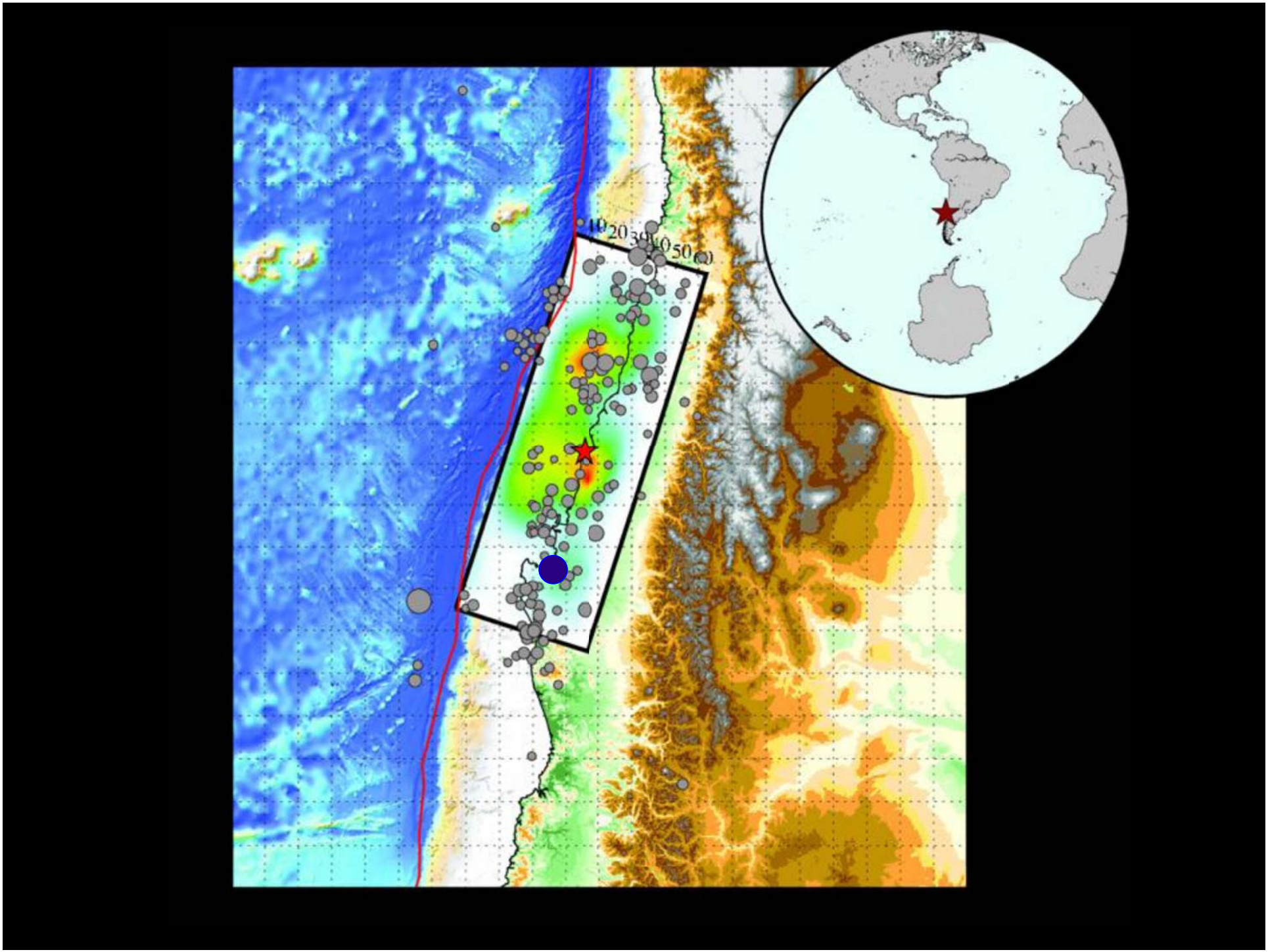
GPS monitoring

- monumentation on rock

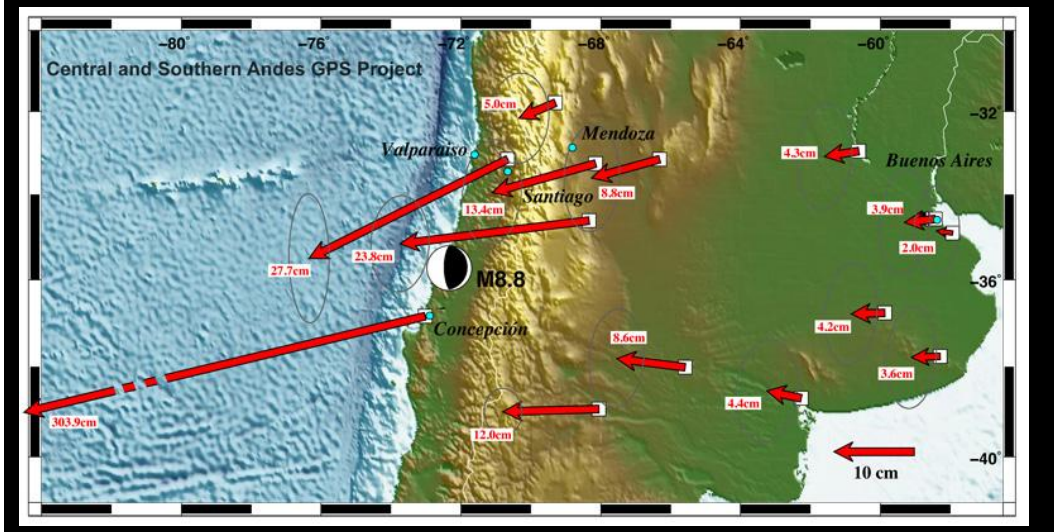
- antenna forced centering with sub-millimetre repeatabiliy (*ad hoc* designed antenna mount, thoroidal level for vertical positioning)

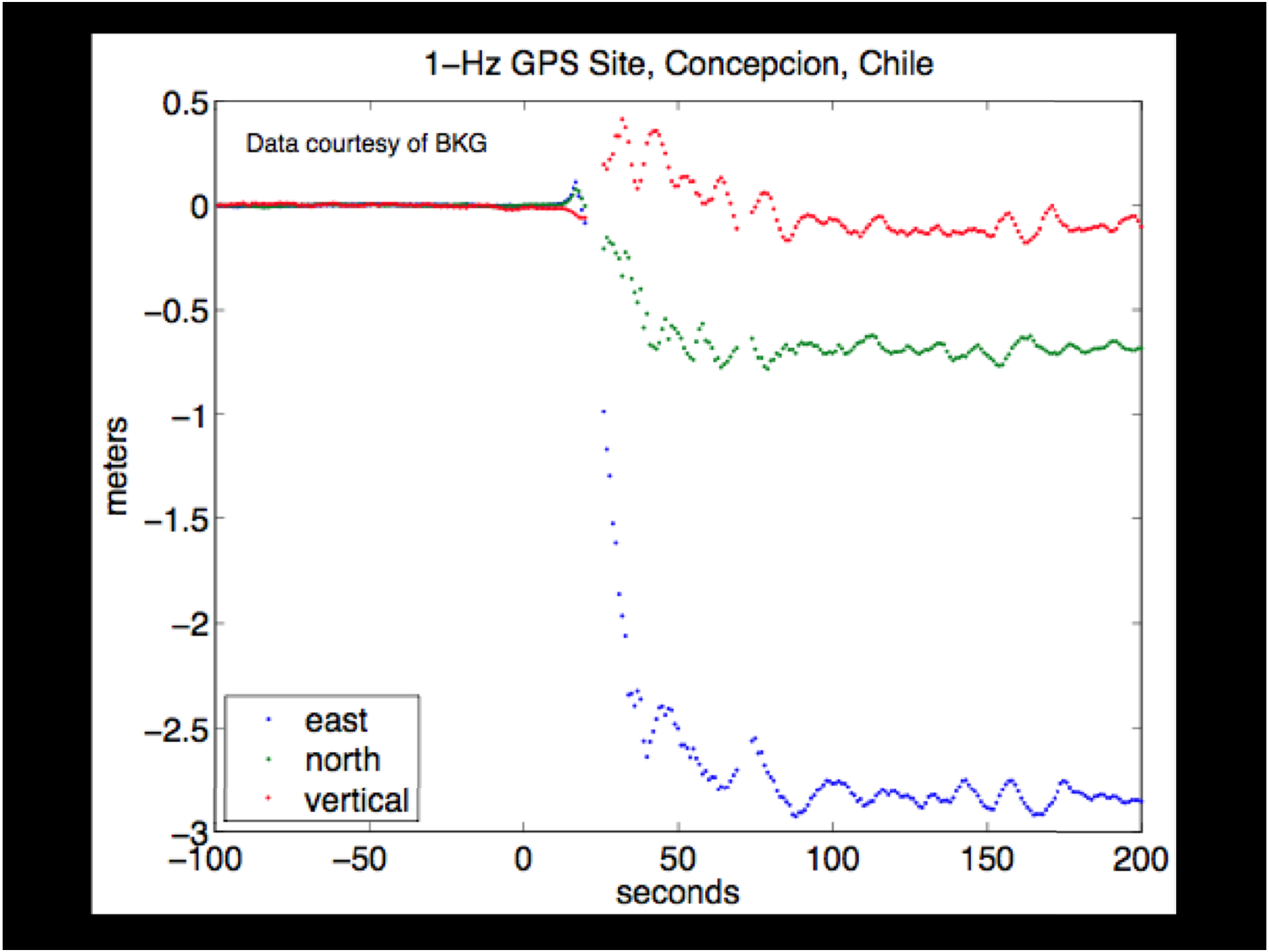
- spirit levelling on each site to check for local vertical stability

How much did the Earth deform during the recent earthquake in Chile?

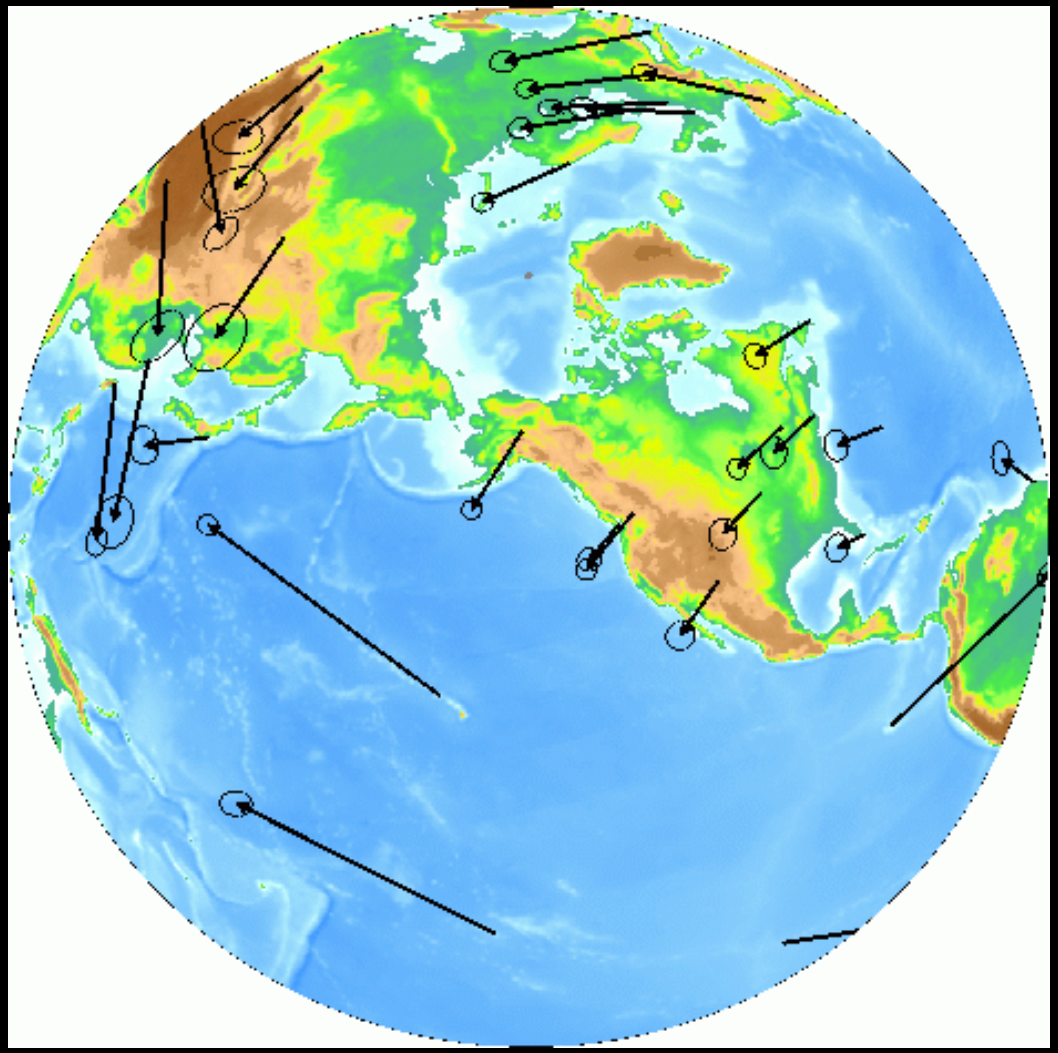


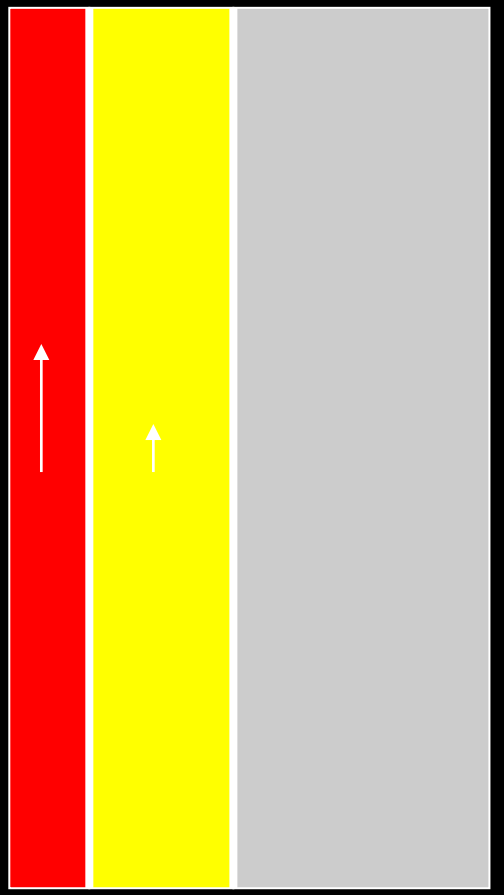
Central and Southern Andes GPS Project
Caracas
Georgetown
Paramaribo
Cayenne
Bogota
Quito
Lima
La Paz
Brasilia
Asuncion
Santiago
Concepcion
Buenos Aires
Montevideo
SCALE
5 cm
3.04m
with data from:
IGM-Chile
RAMSAC-Argentina
Ohio State University
University of Memphis
University of Hawaii
UN Cuyo - Argentina
RBMC - Brazil
International Geodetic Service


Central and Southern Andes GPS Project
Valparaiso
Mendoza
Santiago
Buenos Aires
Concepción
M8.8
5.0cm
4.3cm
8.8cm
13.4cm
3.9cm
2.0cm
27.7cm
23.8cm
4.2cm
8.6cm
3.6cm
4.4cm
303.9cm
12.0cm
10 cm

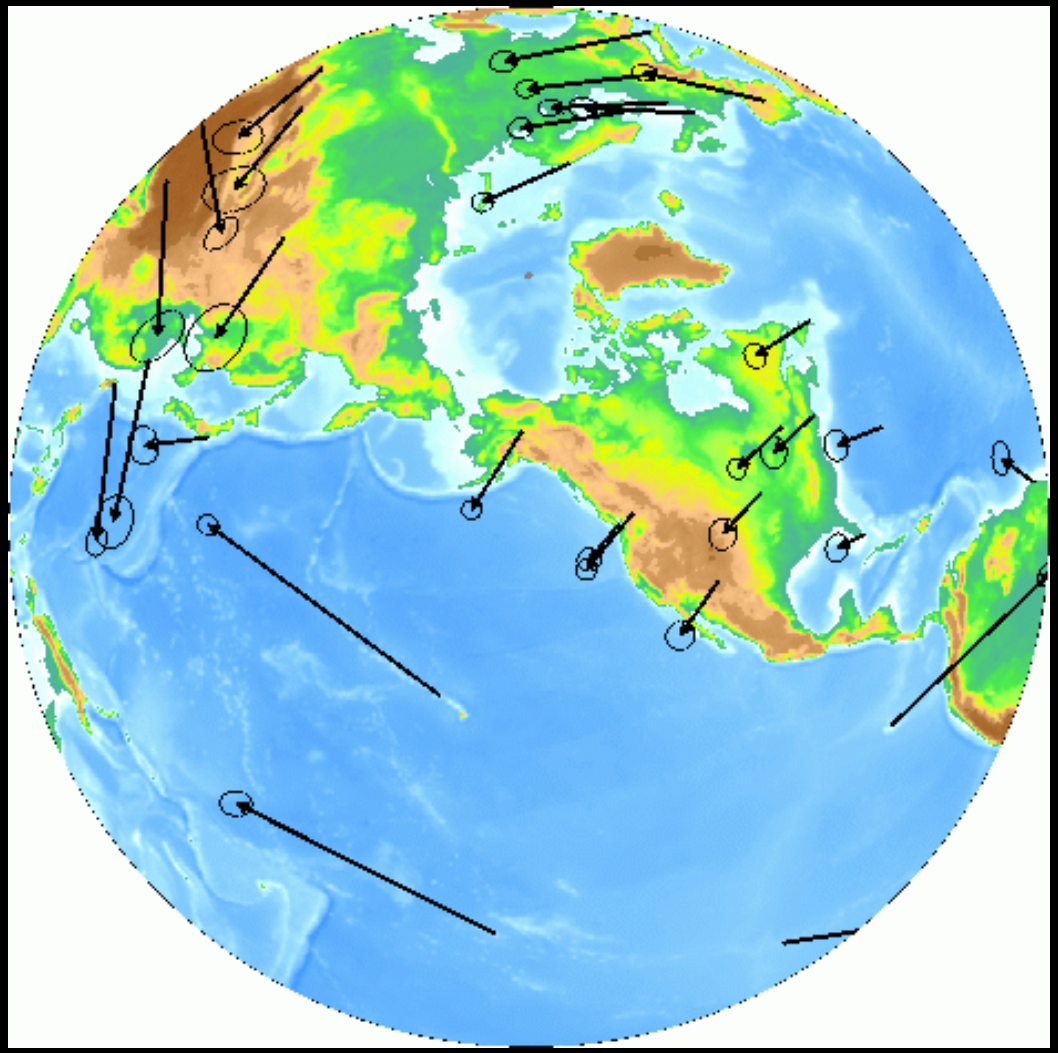

1–Hz GPS Site, Concepcion, Chile
Data courtesy of BKG
0.5
0
−0.5
−1
−1.5
−2
−2.5
−3
meters
−100
−50
0
50
100
150
200
seconds
east
north
vertical

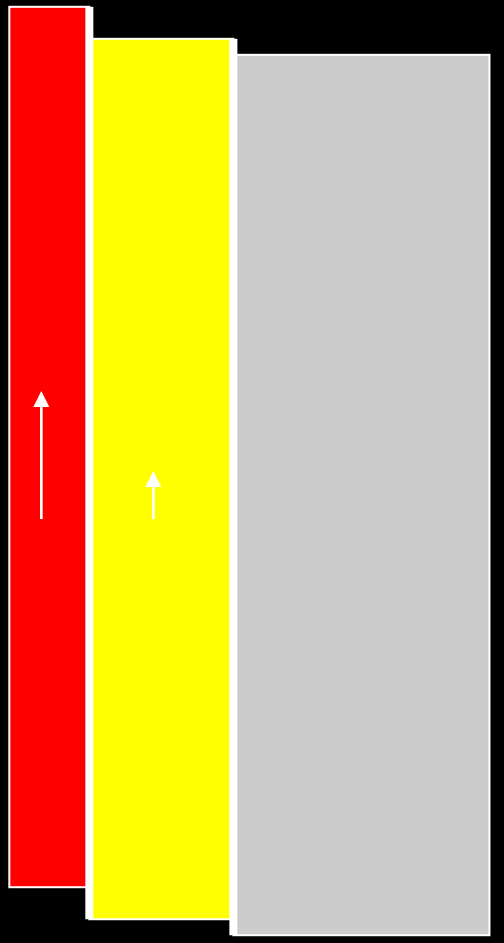
Block-like Motion



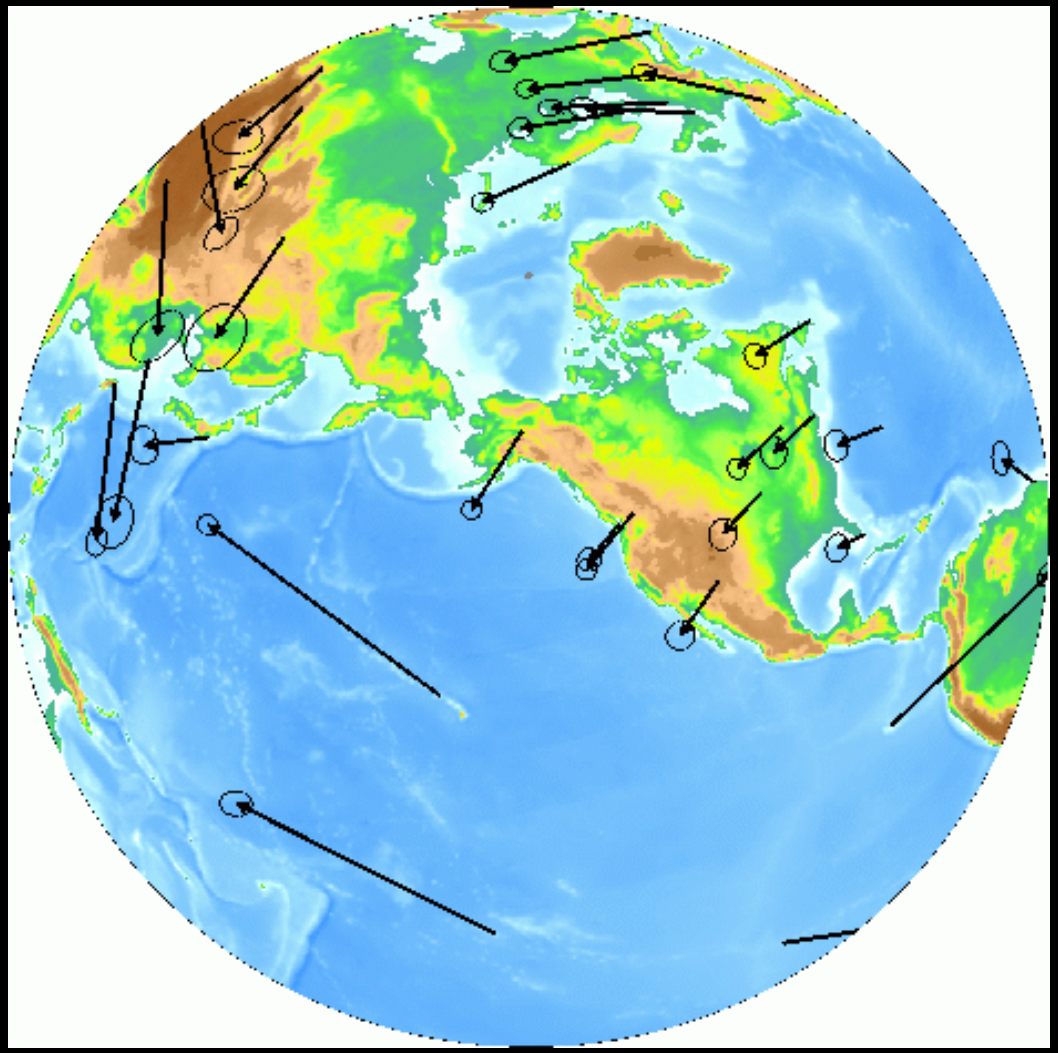


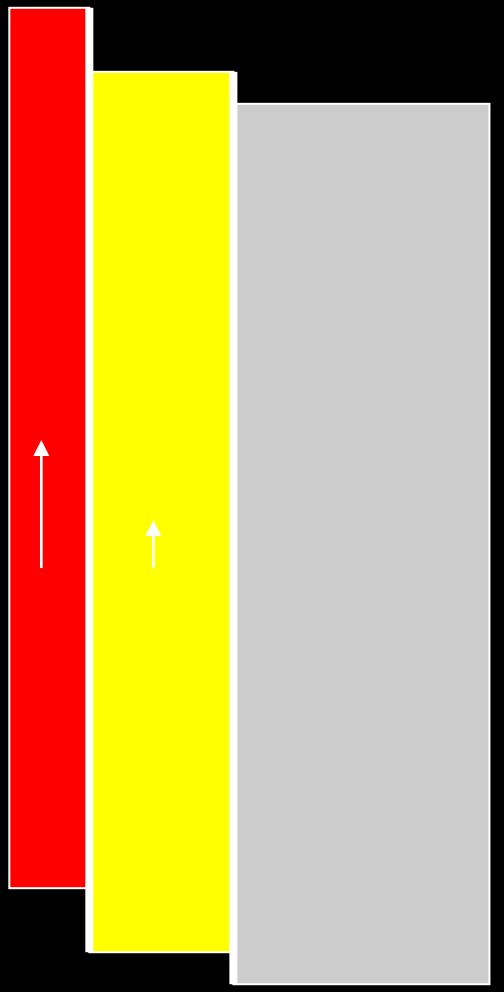
Block-like Motion



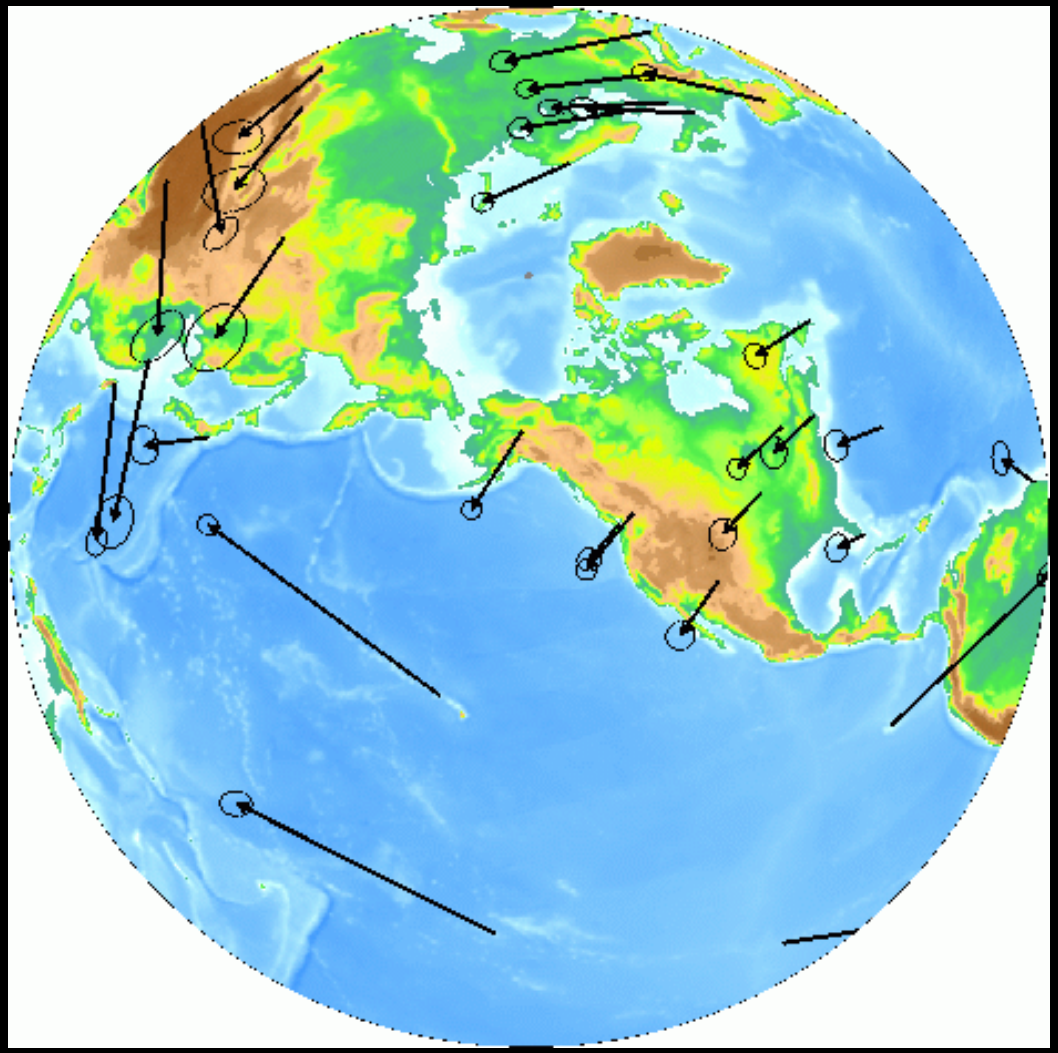


Block-like Motion





Block-like Motion



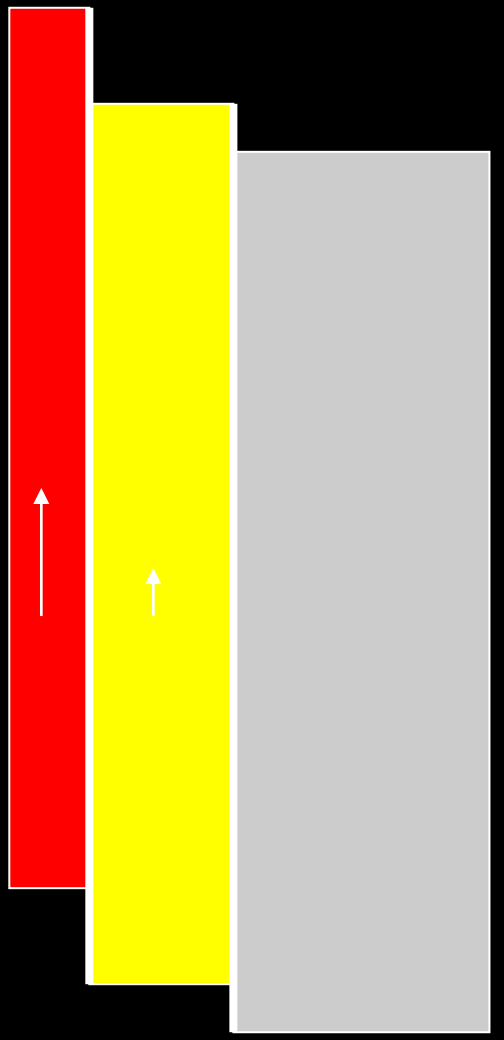
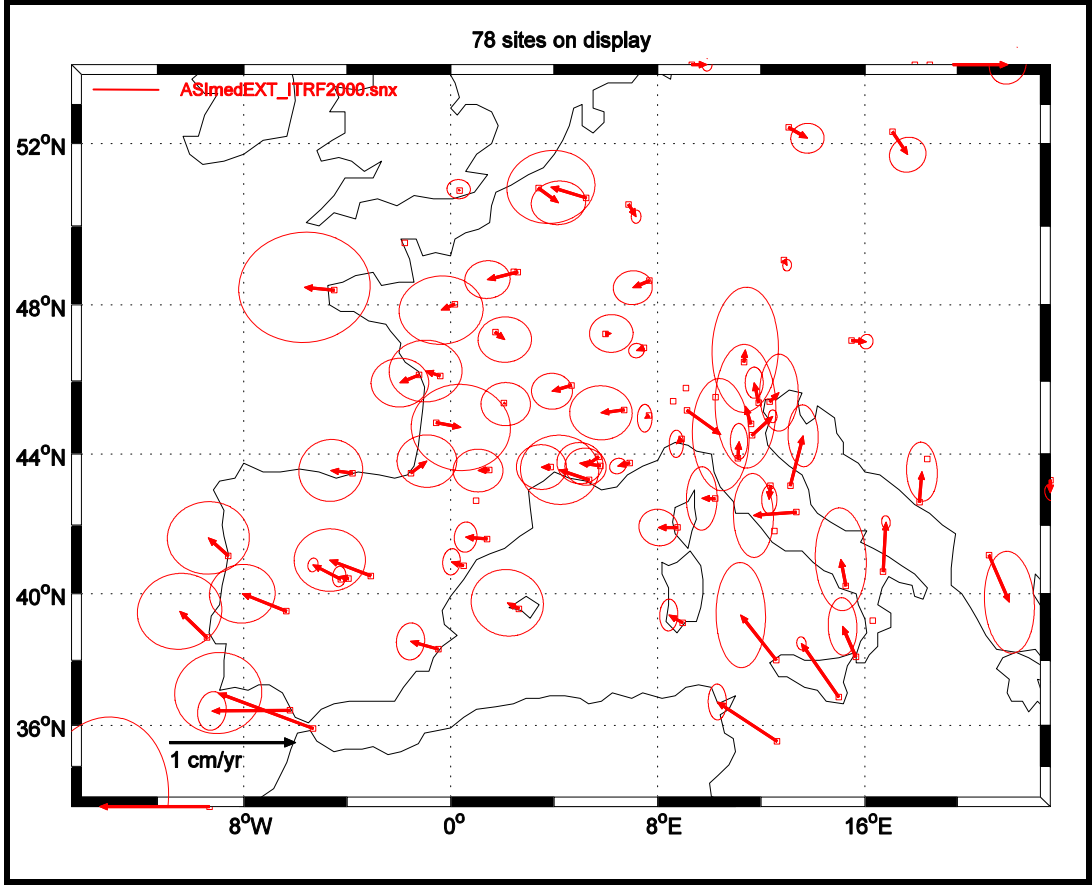
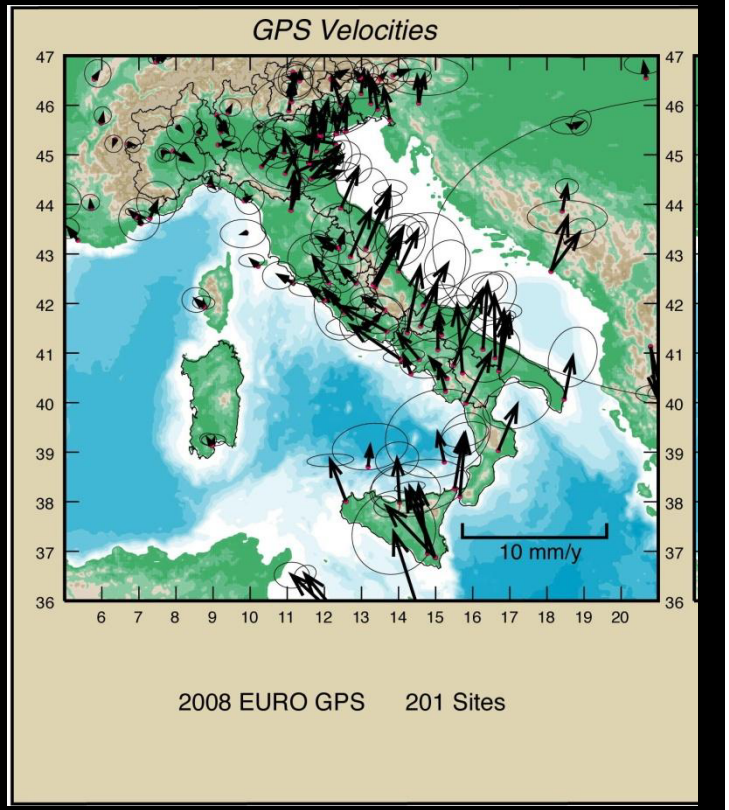
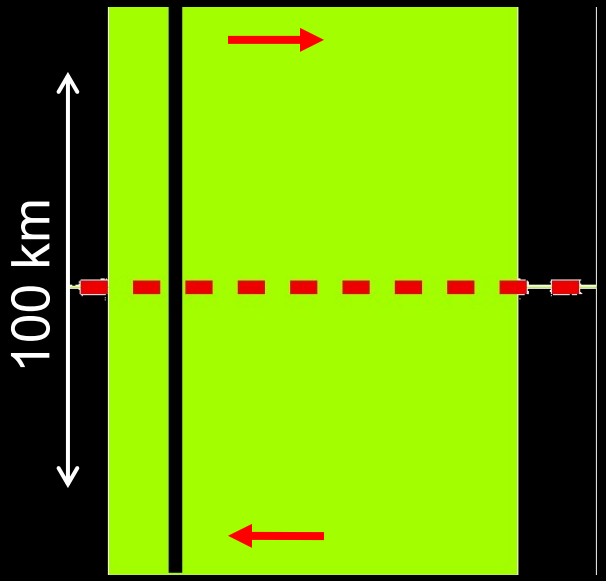


Plate boundary scale

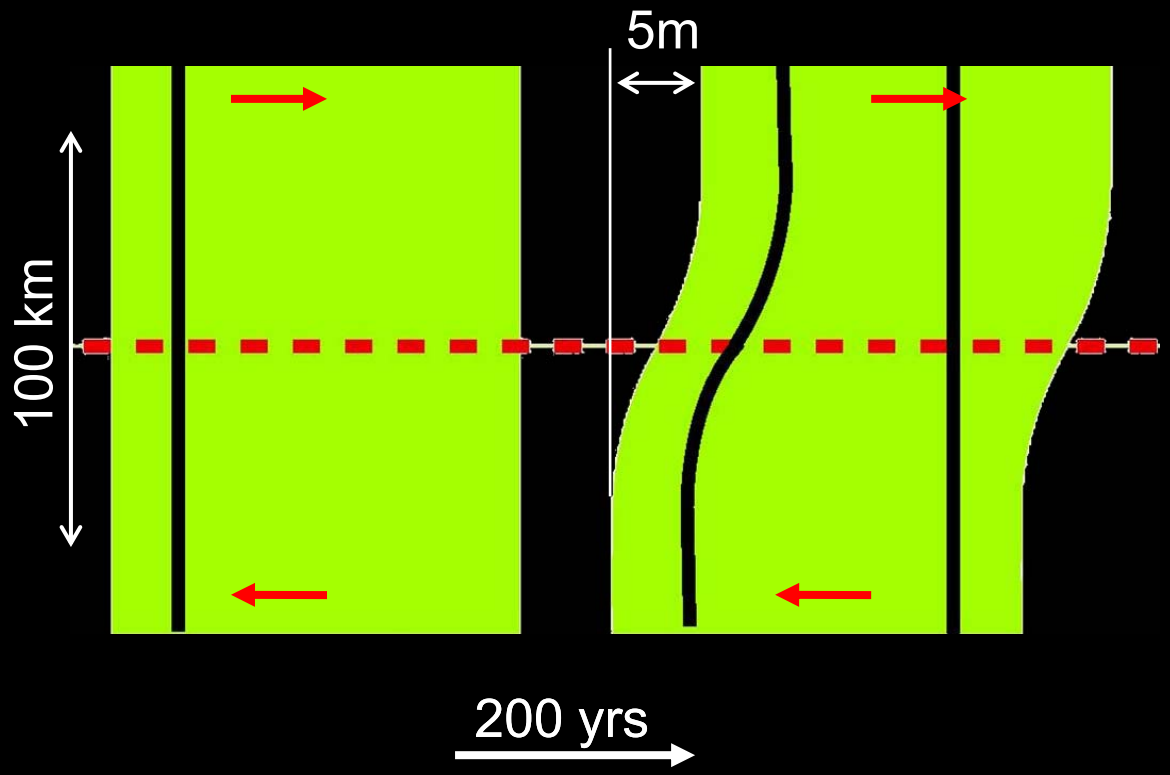




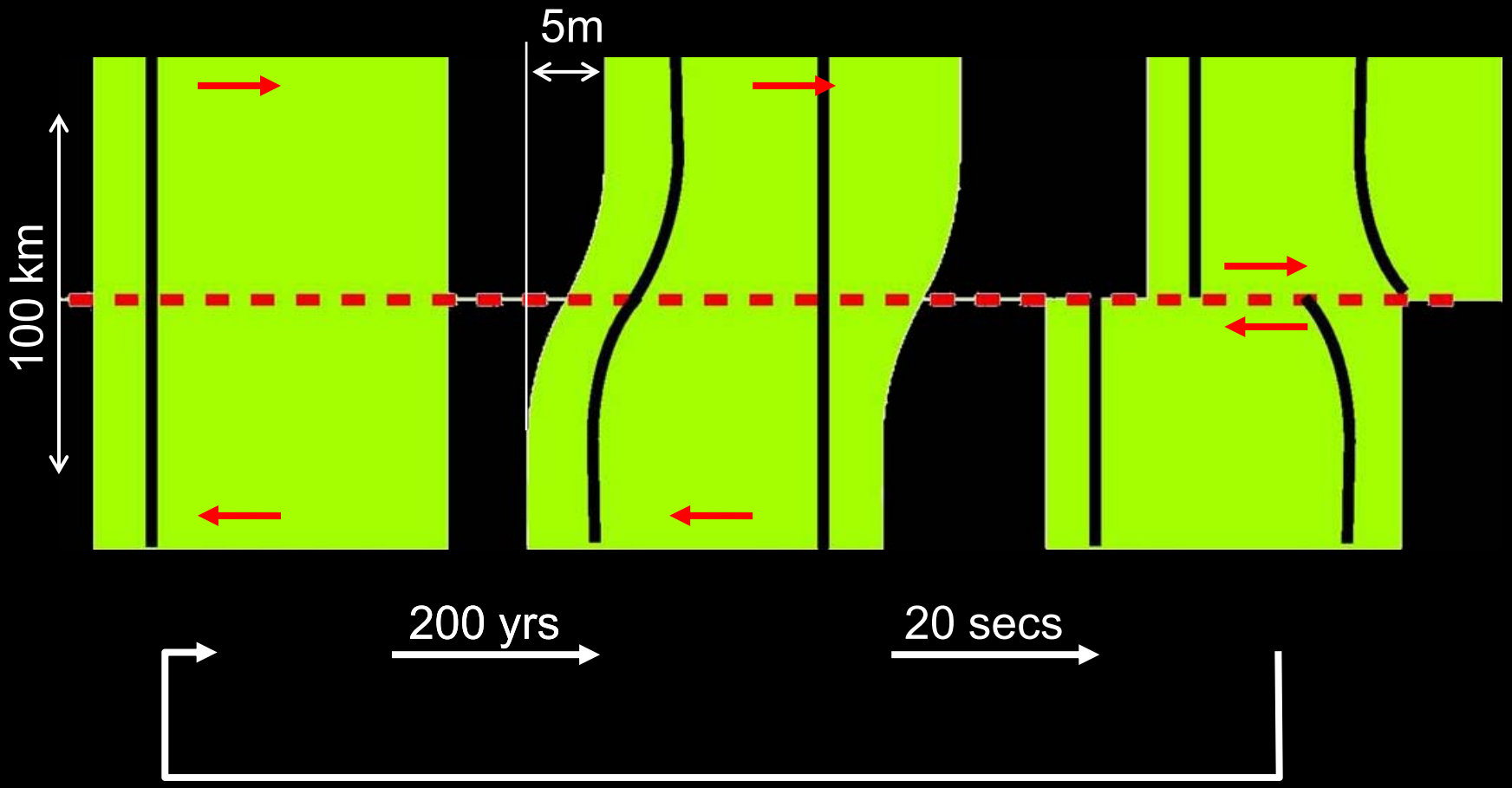
Fault scale:
The Earthquake Cycle

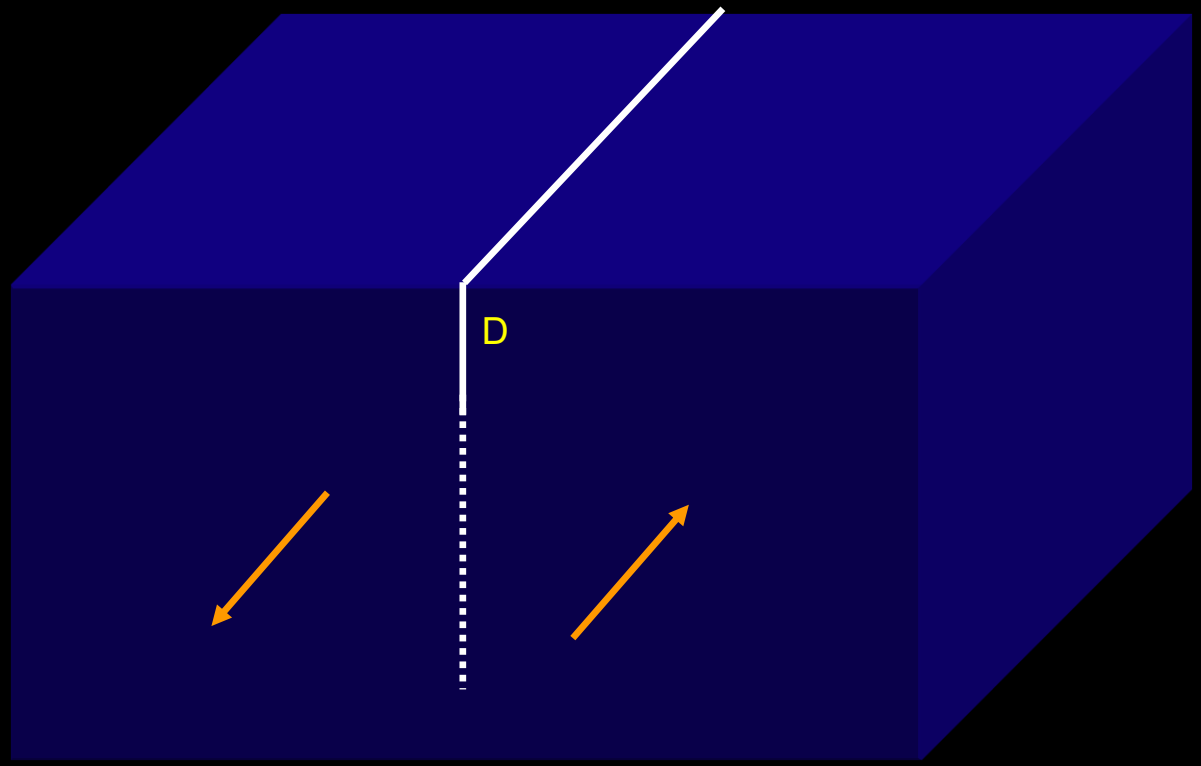


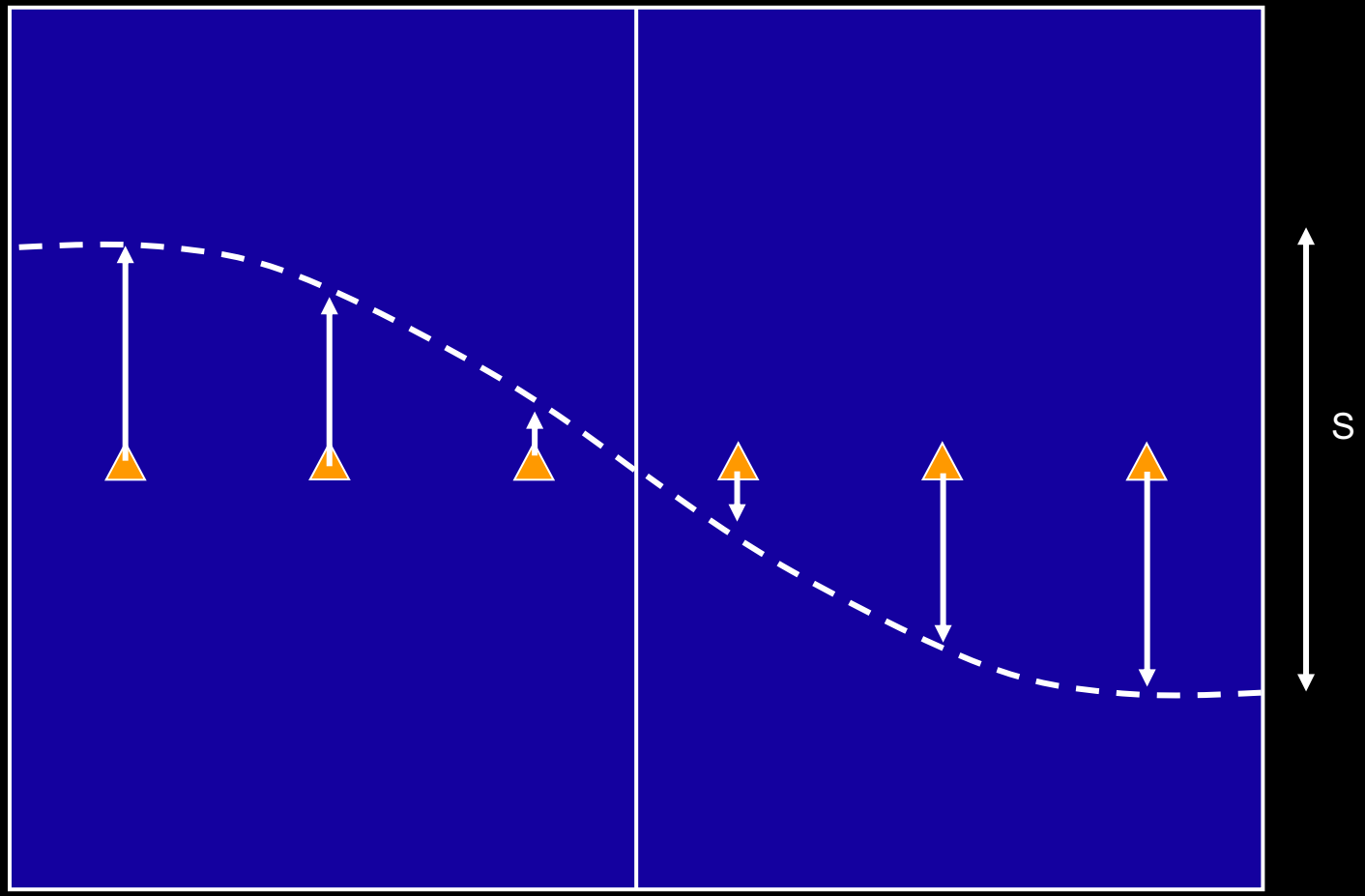
The Earthquake Cycle



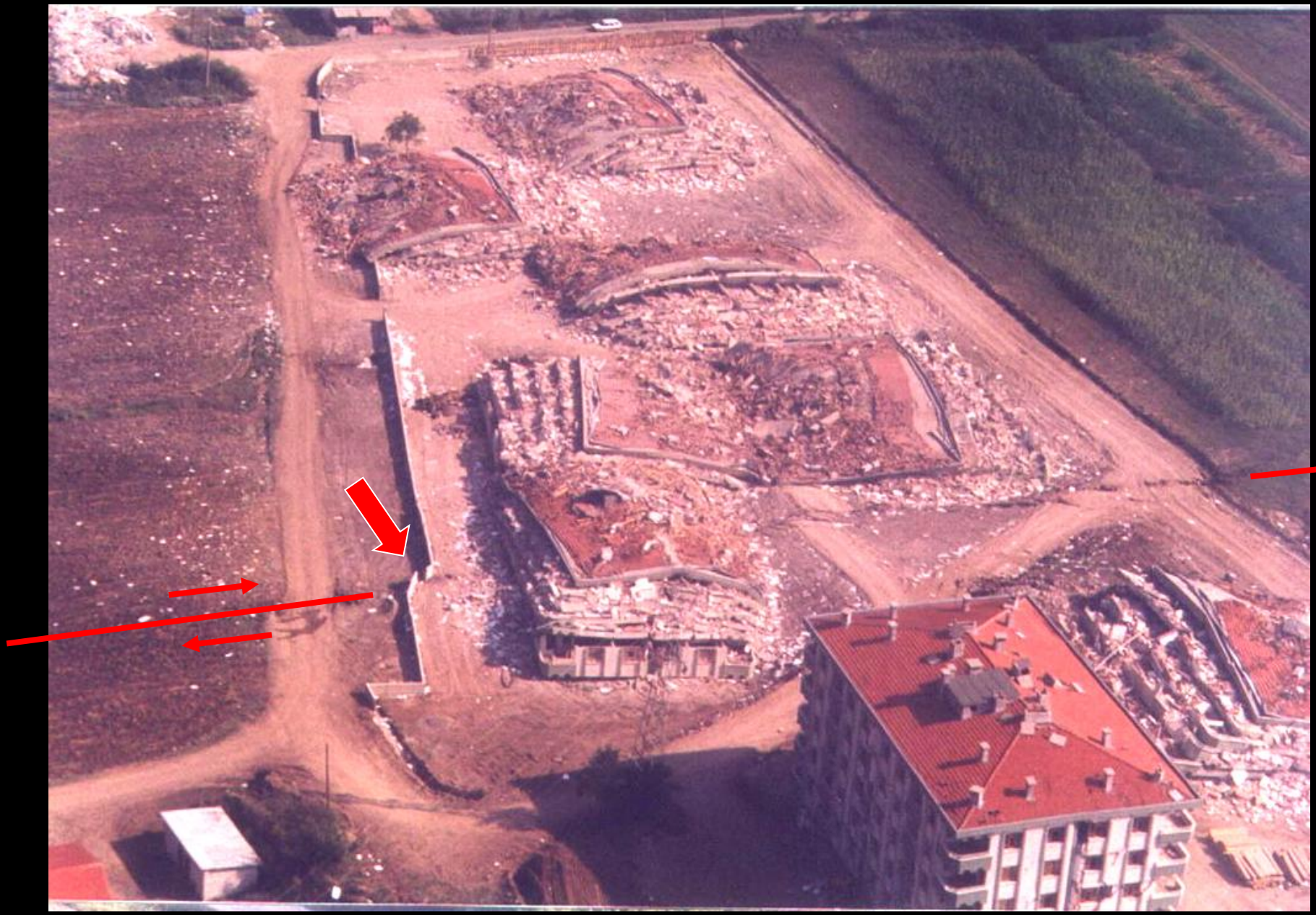
The Earthquake Cycle



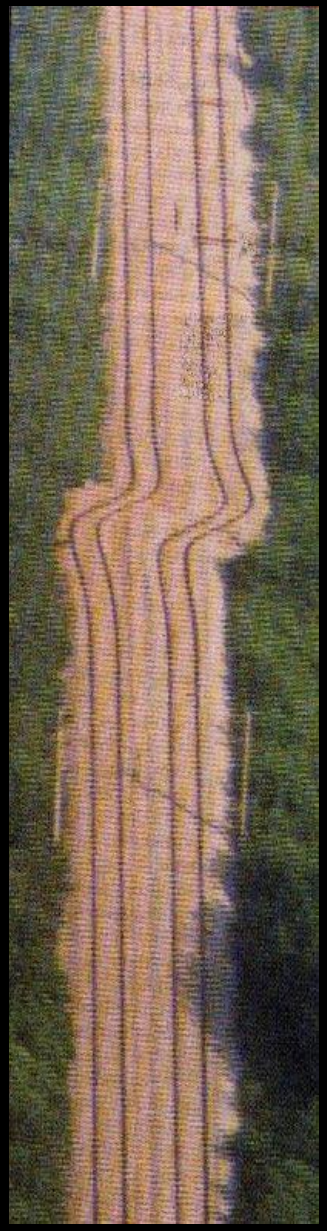

D


S

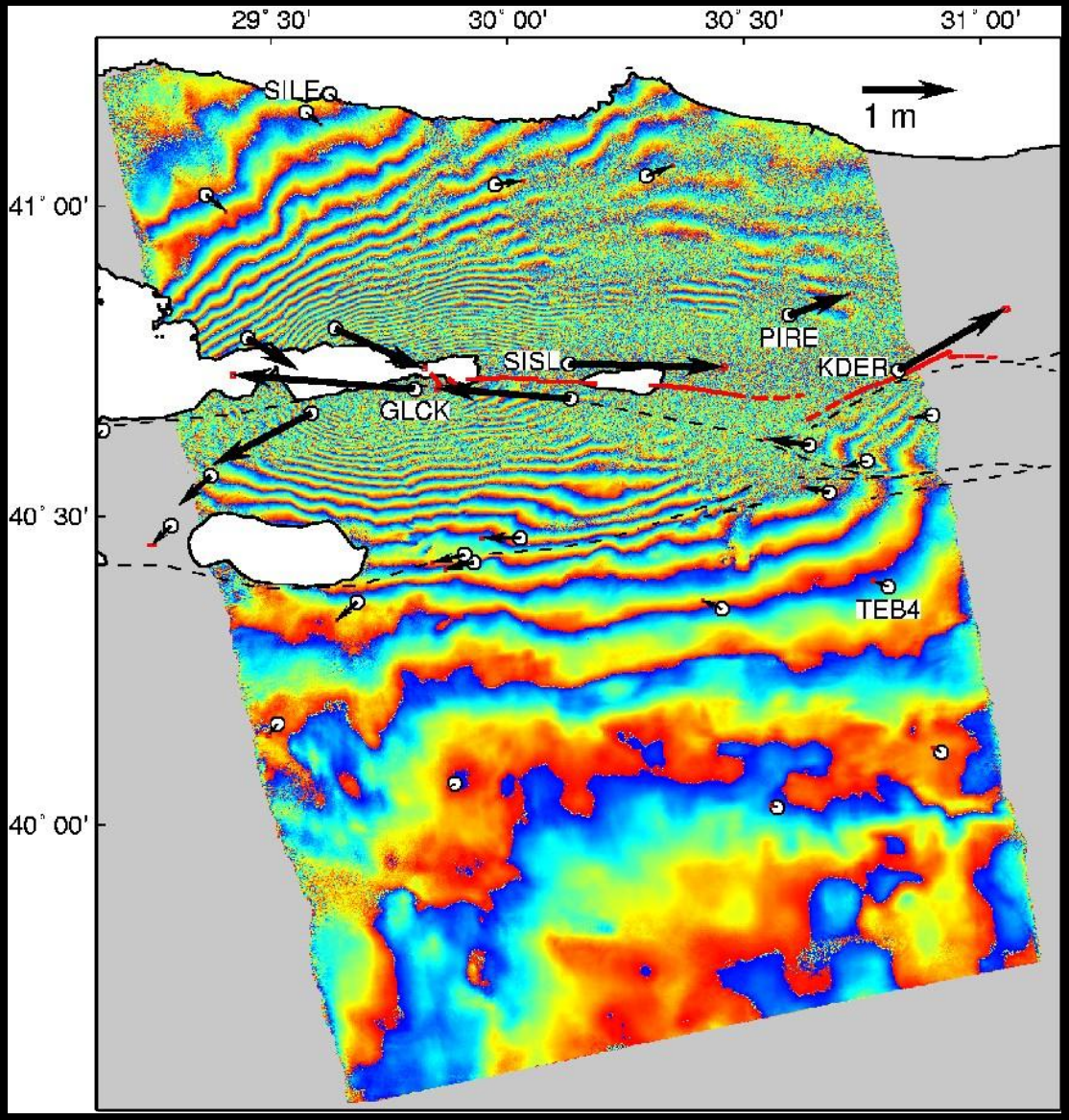
17 August 1999, Izmit (Turkey)



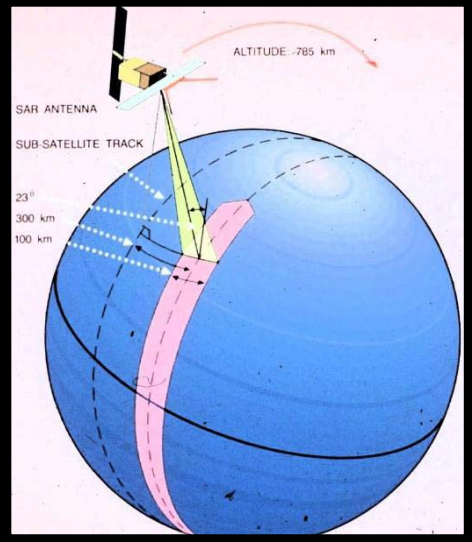
17 August 1999, Izmit (Turkey)

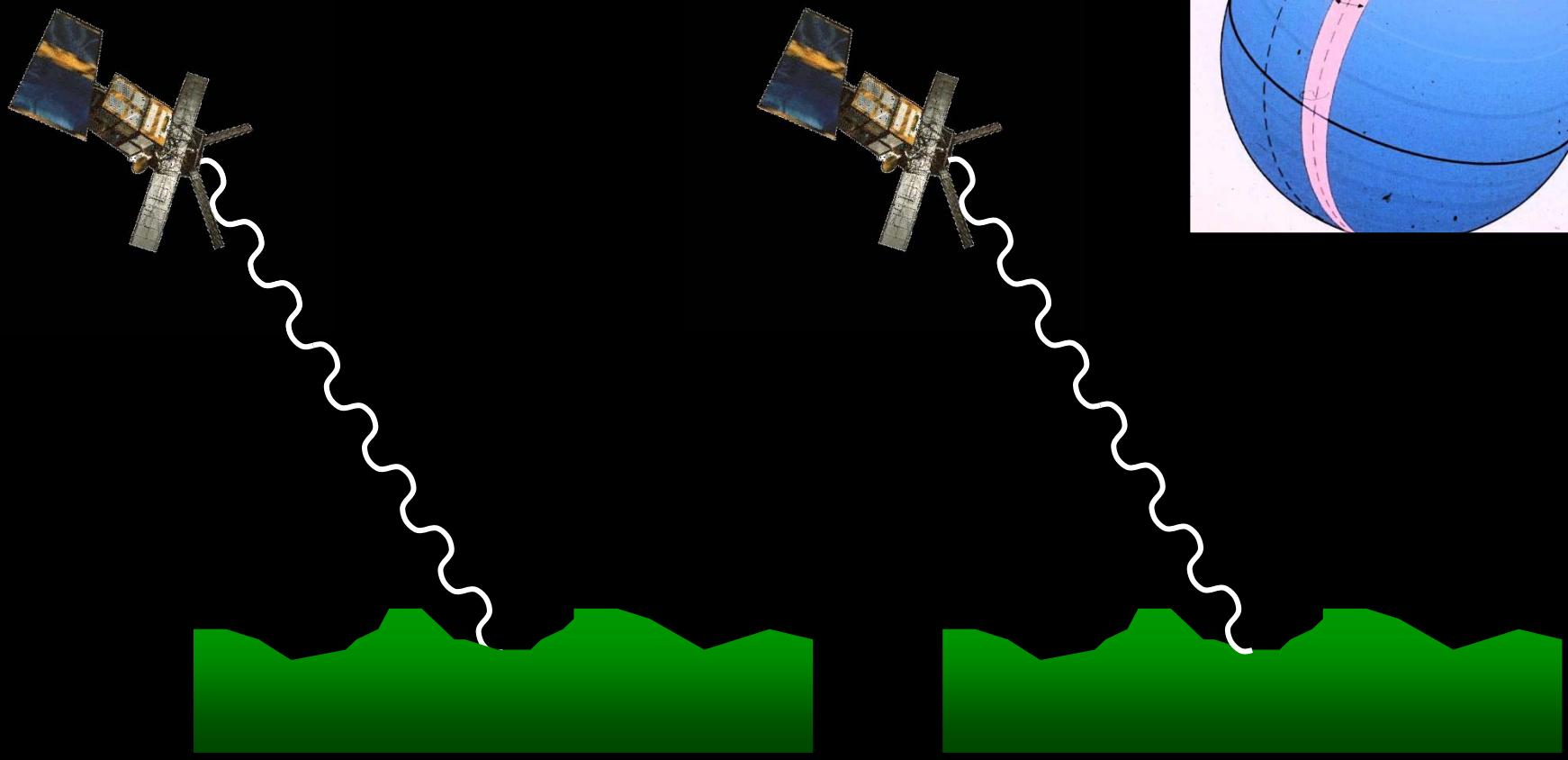


The Izmit earthquake displacement field



InSAR – how it works





InSAR – how it works

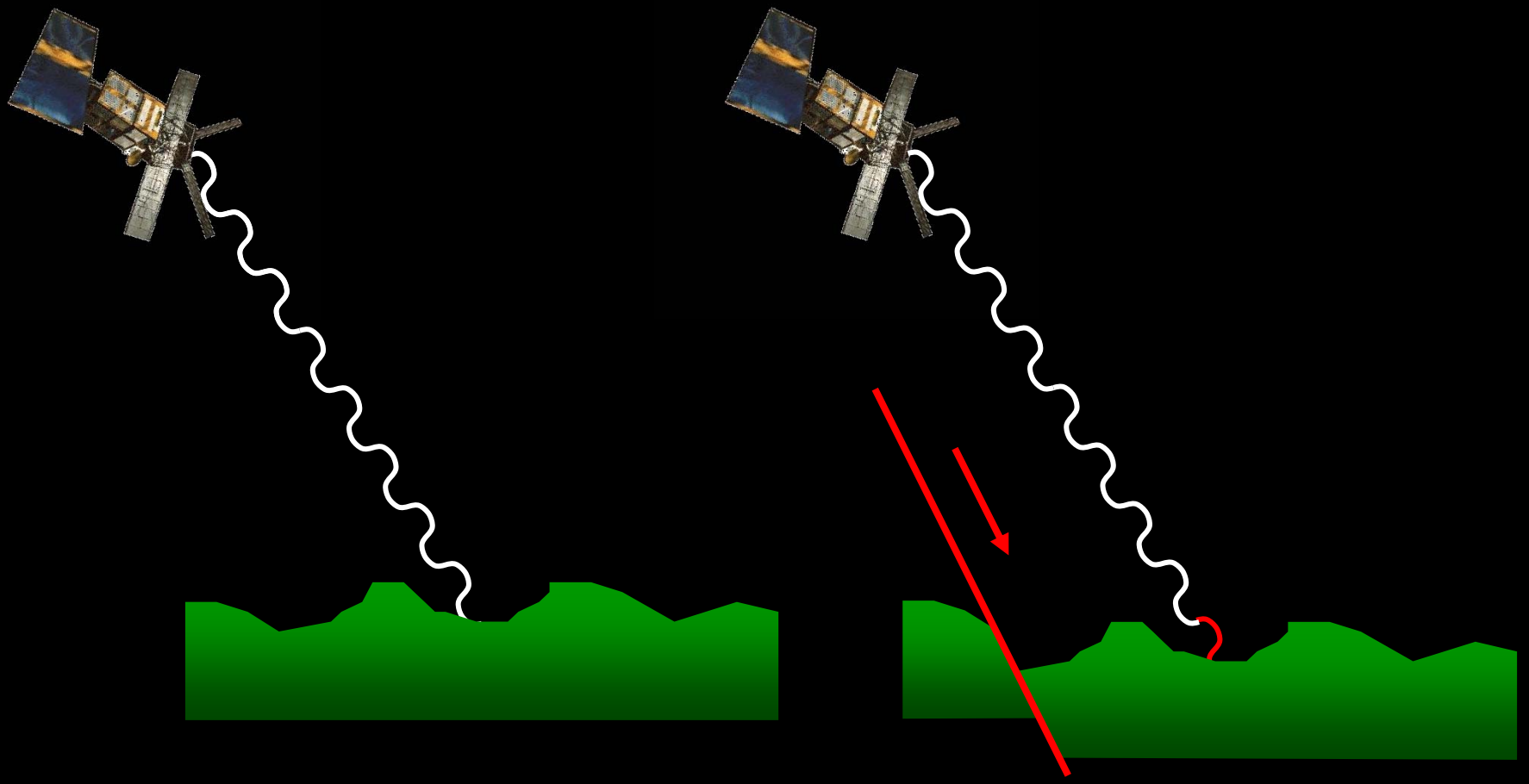
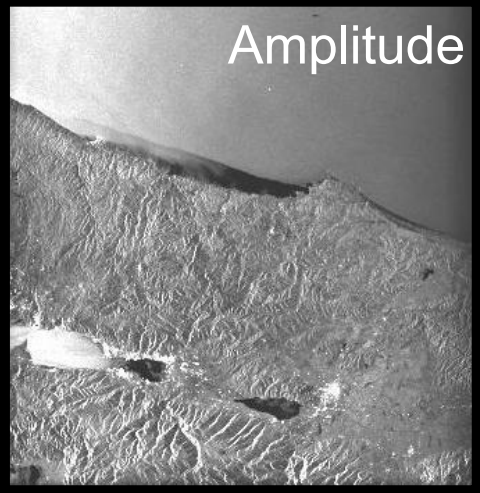
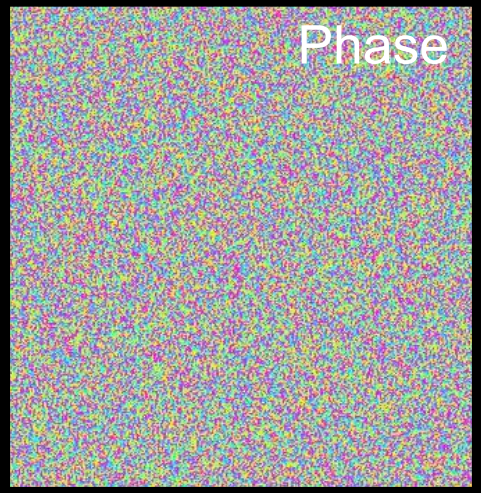


Image A - 12 August 1999





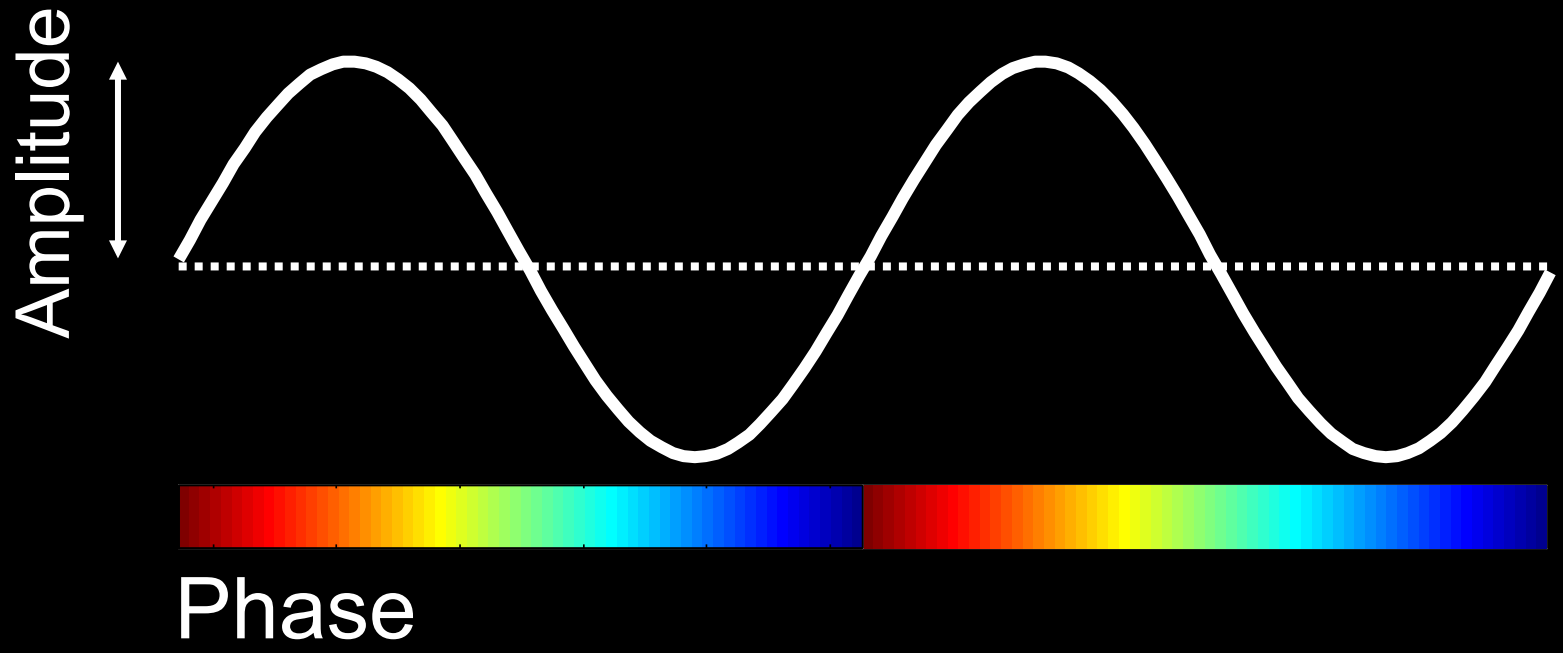
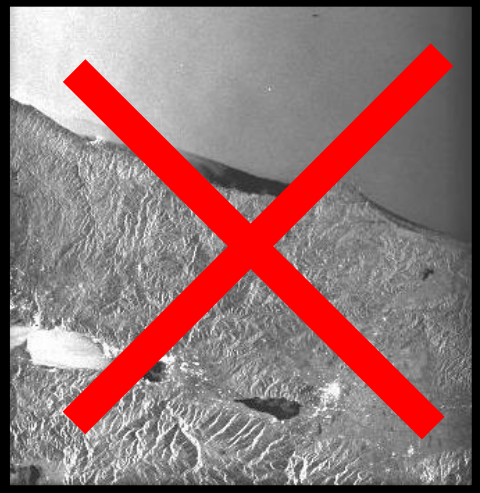
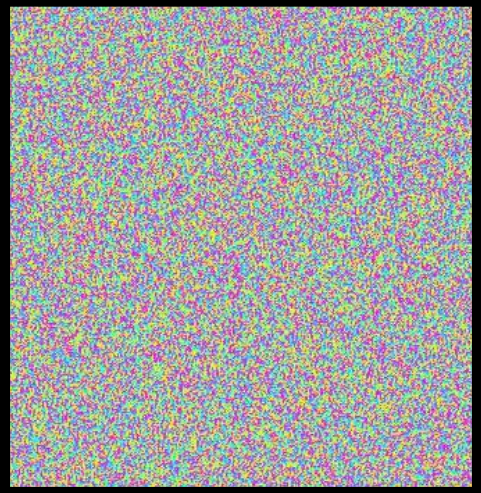
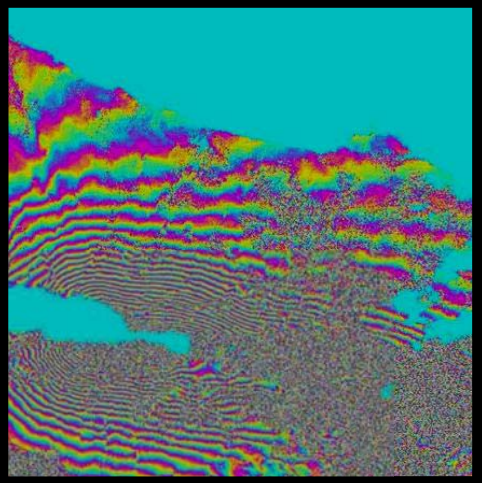


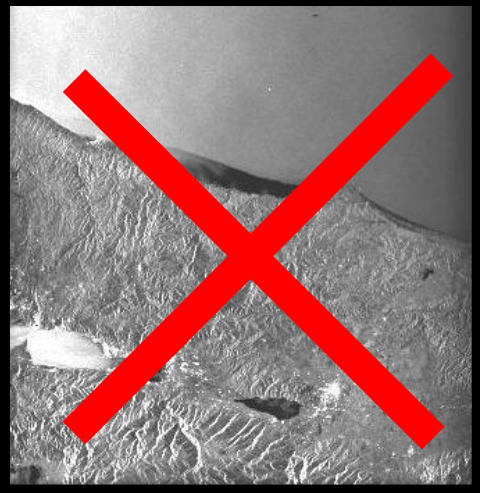
Image A - 12 August 1999





Interferogram =
Phase A - Phase B





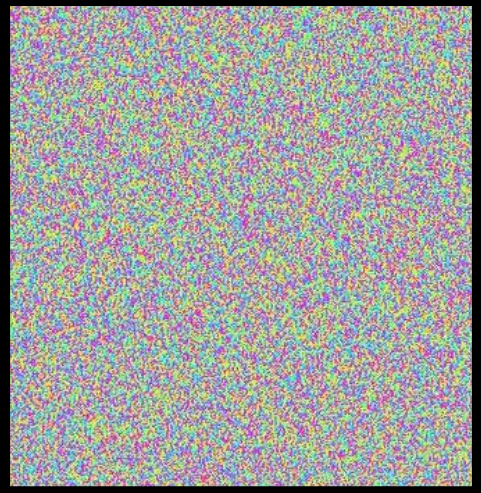
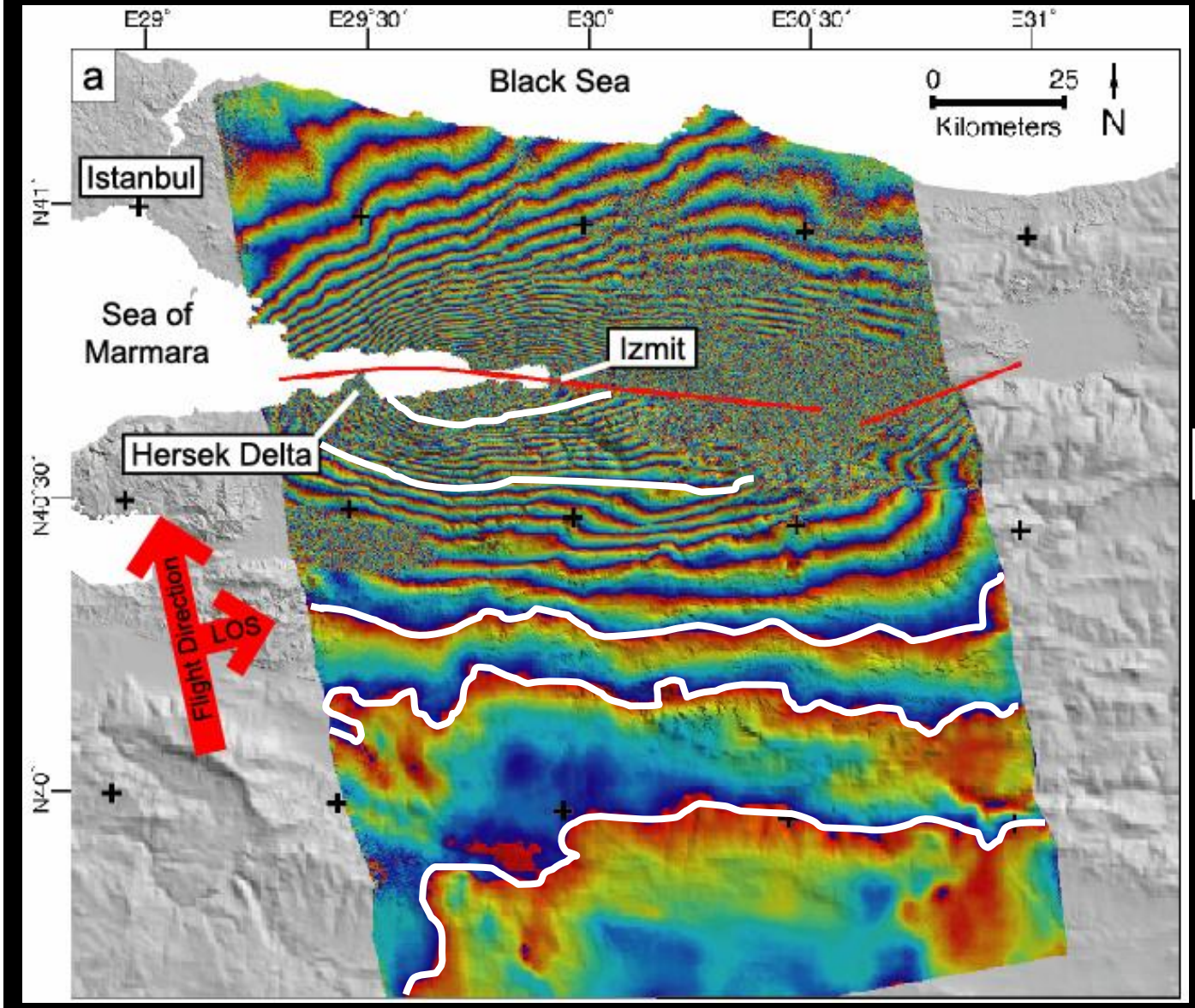


Image B - 16 September 1999

Remove phase from
topography
satellite positions
earth curvature



(-20) 567 mm range decrease

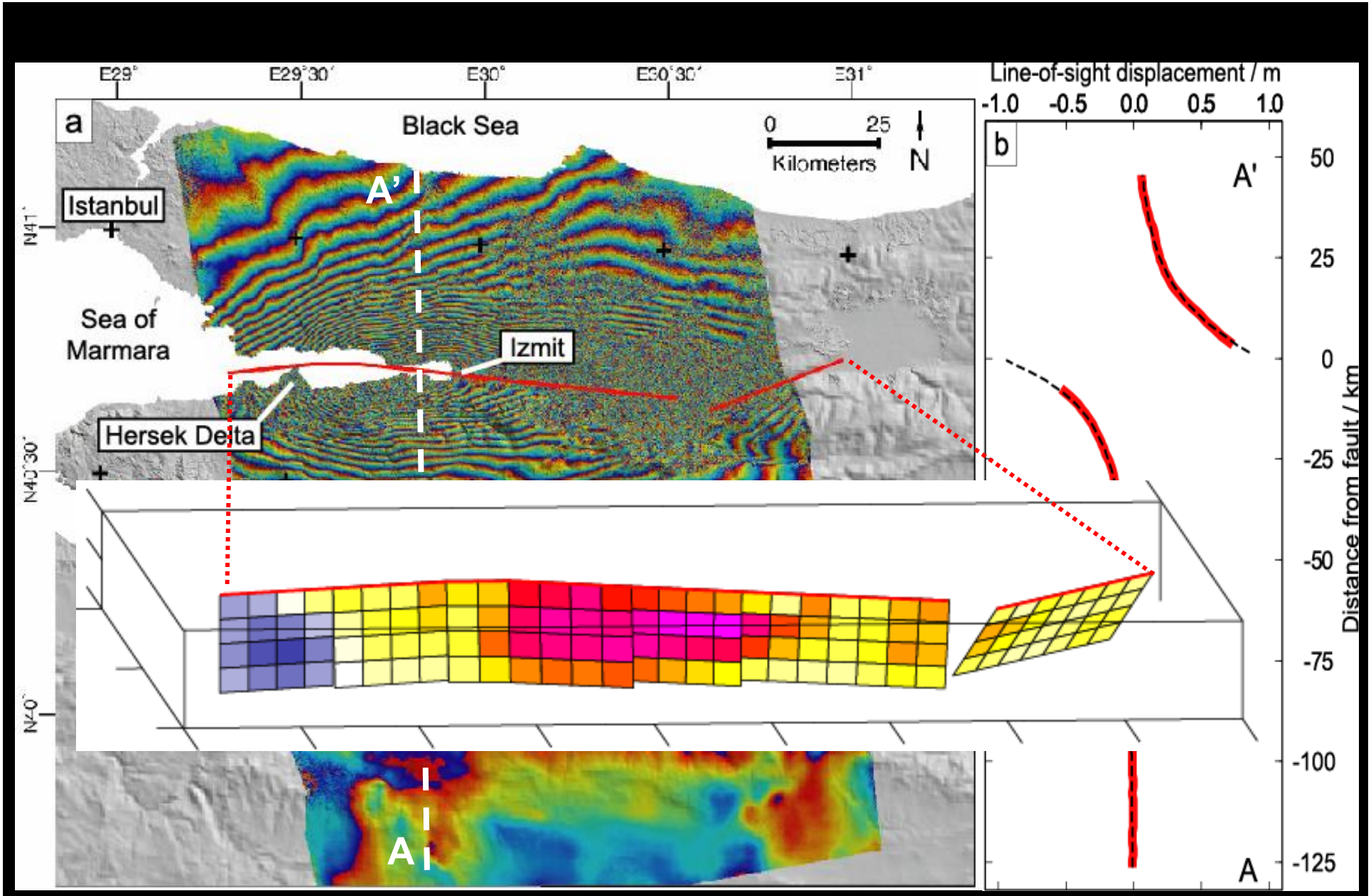
(-10) 283 mm range decrease

(-2) 57 mm range decrease

(-1) 28 mm range decrease

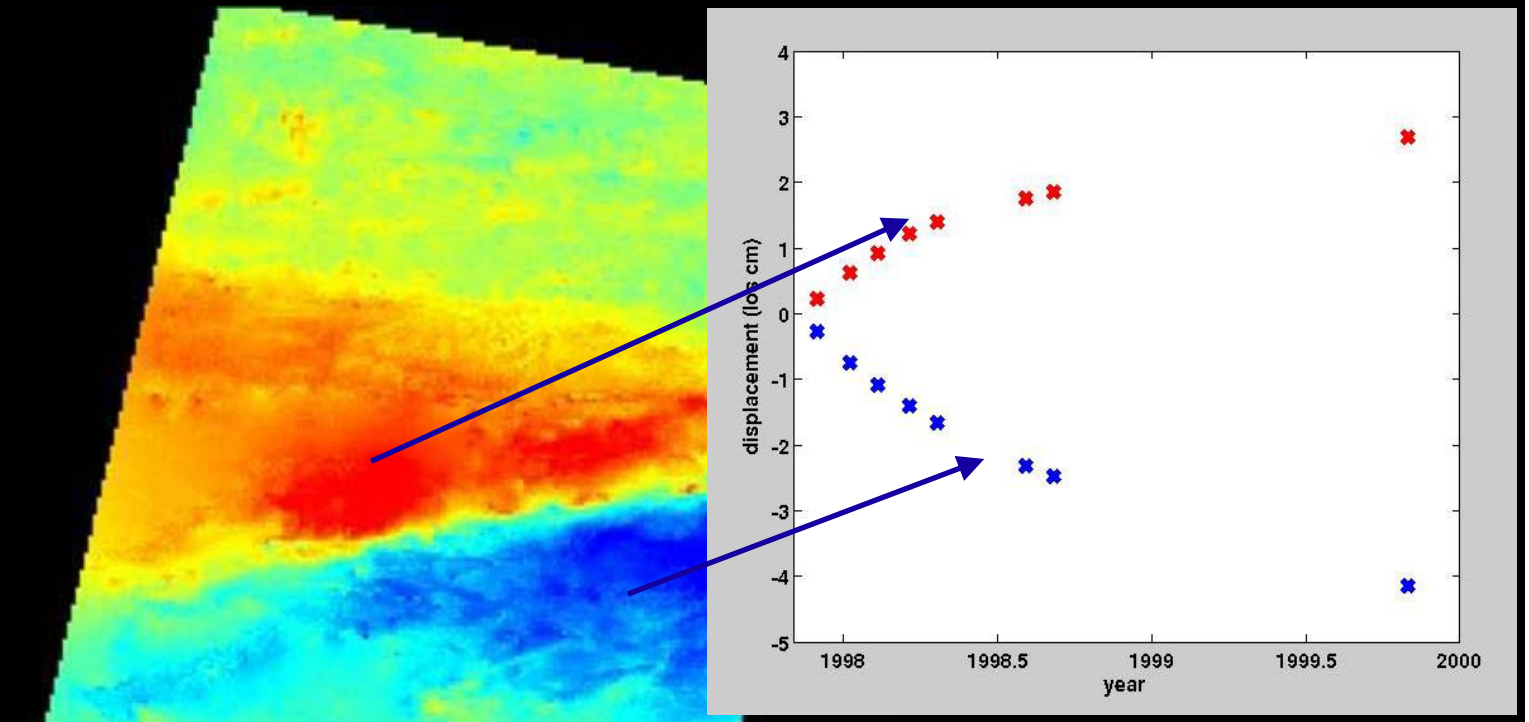
(0) 0 mm range change

17 August 1999, Izmit earthquake (Turkey)



17 August 1999, Izmit earthquake (Turkey)

Post seismic deformation – the 1997 Manyi Earthquake, Tibet

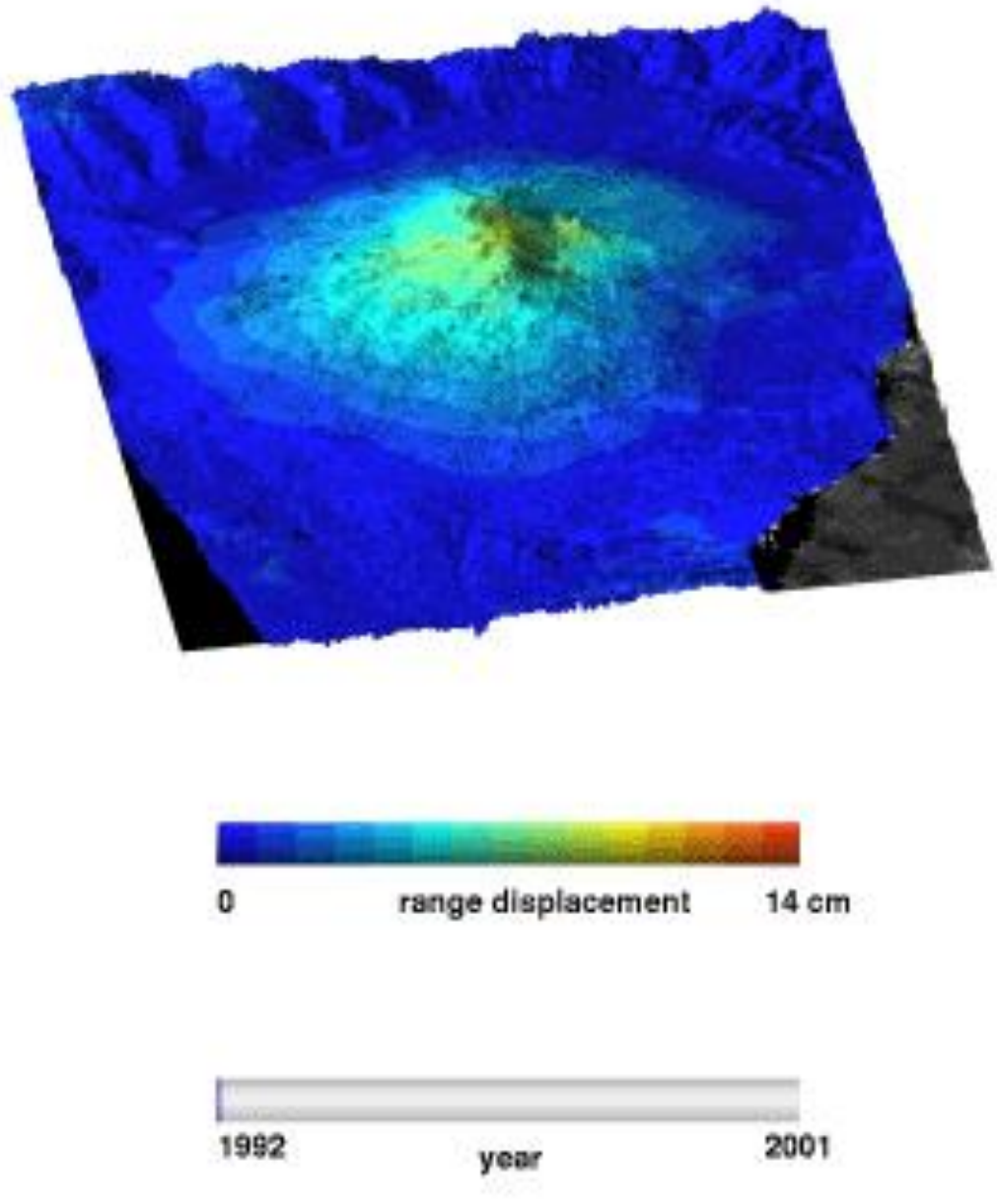


0 50 100

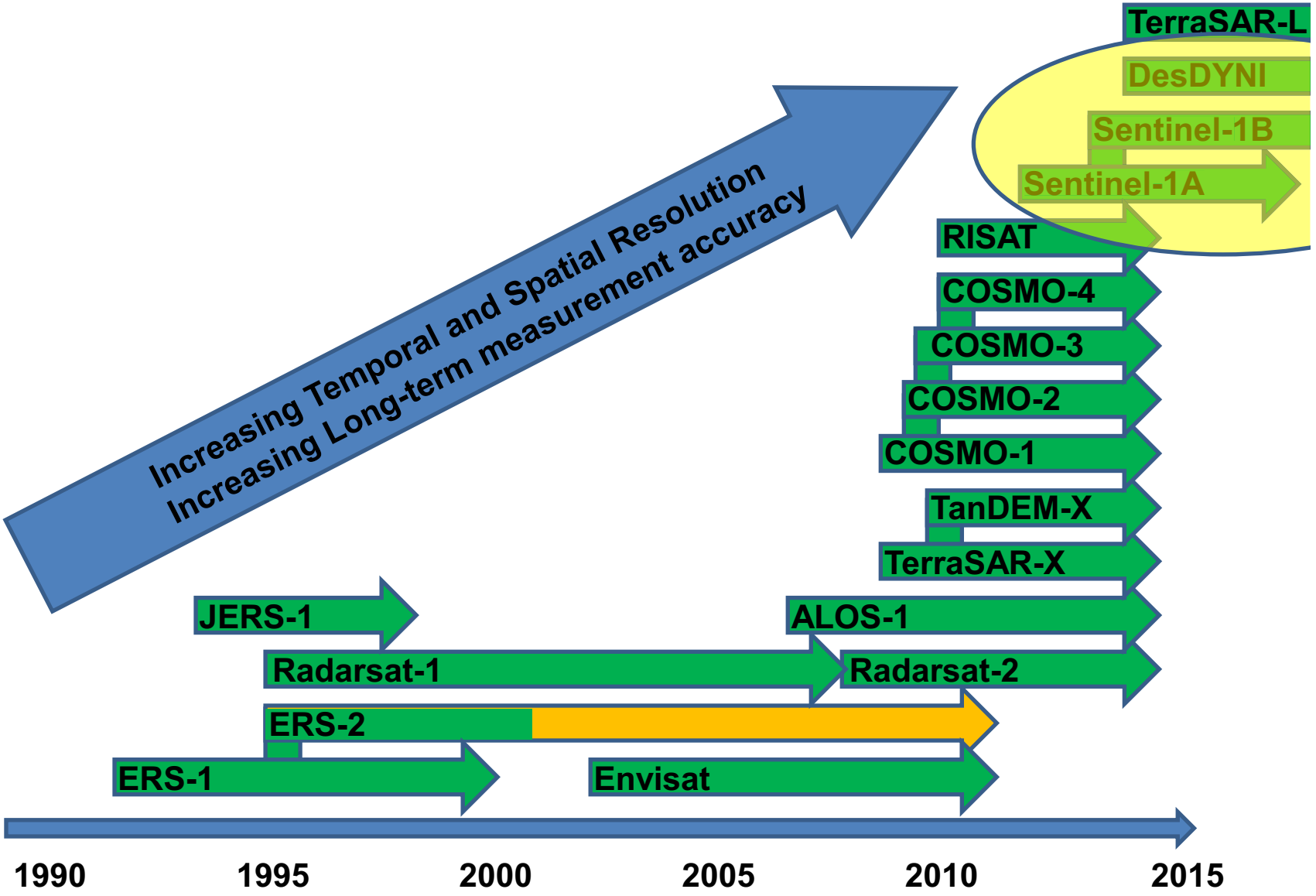
Kilometers

Ryder et al., GJI 2007

Mount Etna “breathing” (from Paul Lundgren, JPL)



Launched and Planned Radar Satellites



The Future

Sentinel-1 (ESA, GMES)

- Funded, Launch 2012

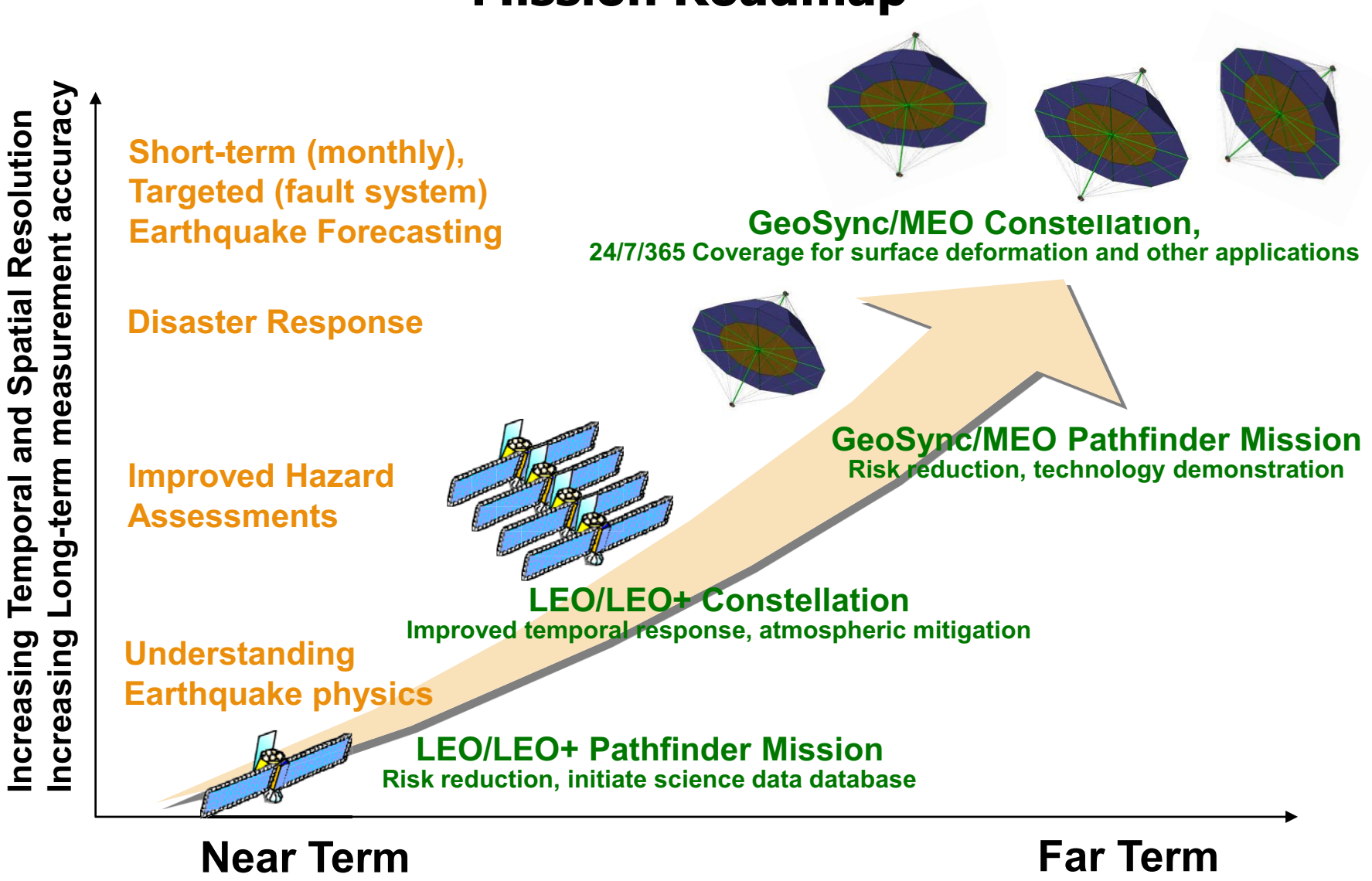
The Future

NASA:

- Funding not yet confirmed
- Proposed launch 2010-2013

The Future

"InSAR everywhere, all the time"

The alternative to satellite monitoring

Global Earthquake Satellite System
Mission Roadmap