

Earth-Oriented Space Research at TU-Delft

The contribution of DEOS to the “South-East Asia: Mastering Environmental Research with Geodetic Space Techniques” (SEAMERGES) project

Kick-off meeting, Chulalongkorn University, Bangkok, Thailand

Prof. Ir. Boudewijn A.C. Ambrosius

March 3, 2004



Faculty of Aerospace Engineering
Department of Earth Observation and Space Systems (DEOS)



Delft University of Technology

WHAT IS DEOS?

OLD DEOS:

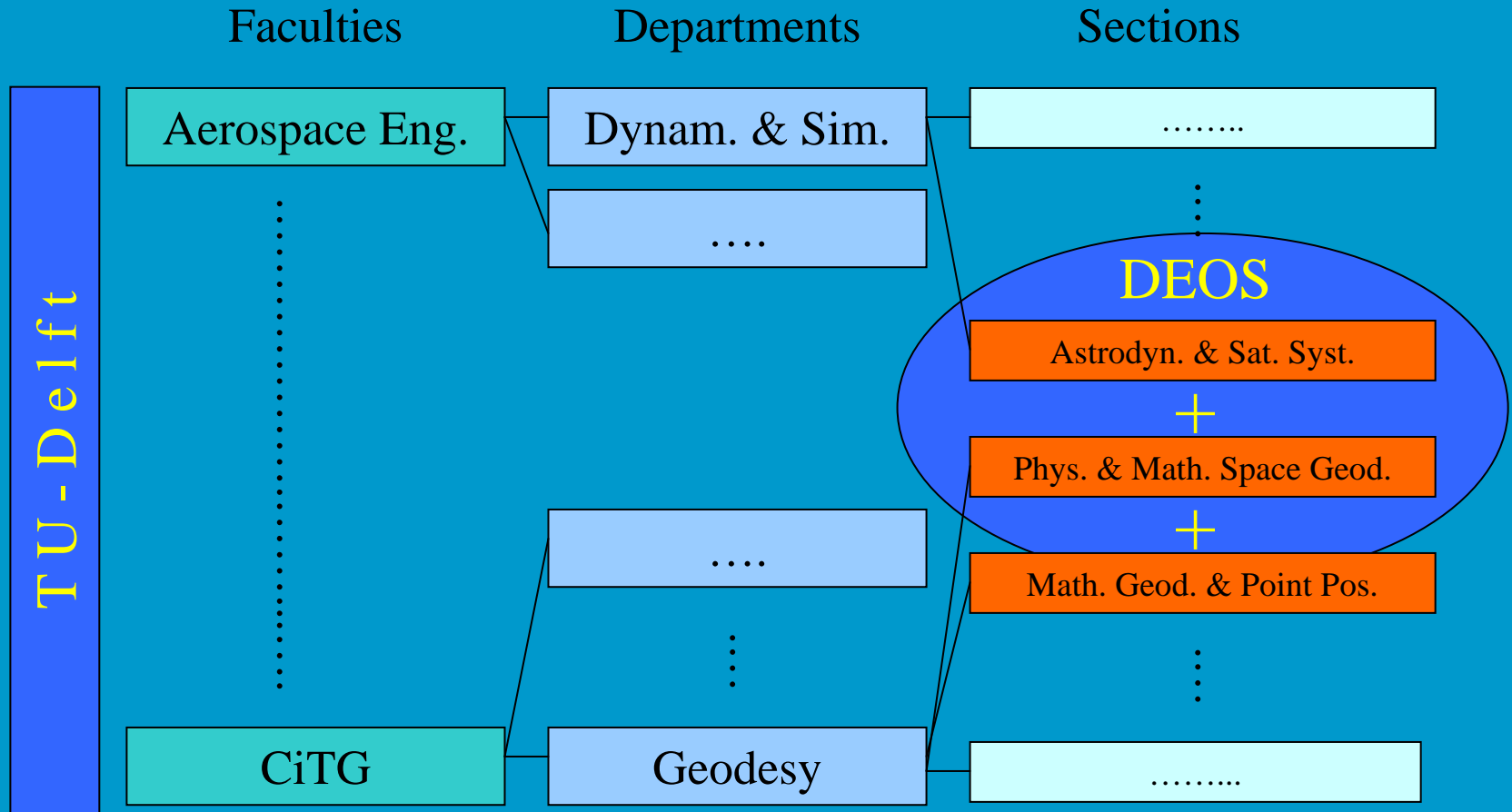
Delft Institute for Earth-Oriented Space Research

NEW DEOS:

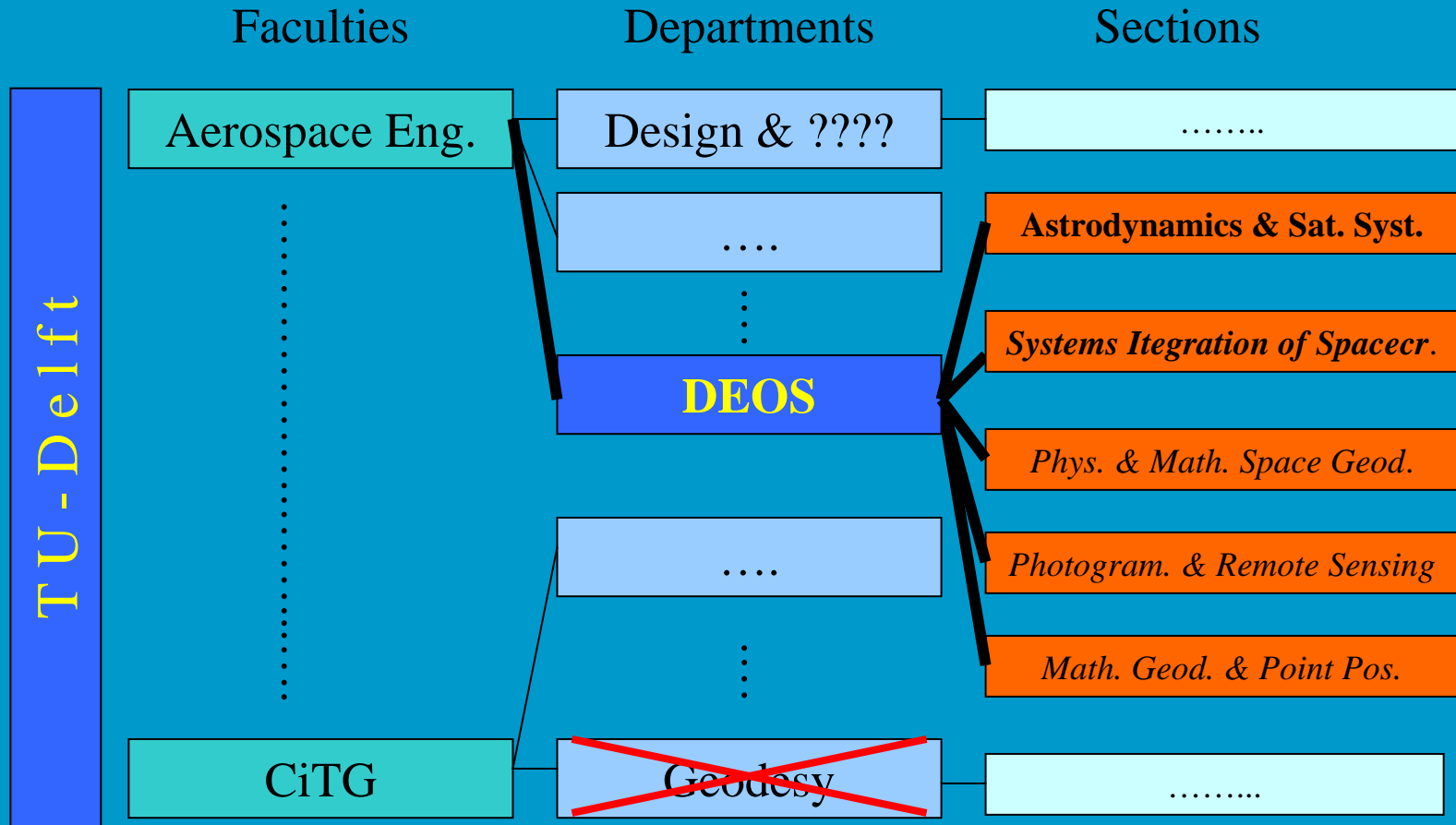
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What is the difference?

OLD POSITION OF DEOS WITHIN TU-DELFT (until 31-12-2003)



NEW POSITION OF DEOS WITHIN TU-DELFT (from 1-1-2004)



DEOS Mission:

“.....develop and exploit (space-)geodetic observation techniques to enhance our knowledge of the kinematic and physical properties of the Earth, comprising its motion, interior, crust, oceans, cryosphere and atmosphere.....”

Main Research Topics:

- Precise satellite orbits
- Geo-kinematics
- Gravity fields
- Geophysical signals
- Instrumentation & operations

Relevant Satellite Missions (instruments):

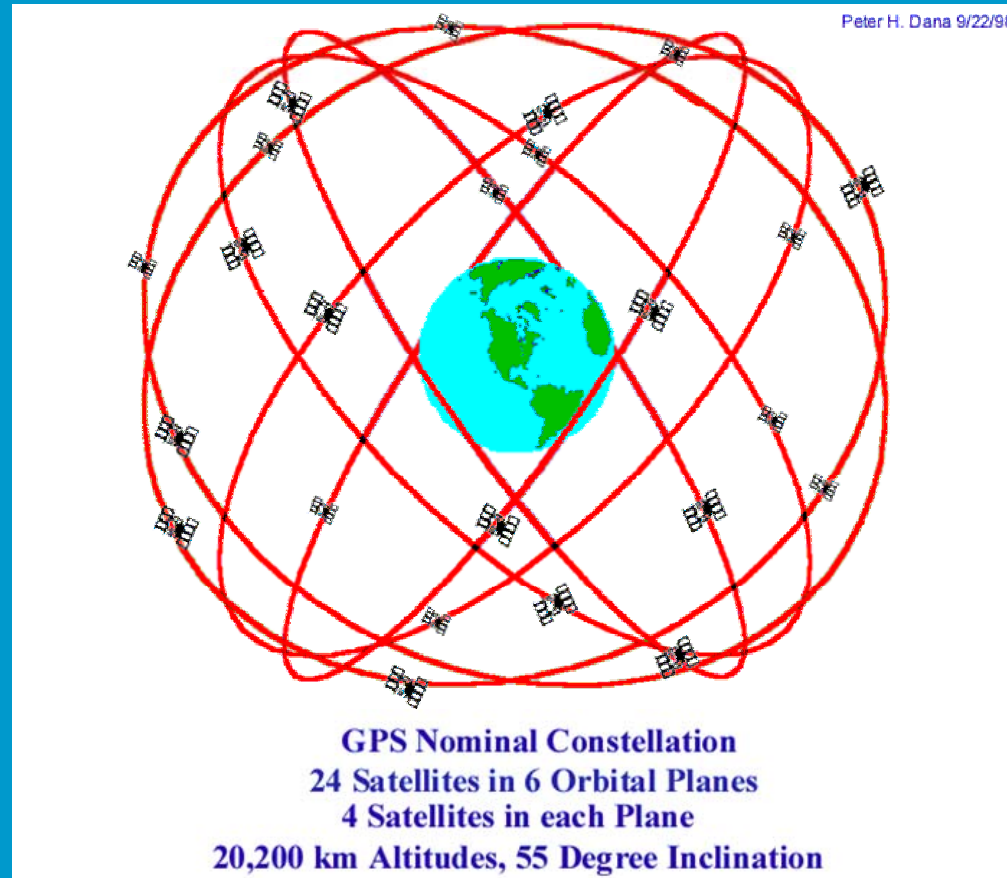
- Lageos-I, Lageos-II, Starlette, Westpac (SLR)
- Topex/Poseidon (RA, SLR, DORIS, GPS)
- ERS-1 and ERS-2 (RA, SLR, PRARE, SAR)
- Global Positioning System (GPS)

- GOCE (SGG, GPS), GRACE (SST, GPS, ACC), CHAMP (SLR, GPS, ACC)
- Jason, GFO (RA, DORIS, GPS)
- ENVISAT (RA, SLR, DORIS, SAR)
- CRYOSAT (RA, DORIS?, GPS?)
-

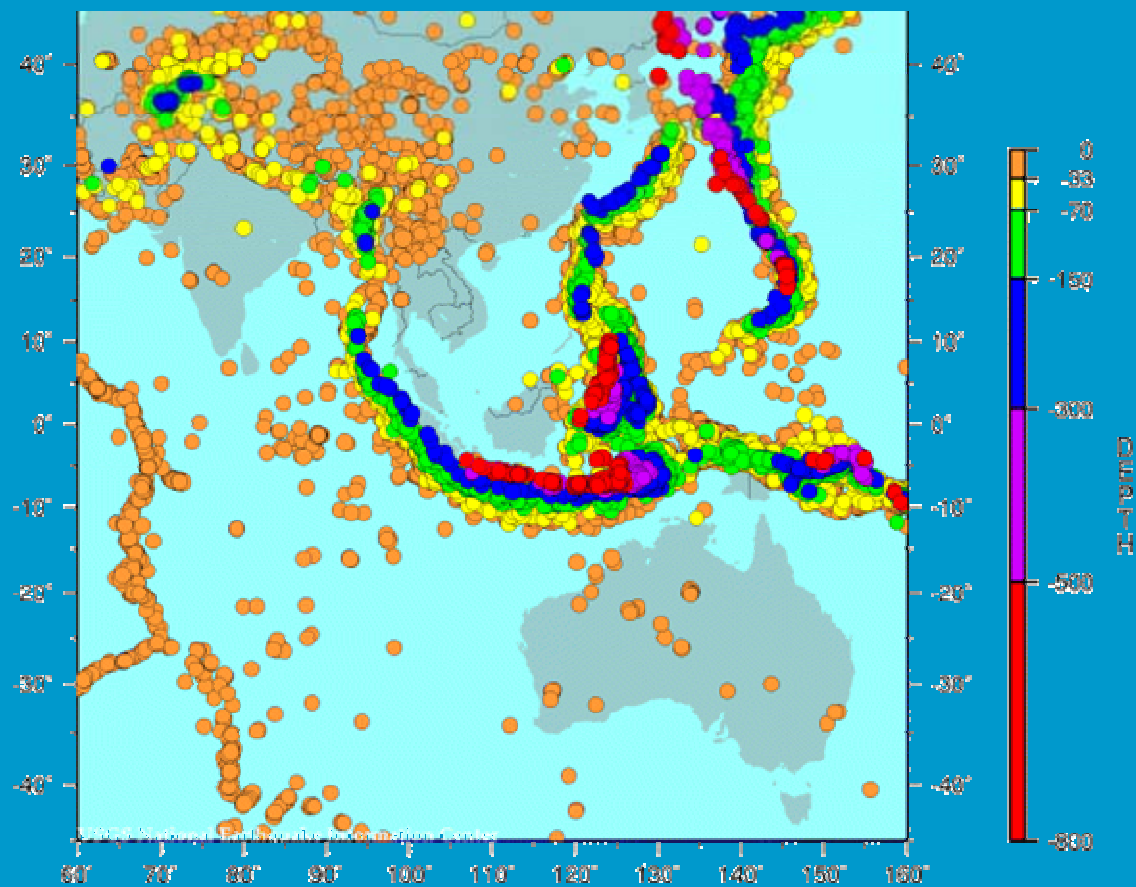
Ongoing GPS projects:

- South-East Asia
- Carpathians (Romania)
- Azores-Gibraltar region (Portugal)
- Umbria-Marche earthquake (Italy)
- Eurasia-Africa plate boundary (Southern Italy)
- Atmospheric water vapor detection
- Permanent GPS stations in Netherlands (2+4), Russia, Singapore, Angola, Azores (2), Romania (6) and Indonesia (3)

The Global Positioning System space segment (nominal constellation)



Earthquakes ($M > 5$) since 1973 in South-East Asia

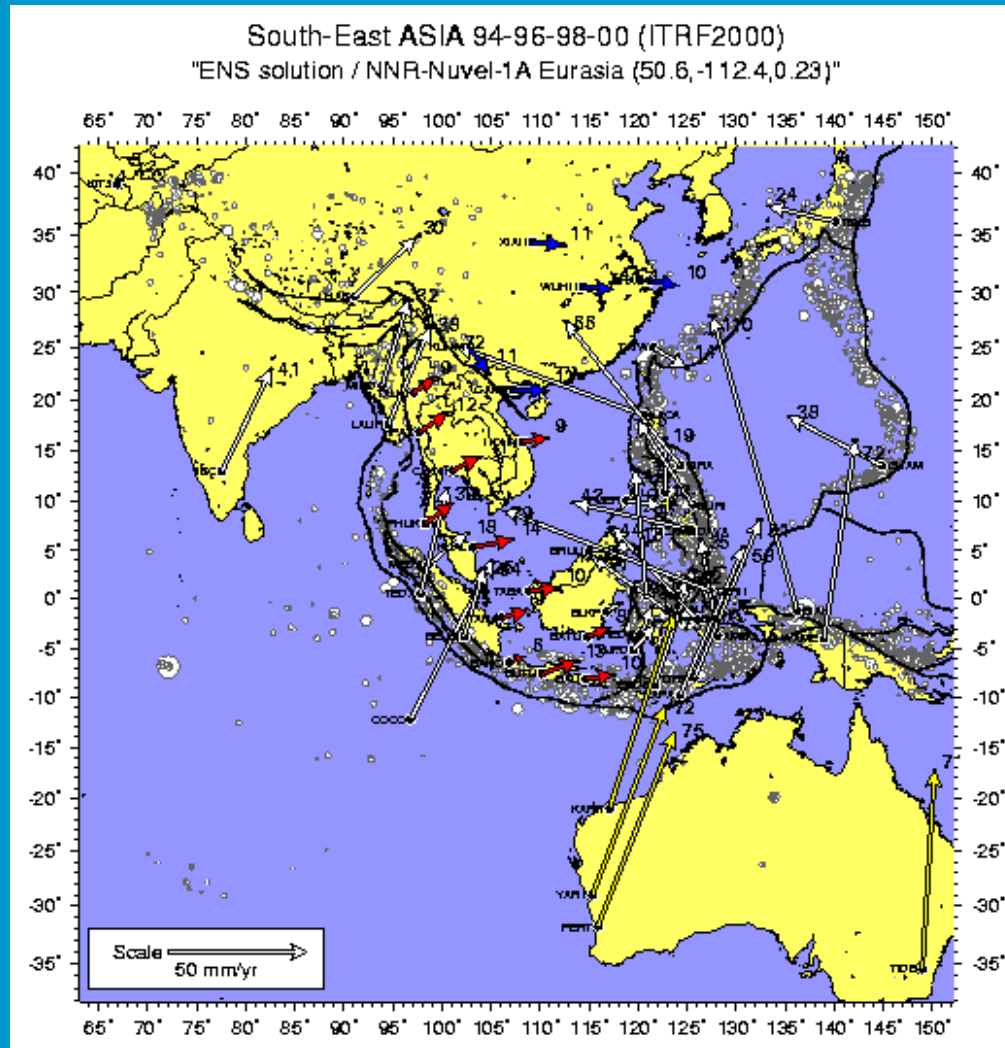


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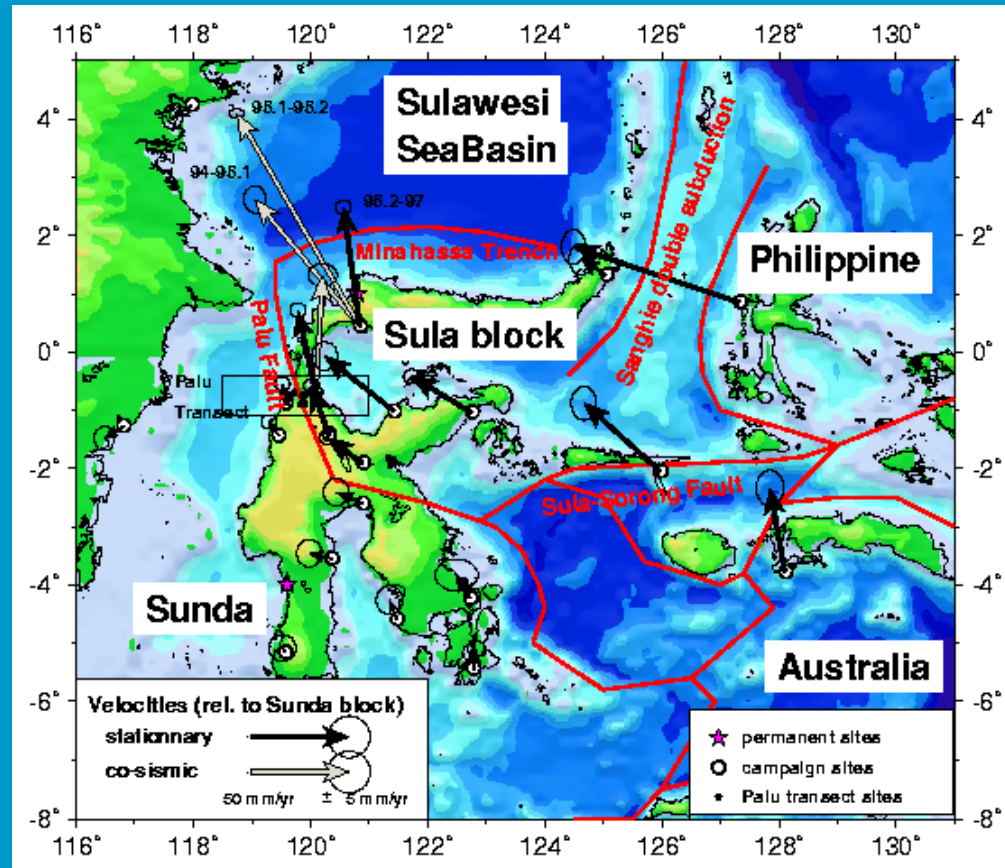
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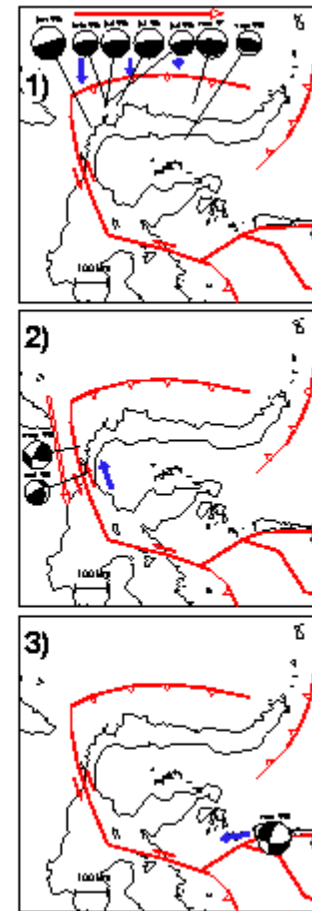
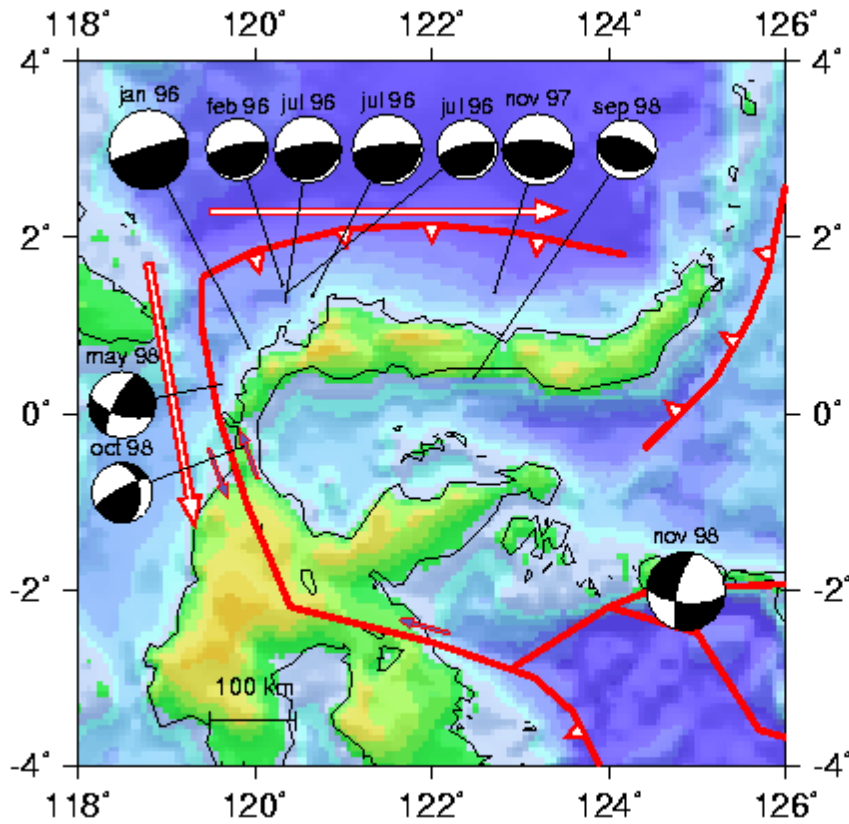
GPS observations of tectonic motions in South-East Asia



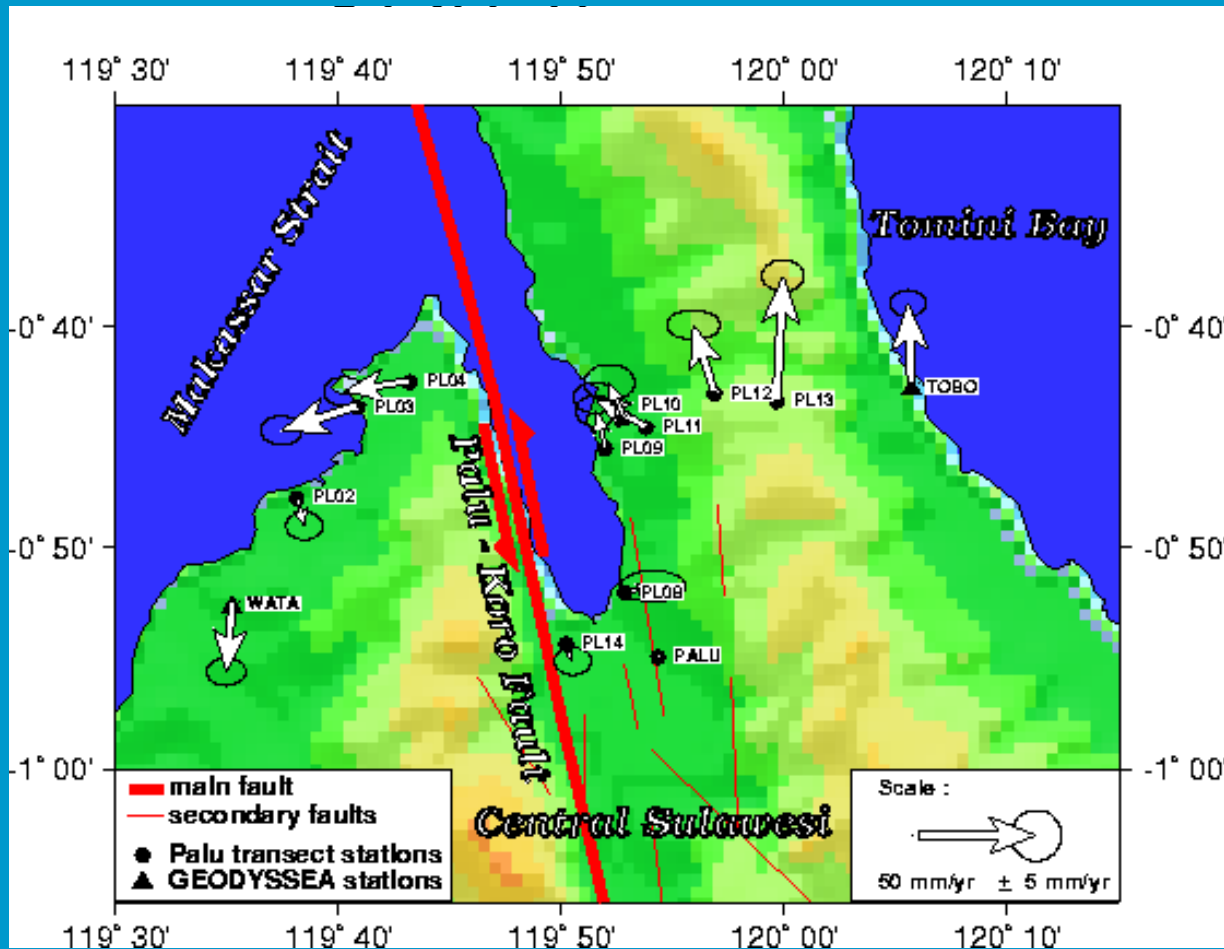
Tectonic setting of the triple plate junction near Sulawesi



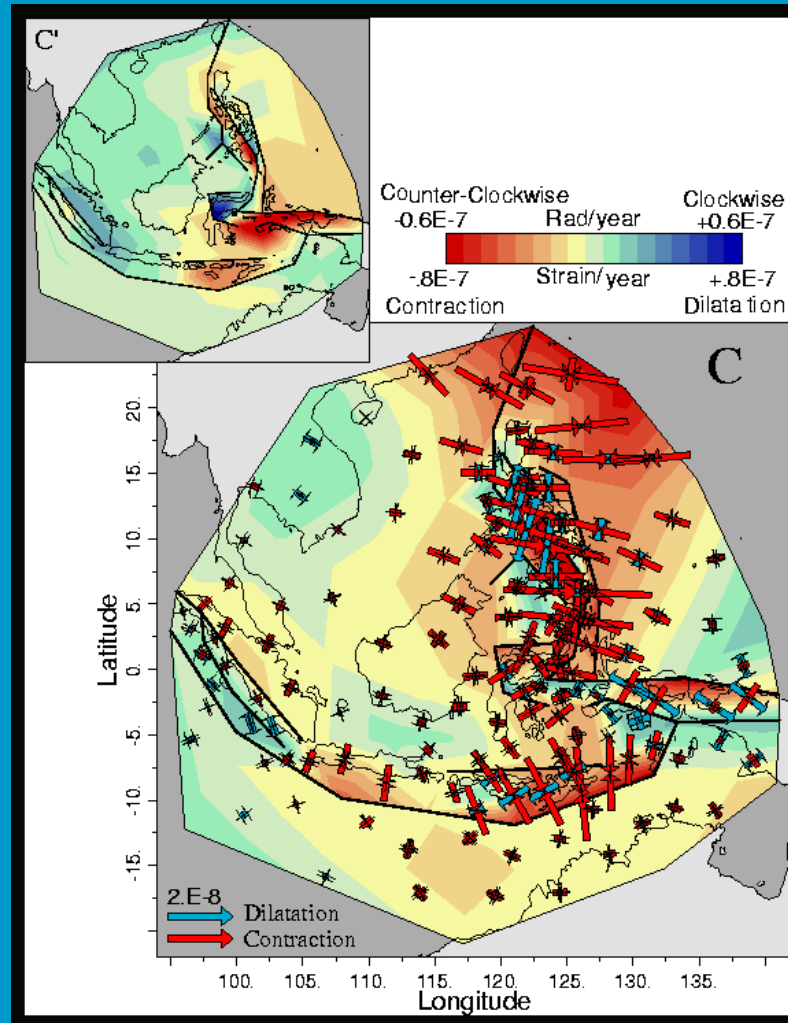
Migration of earthquakes along the Minahassa trench and Palu fault



Relative motion across the Palu-Koro fault (Sulawesi) from GPS obs.



Rotation and strain in South-East Asia derived from GPS observations



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GPS field work in Indonesia in cooperation with local staff



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Setting up a GPS field station in Sulawesi



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Leica GPS receivers for field work (ISES funding)



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Equipment for permanent GPS station in Sulawesi (ISES funding)

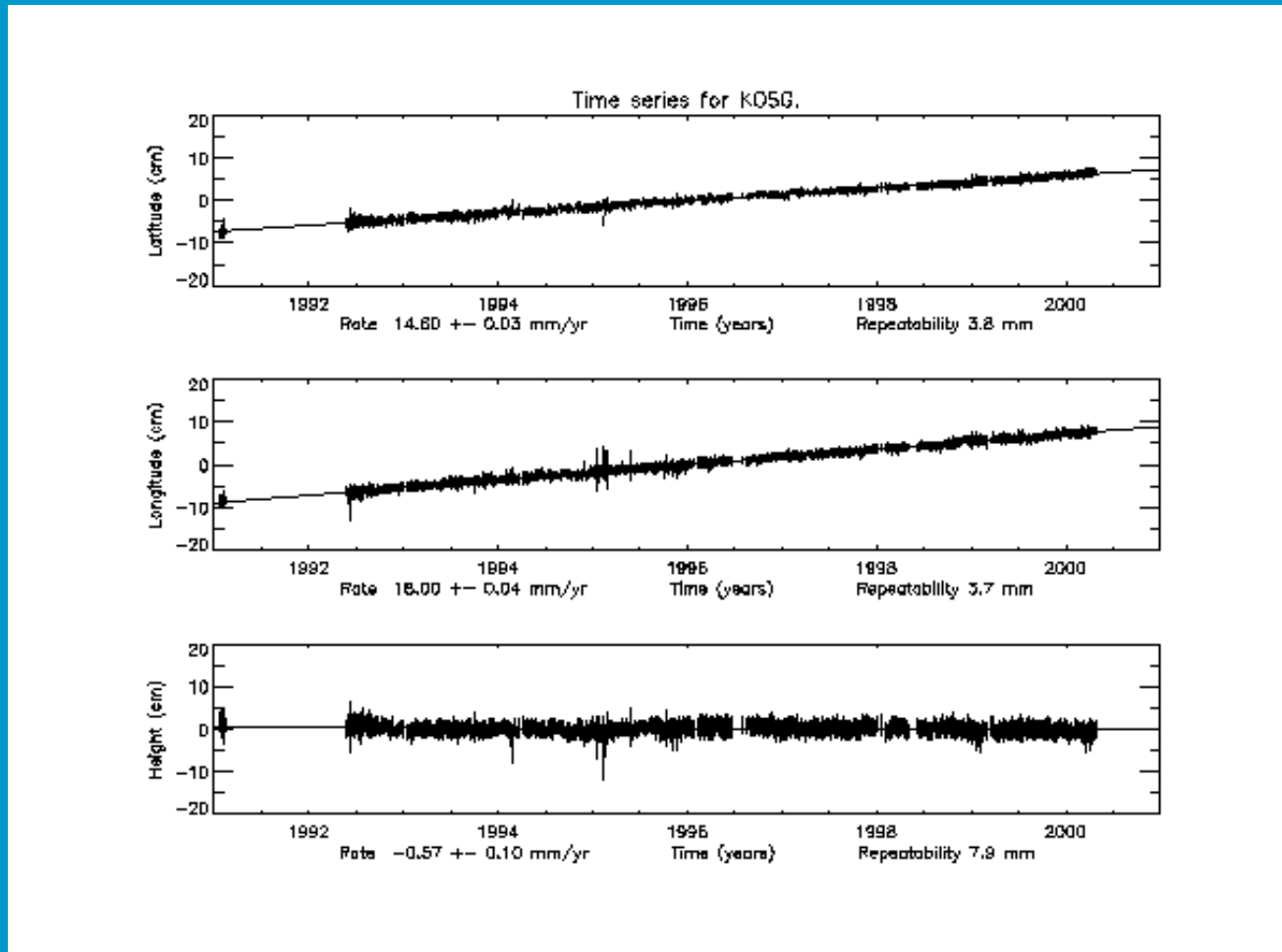


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Time-series of GPS position solutions of KOSG permanent station



Damage to railroad due to Izmit earthquake (Turkey, August 17, 1999)



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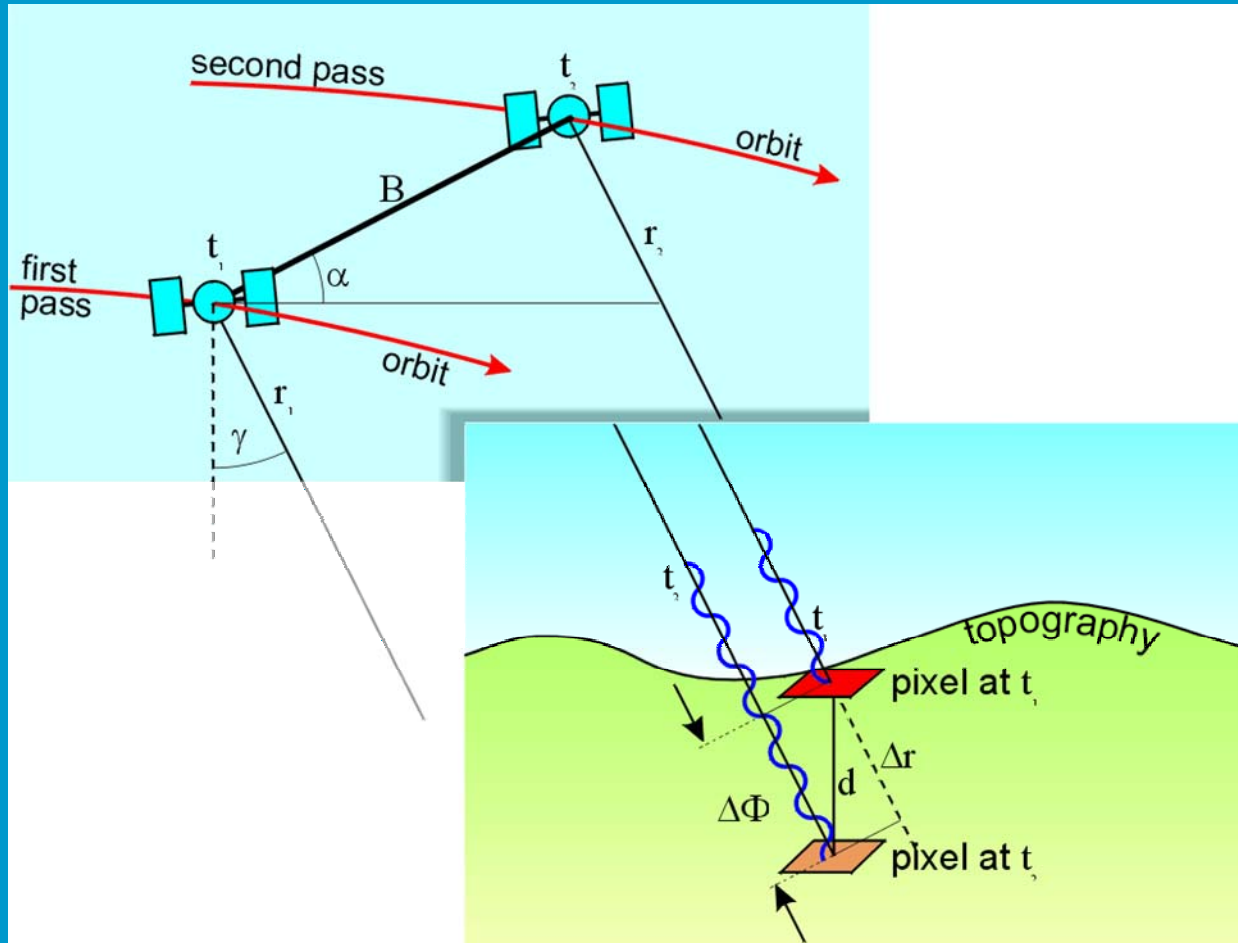
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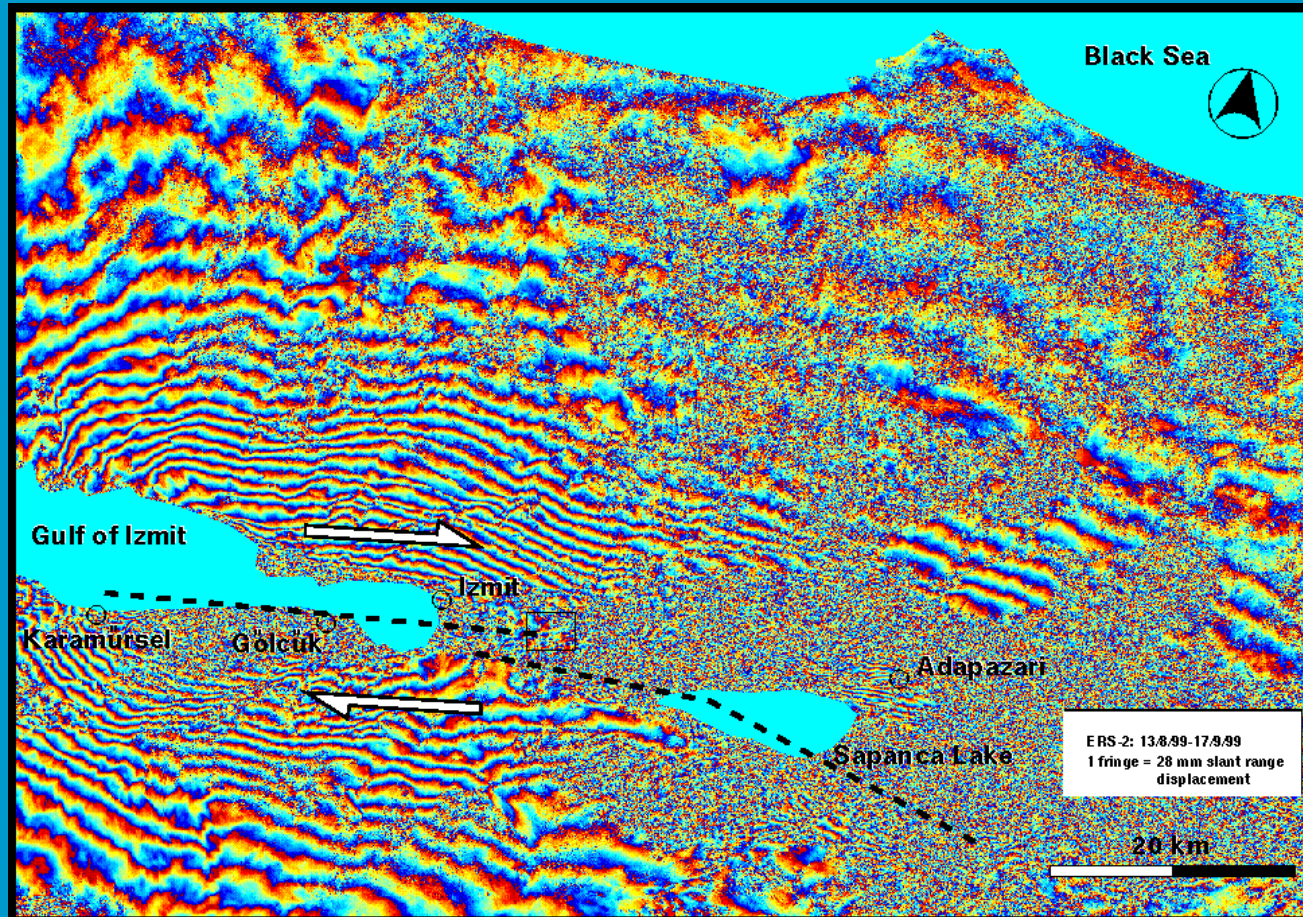
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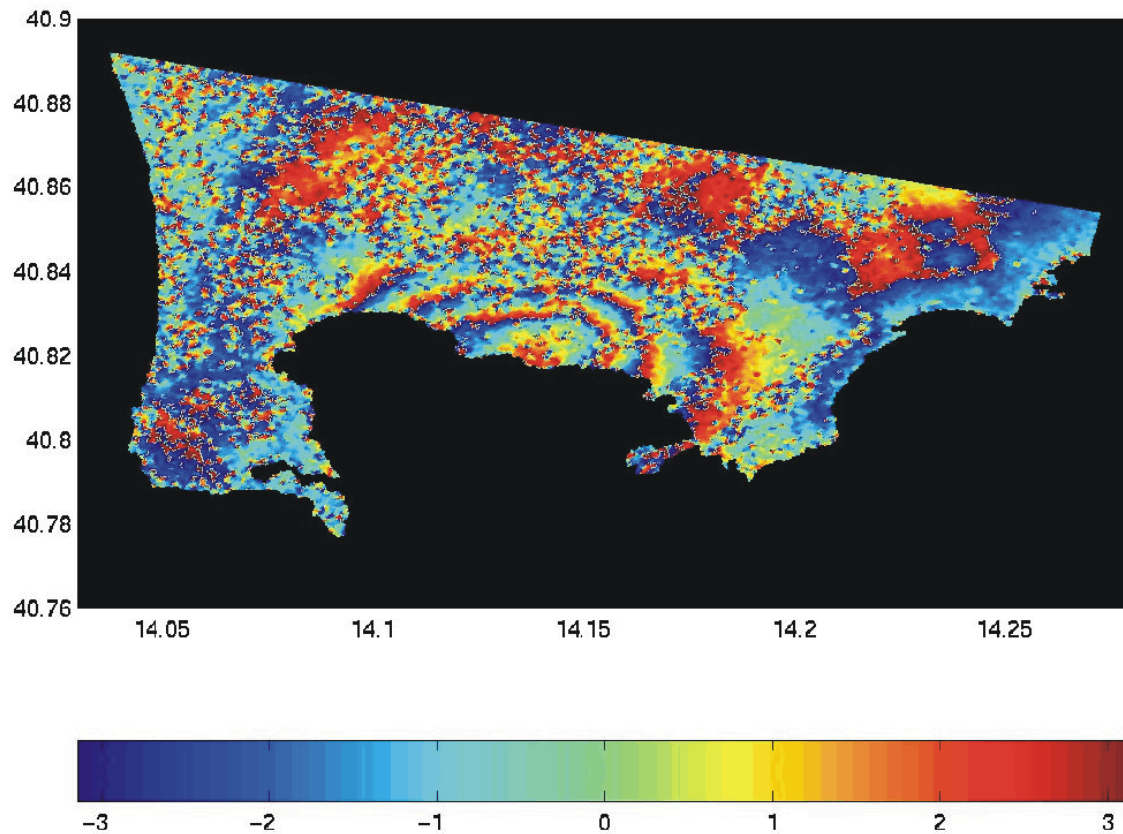
Principle of satellite SAR Interferometry



Interferogram of two ERS-2 SAR images of Izmit earthquake

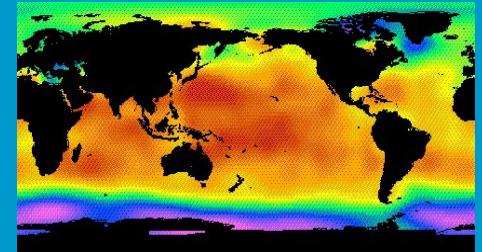


Campi Flegrei, Italy; interferometric phase image (Mar 97-Mar 99)

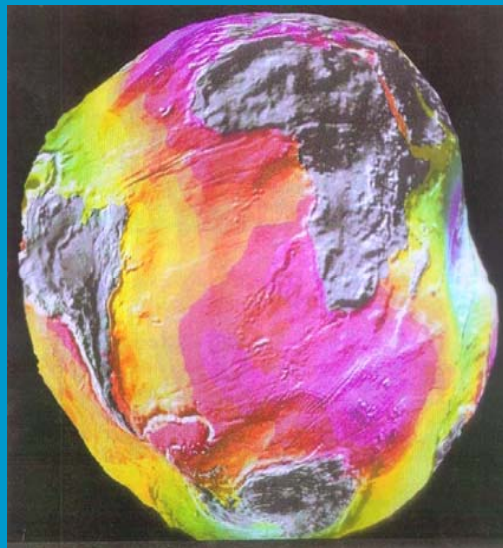
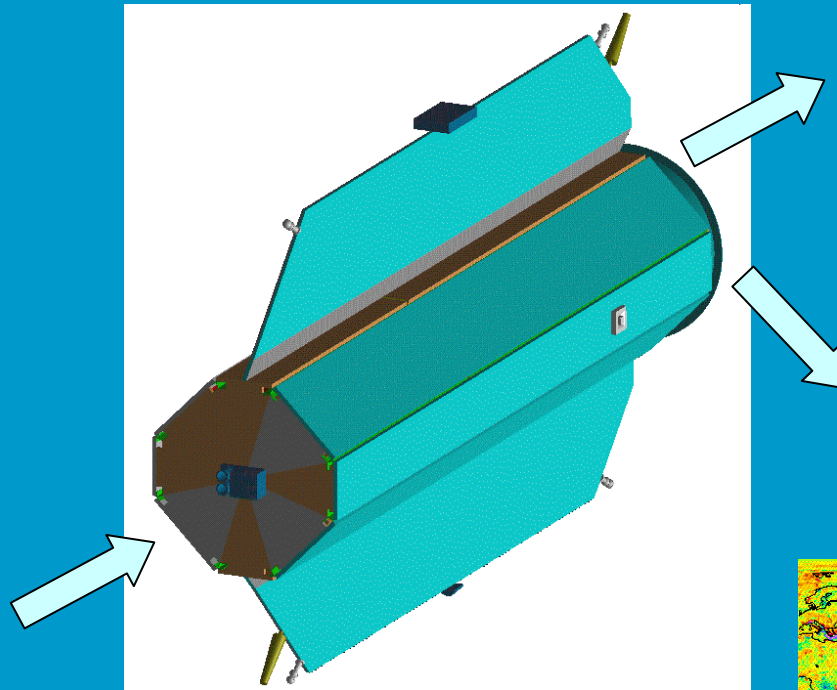
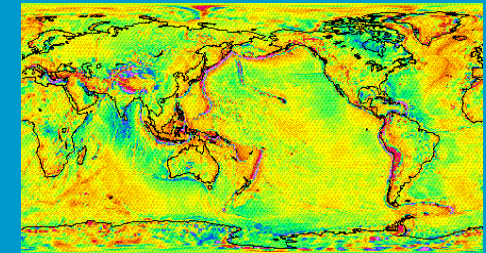


The Gravity and Ocean Circulation Explorer (GOCE) mission

Geoid



Gravity
Anomalies

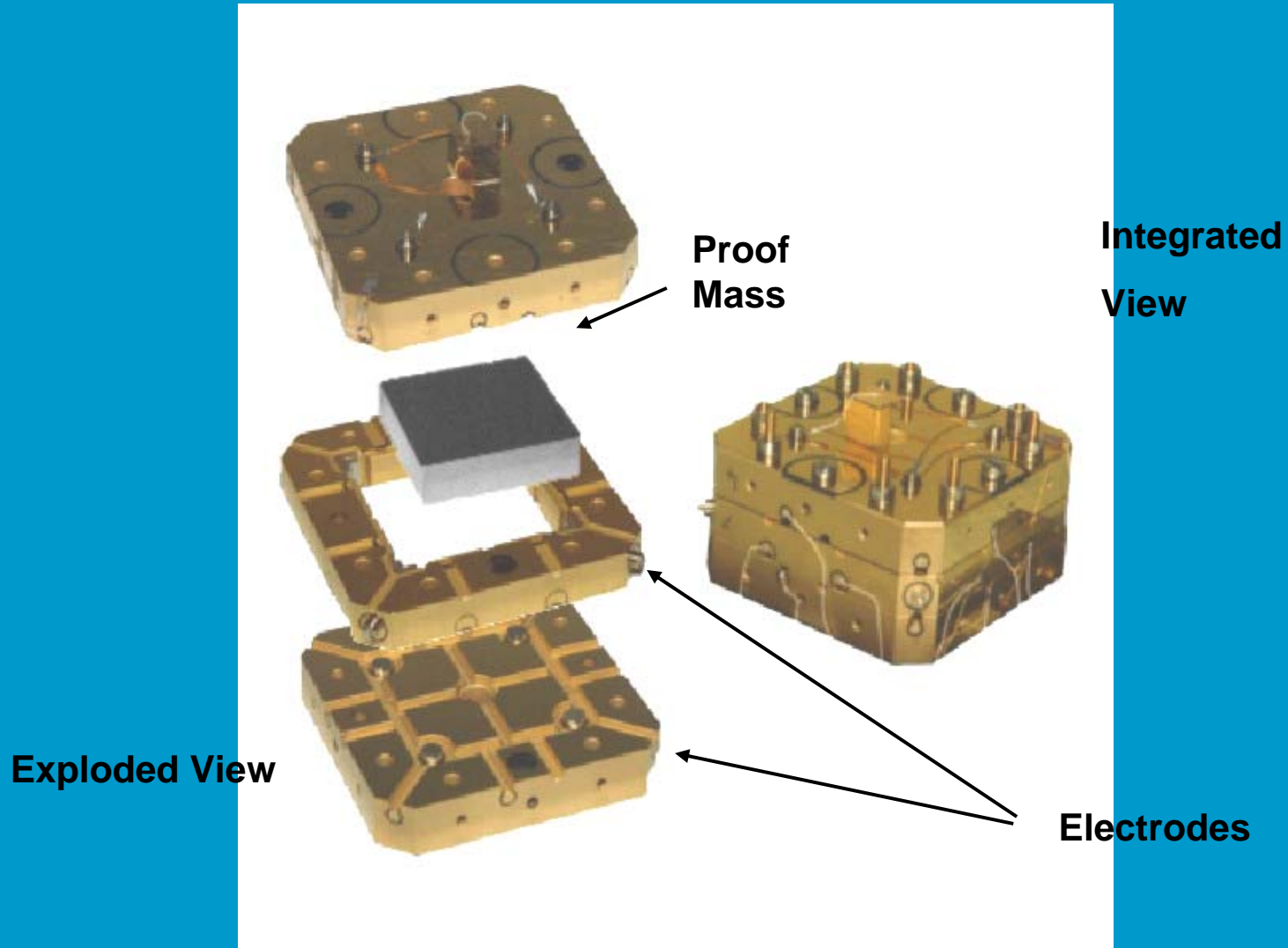


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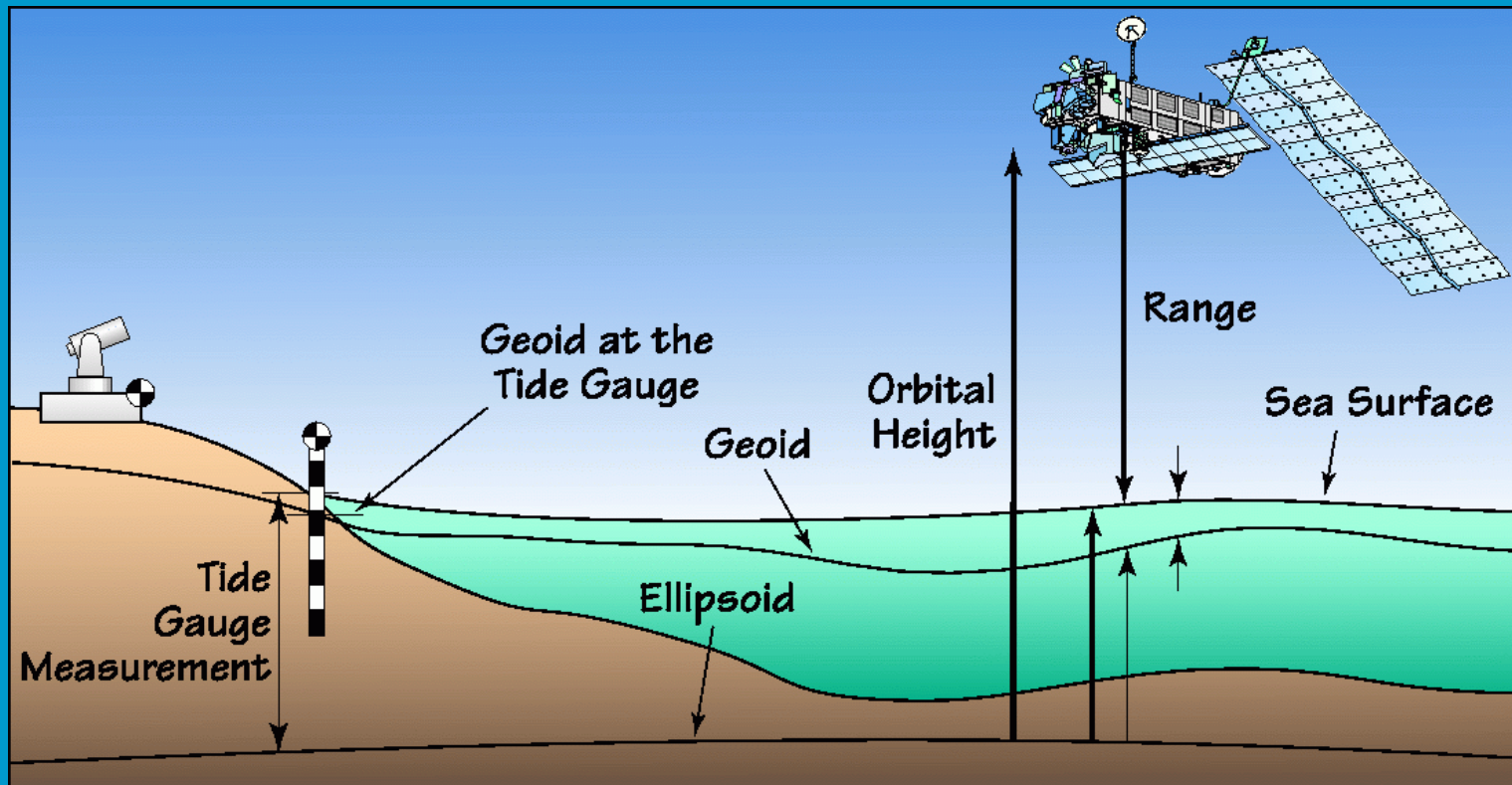
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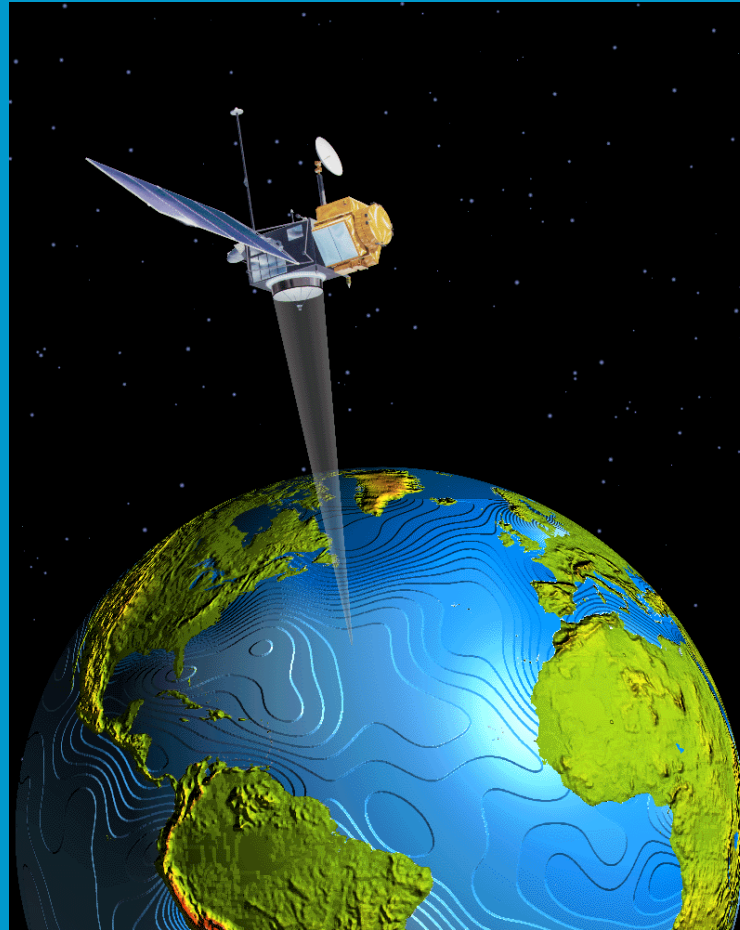
GOCE Satellite Gravity Gradiometer (SGG) equipment (ONERA)



Principle of satellite Radar Altimetry (RA) for sea surface height obs.



The Topex/Poseidon Radar Altimeter (RA) satellite mission



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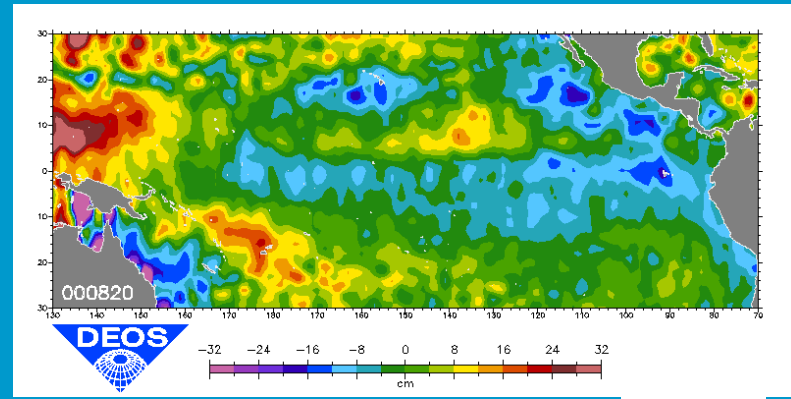
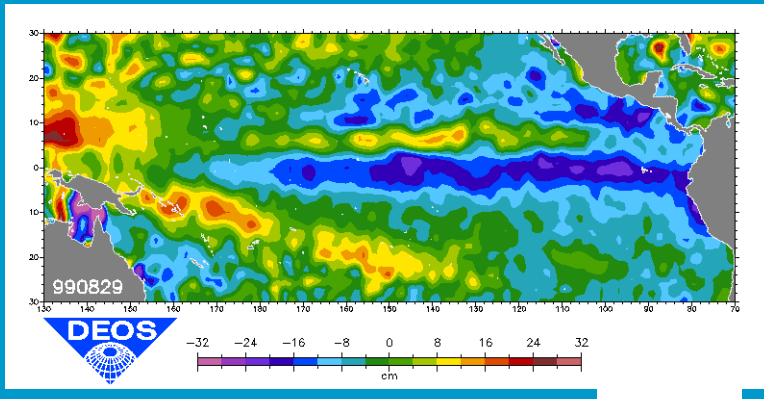
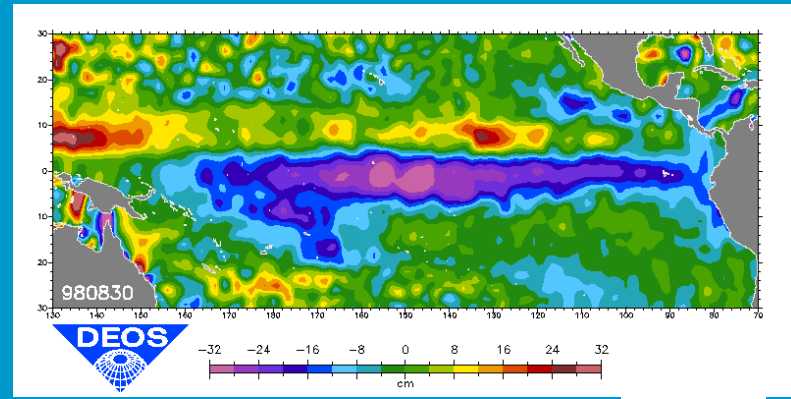
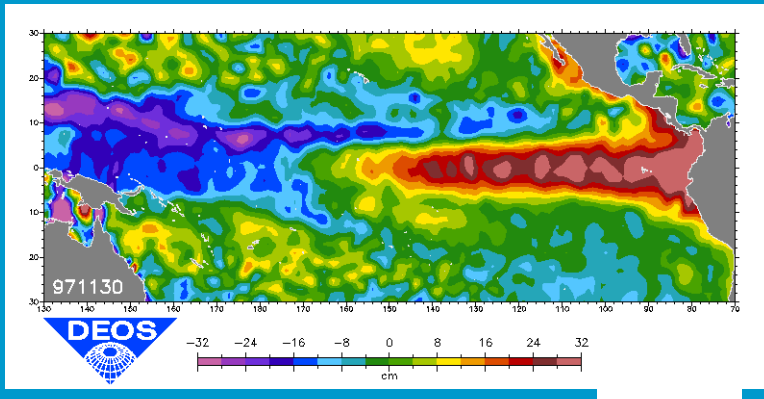
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Evolution of El Nino/La Nina determined from RA observations

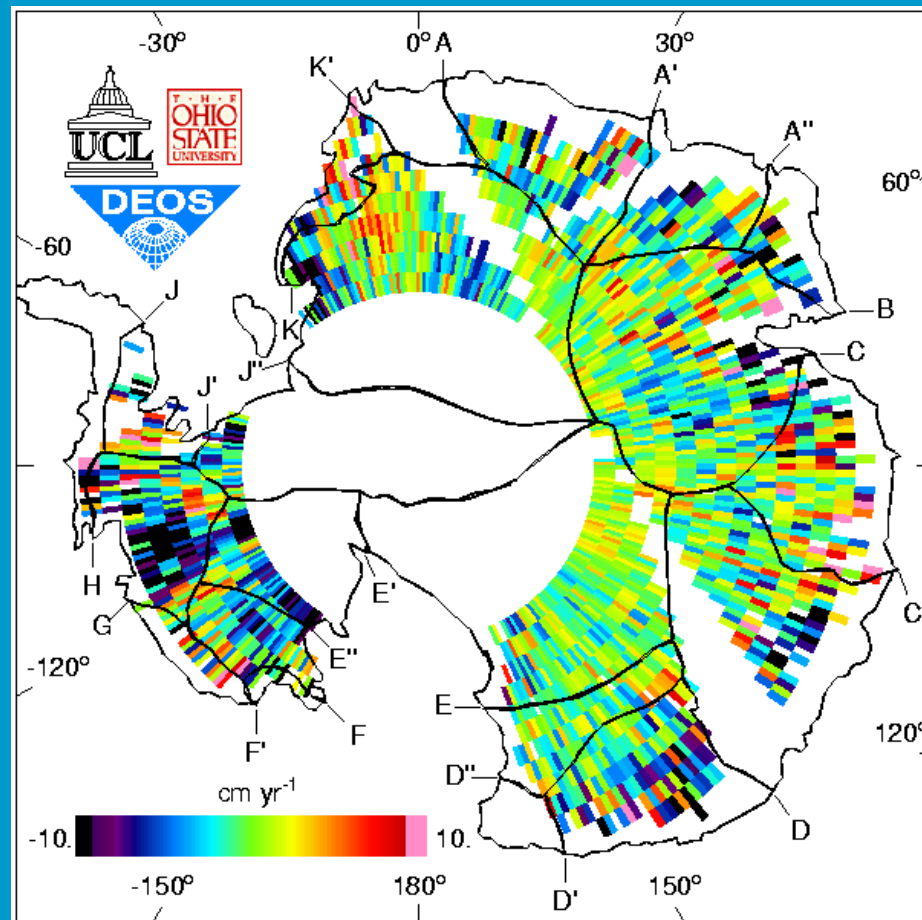


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Changes in thickness of the Antarctic ice sheet from ERS-2 RA data



Measuring atmospheric water vapor with GPS

