



Australian Government

Geoscience Australia



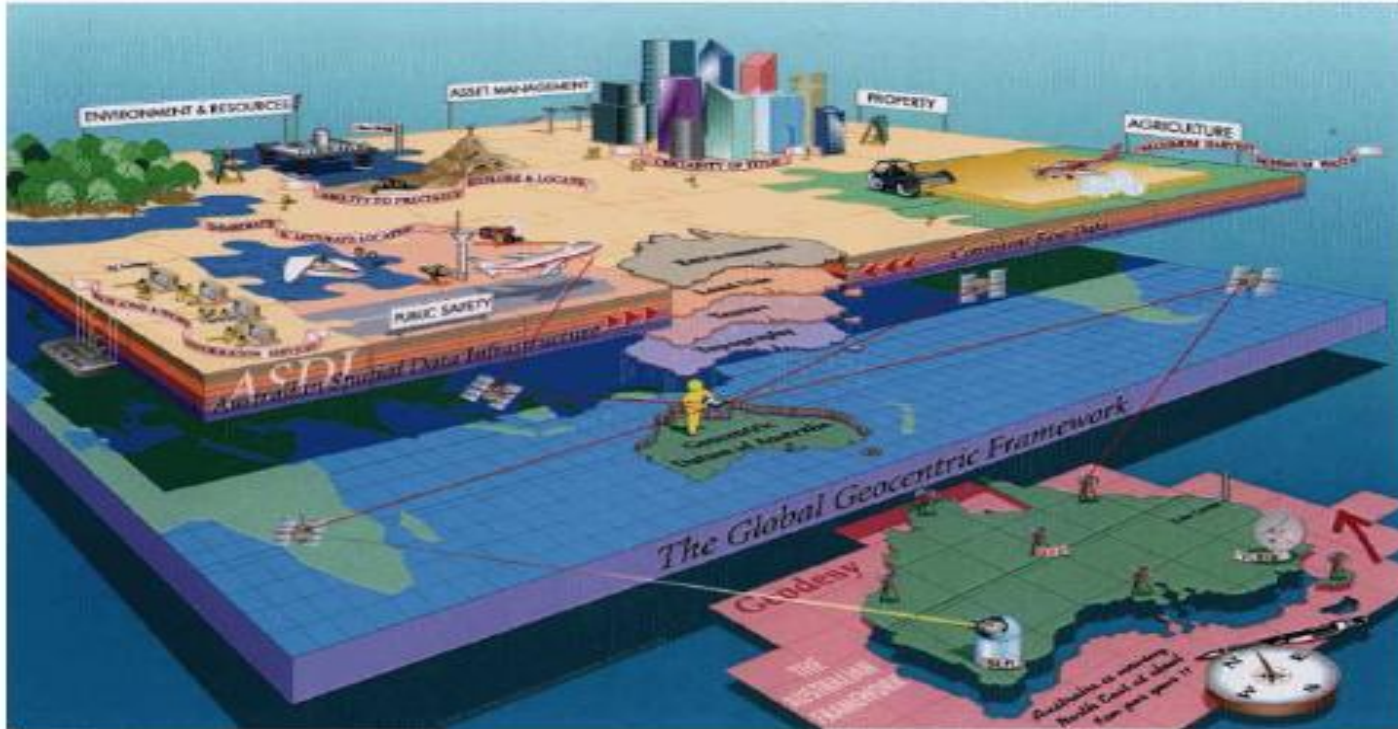
The Global Geodetic Reference Frame: An International Association of Geodesy Perspective

Gary Johnston, Harold Schuh, Chris Rizos

General Background and Motivation



Spatial Data Infrastructure: connecting the national reference frame to the ITRF



IAG Structure since 2003

International Union of Geodesy and Geophysics (IUGG)
65 Members (Adhering Bodies)

International Association of Geodesy (IAG)

Council

Executive Committee

Bureau

Office

COB

Commission 1
Reference Frames

Commission 2
Gravity Field

Commission 3
Earth Rotation and
Geodynamics

Commission 4
Positioning and
Applications

Inter-Commission Committee on Theory (ICCT)

Services:

IERS

IGS

IGFS

BGI

ICET

BIPM

IAS

ILRS

IVS

IDS

ICGEM

IGeS

IDEMS

PSMSL

IBS

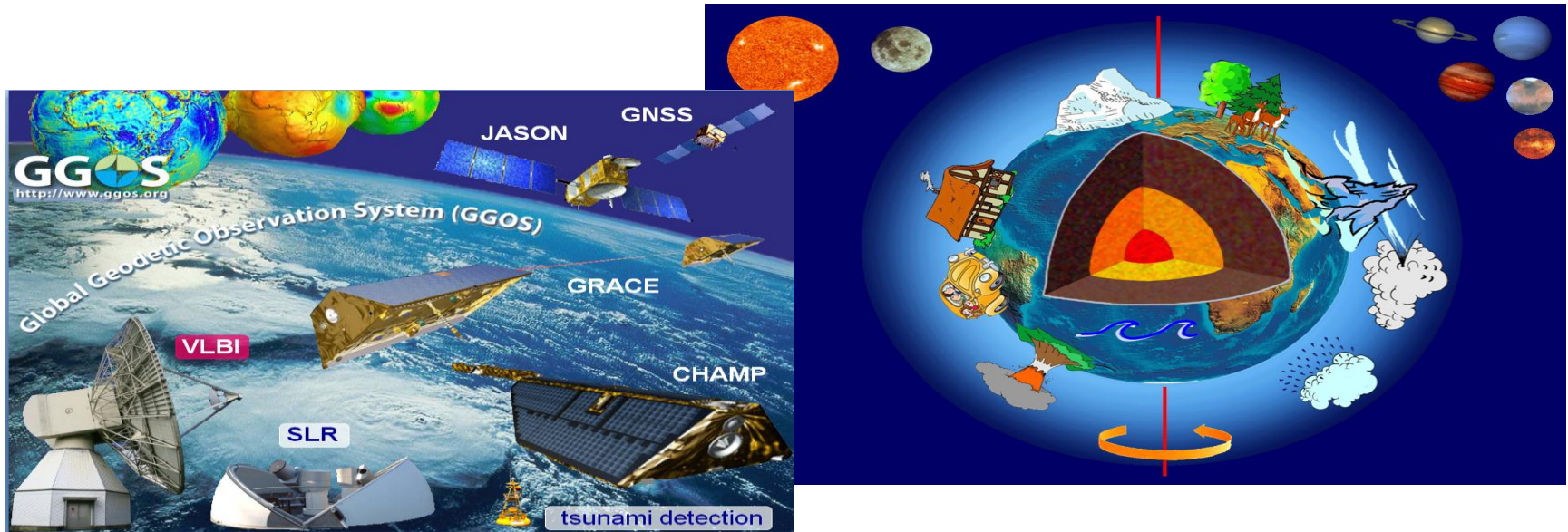
Global Geodetic Observing System (GGOS)

IAG / GGOS – General Goals

- **1 mm position and 0.1 mm/yr velocity** accuracy on global scales for the ITRF
- **continuous measurements** (time series of EOP, station positions and baselines)
- measurements in **near real-time**
- **highest reliability** and **redundancy**
- **low cost** for construction and operation of geodetic infrastructure

Approach

- Combination of all available Geodetic observations
- Improve our understanding of the "System Earth"



GGOS

5 major levels of instrumentation and objects that either actively perform observations or are passively observed

Level 1: terrestrial geodetic infrastructure;

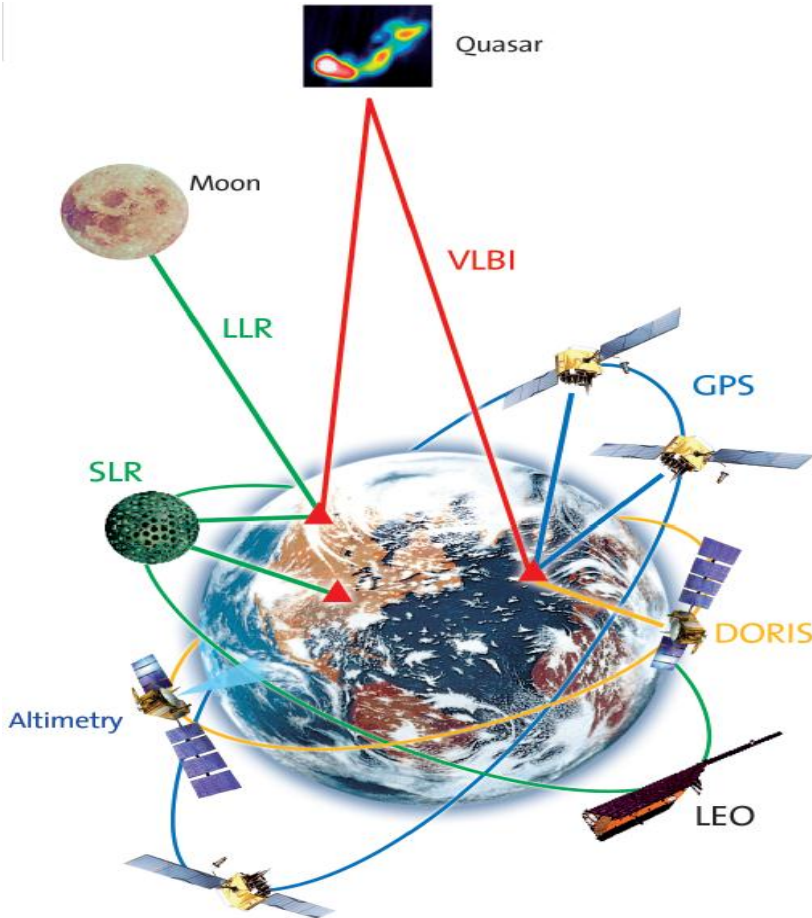
Level 2: LEO satellite missions;

Level 3: GNSS and Lageos-type SLR satellites;

Level 4: planetary missions and geodetic infrastructure on Moon and planets;

Level 5: extragalactic objects.

Source: Plag et al. (2009)



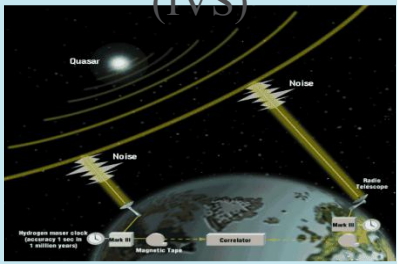
IAG / GGOS – observation techniques / products (1)

International Terrestrial Reference Frame (ITRFxx)

International Earth Rotation and
Reference Systems Service (IERS)

Radio source positions, precise GNSS orbits and clocks,
Earth orientation parameters (EOP), station coordinates and velocities

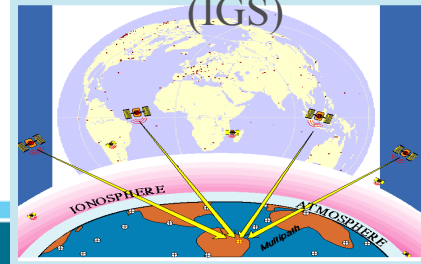
Very Long Baseline
Interferometry
(IVS)



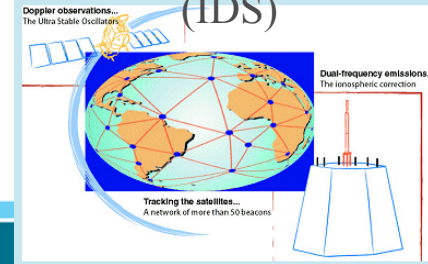
Satellite Laser
Ranging
(ILRS)



Global Navigation
Satellite Systems
(IGS)



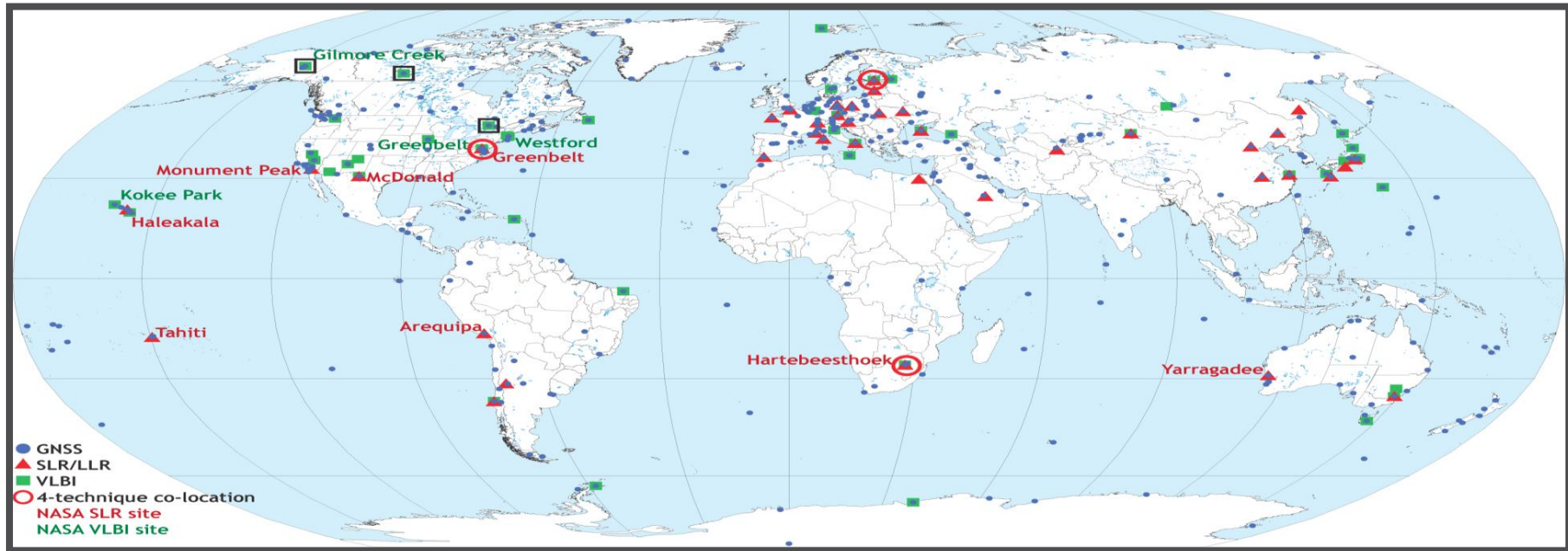
Doppler Orbit Determination
and Radiopositioning
Integrated on Satellite
(IDS)



GGOS Infrastructure: Existing Global Network

Current space geodesy network with co-locations

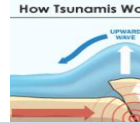
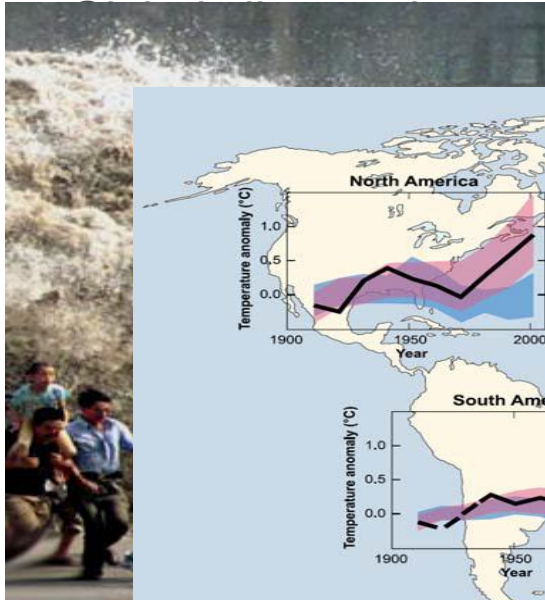
- 2 sites with 4 techniques, 16 sites with 3 techniques, 62 sites with 2 techniques



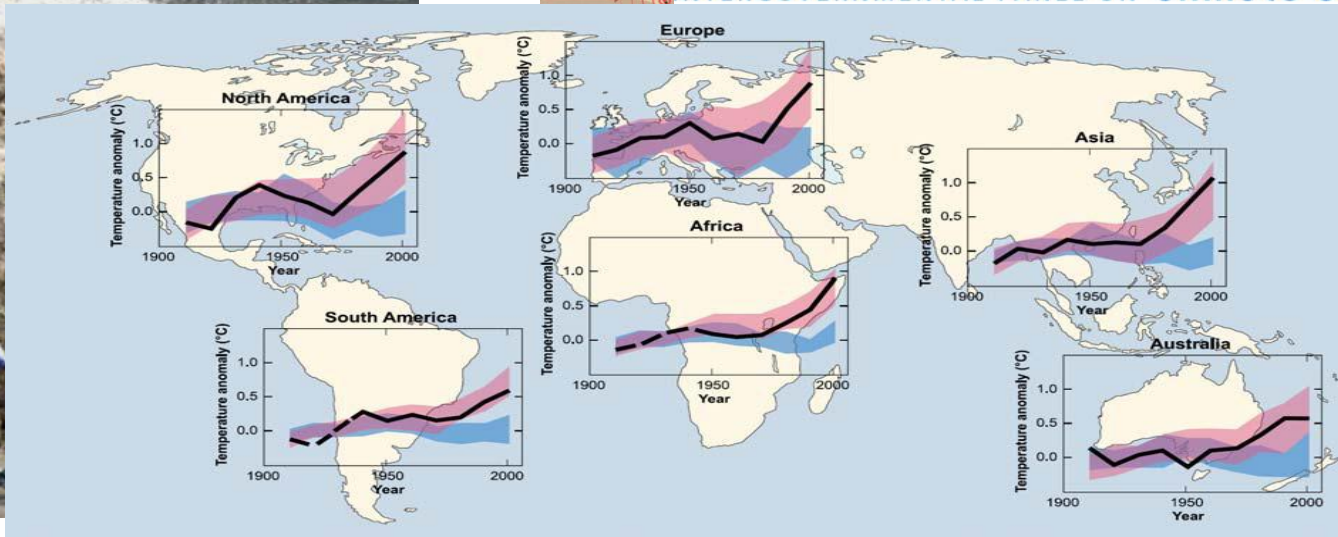
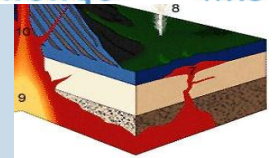
New challenges in geoscience

Increase of natural disasters

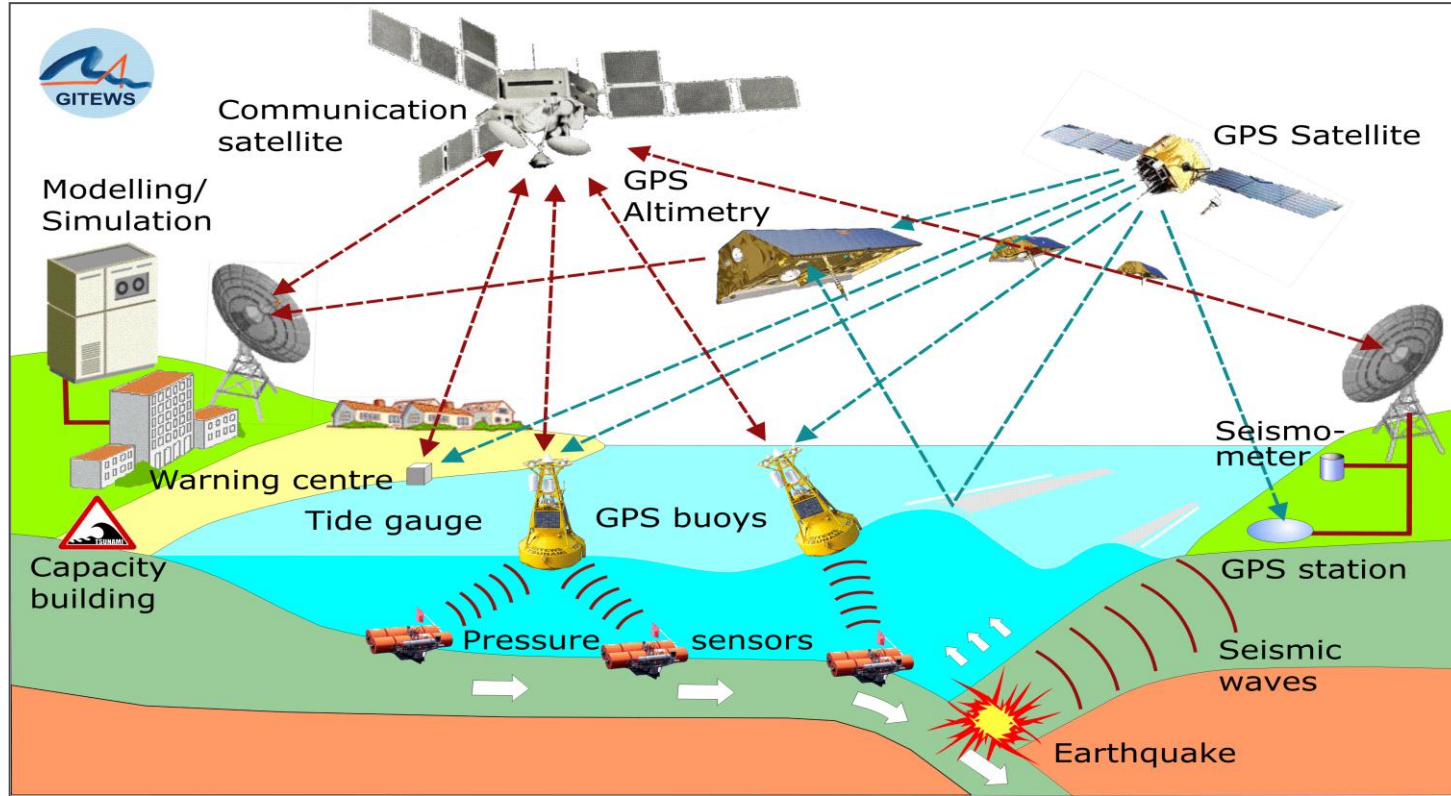
- Strong demand for prediction and warning



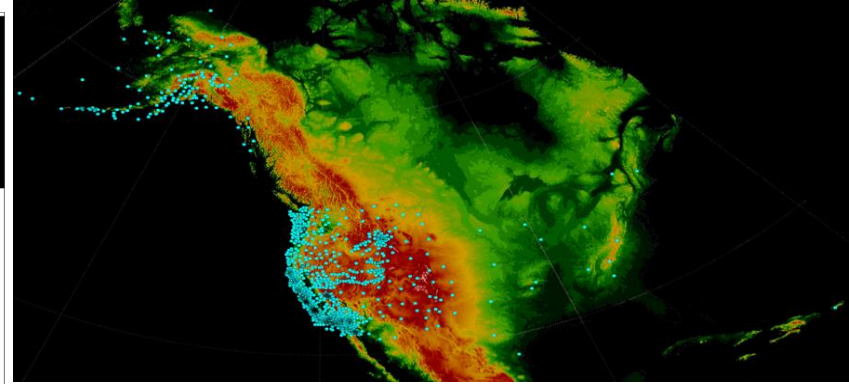
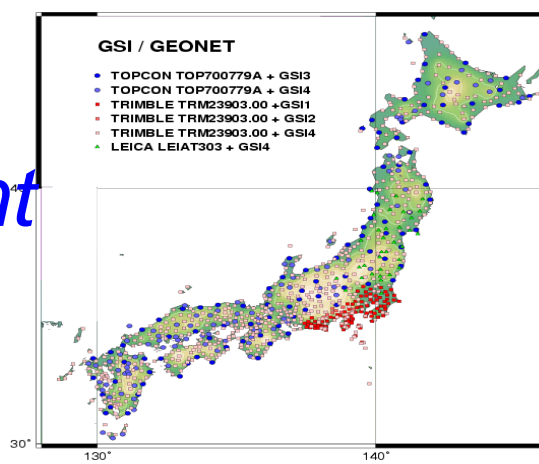
ipcc
INTERGOVERNMENTAL PANEL ON climate change



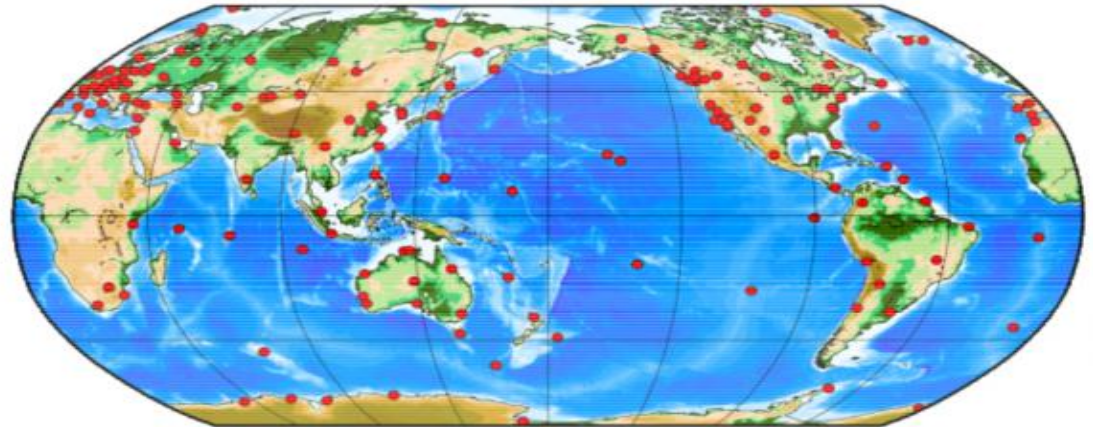
GGOS Infrastructure Support of Regional Early-Warning



RT Ground Displacement Monitoring: Utilising over 3000 Pacific Basin GNSS CORS



US Plate Boundary Observatory

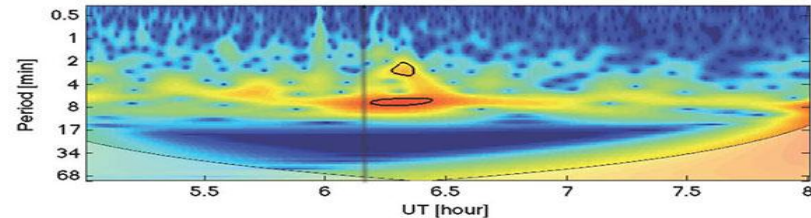
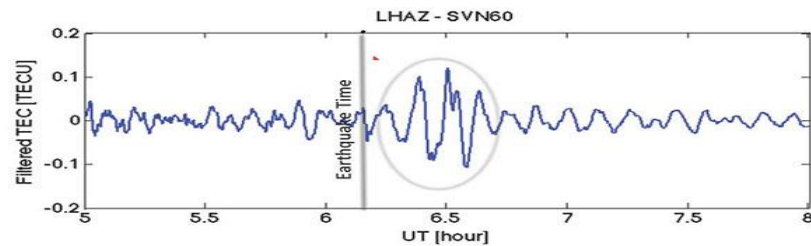
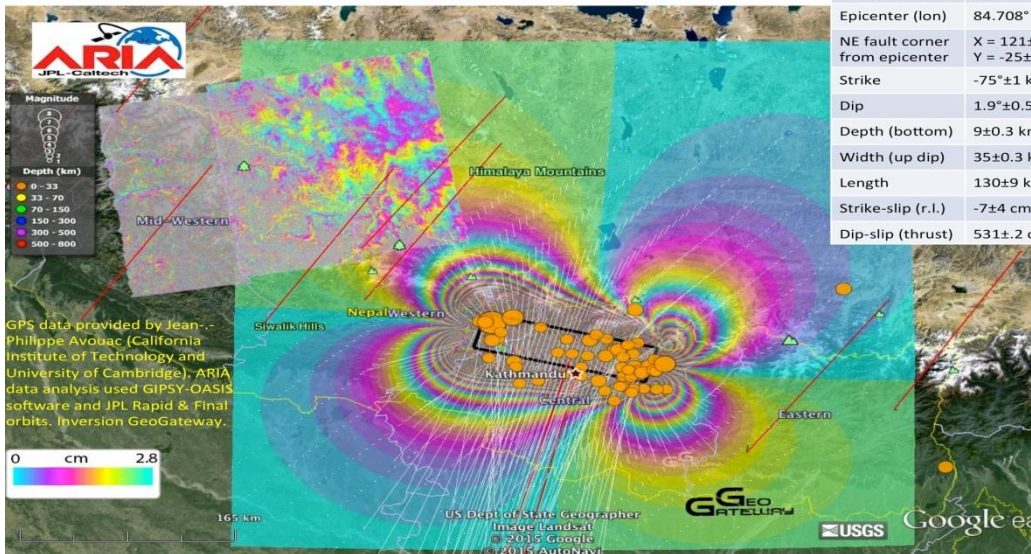


IGS Real-Time Network

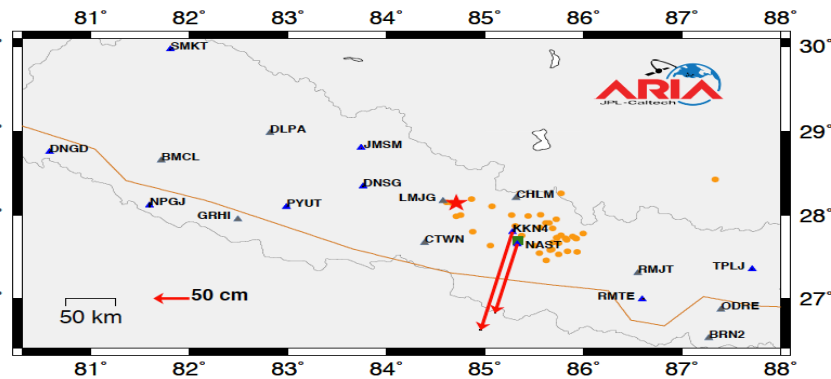
Gorkha, Nepal Earthquake 25 April

Single Fault Model

Parameter	Chi ² =0.6
Epicenter (lat)	28.147°
Epicenter (lon)	84.708°
NE fault corner from epicenter	X = 121±9 km Y = -25±1 km
Strike	-75°±1 km
Dip	1.9°±0.5 km
Depth (bottom)	9±0.3 km
Width (up dip)	35±0.3 km
Length	130±9 km
Strike-slip (r.l.)	-7±4 cm
Dip-slip (thrust)	53±1.2 cm



IGS Lhasa, Tibet



Caltech Stns, Nepal

Conclusions

- Challenges in Earth observation:
 - Need to support Earth System Science with greater accuracy
 - Need products in real time for very fast events (earthquakes, tsunamis, land slides)
- Global Geodetic Observing System (GGOS) is **the** geodetic contribution to Earth observation (within **GEOSS** under **GEO**)
- GGOS provides the metrological basis (in terms of **reference frames, time and frequency transfer**) for a multitude of other Earth observations
- The products and services of IAG benefit all of society, but need your contribution



Thank you for your
attention!

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