



Federal Agency for  
Cartography and Geodesy



# Establishment of the GGOS and the Importance of the Next Generation VLBI

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GGOS Chair

*IVS General Meeting*

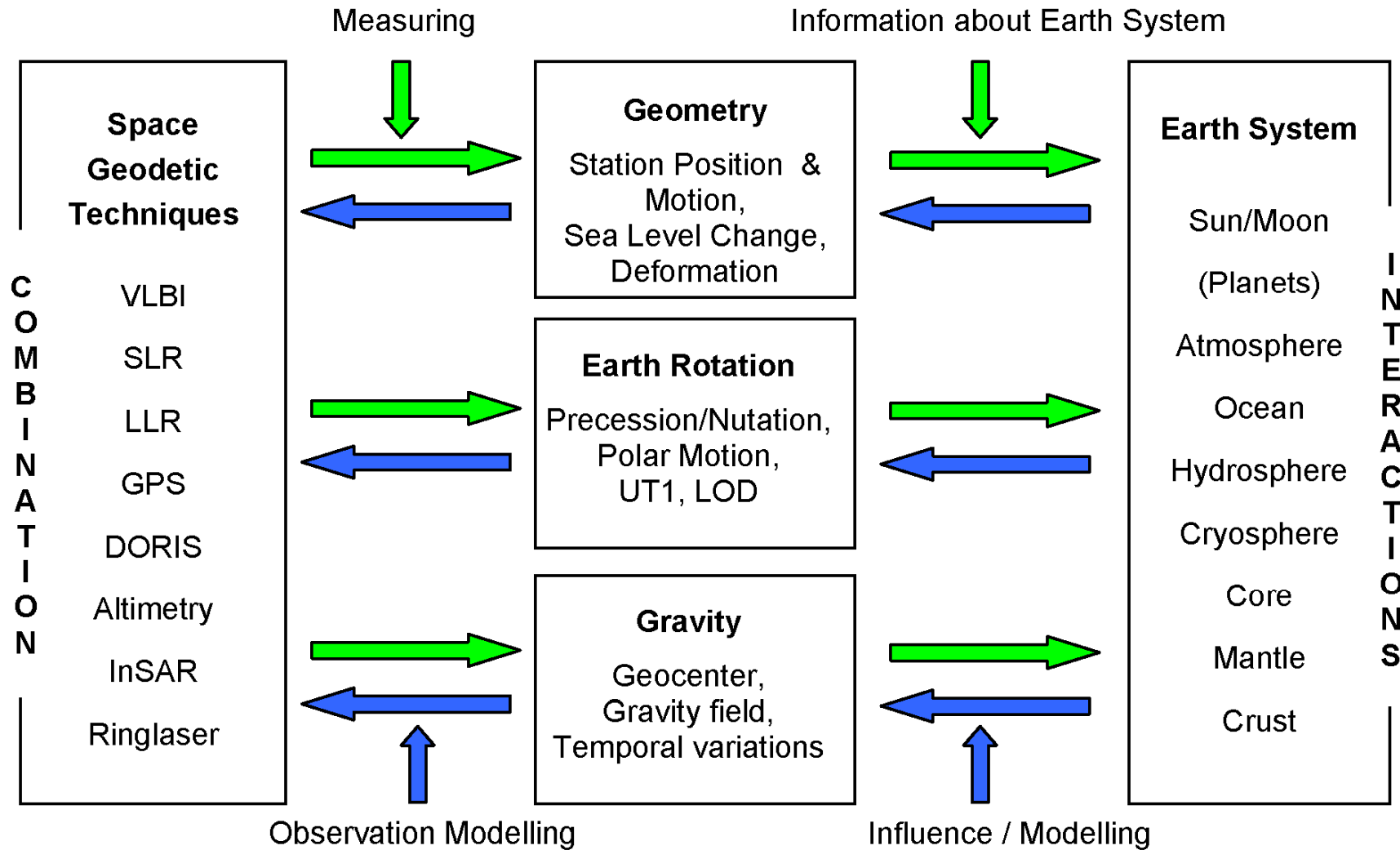
*Madrid, March 5<sup>th</sup>, 2012*



- Introduction
- General Background
- GGOS Today
- GGOS and the IAG Services
- Conclusions



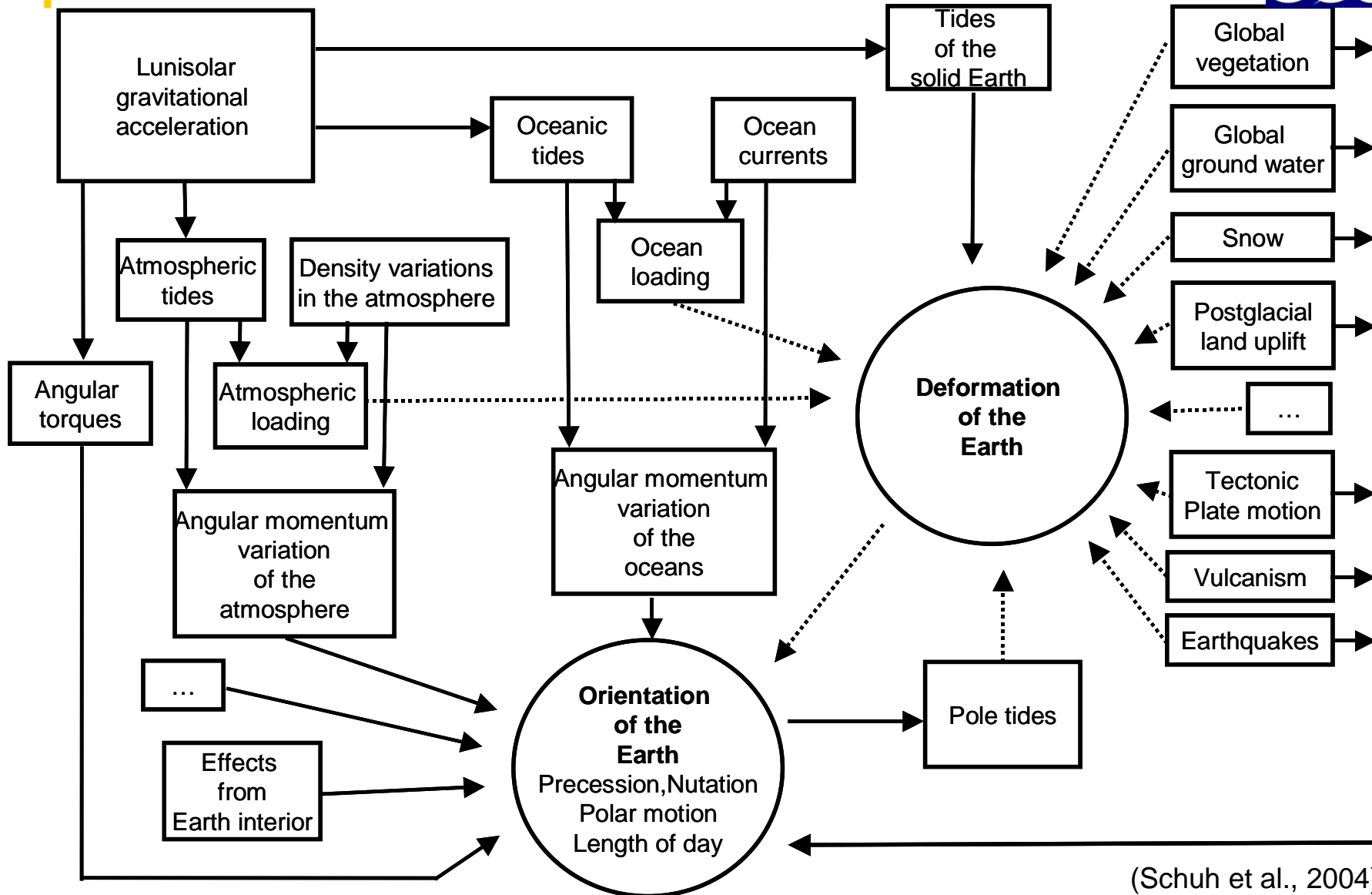
# General Background A Systematic View



(Schuh et al., 2004)



# Example Earth Rotation: Earth System Parameters



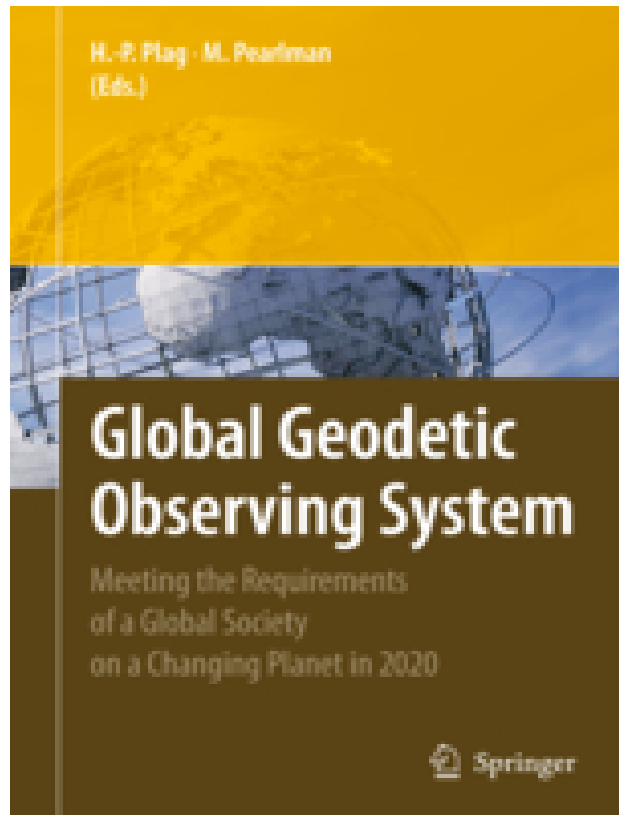
(Schuh et al., 2004)



- 2001–2003: Proposal for the GGOS developed by GGOS planning group
- July 2003: Accepted by IAG EC and IAG Council during XXIII IUGG General Assembly in Sapporo (endorsed by IUGG through Resolution No. 3)
- 2007: GGOS as an integral component of IAG along with Services and Commissions (status transformed from an IAG Project to an IAG component)
- 2009–2011: Revisions primarily of GGOS organizational structure leading to 2011 ToR



# General Background Programmatic View



## GGOS Book (2009) – Contents

- Goals, achievements and tools of modern Geodesy
- Earth science requirements für Geodesy
- Maintaining a modern society
- Future geodetic reference frame
- Future Global Geodetic Observing System
- GGOS 2020



## IAG Bylaws 1(d)

*“The Global Geodetic Observing System works with the IAG components to provide the geodetic infrastructure necessary for monitoring the Earth system and global change research”.*

The vision of GGOS is

*“Advancing our understanding of the dynamic Earth system by quantifying our planet’s changes in space and time”.*

(GGOS ToR 2011)



# GGOS Today – The Mission



*We live on a dynamic planet in constant motion that requires long-term continuous quantification of its changes in a truly stable frame of reference.*

The mission of GGOS is:

To provide the observations needed to monitor, map and understand changes in the Earth's shape, rotation and mass distribution.

To provide the global frame of reference that is the fundamental backbone for measuring and consistently interpreting key global change processes and for many other scientific and societal applications.

To benefit science and society by providing the foundation upon which advances in Earth and planetary system science and applications are built.

(GGOS ToR 2011)





The goals of GGOS are:

1. To be the primary source for all global geodetic information and expertise serving society and Earth system science.
2. To actively promote the sustainment, improvement and evolution of the global geodetic infrastructure needed to meet Earth science and societal requirements.
3. To coordinate with the international geodetic services that are the main source of key parameters needed to realize a stable global frame of reference and to observe and study changes in the dynamic Earth system.
4. To communicate and advocate the benefits of GGOS to user communities, policy makers, funding organizations, and society.

(GGOS ToR 2011)



# GGOS Today – The Tools Observation Techniques and Products

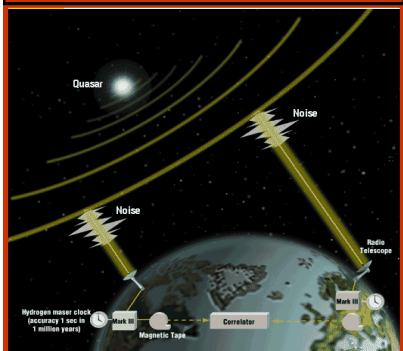


International Terrestrial Reference Frame (ITRF)

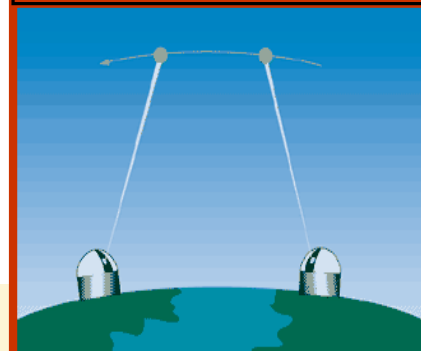
International Earth Rotation Service  
(IERS)

Source Positions, Precise GPS Orbits and Clocks,  
Earth Rotation Parameters, Station Coordinates

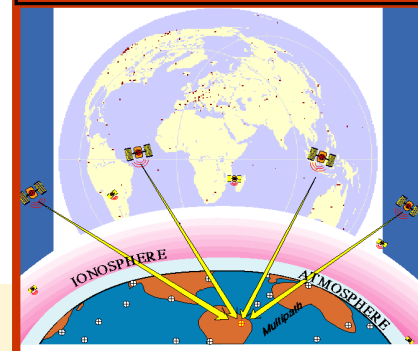
Very Long Baseline  
Interferometry  
(IVS)



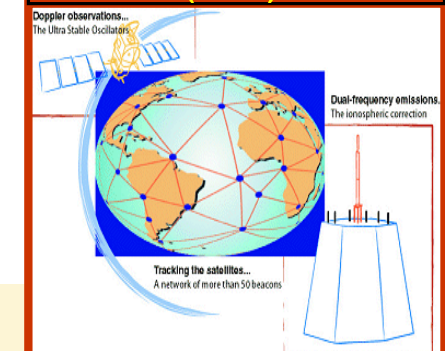
Satellite Laser  
Ranging  
(ILRS)



Global Navigation  
Satellite Systems  
(IGS)



Doppler Orbit Determination  
and Radiopositioning  
Integrated on Satellite  
(IDS)



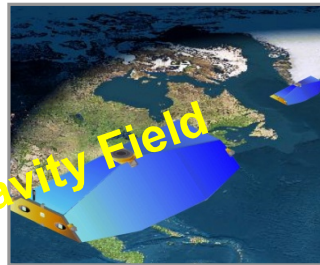


# GGOS Today – The Tools

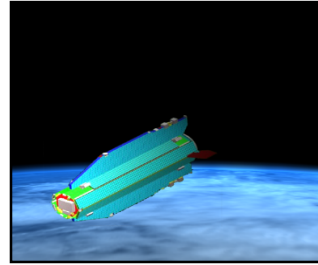
## Observation Techniques and Products



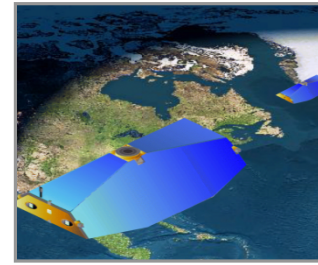
CHAMP



GRACE

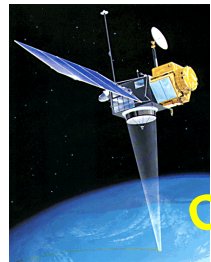


GOCE



GRACE Follow-on ?

...



Topex/Pos.



JASON-1

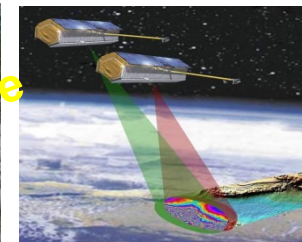


JASON-2

...

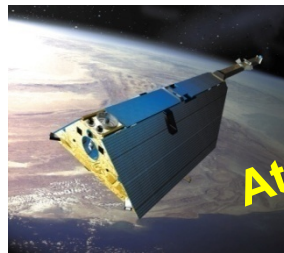


TerraSAR-X

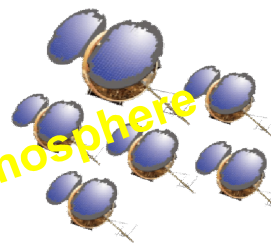


TanDEM-X

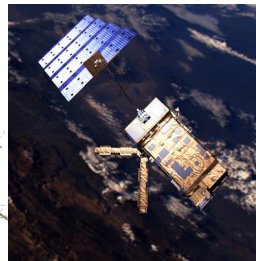
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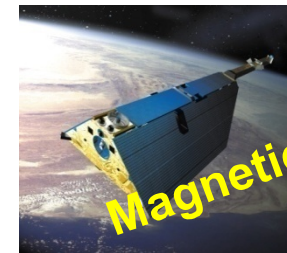


COSMIC



MetOp

...



CHAMP

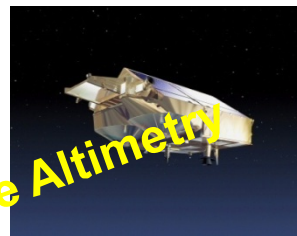


SWARM

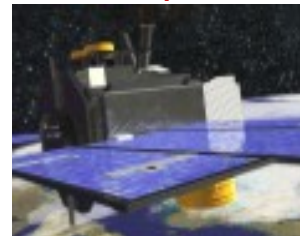
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IceSat-1



Cryosat-2



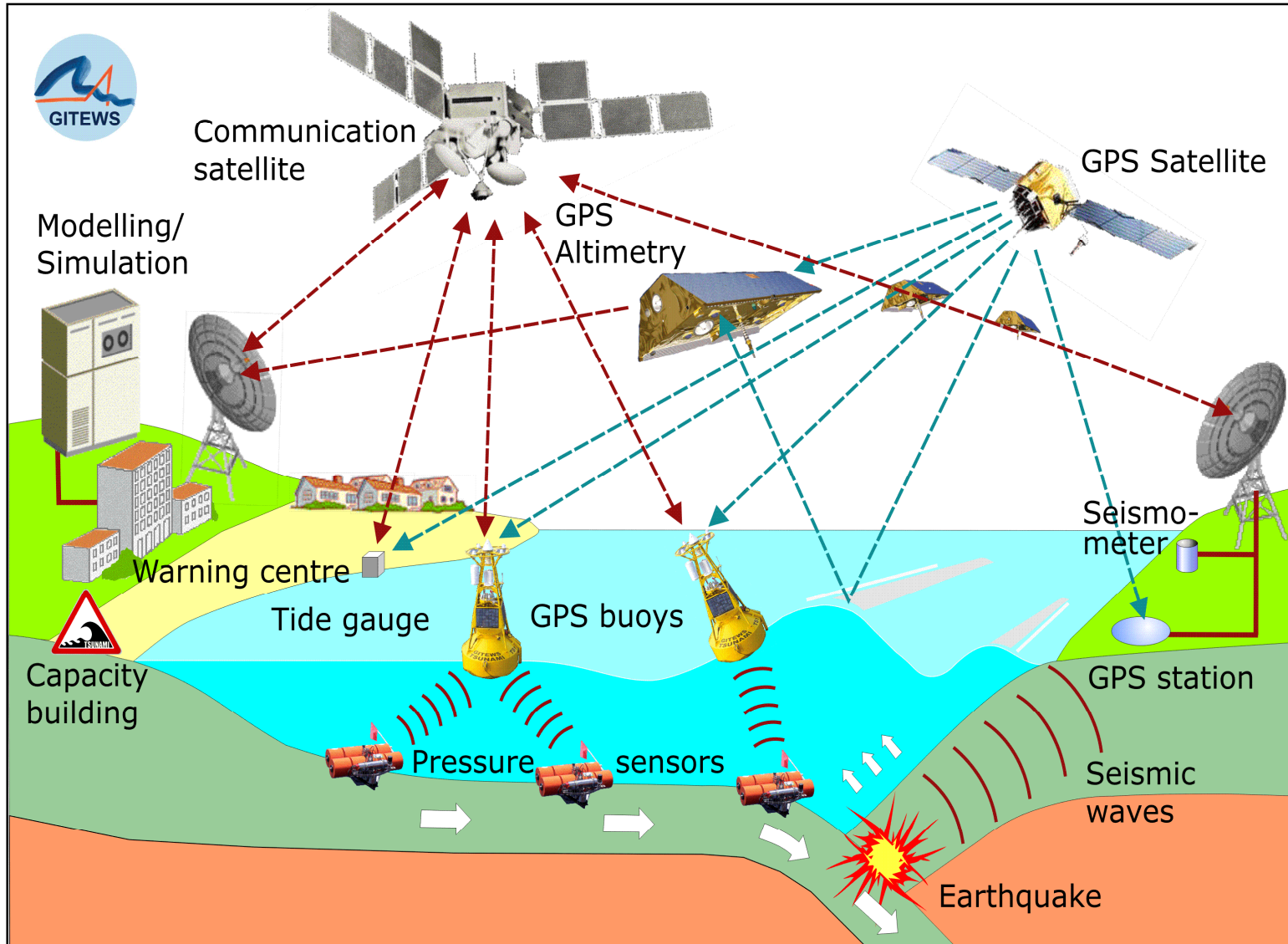
IceSat-2

...

... and new mission concepts,  
satellite constellations, micro-  
satellites, ...



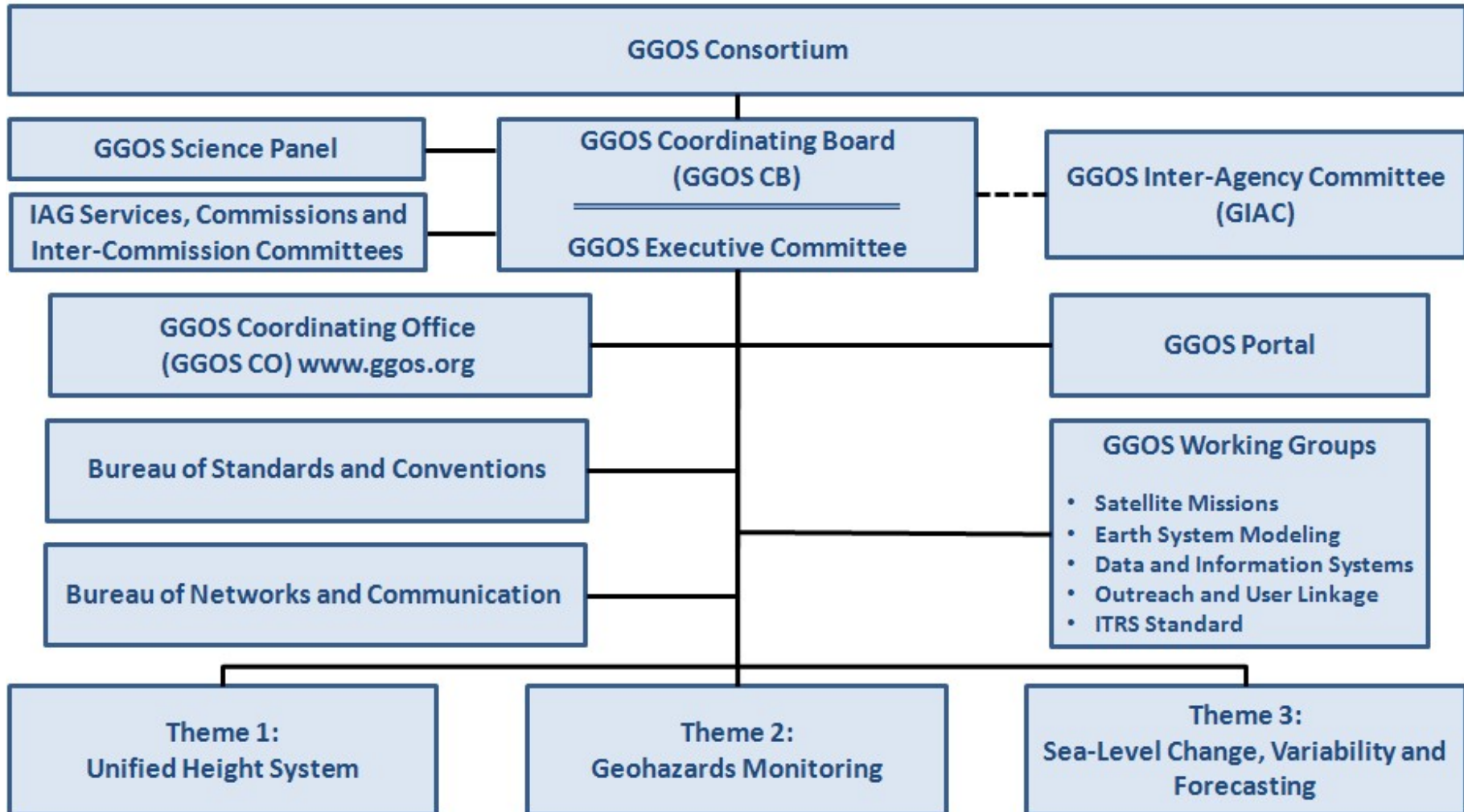
# GGOS Today – Infrastructure





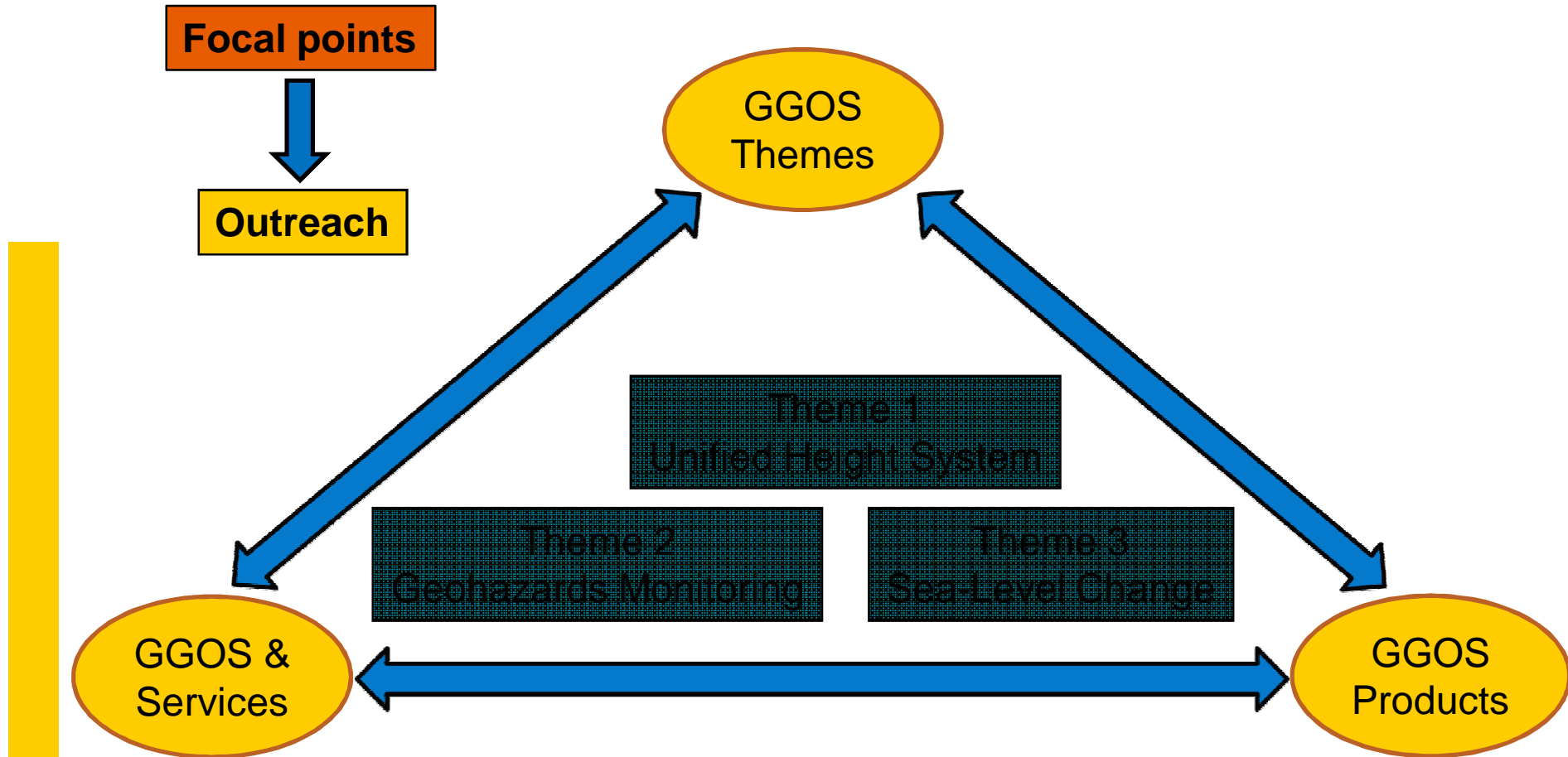


# GGOS Today – The New Structure





# GGOS Today – The Approach





# GGOS and the IAG Services

## IVS: Next Generation VLBI



- Better global coverage, faster observations, broader bandwidth
- Stable geodetic reference frames – CRF and TRF
- High-quality local ties
- Efficient infrastructure for data transfer and processing
- Validated geometric Earth system parameters



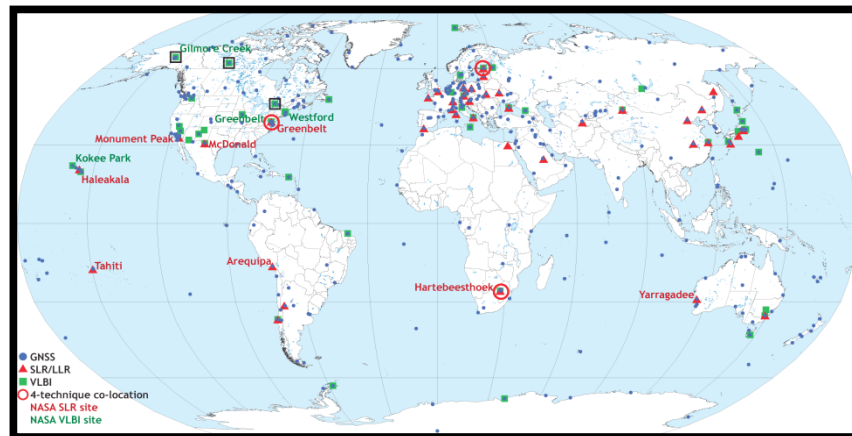
# GGOS and the IAG Services

## Next Generation GGOS Network



### Current space geodesy network co-locations

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



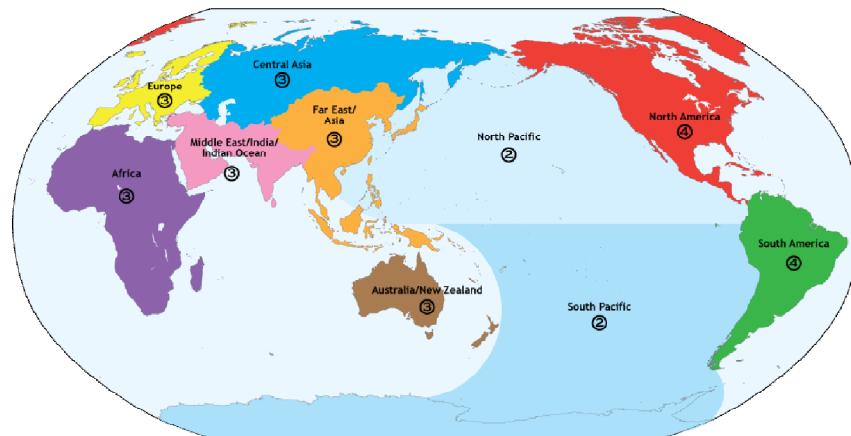
The Global Geodetic Network does not meet current GGOS requirements.

- Old equipment
- Poor network Distribution
- Poor co-location of techniques
- Large systematic observational errors
- Need 100 times improvement in measurement accuracy

### GGOS target network design

- 30 globally distributed, multi-technique co-located ground stations
- 4 techniques/site

GEO Sub-task DA-09-02c



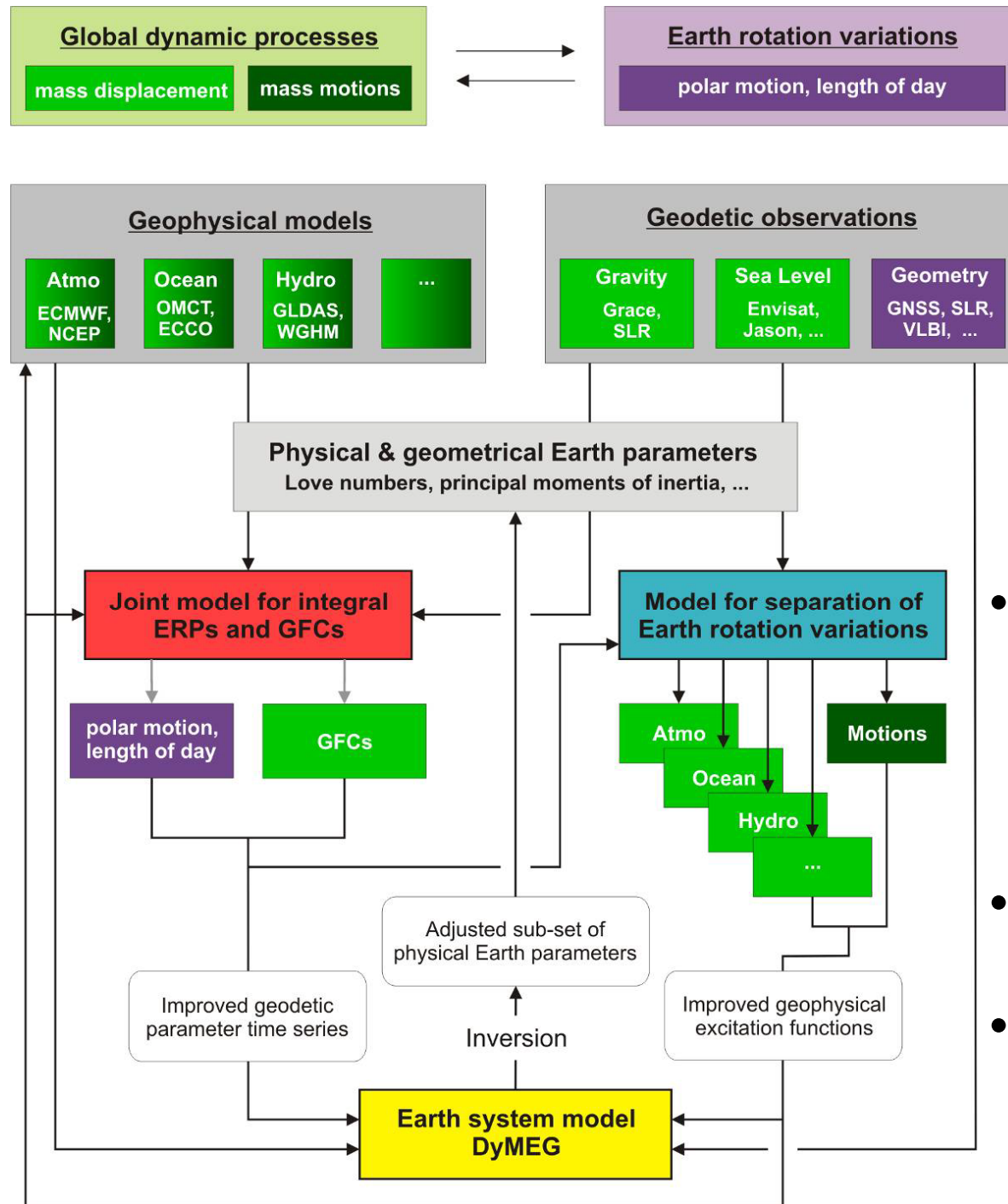
GGOS Member States with Core site activities:

- |               |              |
|---------------|--------------|
| United States | Germany      |
| China         | Korea        |
| Australia     | Russia       |
| New Zealand   | India        |
| Saudi Arabia  | South Africa |
| Spain         |              |





# GGOS and the IAG Services – GGOS Products



## GGOS products – an illustrative example

- German DFG Research Unit FOR 584: „Earth Rotation and Global Dynamic Processes“  
Joint Project together with DGFI and TU Munich
- Integration of ERP + gravity variations + model information
- Metadata required



- Improved organization ⇒ New GGOS structure
- Improved infrastructure ⇒ GGOS Core Network
- Better visibility ⇒ GGOS Themes
- Operational mode ⇒ GGOS Products
- Closer cooperation ⇒ GGOS and IAG Services