Vision for the IGS

Markus Rothacher

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Contents

- GNSS Developments: GALILEO / GPS III / GLONASS
- Real-Time Products and Monitoring
- Integration of LEO Constellations
- GGOS: Consistency and Combination
- GGOS: Integration and Modeling

GNSS Developments

- Equipment of global IGS stations with receivers collecting data from all GNSS (GPS, GLONASS, GALILEO, QZSS, …)
- Develop the capabilities to process all GNSS systems together with the highest quality possible:
  - Refined ambiguity resolution algorithms
  - Making use of all available observation types
  - Monitoring of the biases between observation types
  - Monitoring of biases between the systems
  - Antenna phase center calibration …
- Deliver the best, most accurate and consistent GNSS products (orbits, clocks, EOP, atmosphere, DCBs, …) in the world
- Support the GPS/GALILEO/GLONASS responsible with inter-system information

Real-Time Products and Monitoring

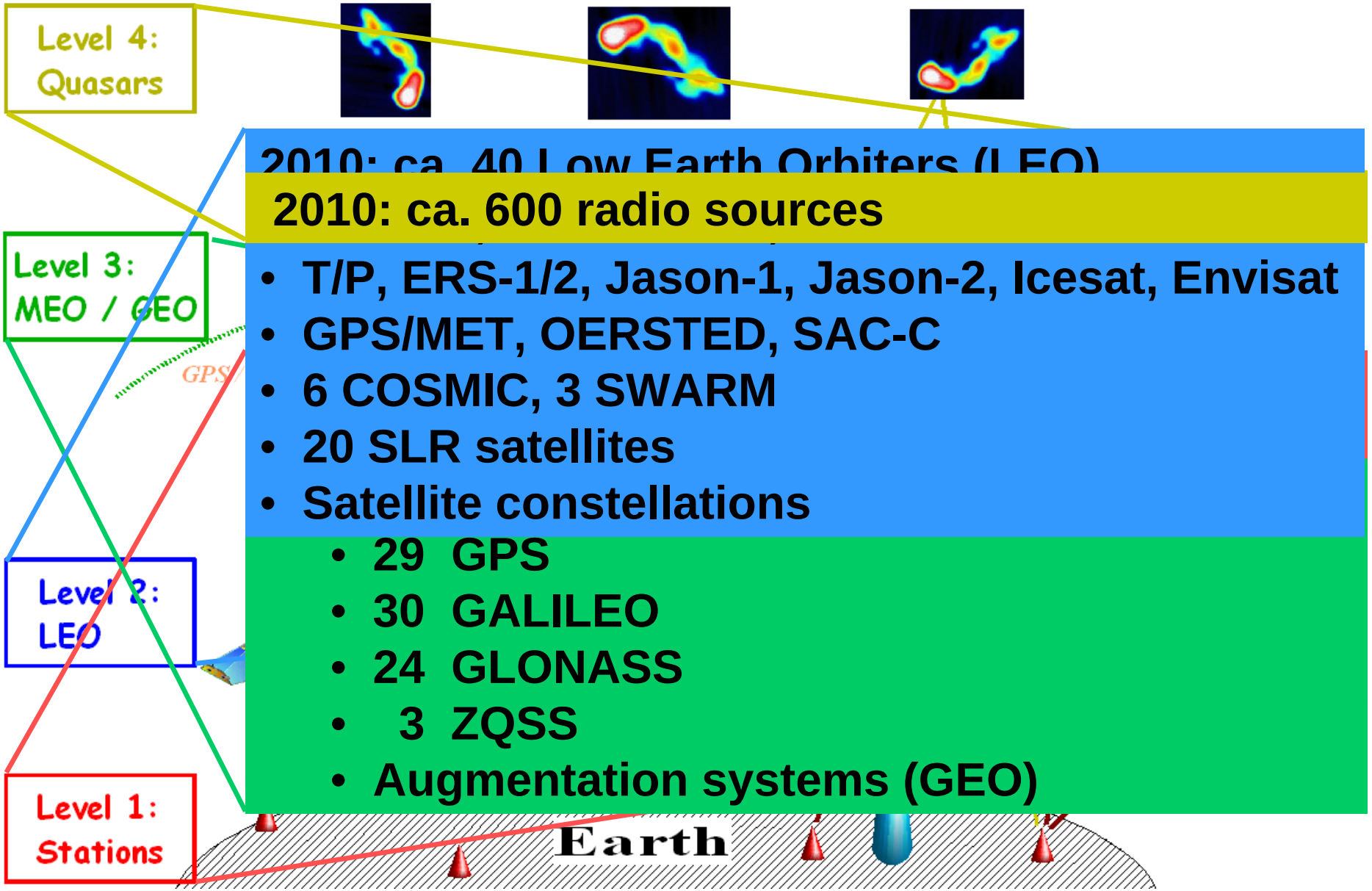
- Establish a dense real-time network of GNSS stations
- Develop capability to transfer 10-20 Hz data if something has happened: real-time monitoring (else 1 sec data)
- Develop real-time data processing for real-time IGS products (including combination ???)
- Establish efficient and easy-to-use product flows to the users
- Real-time processing of all GNSS data for:
  - Global GNSS orbit and clock products, reference frame monitoring
  - Integrity monitoring, integrity information (?)
  - Early warning systems
  - Deformation monitoring
  - GPS seismology (measuring the site motion during an Earthquake)
  - Atmospheric applications (water vapor, space weather)

Integration of LEO Constellations

Inclusion of LEO satellites into the global IGS processing:

- More and more constellations of LEOs with GNSS receivers (GRACE, COSMIC, SWARM, …)
- Form a constellation of GNSS-LEO-satellites in space with an internal orbit accuracy of the constellation of 1-2 mm over 13’000 km (due to ambiguity fixing)
- Improvement of:
  - GNSS satellite orbits and clocks
  - Center of mass determination
  - Gravity field variations of low-degree harmonics coefficients
  - Combine gravity field and geometry; vertical datum definition
- Monitoring of mass transport and mass distribution with gravity missions in the constellation

Vision 2010: Intergation of 4 Levels into a GGOS



2010: ca. 40 Low Earth Orbiters (LEO)

2010: ca. 600 radio sources

- T/P, ERS-1/2, Jason-1, Jason-2, Icesat, Envisat
- GPS/MET, OERSTED, SAC-C
- 6 COSMIC, 3 SWARM
- 20 SLR satellites
- Satellite constellations
  - 29 GPS
  - 30 GALILEO
  - 24 GLONASS
  - 3 ZQSS
  - Augmentation systems (GEO)

GGOS: Consistency and Combination

- IGS should have full reprocessing capabilities/capacity:
  - Extremely important for reference frame contributions to IERS/GGOS
  - Enough individual IGS ACs to participate
  - Including intra-technique combination of products
  - Very efficient processing algorithms and computer facilities

- Combination of products for IERS/GGOS:
  - Daily SINEX files including coordinates, EOPs and troposphere for rapid and final products
  - Combination of daily SINEX files into IGS combined products
  - Increase consistency for the combination (esp. troposphere)
  - Basis for the inter-technique combination (e.g. with VLBI Intensives etc.), faster availability (→ real-time)

Present and Future Combination

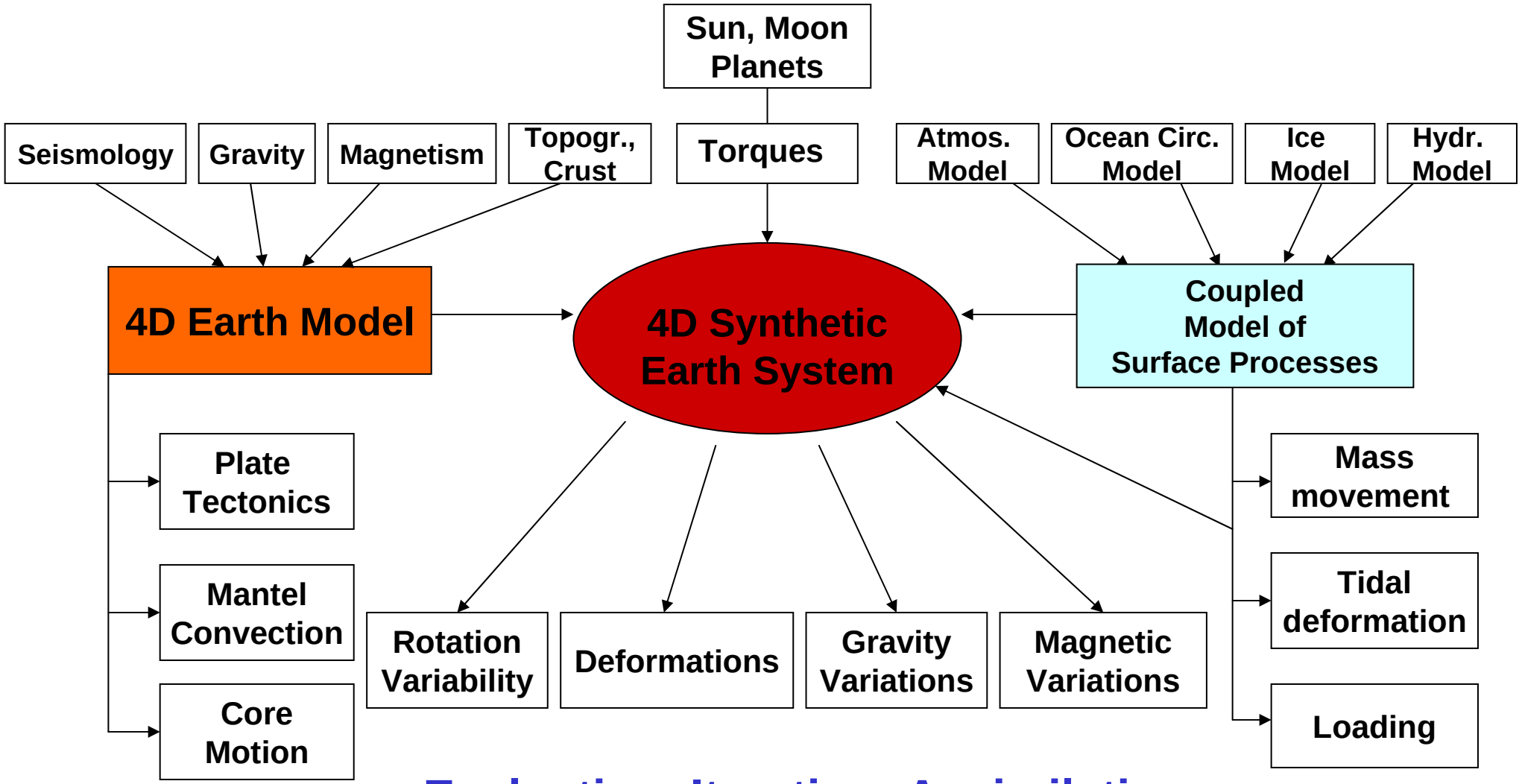
Parameter space for a rigorous combination:

	Parameter Type	VLBI	GPS/ GLON.	DORIS/ PRARE	SLR	LLR	Alti- metry	
ICRF	Quasar Coord. (ICRF)	X						
	Nutation	X	(X)		(X)	X		Earth Rotation
	Polar Motion	X	X	X	X	X		Earth Rotation
	UT1	X						Earth Rotation
	Length of Day (LOD)		X	X	X	X		Earth Rotation
	Coord.+Veloc.(ITRF)	X	X	X	X	X	(X)	
ITRF	Geocenter		X	X	X		X	Gravity Field
	Gravity Field		X	X	X	(X)	X	Gravity Field
	Orbits		X	X	X	X	X	Gravity Field
	LEO Orbits		X	X	X		X	Gravity Field
Atmosphere	Ionosphere	X	X	X			X	
	Troposphere	X	X	X			X	
	Time/Freq.; Clocks	(X)	X		(X)			

GGOS: Integration and Modeling

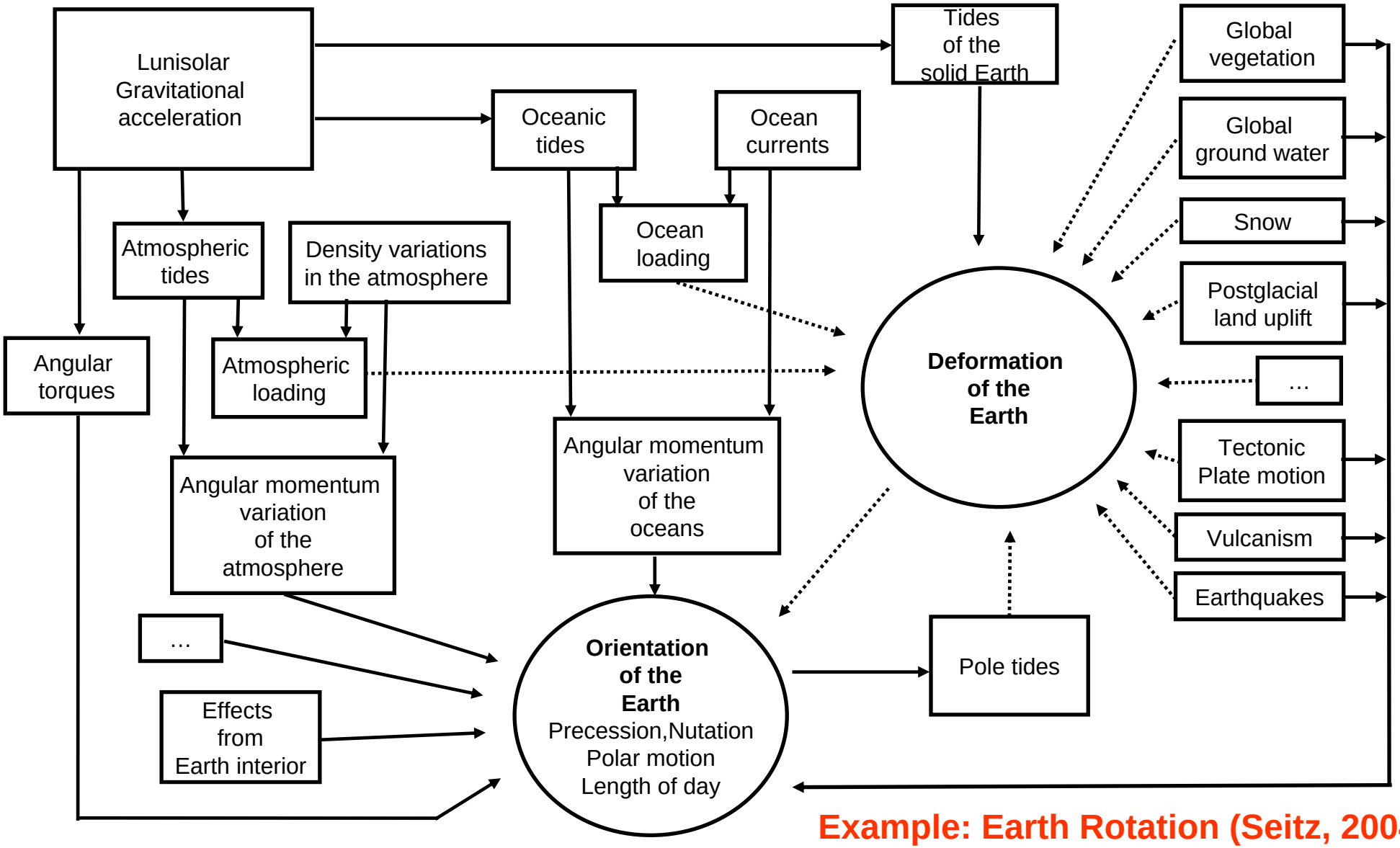
- Participate in the GGOS modeling efforts:
  - Contributions from all IAG Services and Commissions are needed to jointly work on a **4D-Model of the Earth System**
  - Together with other disciplines (geophysics, oceanography, meteorology, climatology, glaciology, …)

GGOS Modeling /Interpretation (4D Earth System Model)



Evaluation, Iteration, Assimilation

Modeling of System Earth: Earth Rotation/ Deformation



Example: Earth Rotation (Seitz, 2004)