Commission 3 Position w.r.t. GGOS

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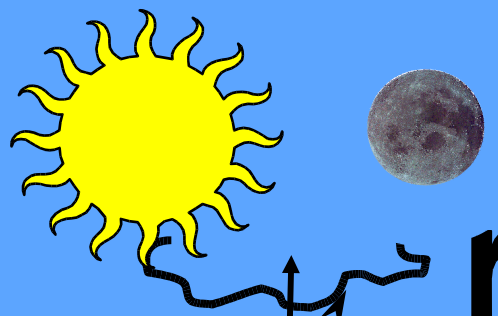
Observatoire Royal de Belgique
presentation given by
Harald Schuh, IGG Vienna

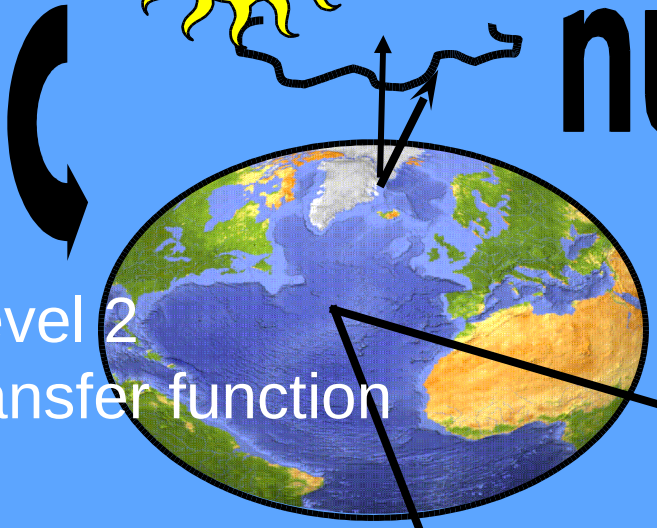
Level 3:
rigid Earth nutation



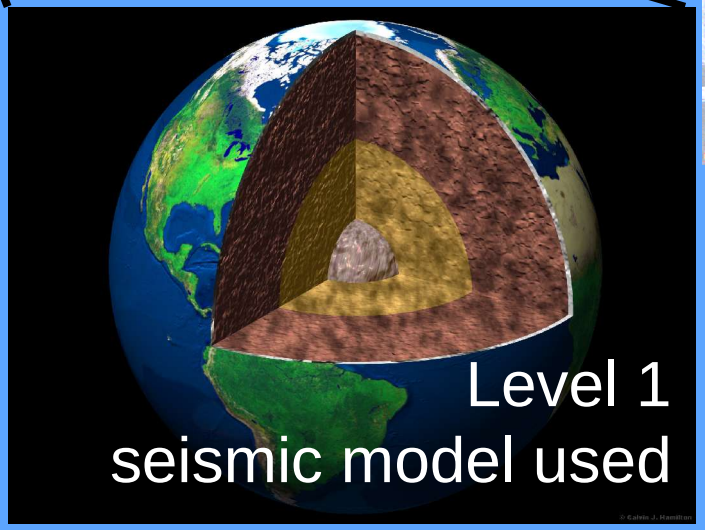
Level 5
oceanic/atmospheric
corrections

nutations

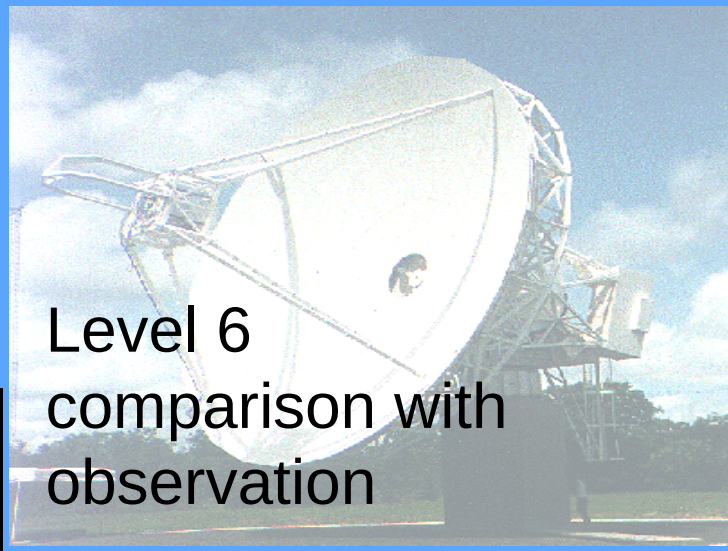
Level 4
convolution



Level 2
transfer function

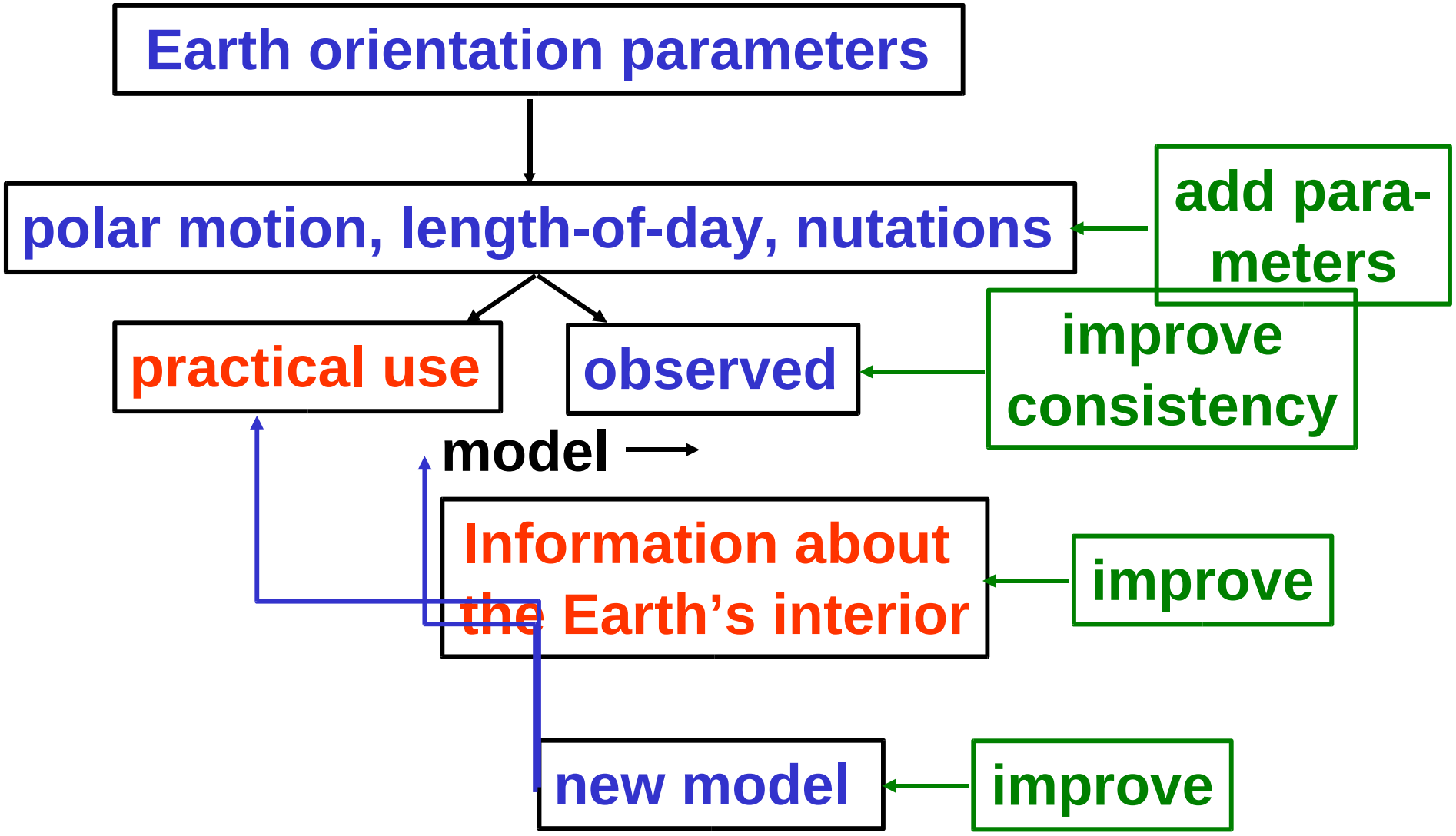


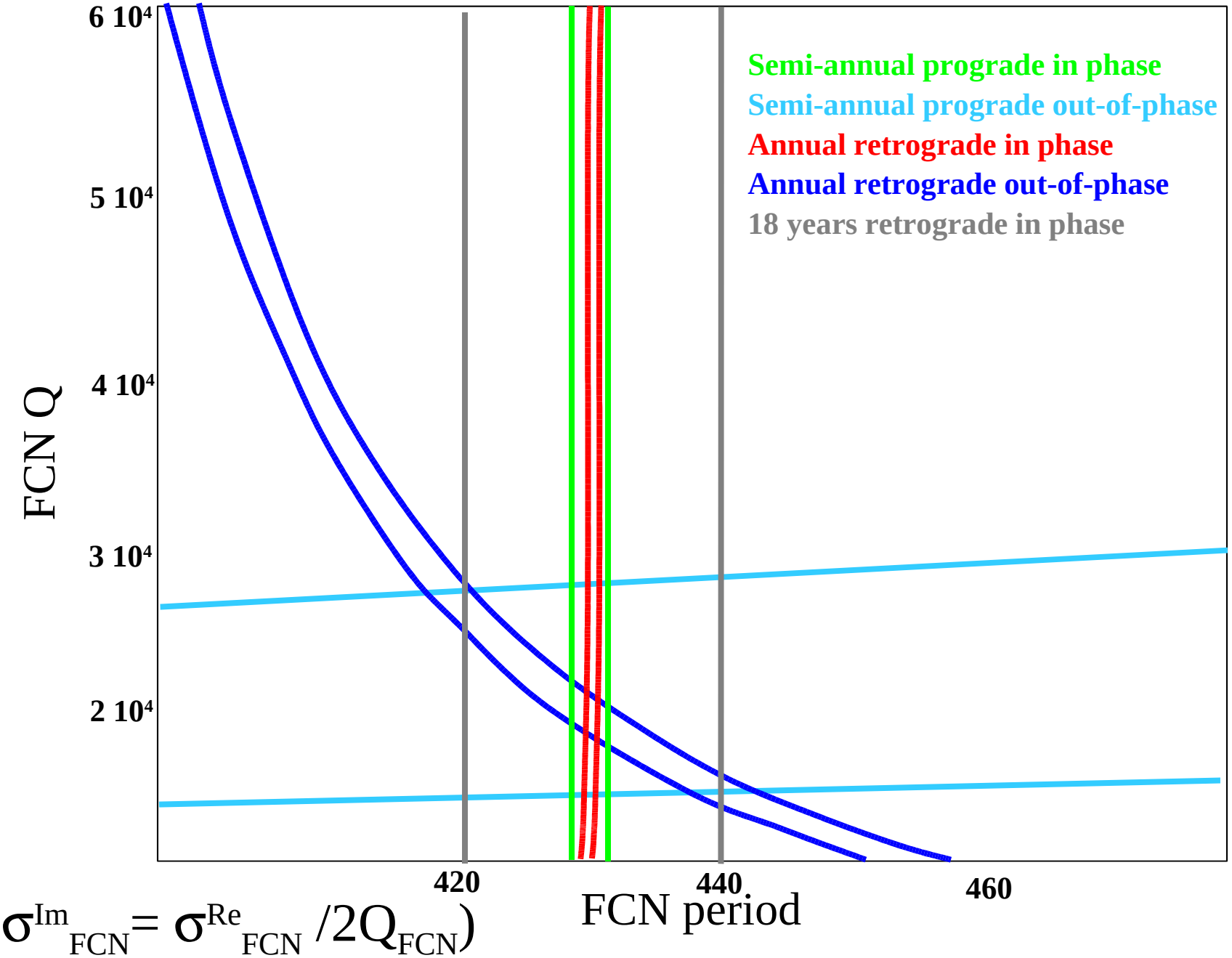
Level 1
seismic model used



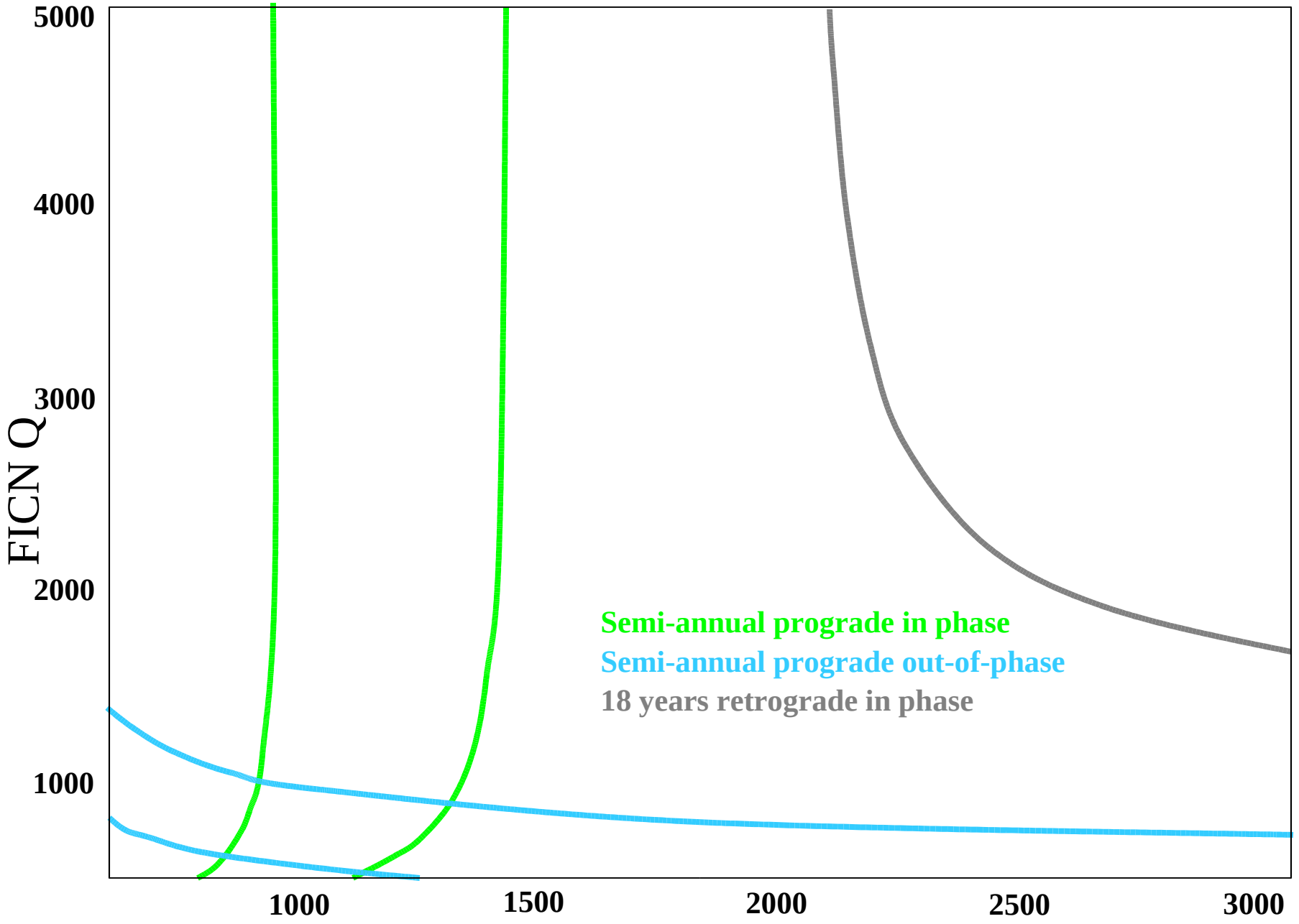
Level 6
comparison with
observation

Planetary forcing





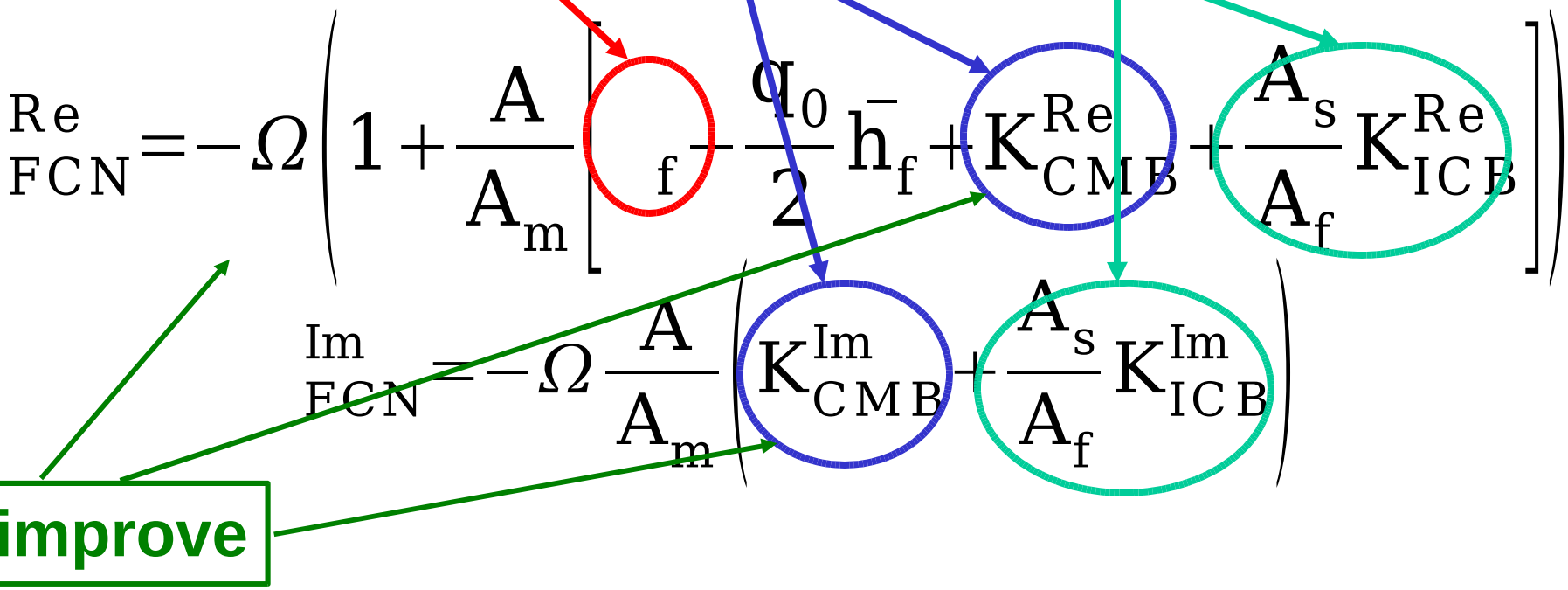
$(\sigma^{Im}_{FCN} = \sigma^{Re}_{FCN} / 2Q_{FCN})$



$(\sigma^{Im}_{FICN} = \sigma^{Re}_{FICN} / 2Q_{FICN})$

Geophysical parameters may be improved from the theoretical point of view

- Link between the FCN frequency and the core flattening and electromagnetic coupling at the **CMB** and the **ICB**



Statement 1

‘From precession/nutation information on deep Earth interior can be obtained‘

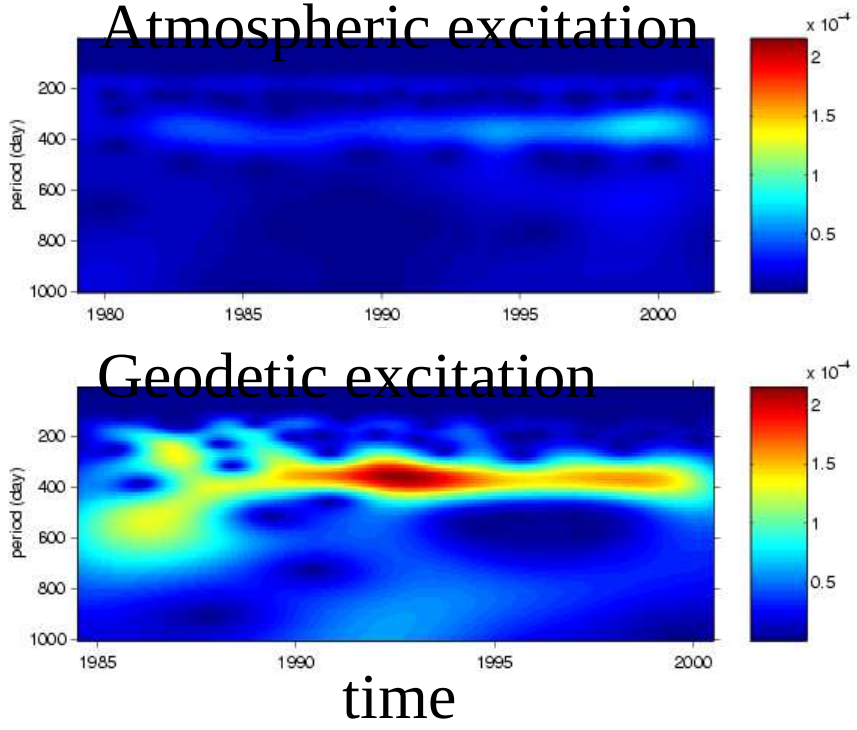
- Core-mantle coupling, mantle anelasticity, or inner core coupling with the liquid core and the mantle can be investigated
- **But:** constraints are obtained for the coupling constants, not for the physical coupling mechanisms (inertial coupling, electromagnetic coupling, topographic coupling, or viscous coupling)

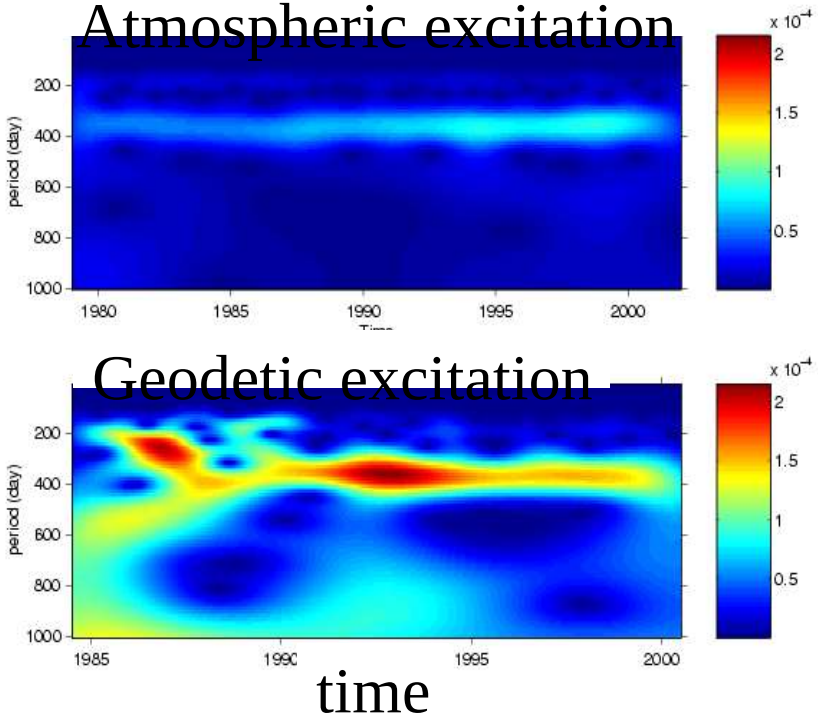
Geophysical fluids forcing on nutation

How does atmosphere explain the residuals?

Real part

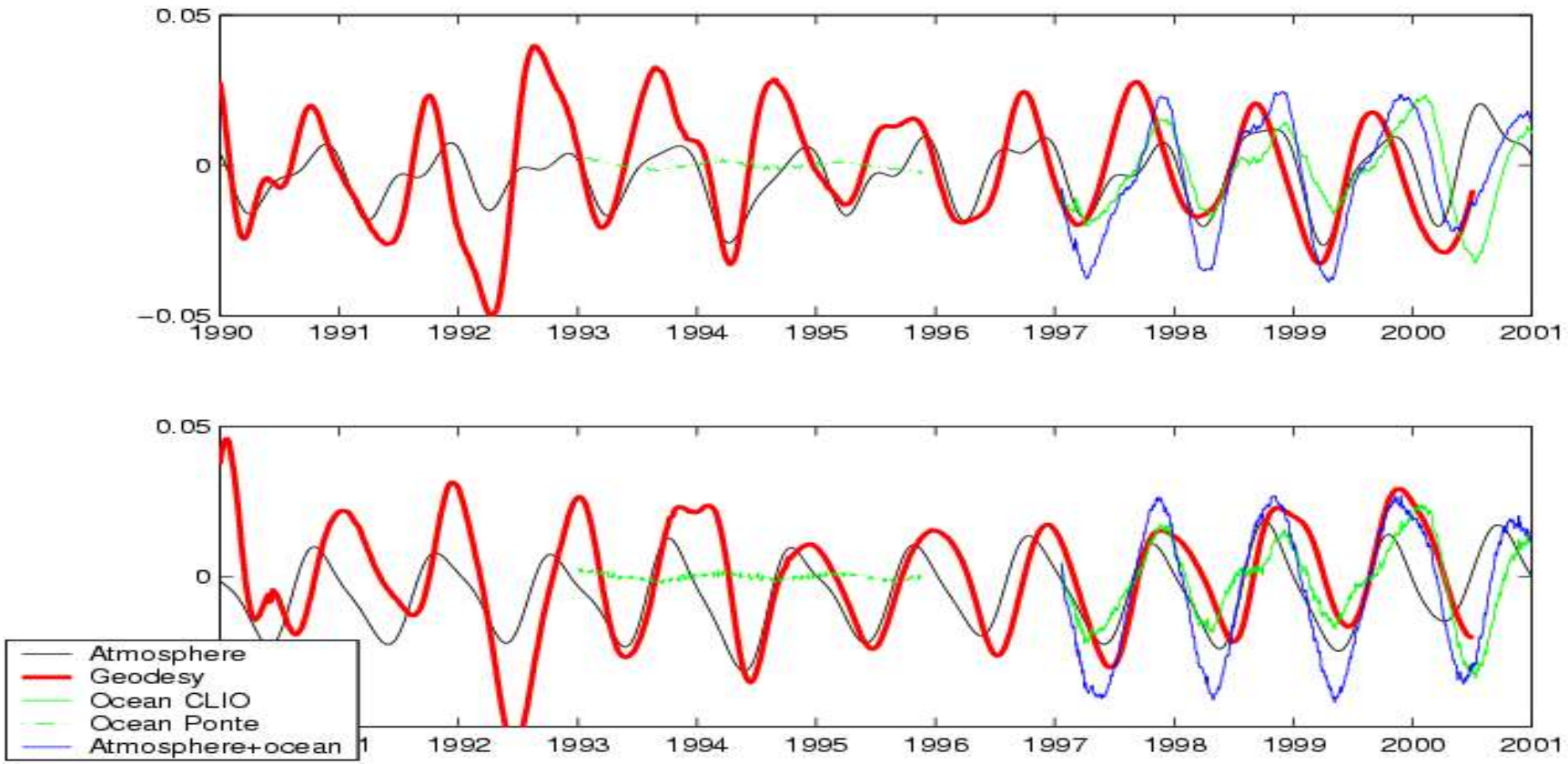
Imaginary part





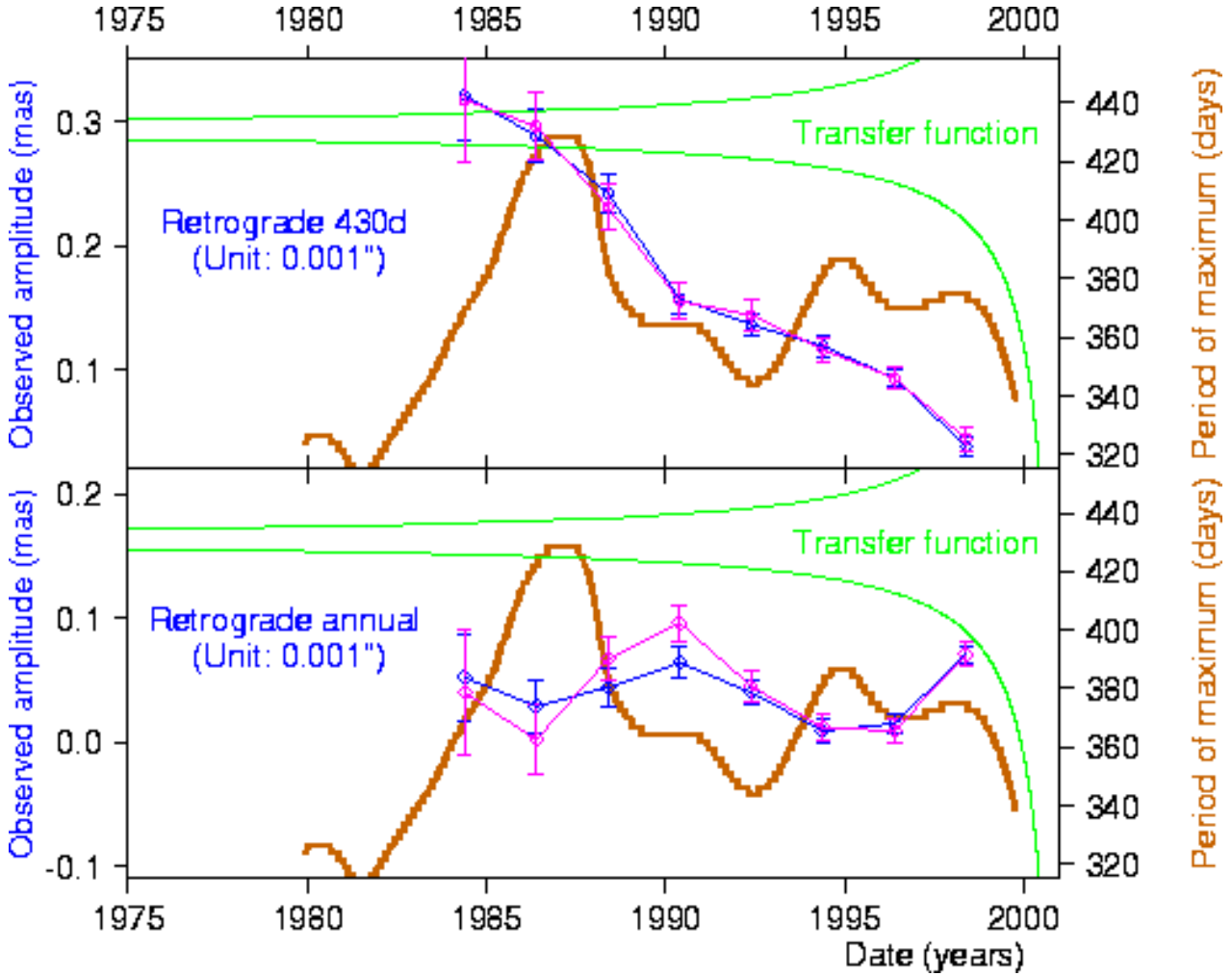
Needs improvement!

Comparison between atmospheric + **oceanic effects** and observed nutation



Geophysical fluids forcing and FCN

Does atmospheric excitation explain the variable amplitudes of VLBI-derived FCN and annual nutation?



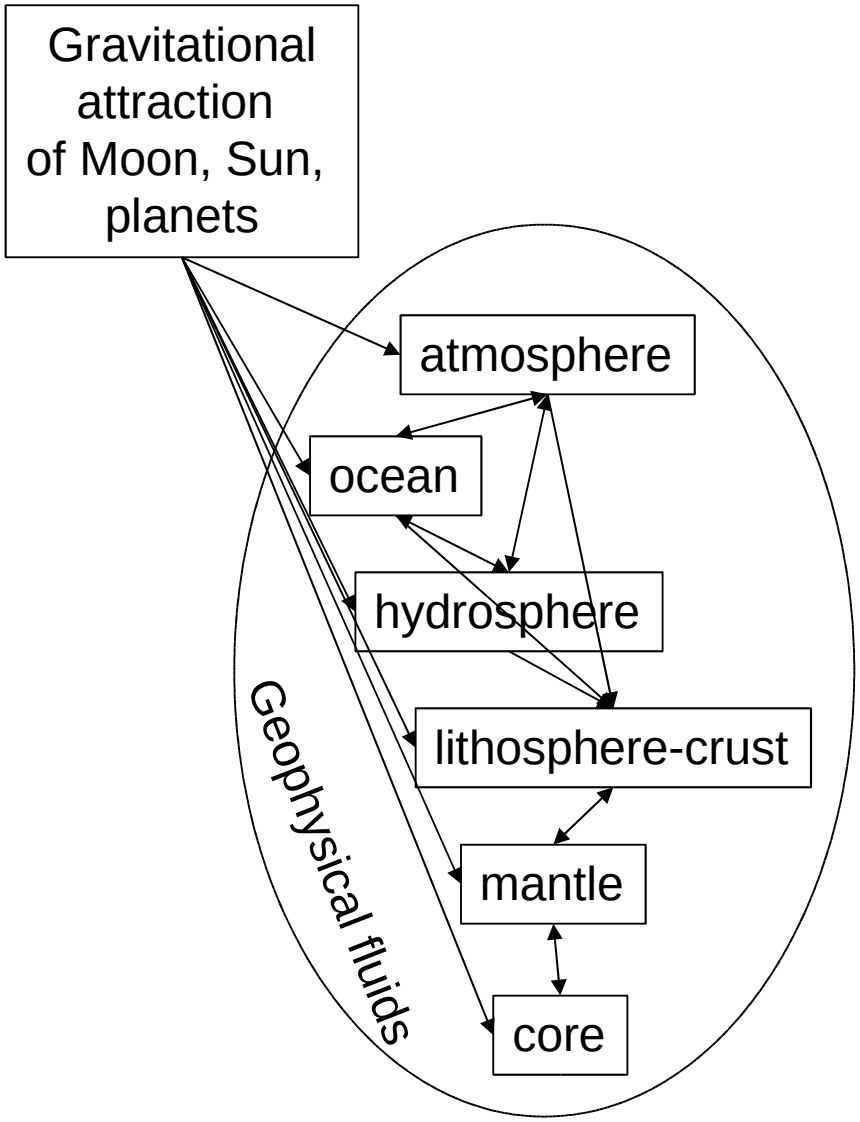
Period of maximum atmospheric excitation and observed amplitudes of the Retrograde FCN and Annual term (all sources and with selected sources); *Dehant et al., 2002; Feissel et al., 2002*

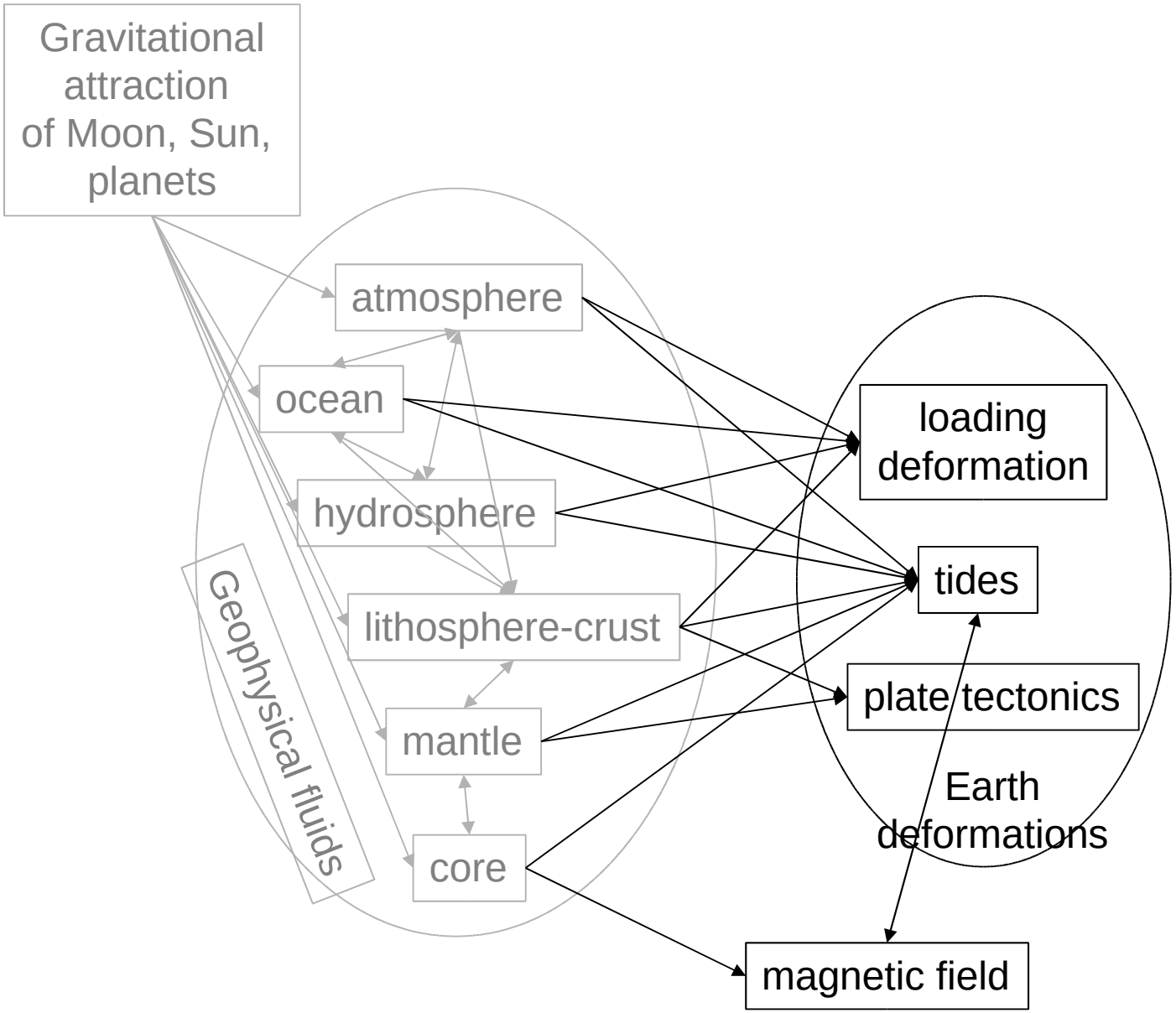
ROB

Statement 2

‘*GGOS will help to better determine the geophysical fluids effect on Earth nutation*‘

- This will allow to better investigate the internal geophysical contribution to nutation
- and to better constrain the physics of the Earth interior


Gravitational attraction of Moon, Sun, planets
atmosphere
ocean
hydrosphere
lithosphere-crust
mantle
core
Geophysical fluids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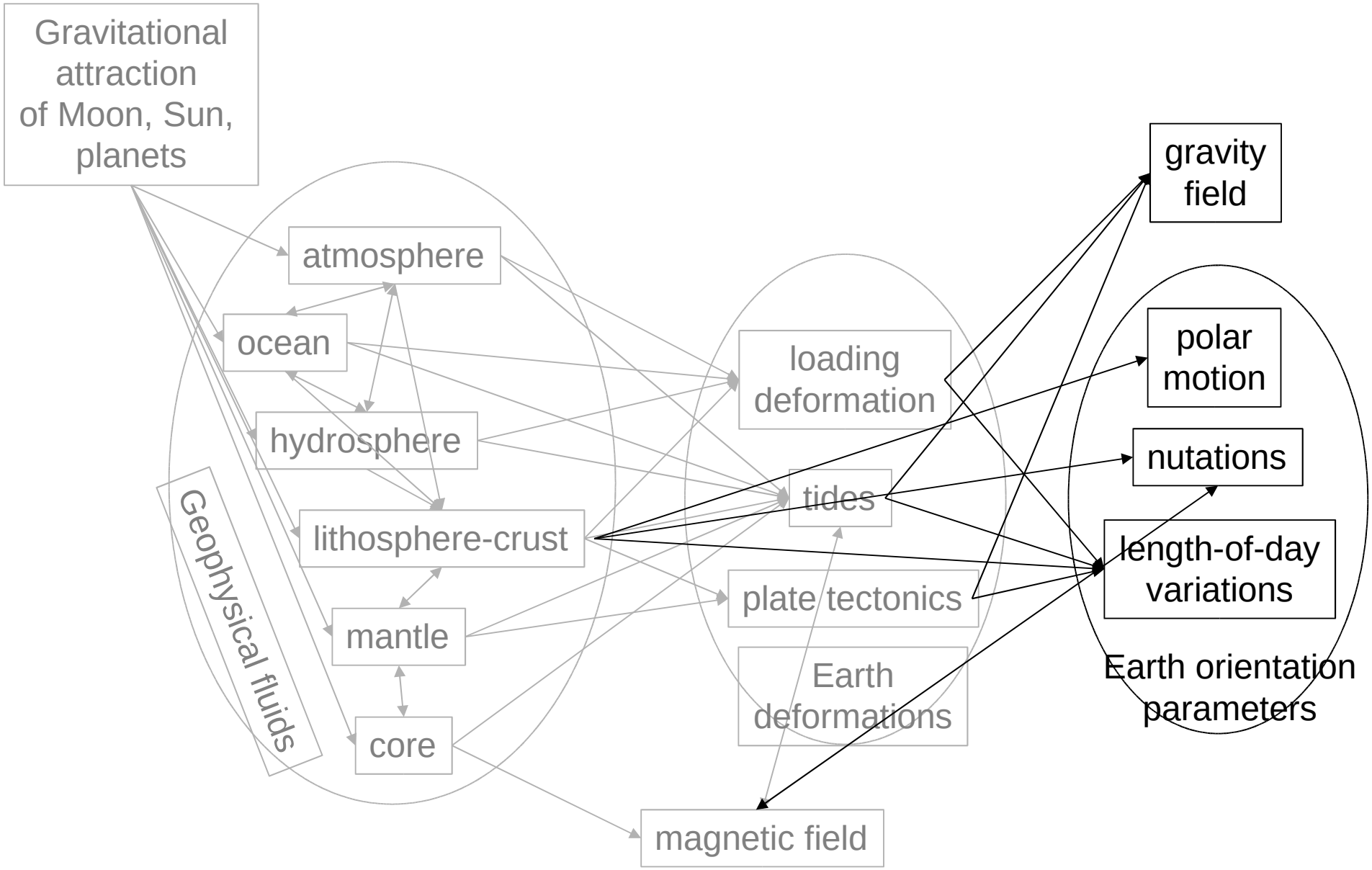
Geophysical fluids
loading deformation
tides
plate tectonics
Earth deformations
magnetic field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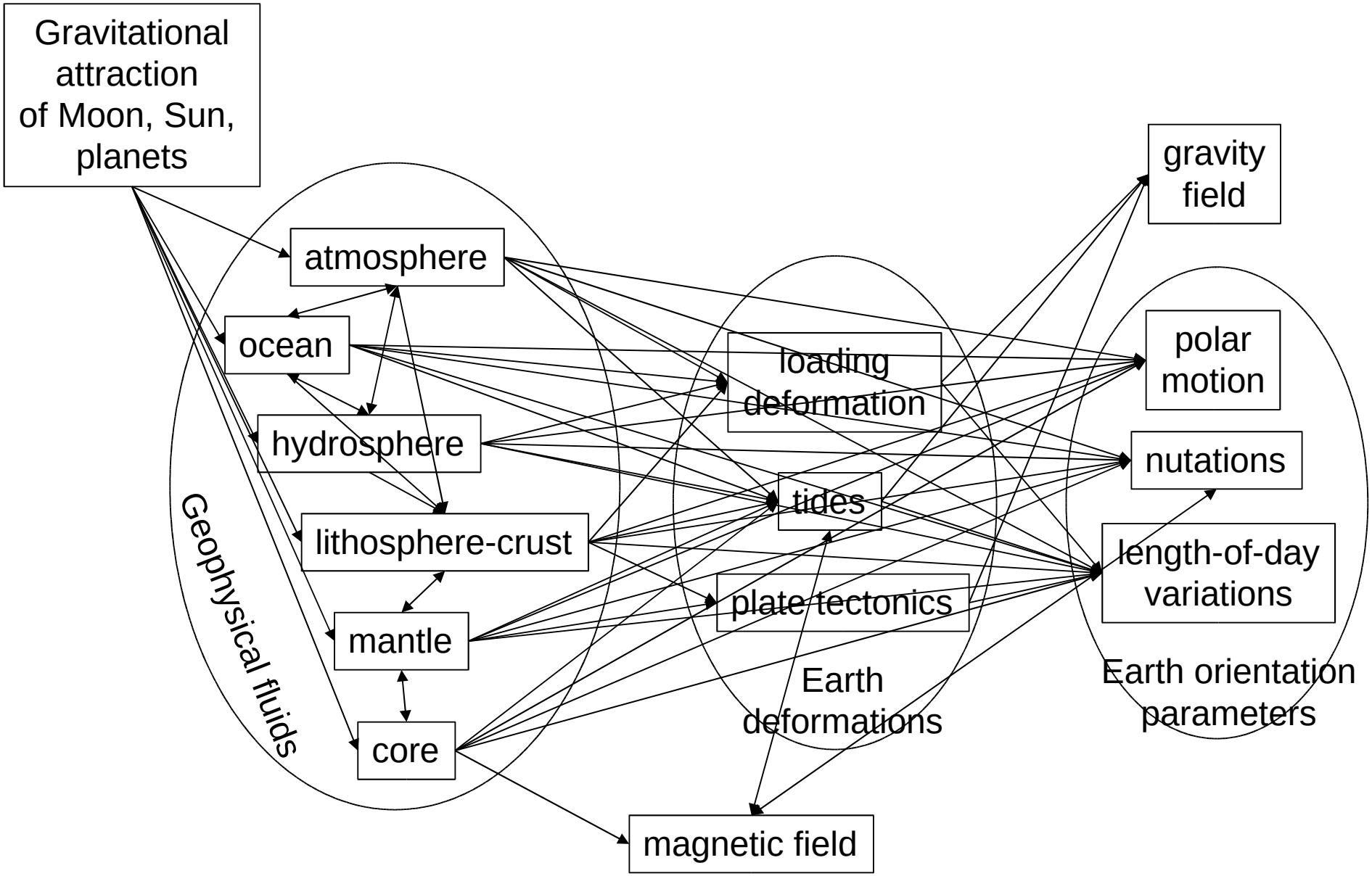
Earth deformations
magnetic field
gravity field
polar motion
nutations
length-of-day variations
Earth orientation parameters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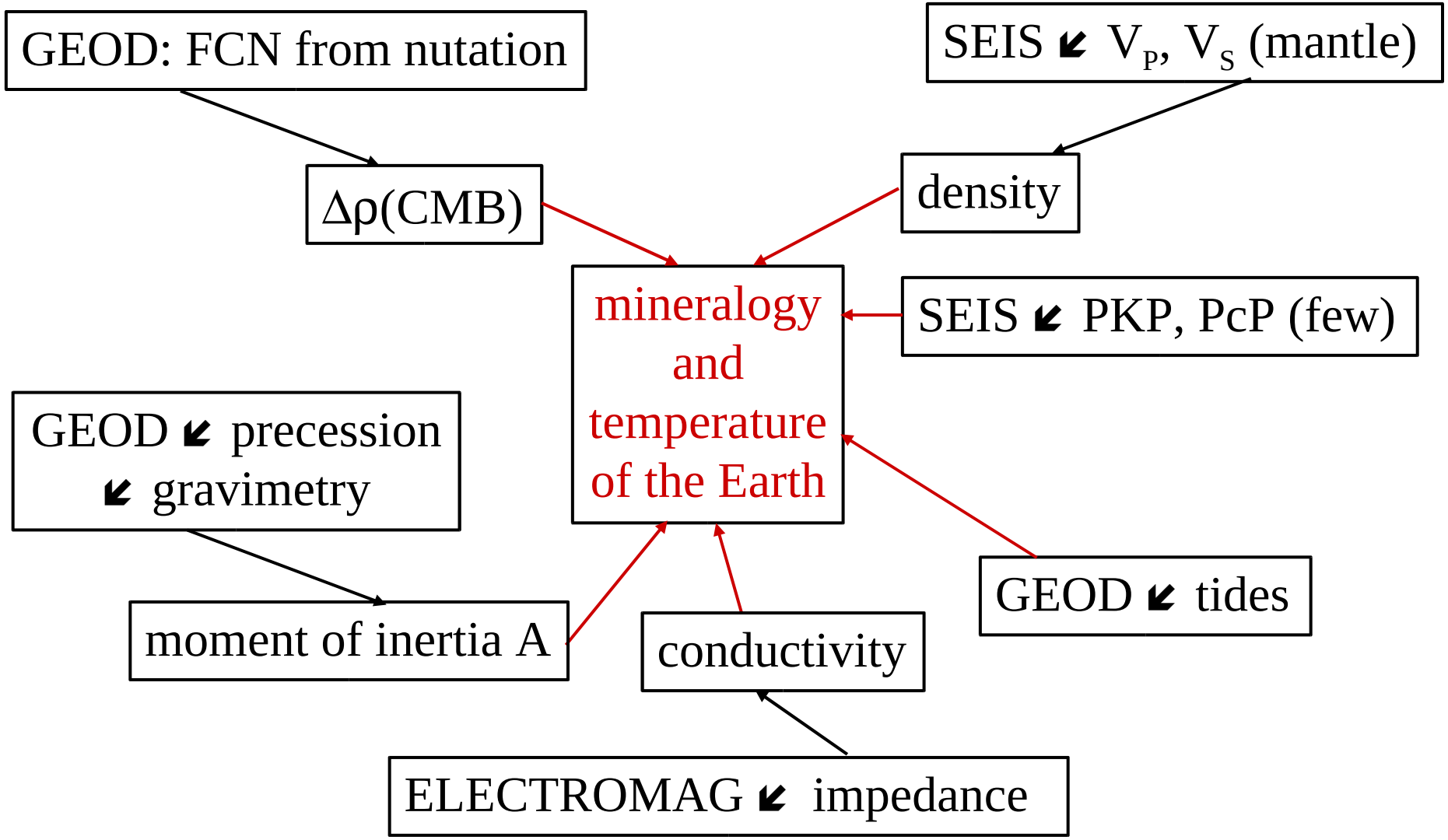
Statement 3

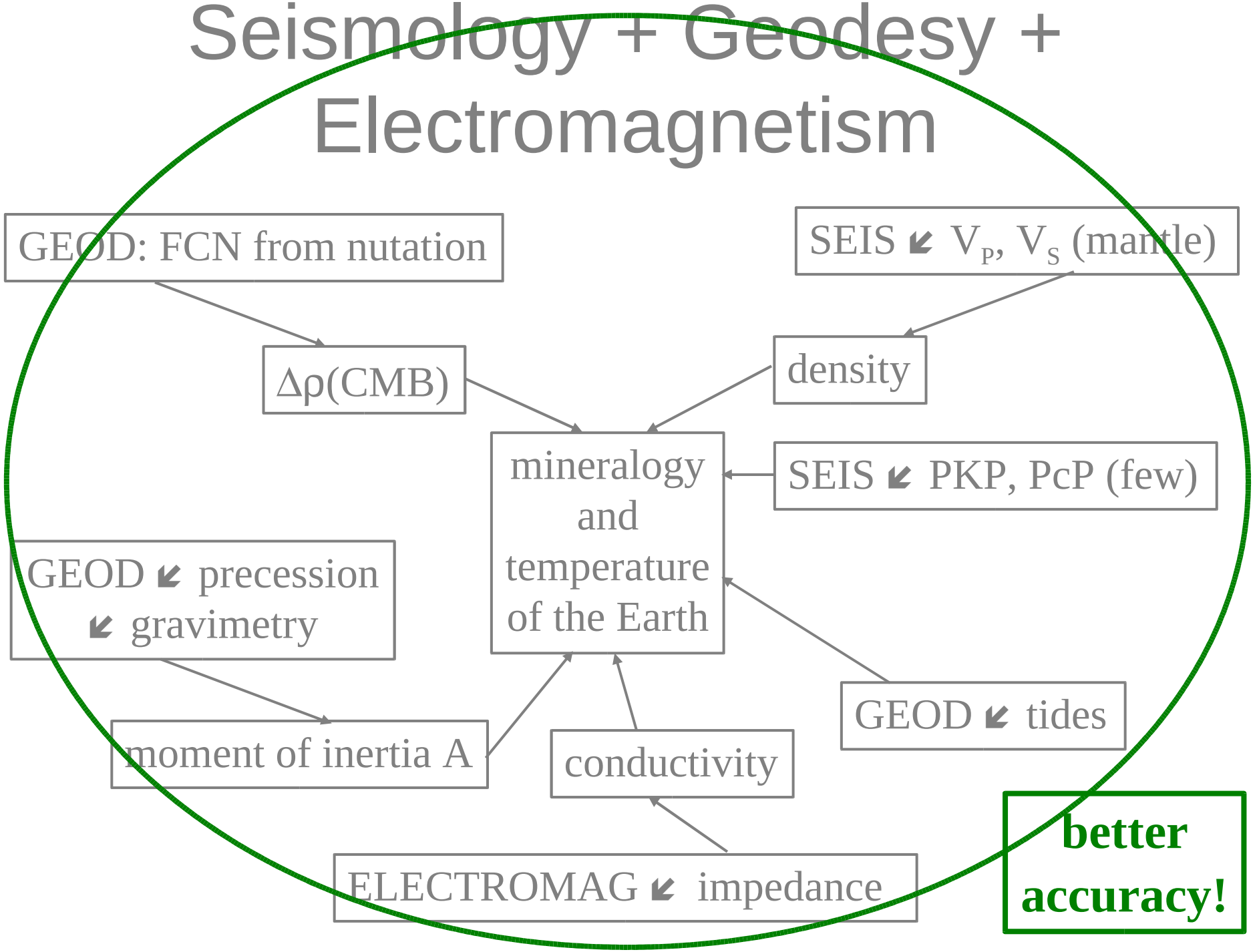
‘*Observations of polar motion and lod variations provide access to the global contributions from geophysical fluids*‘

- Geophysical fluids such as ocean, atmosphere, hydrosphere, and cryosphere are the most important contributions
- Remaining problem is to separate the relative contributions

Seismology + Geodesy + Electromagnetism



Seismology + Geodesy + Electromagnetism



Statement 4

‘*Geodesy is linked to seismology and electromagnetism via mineralogy and temperature of the Earth*‘

Statement 5

‘*The principal of using Earth orientation parameters to get information on the interior properties may be applied to other planets*‘

- Free modes such as Chandler Wobble, FCN, …. occur also for other planets
- Lod variations are mostly related to fluids (core, ocean, atmosphere)
- Condensation/sublimation of ice caps induce polar motion (e.g. Mars)
- Information on planetary interiors can also be obtained from the gravity field
- Tidal effects (represented by Love numbers) can be used to determine the internal structure of planets, Moon, …

General concluding remarks

- High precision observations in different fields (Earth orientation, deformation, gravity, geophysical fluids) are necessary to better understand our planet (as well as other planets)
- GGOS by aiming at refining the consistency and determination of all phenomena will greatly enhance our understanding of these effects and have a very large potential for a better understanding of the interior of the Earth