A new numerical theory of Earth rotation

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Motivation

- currently used theories of Earth rotation
  - start from a theory for rigid Earth (REN2000, SMART97 etc.)
  - MHB2000 transfer function
  - IAU 2000 precession-nutation model (accuracy: $\sim300\mu$as)
- observation of Earth rotation with very high accuracy

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- **our goal:** a consistent relativistic model of Earth rotation
  - purely numerical
  - fully consistent with General Relativity
  - model for a 'realistic' Earth

Our relativistic model - scheme
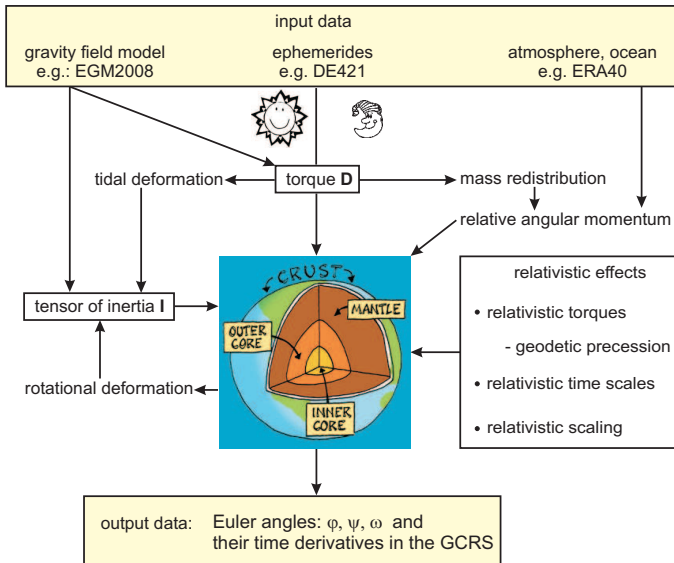
A 3-layered Earth - included effects in detail

- rotational and tidal deformation
  - → using compliance parameters - Mathews et al. (1991)
  - → changes tensor of inertia ($\delta \mathcal{C}_{13}, \delta \mathcal{C}_{23}$)
- coupling torques between layers
  - → gravitational, topographic and electromagnetic torques
  - → model from Mathews et al. (1991), Buffet et al. (2002)
- inclusion of atmosphere and ocean
  - → no tidal model, but re-analysis data (e. g. ERA 40)
  - → relative angular momenta and $\delta \mathcal{C}_{13}, \delta \mathcal{C}_{23}, \delta \mathcal{C}_{33}$

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A lot of parameters for fitting!

Beyond Earth - relativistic rotation of other bodies

- highly accurate, relativistic models of e. g. Mercury of interest
- relativistic effects expected to be much larger

body	geodetic precession [" per century]	geodetic nutation [μas]
Earth	1.92	153
Mercury	21.49	5080
Venus	4.32	85
Mars	0.68	567

- our code is ideal to study this
- mostly simple changes of constants etc.