

Eine neue numerische Theorie für Präzession und Nutation der Erde

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Content

- 1 Motivation
- 2 Our model of Earth rotation
- 3 Beyond Earth
- 4 Summary

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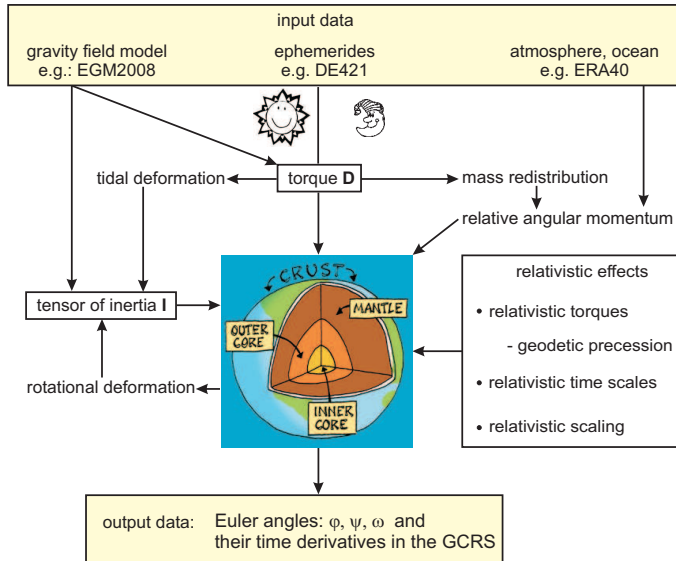
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What's **new** about this model?

- the first consistent relativistic model of Earth rotation
- purely numerical
- model for a 'realistic' Earth

Our model of Earth rotation - scheme



Our model of Earth rotation - implementation

- numerical code written in Fortran 95
- at the moment ~ 30000 lines of code
- 2 numerical integrators: ODEX and ABM (cross-checks possible)
- using any available arithmetic (64, 80 or 128 bit)
- arbitrary precision possible for precision-critical operations
- always forward and backward integration in time
- current baseline: ODEX using 80 bit arithmetic (numerical errors **below $10^{-3} \mu\text{as}$ after 150 years**)
- easy switching between different Earth models

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 to fit!

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 [μ as]
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.

Summary

- world-best consistent relativistic model for rigid Earth
- effects of non-rigidity included
- 3 different layers
- fitting of parameters done currently
- fit to observations will follow

**Vielen Dank für Ihre
Aufmerksamkeit!**