The global radiational S1 tide - current Earth rotation research at TU Wien

A. Girdiuk, M. Schindelegger, J. Böhm

TU Wien, Geodesy and Geoinformation, Vienna, Austria

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Atmosphere-Induced Short Period Variations of Earth Rotation

Purpose

Derive reliable estimates of diurnal/semidiurnal atmosphere-induced excitation signals ($S_1$, $S_2$) in polar motion (PM) and length of day (LOD).
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Methods

Angular Momentum Approach and Torque Approach
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Angular Momentum Approach and Torque Approach

Cross-check
Angular Momentum budget validation with respect to torque approach at diurnal and semi-diurnal periodicities
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Innovation
Modern-day circulation models verify their reliability by AAM budget check similar considerations for consistently forced ocean model
ASPIRE

Atmospheric Angular Momentum: verify by torques and AAM budget

Combined geophysical excitations

Ocean Model for Circulation and Tides

estimation of tidal terms from VLBI analysis

TU WIEN

FWF
Der Wissenschaftsfonds.

GFZ
Helmholtz Centre Potsdam

DFG
Deutsche Forschungsgemeinschaft
Combined geophysical excitation: geodetic observations

24-hours VLBI sessions
Network geometry: volume and global coverage
Geodetic observations: Earth Rotation Parameters (ERP)

- high-frequency ERP time series
- 24-hours VLBI sessions
Data set: reduced data set VS. complete data set (selected by network geometry)

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Geodetic observations: Earth Rotation Parameters (ERP)

- tidal estimates, focus on $S_1$
- high-frequency ERP time series
- 24-hours VLBI sessions
Geodetic observations: estimates of $S_1$ tide

Prograde polar motion

changes in LOD

$B^+, \mu\text{as}$

$A^+, \mu\text{as}$

$B^l, \mu\text{s}$

$A^l, \mu\text{s}$

reduced DS
Geodetic observations: estimates of $S_1$ tide

Prograde polar motion

changes in LOD

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reduced DS

complete DS
Geodetic observations: Earth Rotation Parameters (ERP)

- comparison to geophysical excitation
- tidal estimates, focus on $S_1$
- high-frequency ERP time series
- 24-hours VLBI sessions
Geophysical excitation: $S_1$

Prograde polar motion

Oceanic excitation

MERRA: Modern-Era Retrospective Analysis for Research and Applications

EC OP: European Centre for Medium-Range Weather Forecasts Operational Model
Geophysical excitation: $S_1$

Prograde polar motion

Oceanic excitation and
Atmospheric excitation

$B^+, \mu\text{as}$ vs. $A^+, \mu\text{as}$

**MERRA:** Modern-Era Retrospective Analysis for Research and Applications

**ECOP:** European Centre for Medium-Range Weather Forecasts Operational Model
Combined geophysical excitation

Prograde polar motion

\[ B^+, \mu\text{as} \]

\[ A^+, \mu\text{as} \]

- MERRA
- EC OP

\[ S_1 \]
Combined geophysical excitation

Prograde polar motion

- MERRA
- EC OP
- geodetic VLBI: global solution
- geodetic VLBI: time series approach

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Combined geophysical excitation

Prograde polar motion

- MERRA
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- geodetic VLBI: global solution
- geodetic VLBI: time series approach

$S_1$
Combined geophysical excitation

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- geodetic VLBI: time series approach
Upcoming: similar comparisons in LOD;
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The other comparison of atmosphere-ocean contributions to the prograde annual nutation shows a good agreement with geodetic VLBI estimates (both MERRA and EC OP).
Outlook: The global radiational S1 tide – current Earth rotation research at TU Wien

- Upcoming: similar comparisons in LOD;
- The other comparison of atmosphere-ocean contributions to the prograde annual nutation shows a good agreement with geodetic VLBI estimates (both MERRA and EC OP).
- We find a reasonably good agreement between published results of other authors (Böhm et al., Artz et al., Gipson et al.) with our time series approach.
Thank you for your attention!

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