

High frequency Earth rotation parameters estimated from the CONT campaigns

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Introduction

Data analysis

High freq. EOP

Atmospheric
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Effect of CRF

Ring laser data

Conclusions

Introduction

- ▶ Continuous VLBI campaigns cover two weeks of continuous VLBI observations
- ▶ CONT02, CONT05, CONT08, CONT11
- ▶ Main purpose: to show the best possible performance of VLBI (high number of stations, larger bandwidth, . . .)
- ▶ This allows to estimate Earth orientation parameters (EOP) with sub-diurnal resolution
- ▶ We investigate hourly EOP from the latest CONT campaigns

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CONT campaigns

HF EOP from
CONT

T. Nilsson et al.

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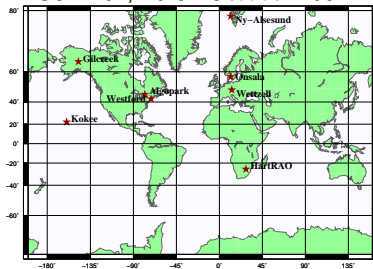
Atmospheric
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Effect of CRF

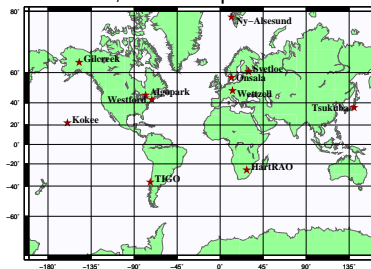
Ring laser data

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CONT02, 16-31 October 2002



CONT05, 12-27 September 2005



CONT08, 12-26 August 2008



CONT11, 15-29 September 2011



Data analysis

- ▶ Each CONT campaign consists of 15 one-day sessions
- ▶ For each session the normal equations were set up using the Vienna VLBI Software (VieVS)
- ▶ The normal equations of each CONT campaign were stacked and then inverted
- ▶ Polar motion and DUT1 estimated with 1 h resolution, precession/nutation fixed to IAU 2006 + IERS C04 corrections
- ▶ Station coordinates (one set per CONT campaign), zenith wet delays (30 min res.), trop. gradients (6 h), and clocks (1 h) also estimated



High frequency EOP from CONT08

HF EOP from
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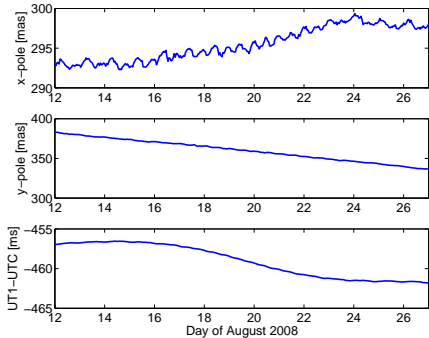
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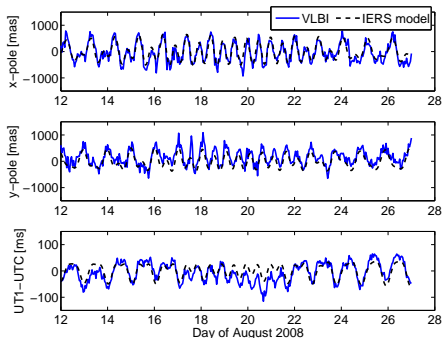
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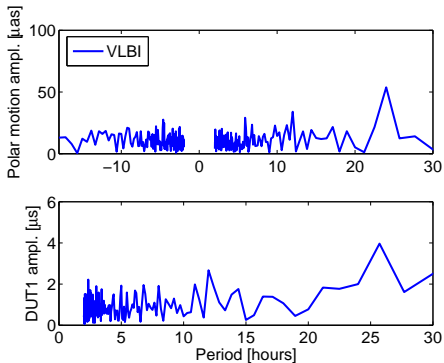
► Hourly EOP from
CONT08

High frequency EOP from CONT08



- ▶ Hourly EOP from CONT08 after removing the IERS 08 C04 daily values
- ▶ IERS high frequency EOP model (ocean tides, libration) shown as comparison

CONT08 EOP spectra



▶ Spectra of residuals
after removing the
IERS model

CONT08 EOP spectra

HF EOP from
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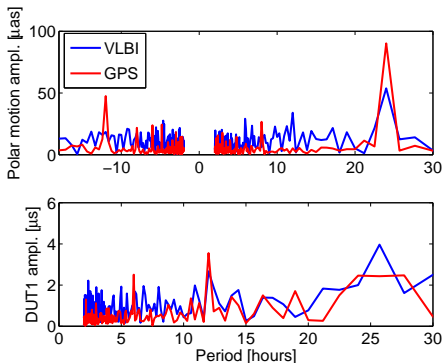
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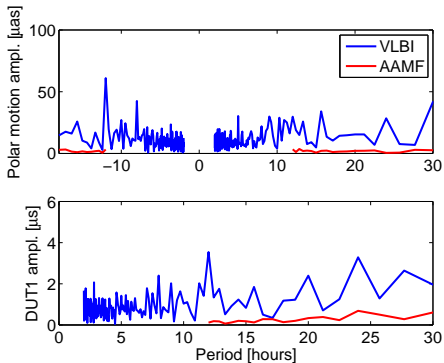
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- ▶ Spectra of residuals after removing the IERS model
- ▶ Comparison with GPS EOP spectra

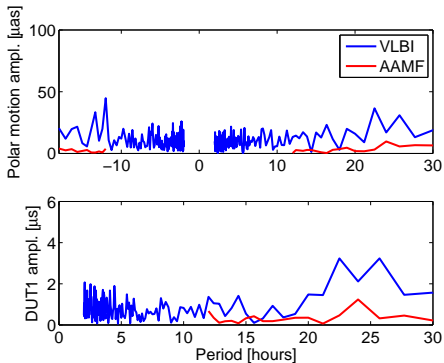
Atmospheric excitation: CONT02



- ▶ Spectra of EOP residuals from CONT02
- ▶ Compared with atmospheric excitation estimated from ECMWF data¹

¹: <http://ggoatm.hg.tuwien.ac.at/>

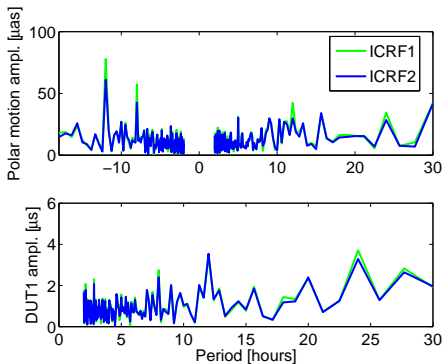
Atmospheric excitation CONT05



- ▶ Spectra of EOP residuals from CONT05
- ▶ Compared with atmospheric excitation estimated from ECMWF data¹

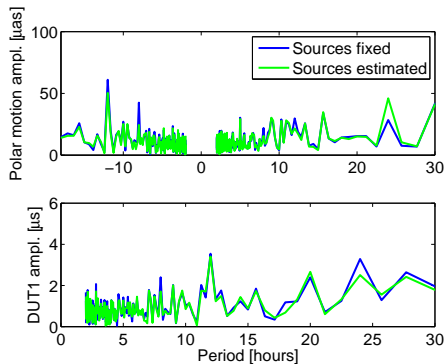
¹: <http://ggosatm.hg.tuwien.ac.at/>

Effects of the celestial reference frame



- ▶ Spectra of EOP residuals from CONT02
- ▶ Source coordinates from ICRF1 Ext 2 (green) and ICRF2 (blue)
- ▶ Noticeable differences in the amplitudes of some peaks

Effects of estimating source positions: CONT02

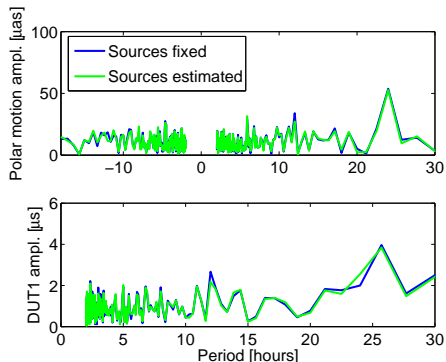


- ▶ Effect of estimating the source positions in the CONT02 data analysis

- ▶ Sources constrained to their ICRF2 coordinates with the uncertainties given in the ICRF2 catalogue

- ▶ -8 h peak significantly reduced

Effects of estimating source positions: CONT08



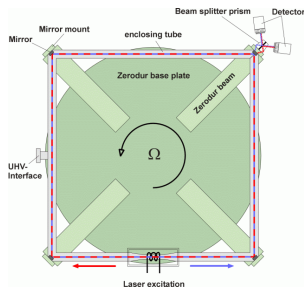
- Effect of estimating the source positions in the CONT08 data analysis
- No major impact on the spectra

Ring laser observations

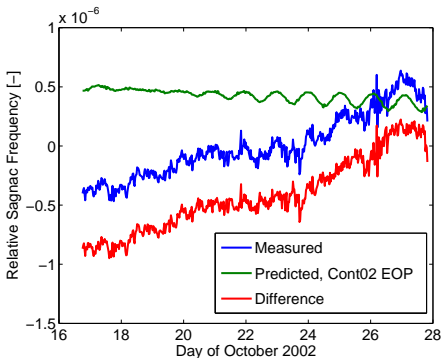
- ▶ Large ring laser gyroscopes can be used to measure Earth rotation
- ▶ Sensitive to the projection of the instantaneous rotation vector $\vec{\Omega}$ onto the normal of the ring laser \vec{n}

$$f_{\text{sagnac}} \propto \vec{\Omega} \cdot \vec{n} \quad (1)$$

- ▶ Data from the “G” ring laser gyroscope in Wettzell



Comparison with ring laser data: CONT02



- ▶ Ring laser measurements of Sagnac frequency during CONT02
- ▶ Expected Sagnac frequency due to the EOP variations estimated from the VLBI data
- ▶ Ring laser data too noisy to make any more detailed studies

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High freq. EOP

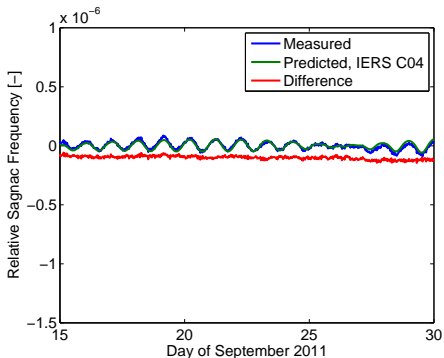
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CONT11 ring laser data



- ▶ Ring laser measurements of Sagnac frequency during CONT11
- ▶ Expected Sagnac frequency due to the EOP from IAU 2006 and IERS C04
- ▶ Could be interesting to compare with VLBI estimates as the accuracy of the ring laser data has improved 1–2 orders of magnitude.

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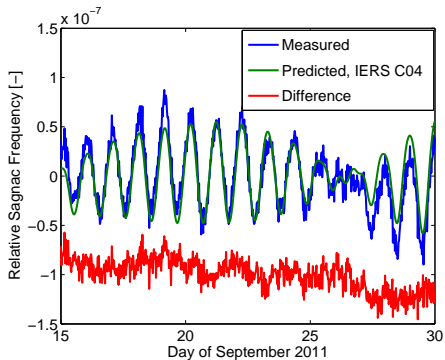
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CONT11 ring laser data



- ▶ Ring laser measurements of Sagnac frequency during CONT11
- ▶ Expected Sagnac frequency due to the EOP from IAU 2006 and IERS C04
- ▶ Could be interesting to compare with VLBI estimates as the accuracy of the ring laser data has improved 1–2 orders of magnitude.

Conclusions

- ▶ Hourly EOP from the latest CONT campaigns have been investigated
- ▶ Some unexplained peaks in the EOP spectra
- ▶ Atmospheric excitation at sub-daily frequencies are small
- ▶ The -8 h peak seen in the CONT02 polar motion spectrum are probably an artifact caused by inconsistencies in the sources positions
- ▶ CONT11 will be analysed as soon as the data are available
- ▶ Ring laser data promising for comparison with VLBI

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Thank you for your attention!