

High Resolution Earth Rotation Parameters Determined During the CONT02 Campaign

H. Schuh*, J. Boehm*, R. Weber*,
J. Nastula**, B. Kolaczek**

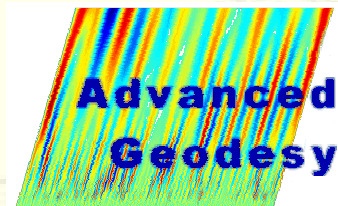
* Institute of Geodesy and Geophysics (IGG),
University of Technology, Vienna, Austria

** Space Research Center, PAS, Warsaw, Poland



TECHNISCHE
UNIVERSITÄT
WIEN

VIENNA
UNIVERSITY OF
TECHNOLOGY





Outline

- CONT02 Campaign
- VLBI, GPS ERP solution characteristics
- Comparisons in time and frequency domain
- Conclusions and outlook

CONT02

Continuous VLBI session between Oct. 16, 2002 and Oct. 31, 2002

8 contributing stations, almost global network, VLBI technology best-practice

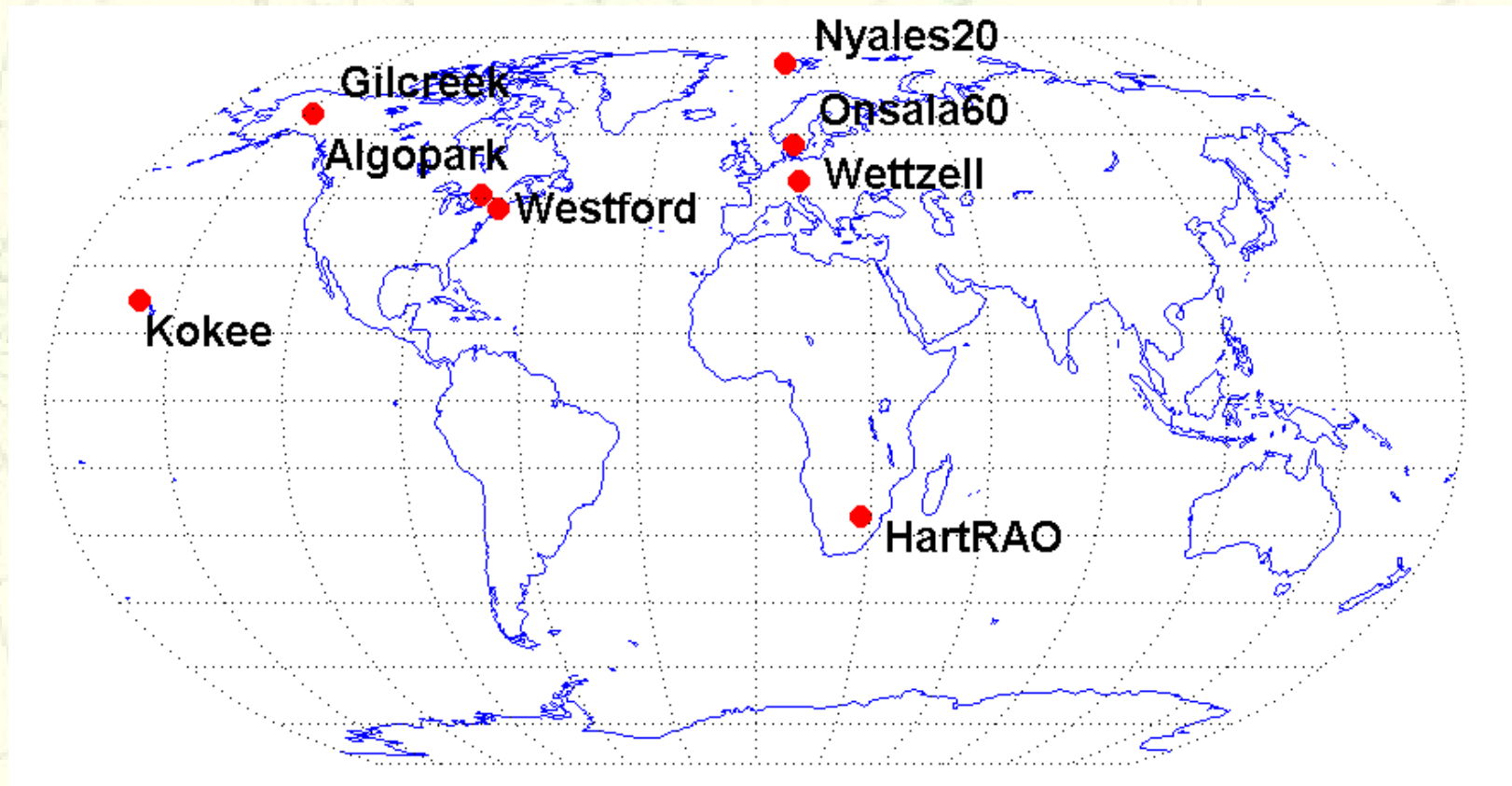
Goals

- to demonstrate the ultimate accuracy VLBI is able to provide, e.g. of the Earth Rotation Parameters
- to investigate the very short periods of the ERP and other effects (episodic, ...)

VLBI Solution

- hourly ERP series determined at the IGG by OCCAM, stations fixed to ITRF2000

CONT02 VLBI – Station Network

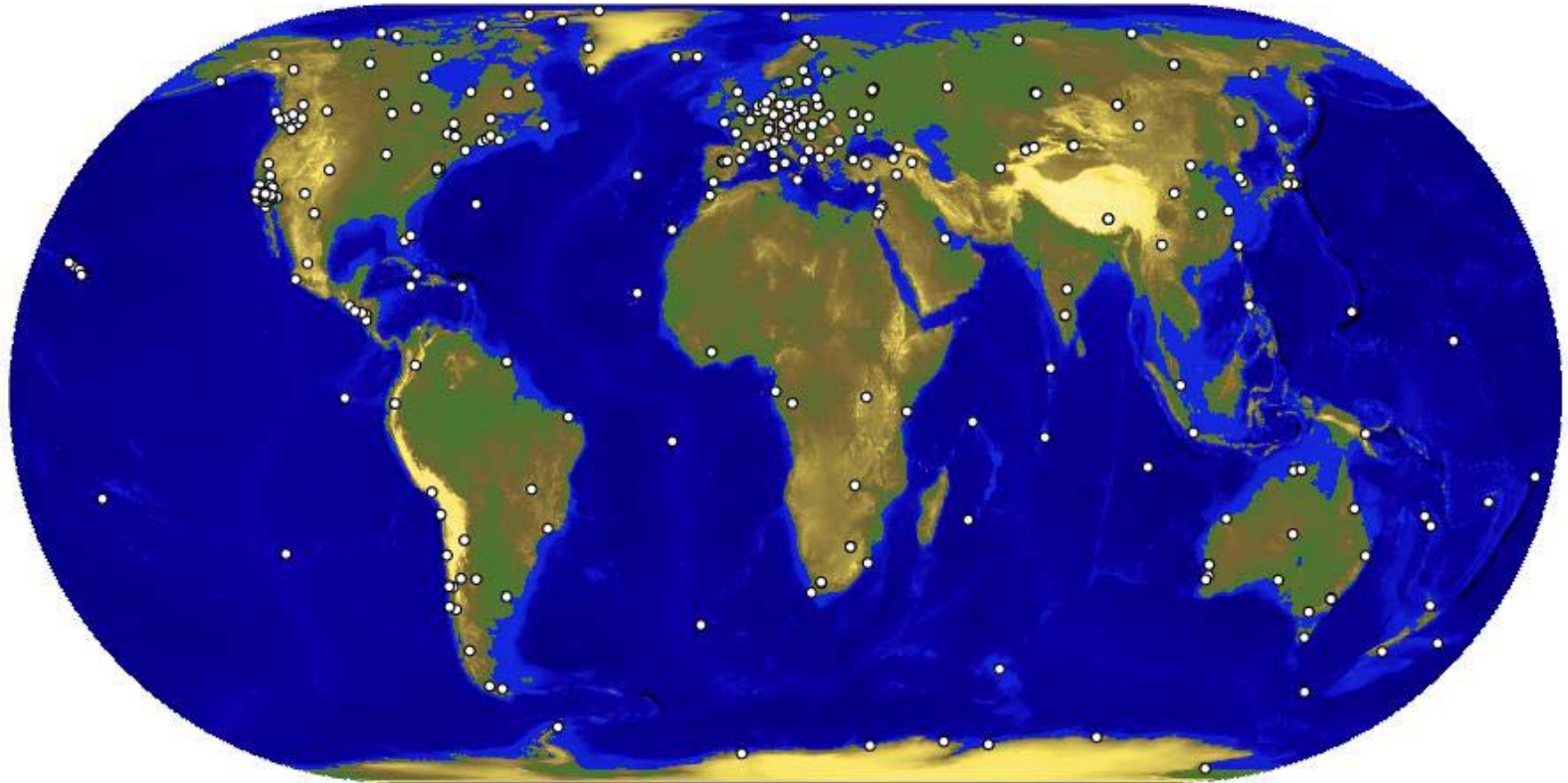




Question

How well do the subdaily CONT02 VLBI
ERP series match the high resolution GPS
ERP series provided by CODE?

IGS Global Tracking Network as of June 2003



Characteristics of GPS ERP-Solution at CODE

- about 140 global IGS sites included
- 54 IGS sites constrained to ITRF2000
- overlapping 3-day solutions with 3-day arcs
- a priori model for subdaily ERP: Ray96
- estimates: offset + drift per interval
- resolution 1 hour, interpolated from 2 hours solution (formal errors ± 0.02 mas; ± 0.002 msec)
- a priori model (Ray96) added back

Orbit Modelling

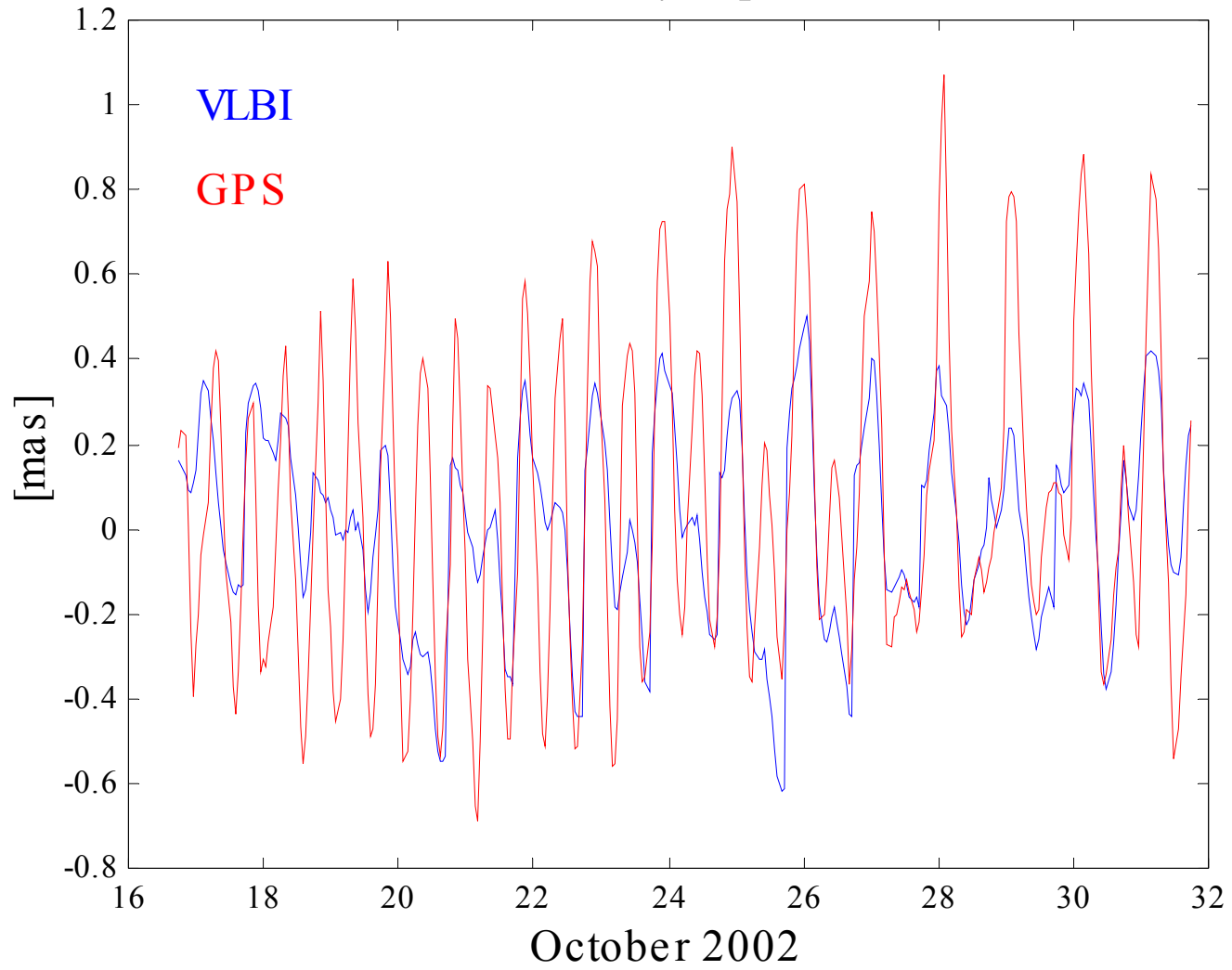
- Orbit parameters for each satellite
 - 6 initial conditions (6 Keplerian elements)
 - 5 radiation pressure parameters
 - pseudo-stochastic pulses once per revolution in radial and along track direction
- Ocean model applied



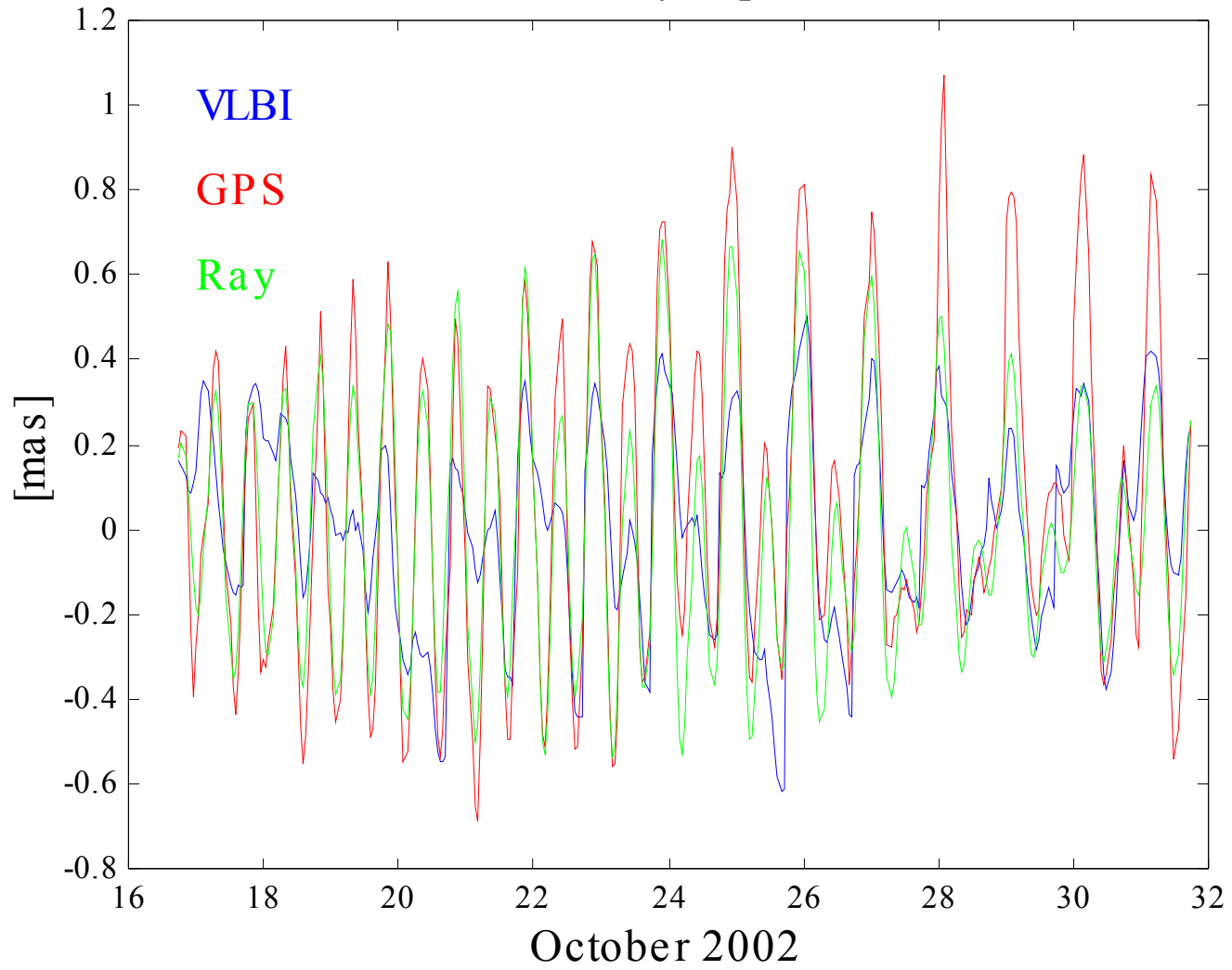
Comparison of Time Series

- 360 VLBI and GPS data points are available
- Comparisons of the two space technique series and the Ray96 model
- Comparisons in time and in frequency domain

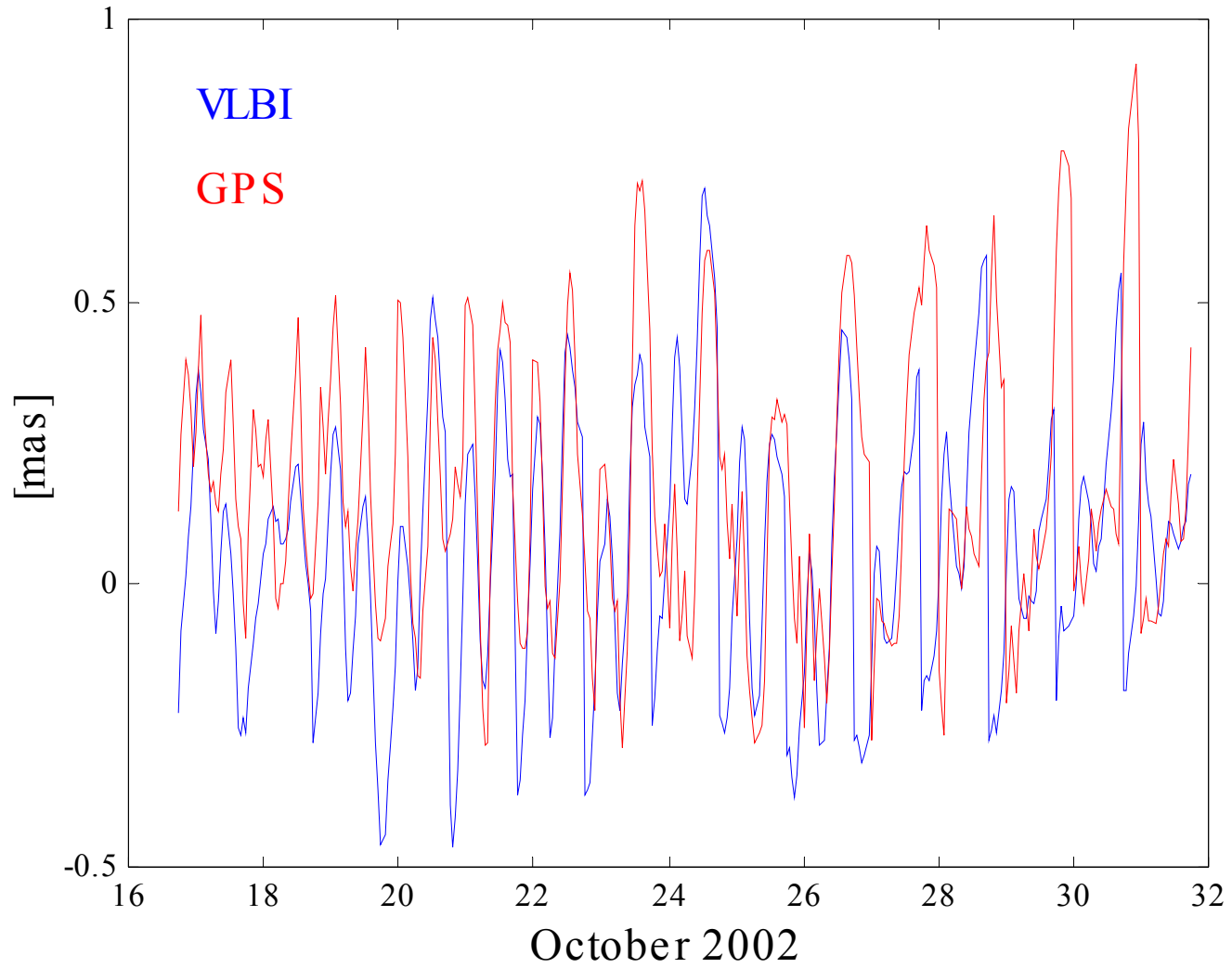
Subdaily X-pole



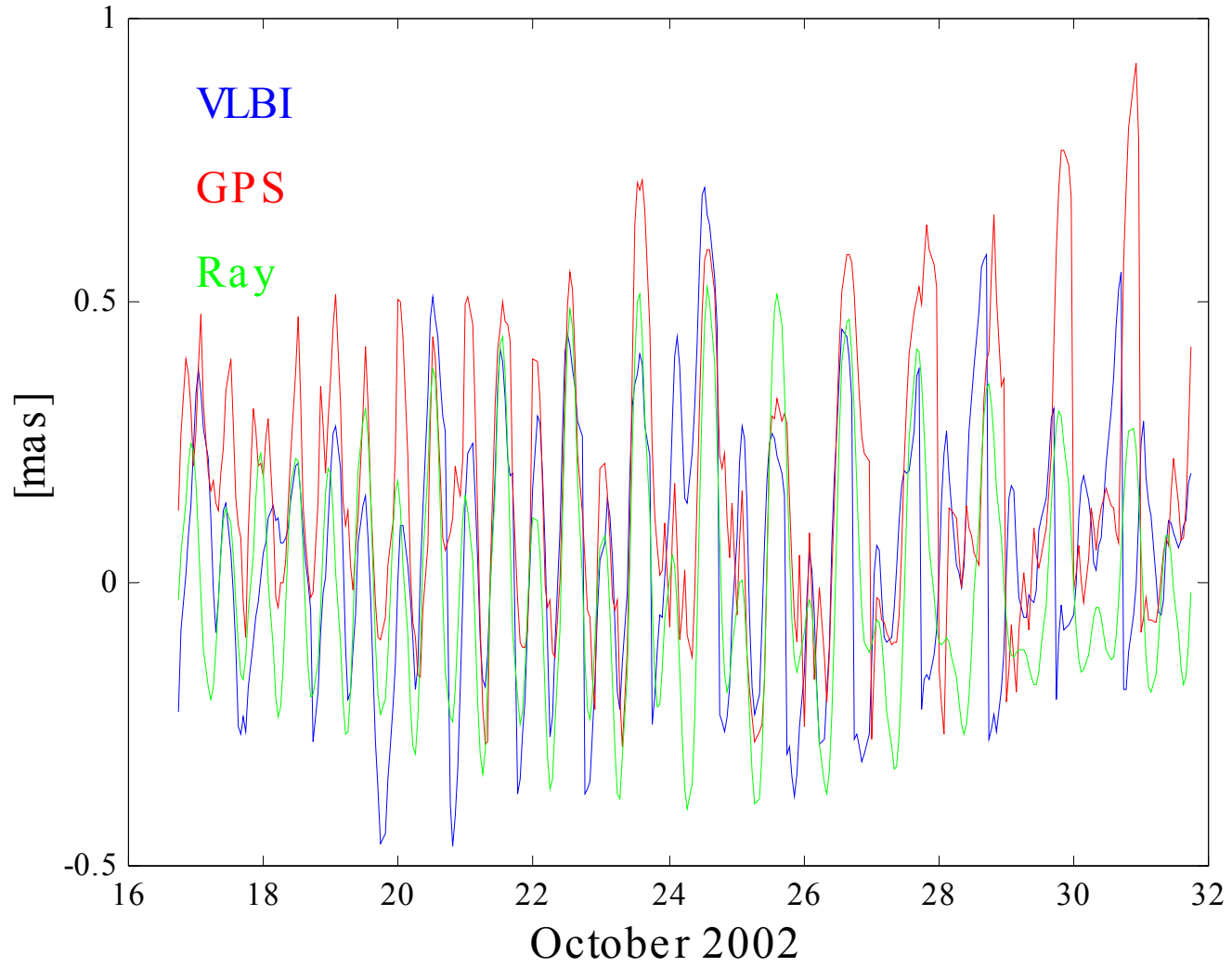
Subdaily X-pole



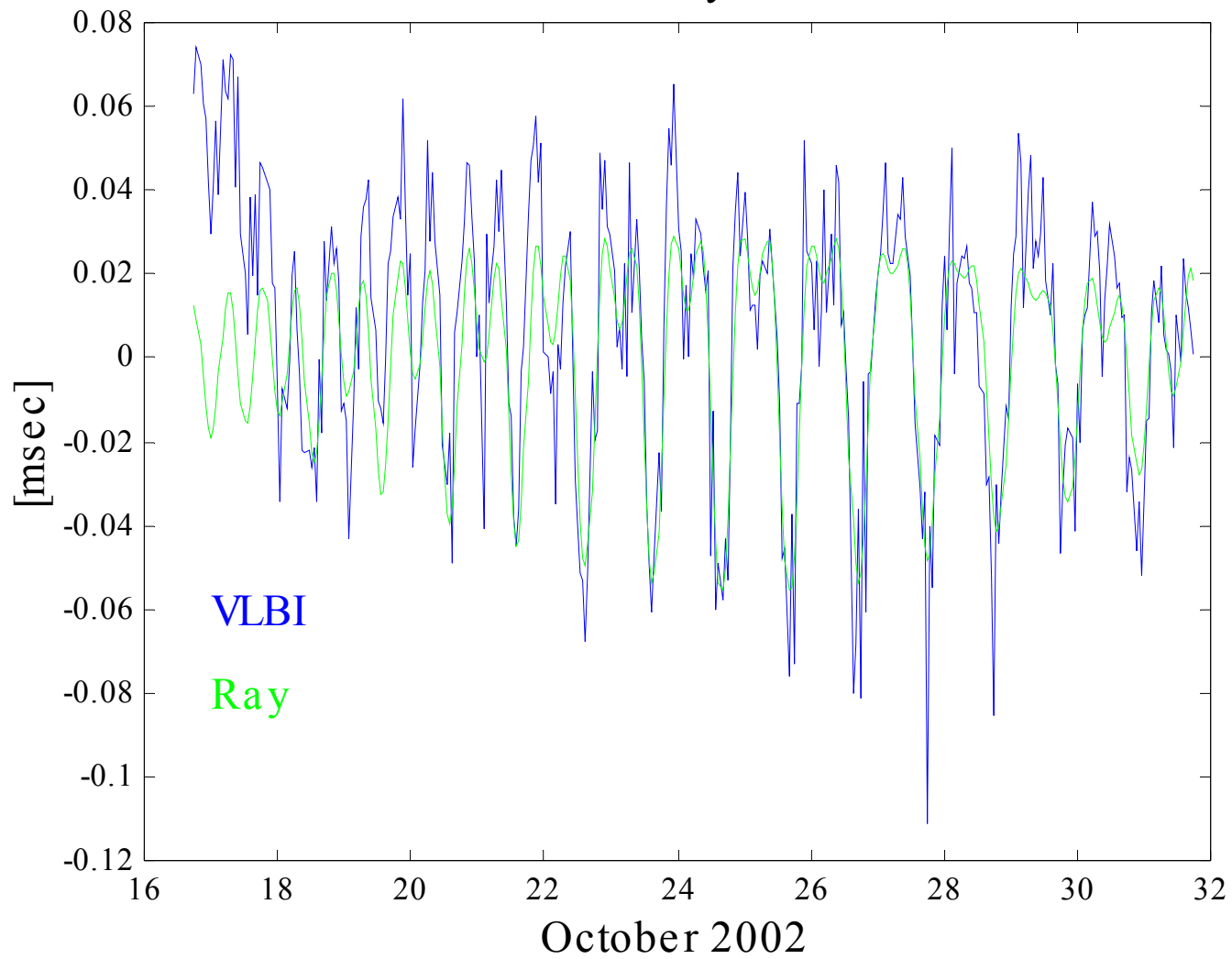
Subdaily Y-pole



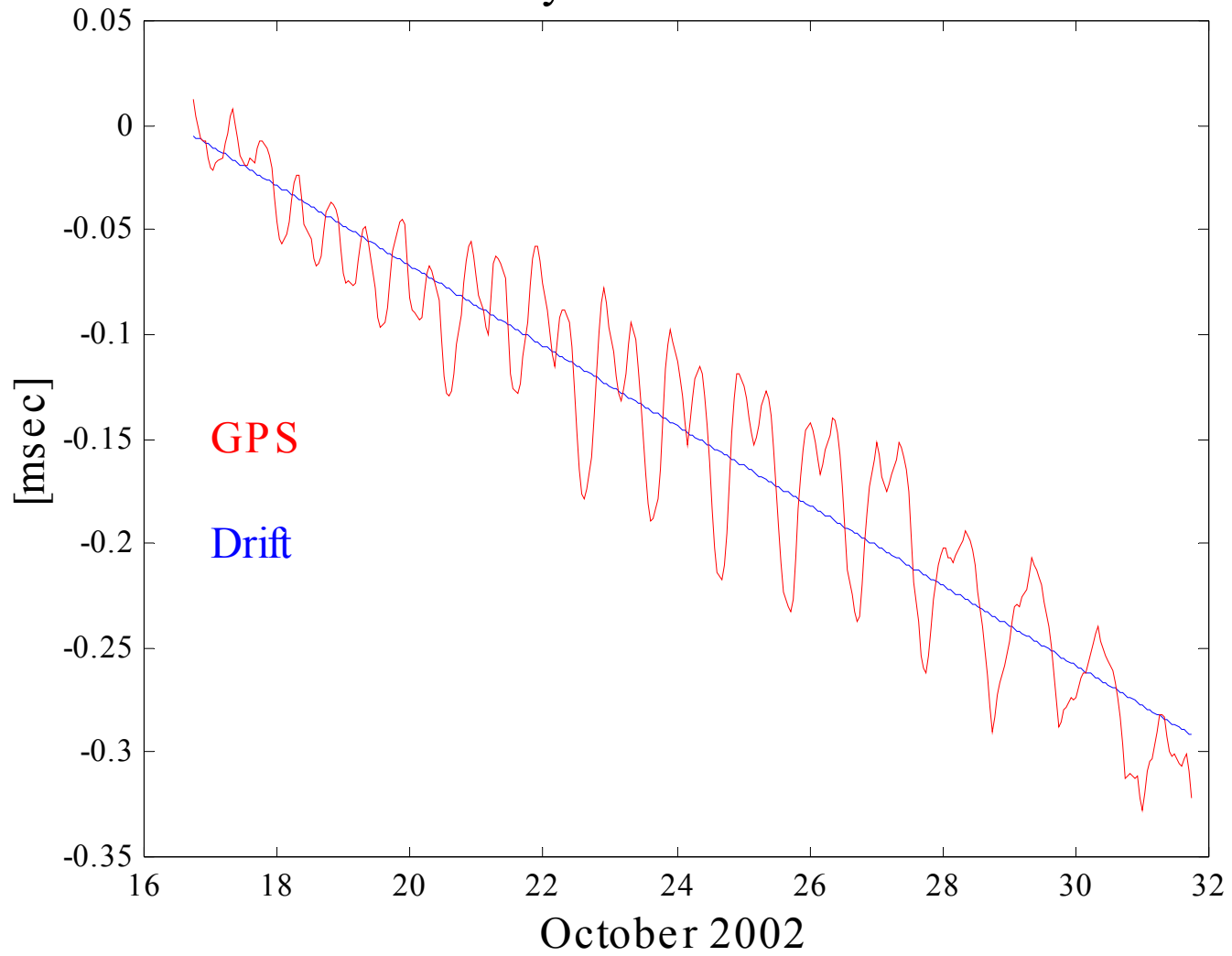
Subdaily Y-pole



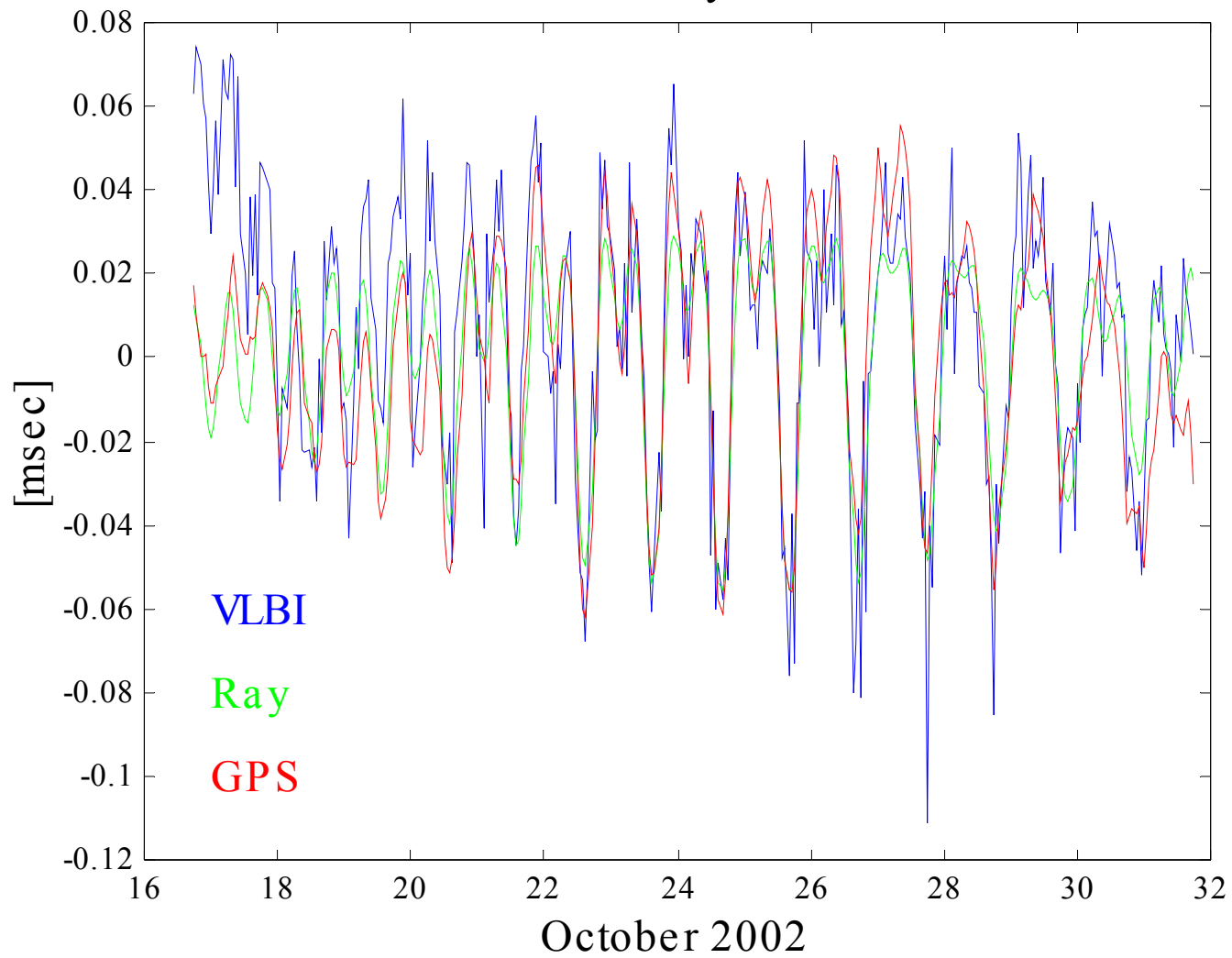
Subdaily UT



Subdaily UT / Drift reduced



Subdaily UT





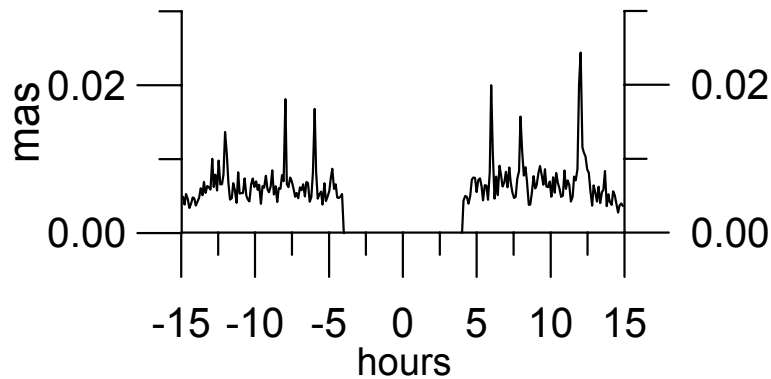
Spectral Analysis

Amplitude Spectra

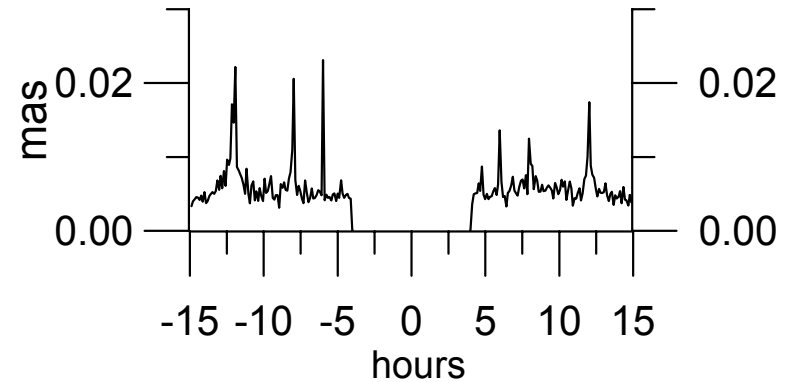
FTBPF Spectra

Former Results

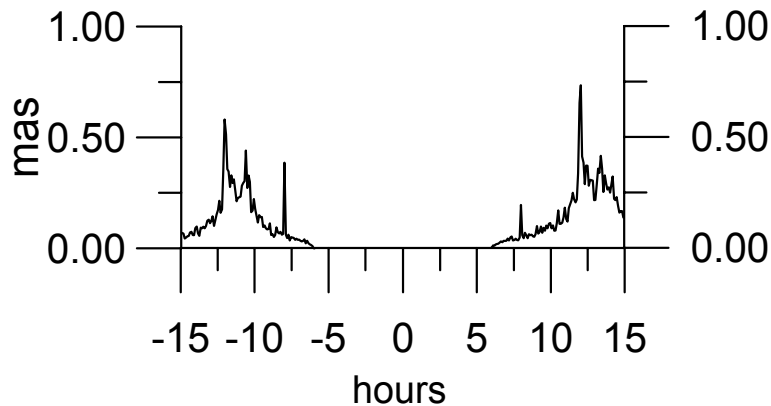
FTBPF X-iY, 1997-1999



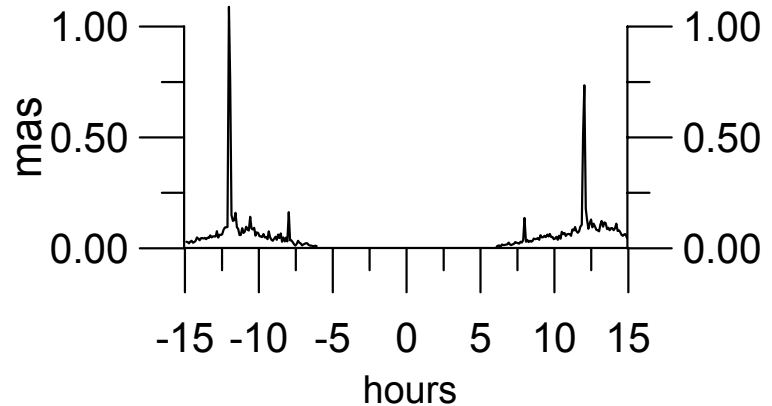
FTBPF X-iY, 1999-2000



FTBPF Chi 1 + i Chi2, pressure, 1995-1997

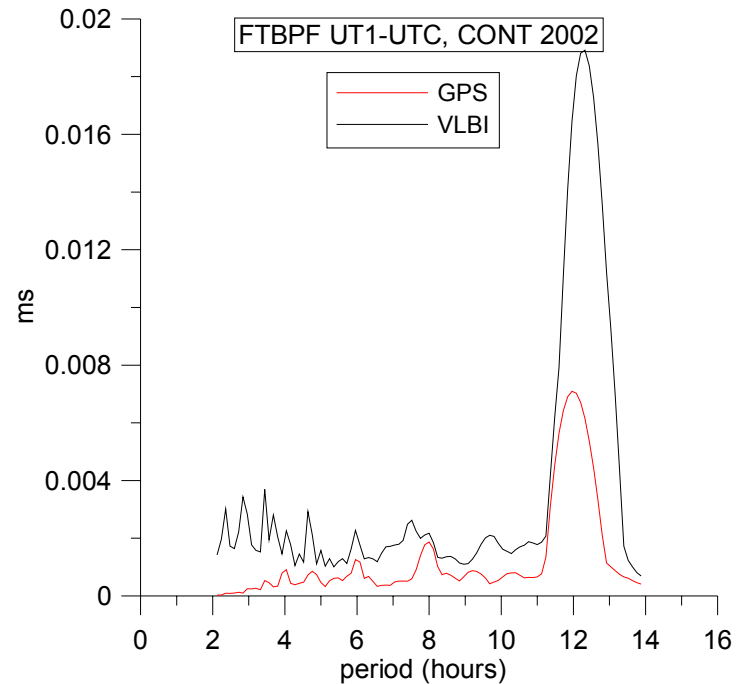
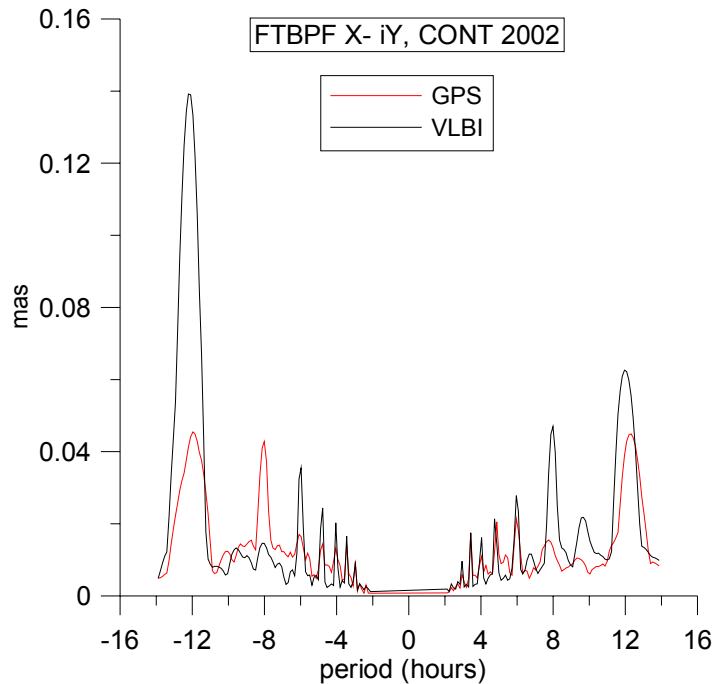


FTBPF Chi 1 + i Chi2, pressure + IB, 1995-1997

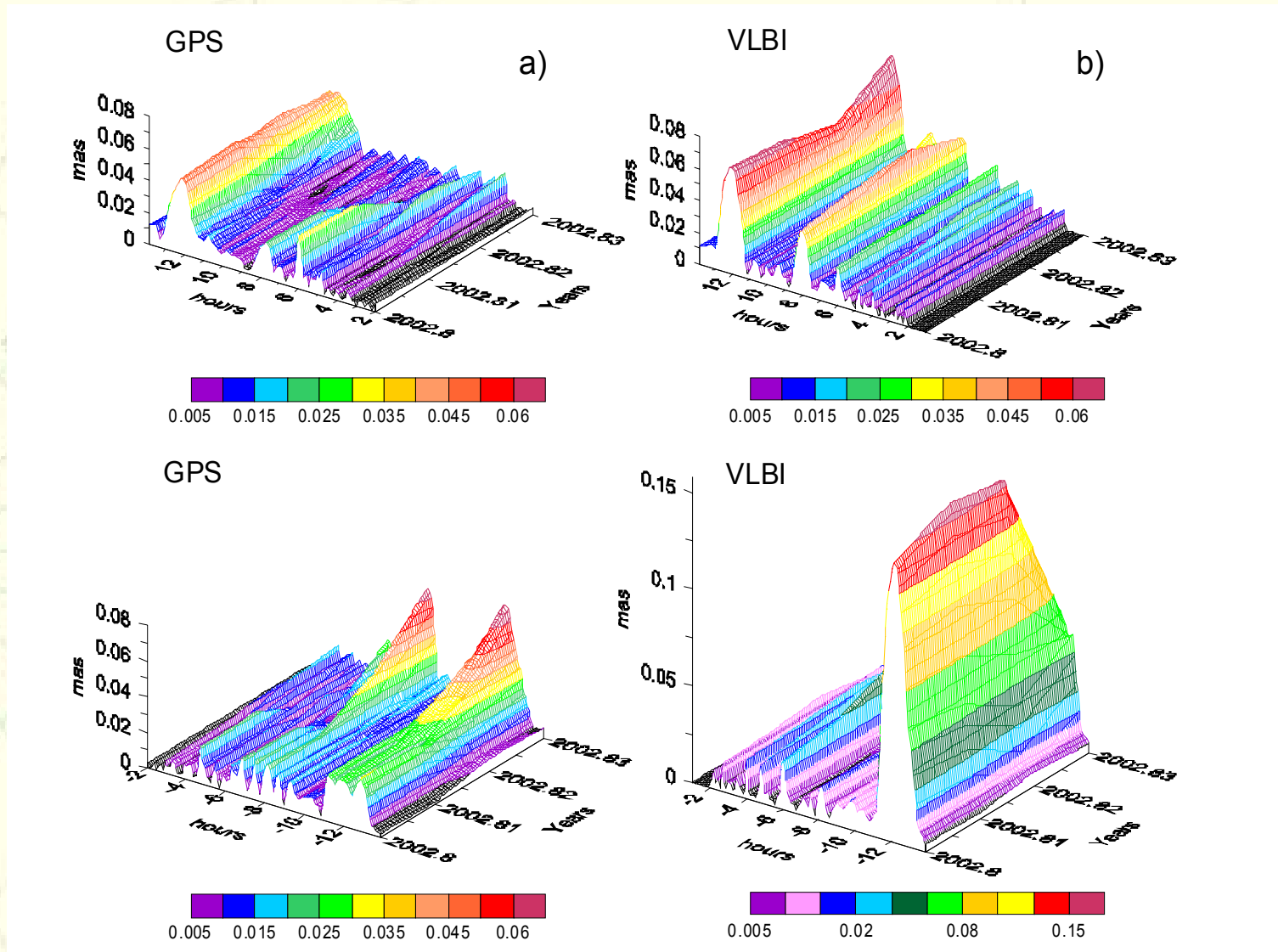


FTBPF spectra of short period oscillations of GPS (CODE) polar motion and atmospheric excitation functions (NCEP) [Weber et al., 2002].

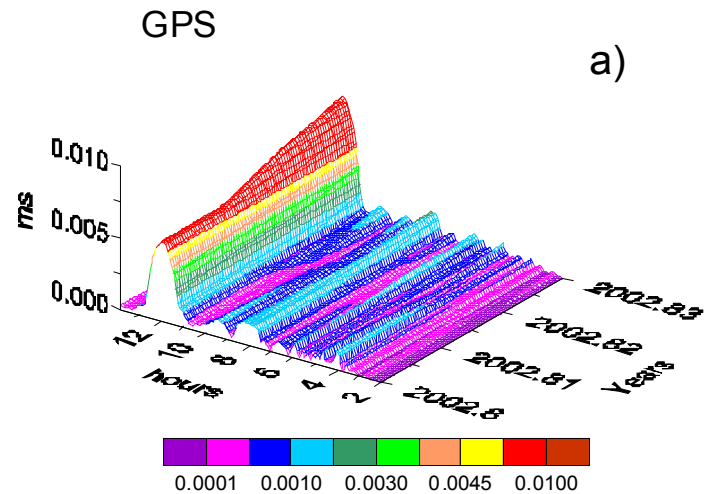
CONT02



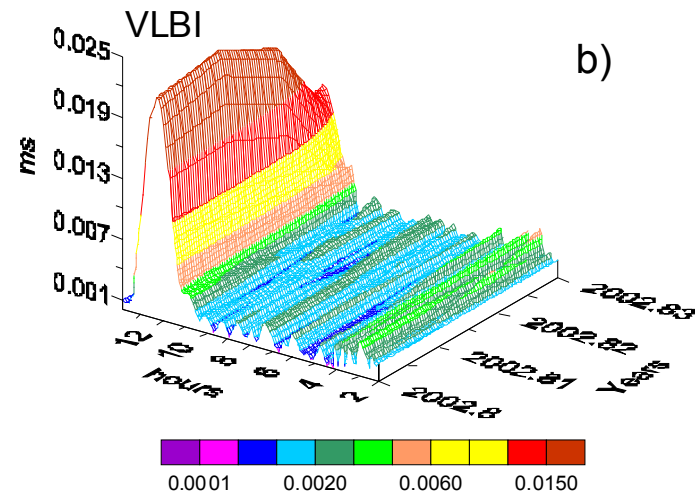
FTBPF spectra of short period oscillations of GPS and VLBI polar motion and UT1-UTC ($\lambda = 0.006$).



FTBPF spectra of short period oscillations (periods < 13 hours) of polar motion determined by GPS and VLBI ($\lambda = 0.006$).

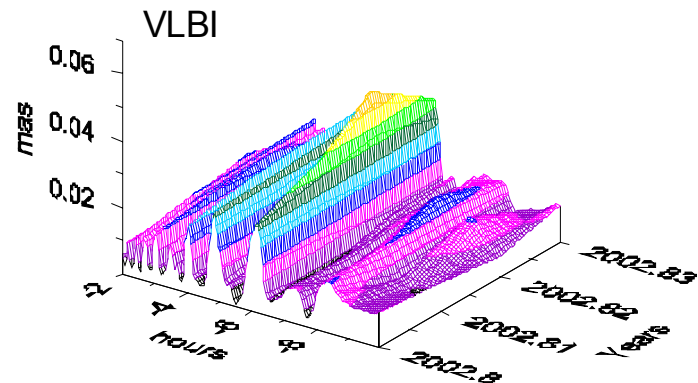
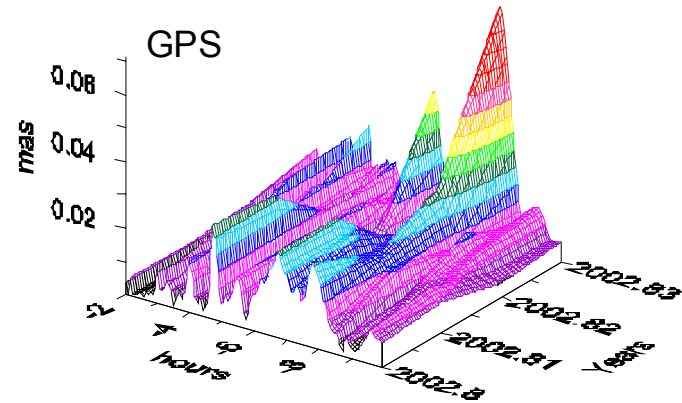
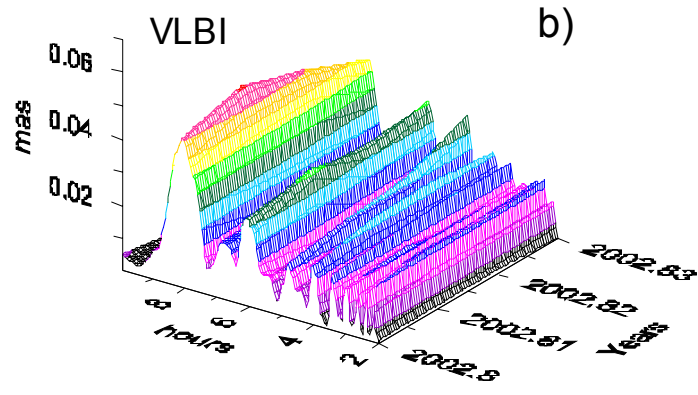
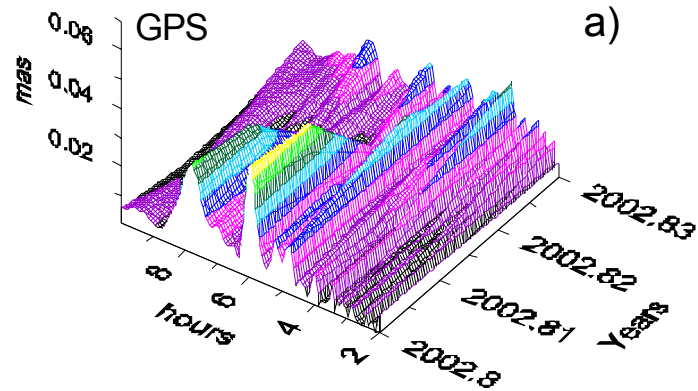


UT1-UTC



UT1-UTC

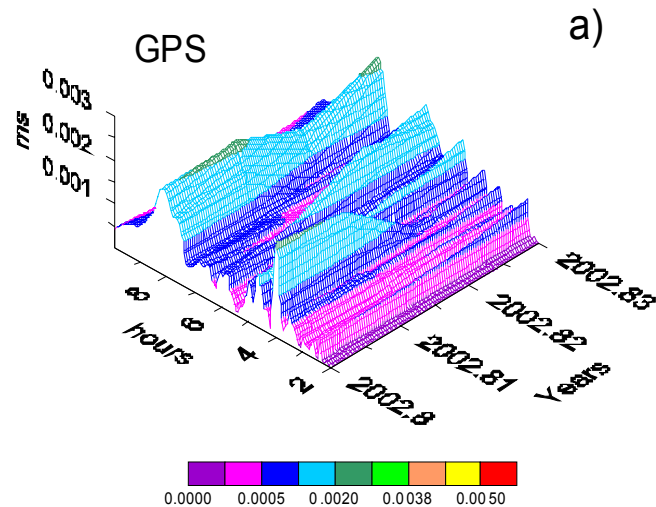
FTBPF time variable spectra of short period oscillations (periods < 13 hours) of UT1-UTC determined by GPS and VLBI ($\lambda = 0.006$).



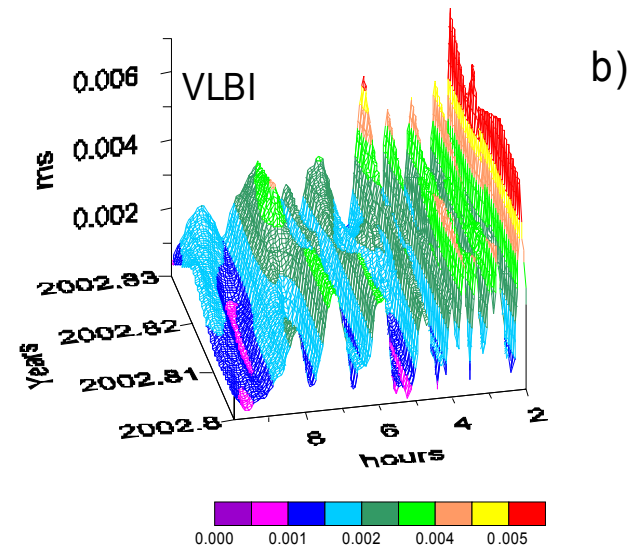
X-iY

X-iY

FTBPF time variable spectra of short period oscillations (periods < 10 hours) of polar motion determined by GPS and VLBI ($\lambda = 0.01$, which gives higher time resolution than $\lambda = 0.006$).



UT1-UTC

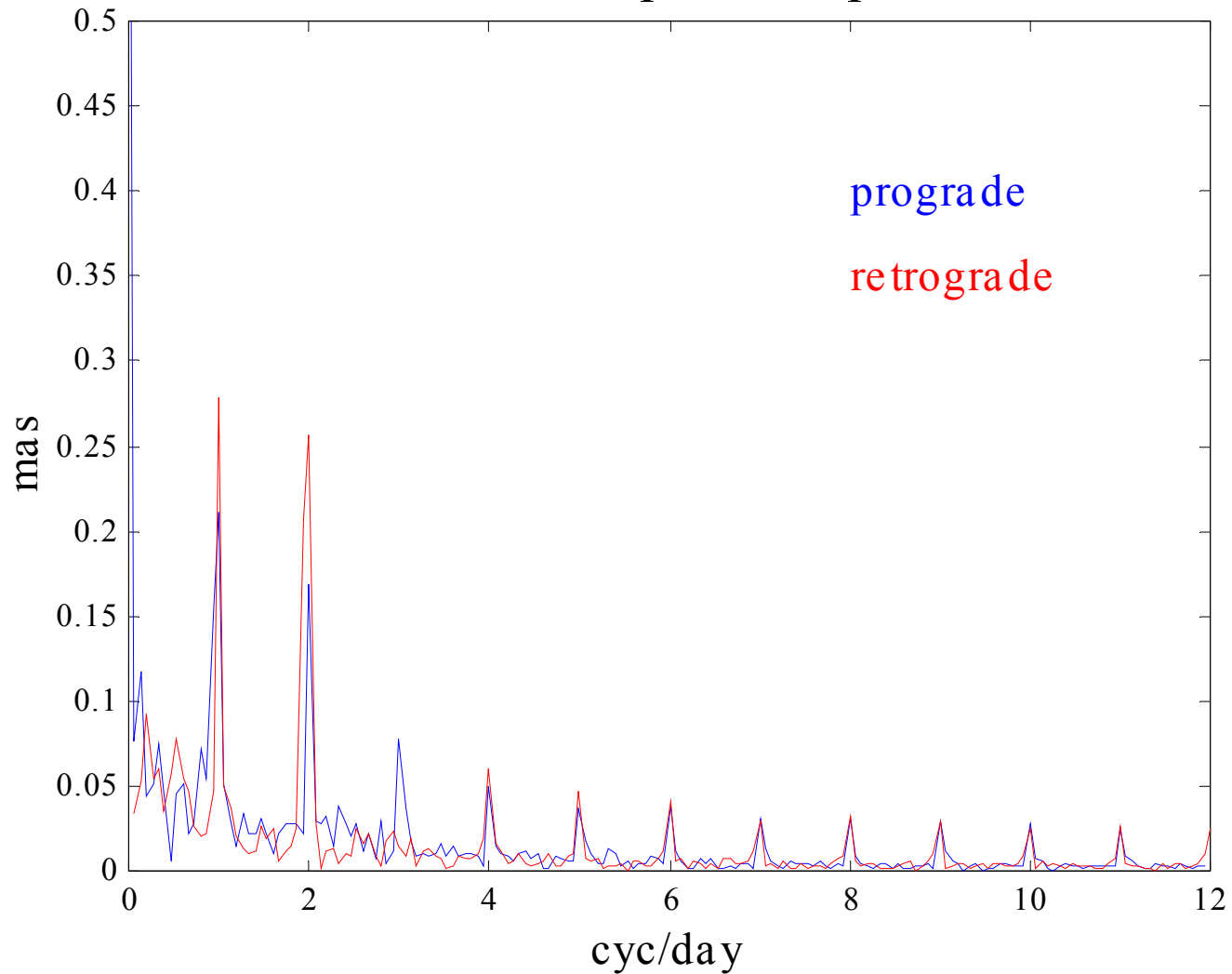


UT1-UTC

FTBPF time variable spectra of short period oscillations (periods < 10 hours) of UT1-UTC determined by GPS and VLBI ($\lambda = 0.01$, which gives higher time resolution than $\lambda = 0.006$).

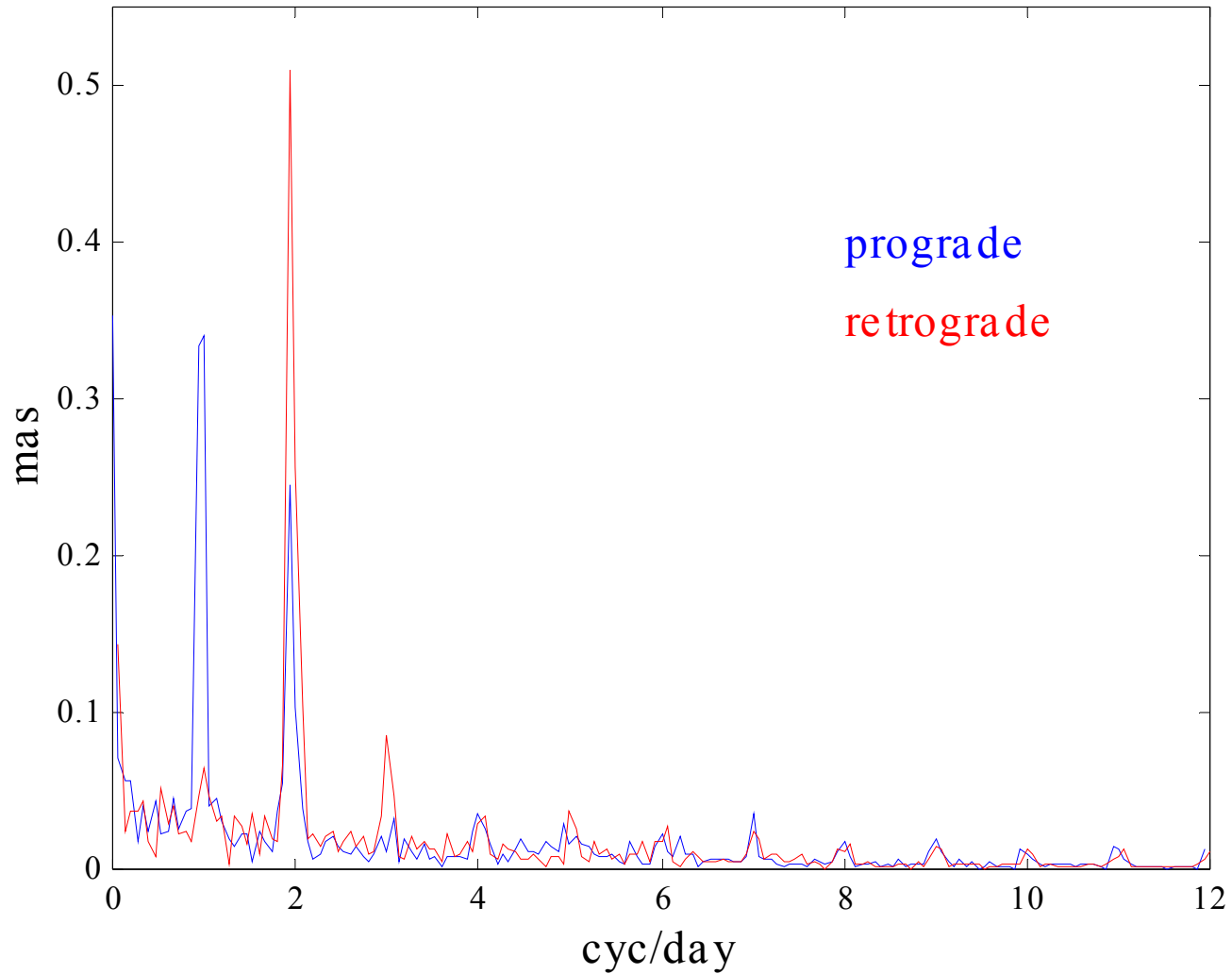
CONT02 polar motion

VLBI / PM Amplitude Spectrum

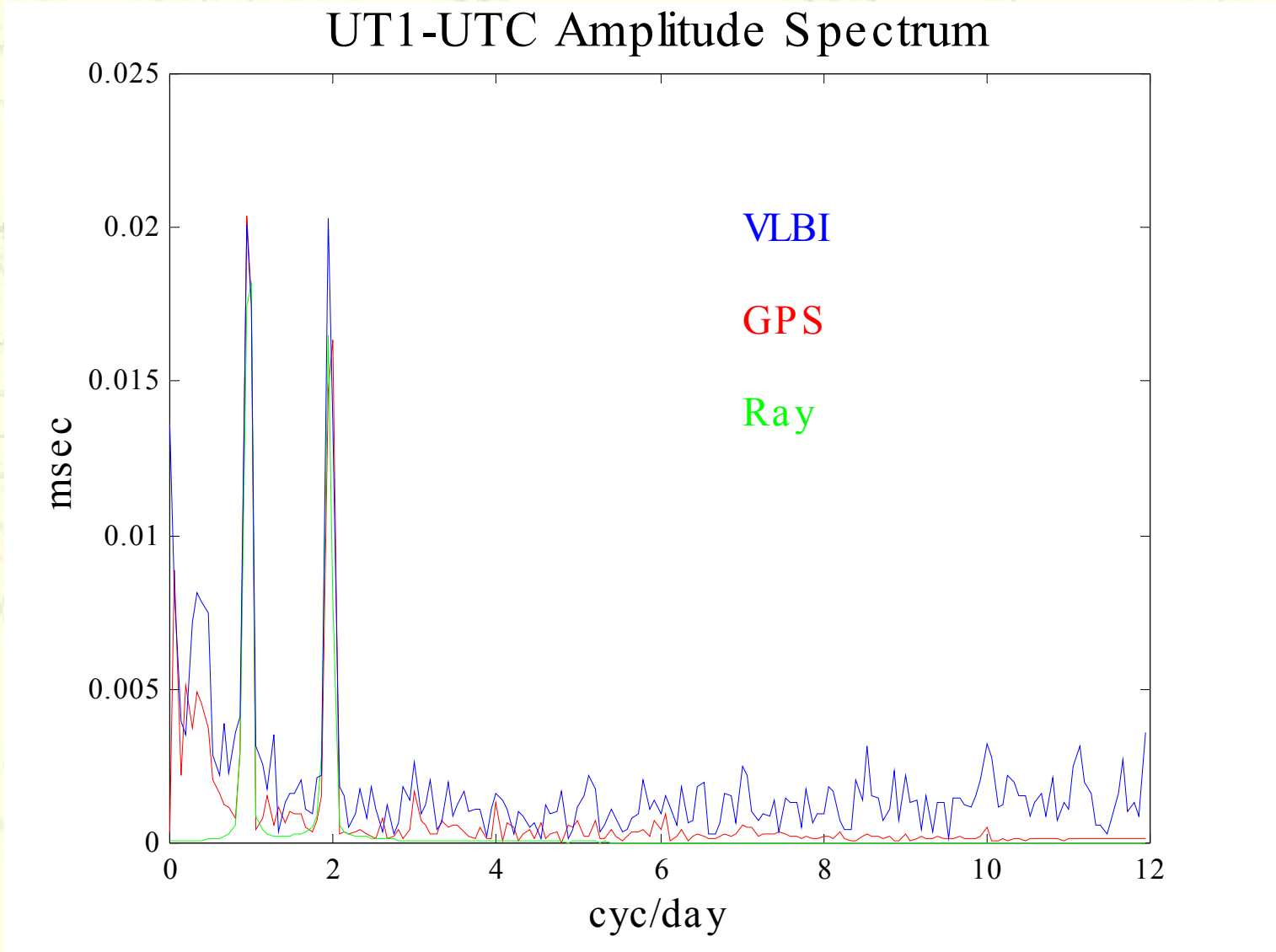


CONT02 polar motion

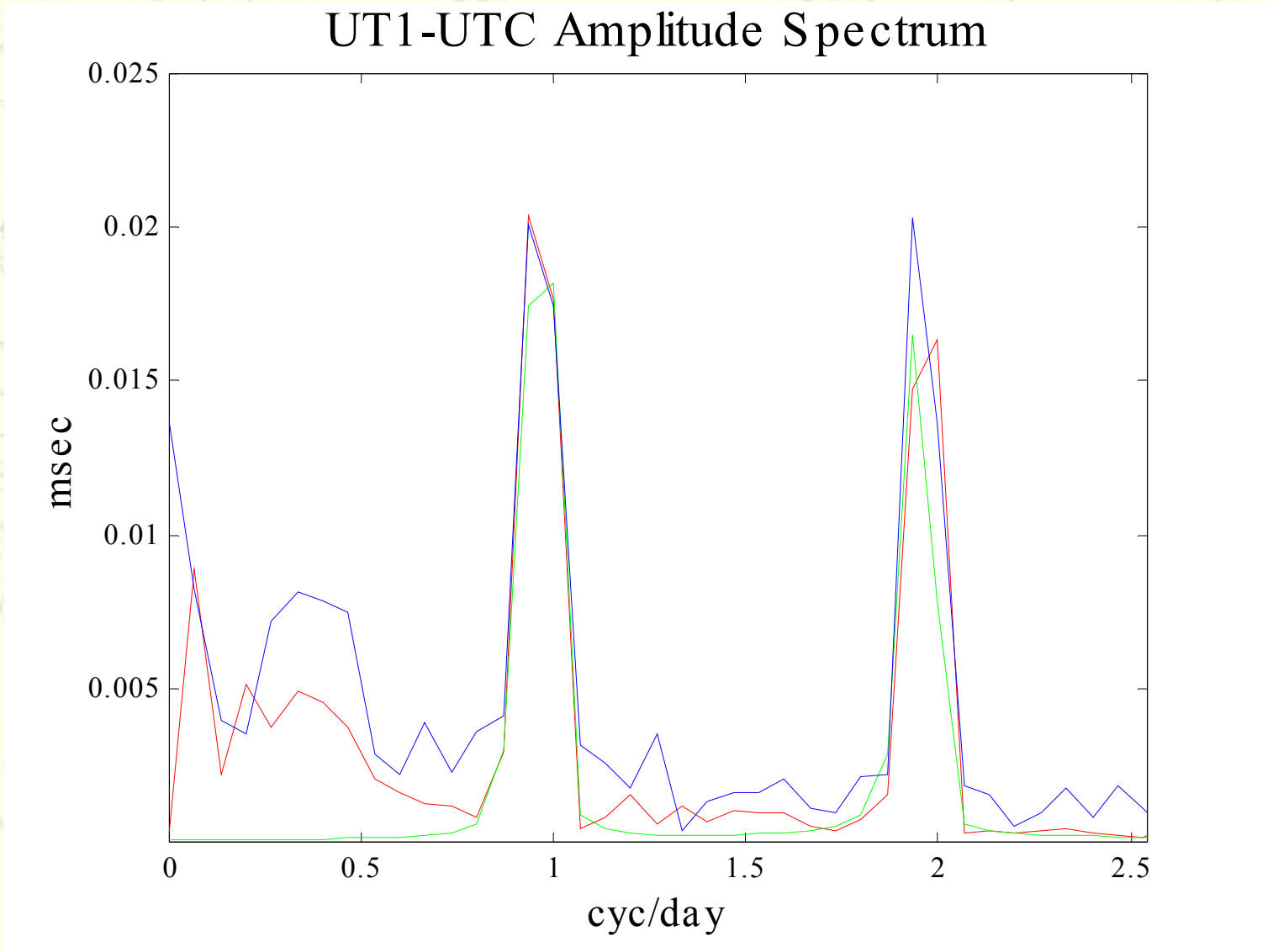
GPS / PM Amplitude Spectrum



CONT02 UT1-UTC



CONT02 UT1-UTC



Conclusions

- good matching of high resolution UT1 series observed by VLBI and GPS during CONT02
- only fair (sometimes poor) correspondence in x-pole and y-pole
- sub-semi-diurnal signals (8h, 6h, 4-5h) in both time series
- discrepancy of 8h period (prograde in VLBI, retrograde in GPS)

Outlook

- further investigations dealing with high resolution AAM and OAM during CONT02 are carried out
- other VLBI sessions investigated w.r.t. sub-diurnal ERP periods (IVS-R1, IVS-R4, ...)
- comparisons with results of a third observing technique are extremely important

THANK YOU FOR YOUR ATTENTION!

