Search for changes in the STJB station behaviour, a case study

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STJB: the story

The station is operated since September 1999

Data gap: Aug. 19 – Sep. 16, 2002
Event known: the STJB beacon had to be reprogrammed due to an electric storm.

No operation was carried out on the antenna.

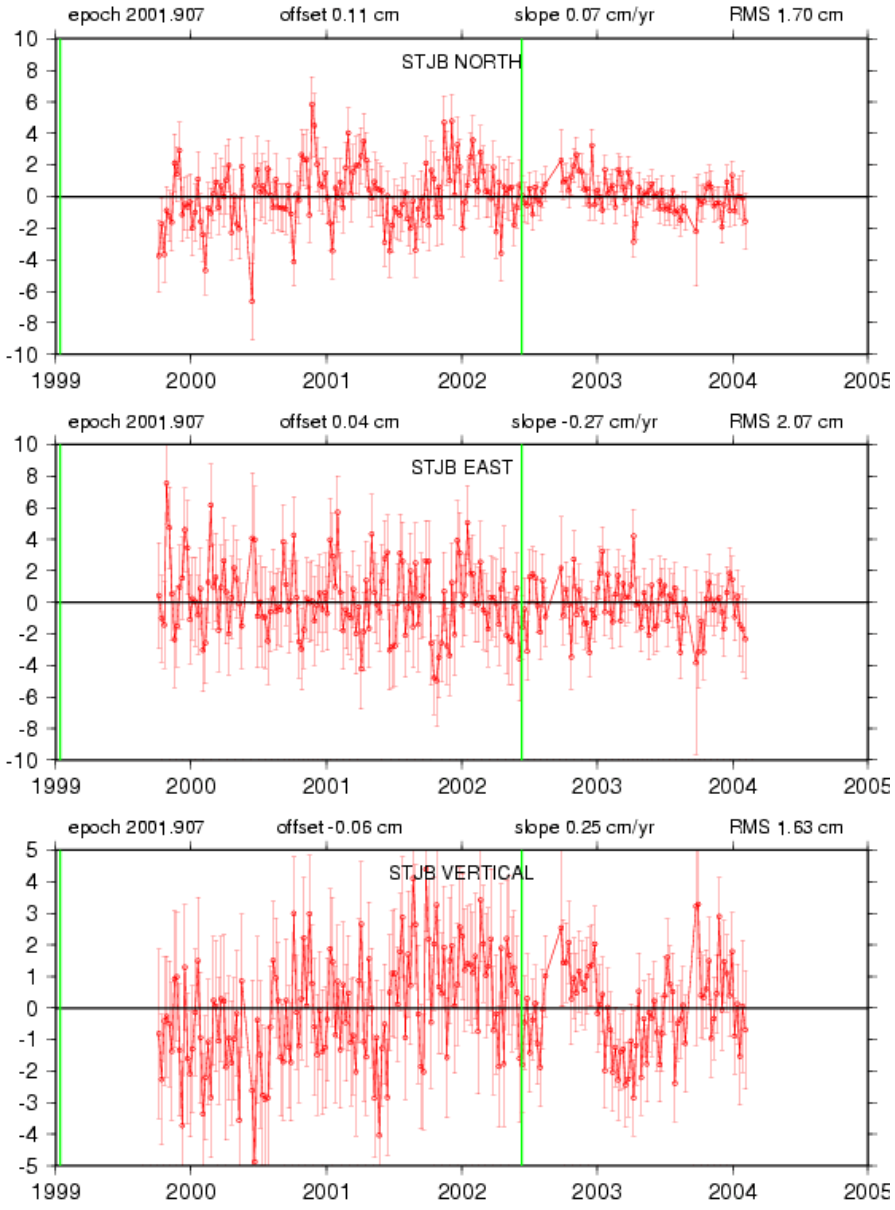
The antenna is supported by a strong metal plate set on three metal rods embeded in a concreta pillar.

Step subsequent to antenna damage more likely horizontal than vertical.

Source: H. Fagard

Diagnosis 1
(IGN-JPL):

Break in Up, 20 Jan 2003: -17 mm



Investigations of the times series

Data: time series of weekly E, N, U residuals of
ignwd05 (free-network)
projected onto ITRF2000 by CATREF (Z. Altamimi)

Features investigated:

- slopes
- low frequency non-linear trend
- periodic components
- high frequency standard deviation
- statistical stability

Crono_Vue analysis

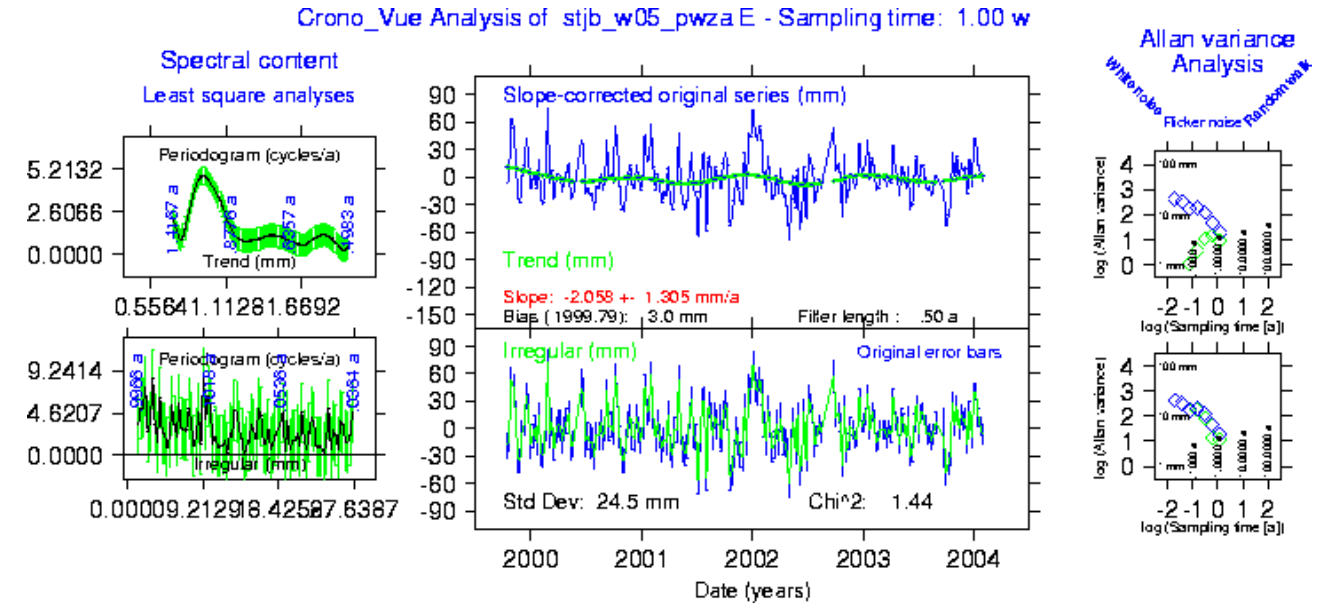
- Extraction: trend, seasonal (optional), and irregular components
- Linear trend, irregular component's standard deviation
- Least-squares low- and high-frequency periodograms
- Spectral continuum characterization (Allan variance)

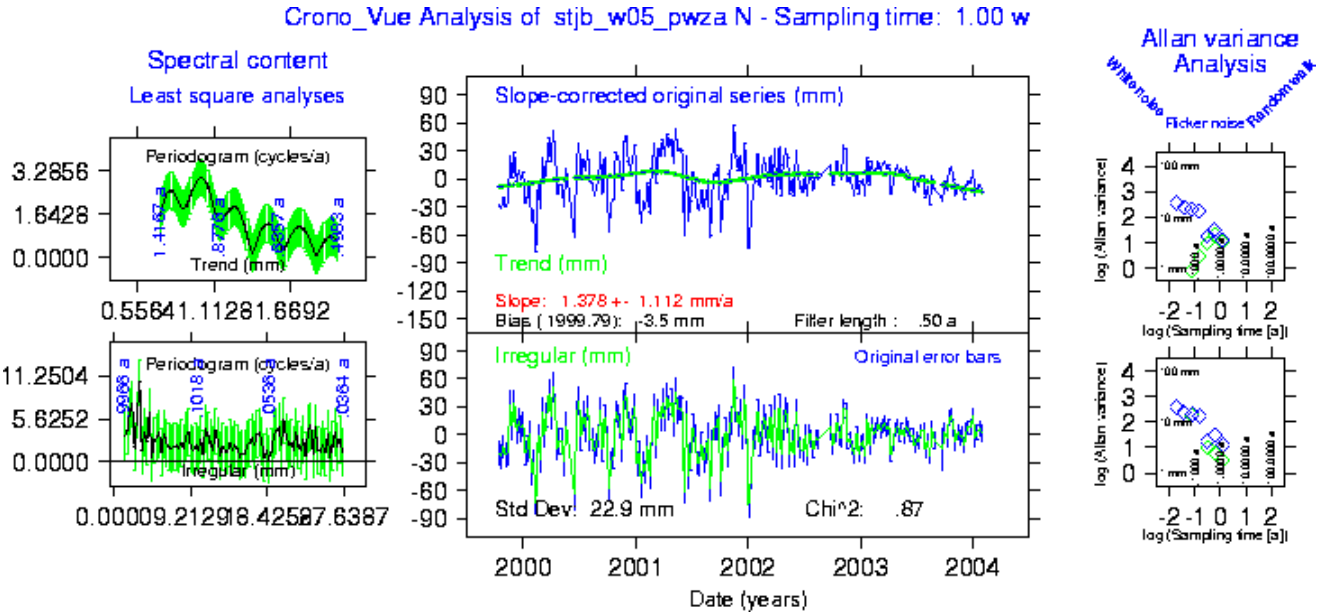
Singular Spectrum Analysis

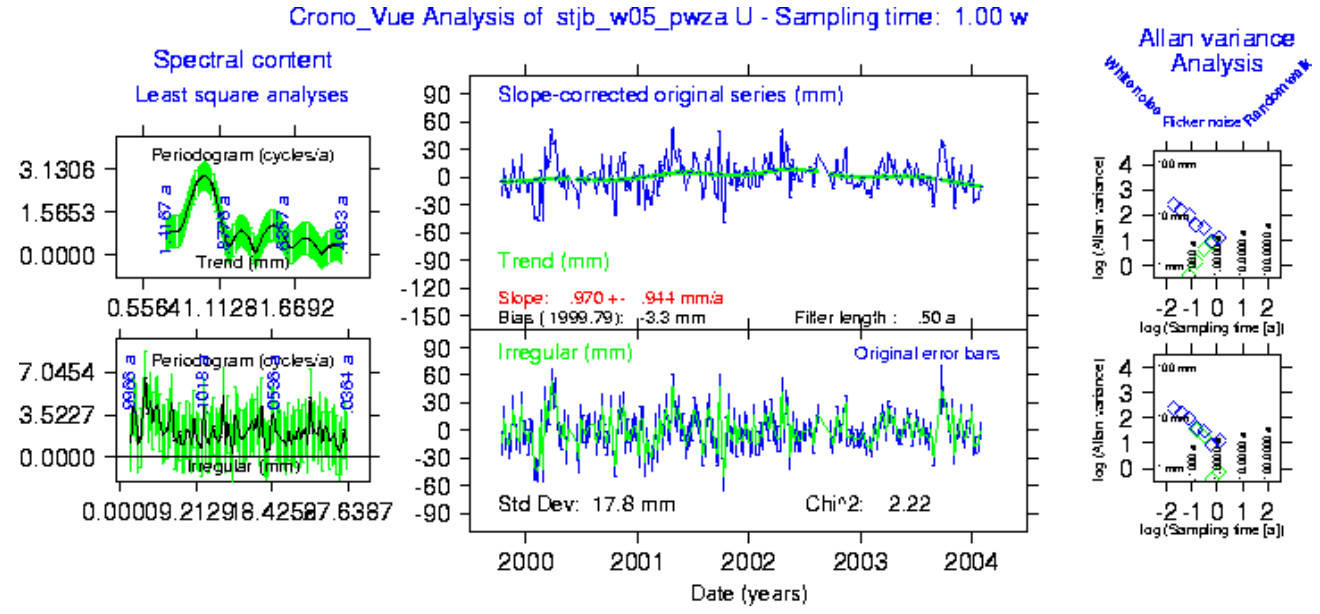
Sequence of analyses

- FFT spectrum to detect periodic components
- Analysis of the series autocovariance, for frequencies lower than those of major periodic components
- Reconstruct partially the signal

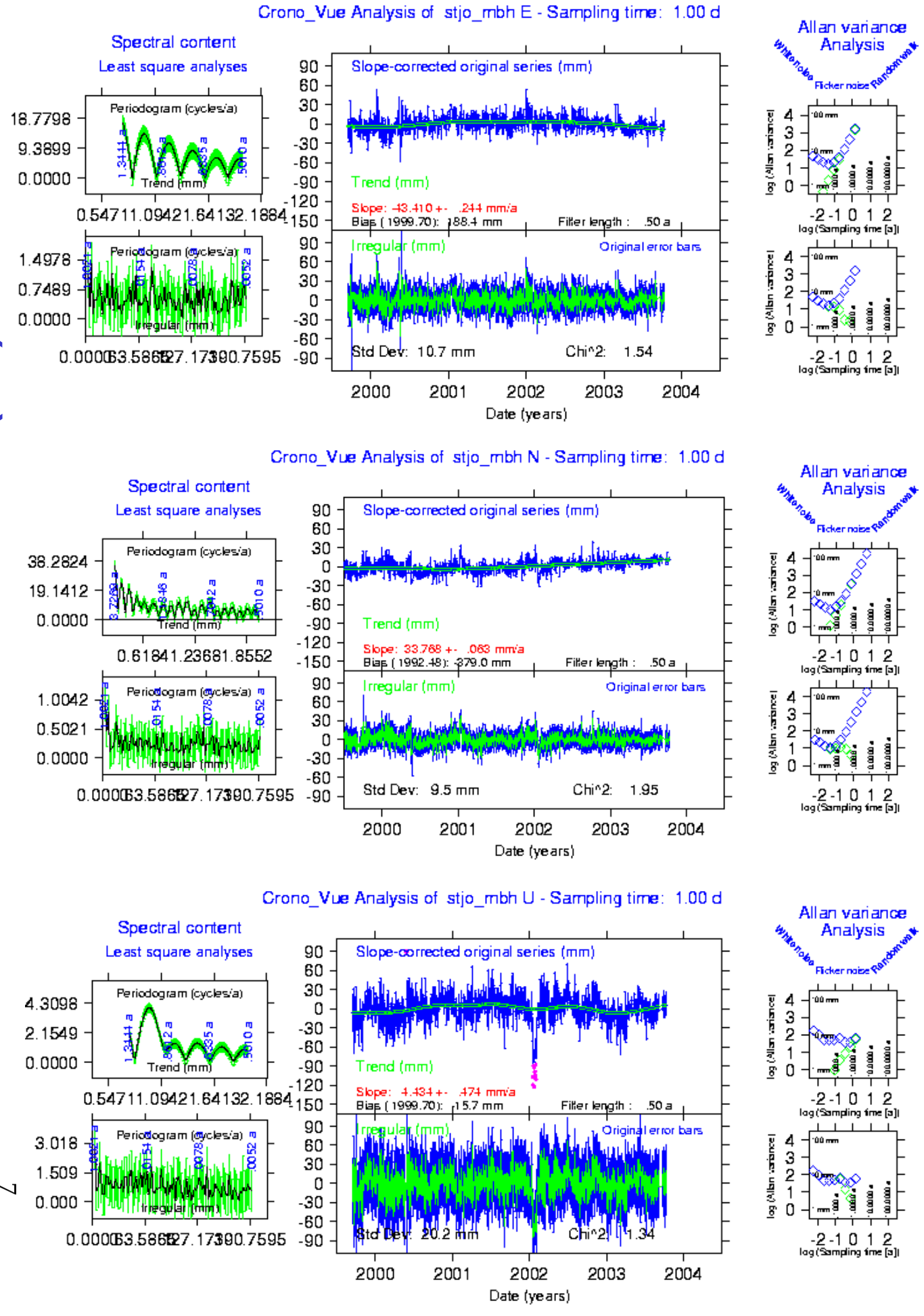
DORIS-measured motion of STJB (IGN-JPL)







GPS-measured motion of STJO (JPL)

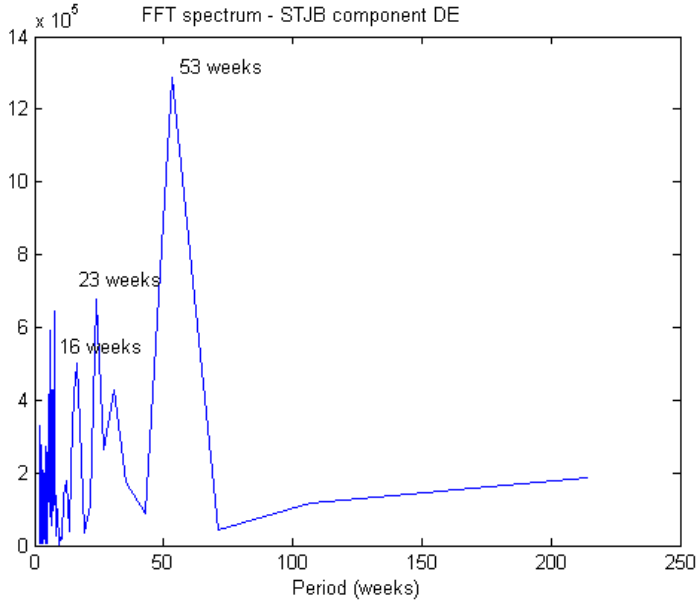


Residual velocities wrt ITRF2000

Data span	Residual velocity (mm/year) East	North	Up
1999.8-2004.1	-2.1 +- 1.3	1.3 +- 1.0	1.0 +- 0.9
Splitting the series at the date of beacon restart			
1999.8-2002.6	-6.6 +- 2.7	3.7 +- 2.5	6.4 +- 1.9
2002.7-2004.1	-0.4 +- 6.0	-12.0 +- 3.8	-5.7 +- 4.4
Change:	+6.2 +- 6.6	–15.7 +- 4.5	–12.1 +- 4.8

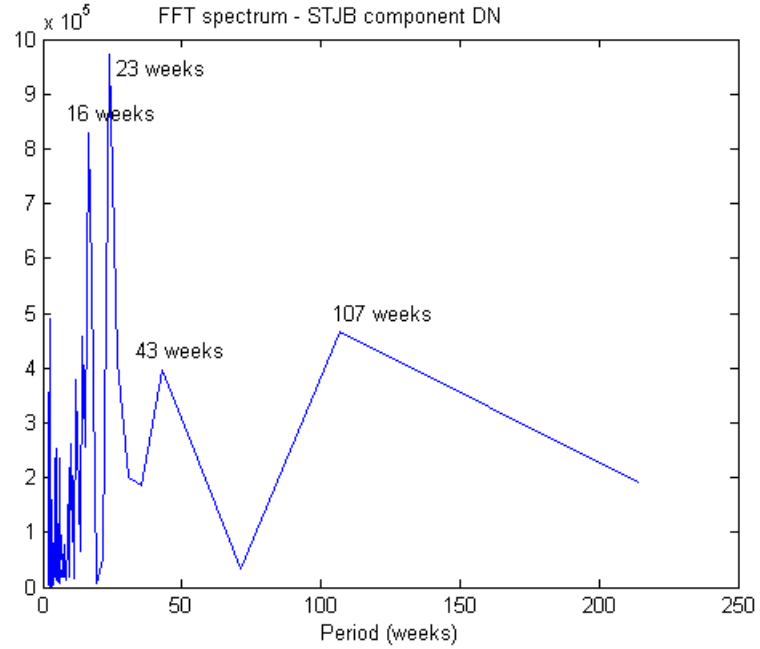
Standard deviations

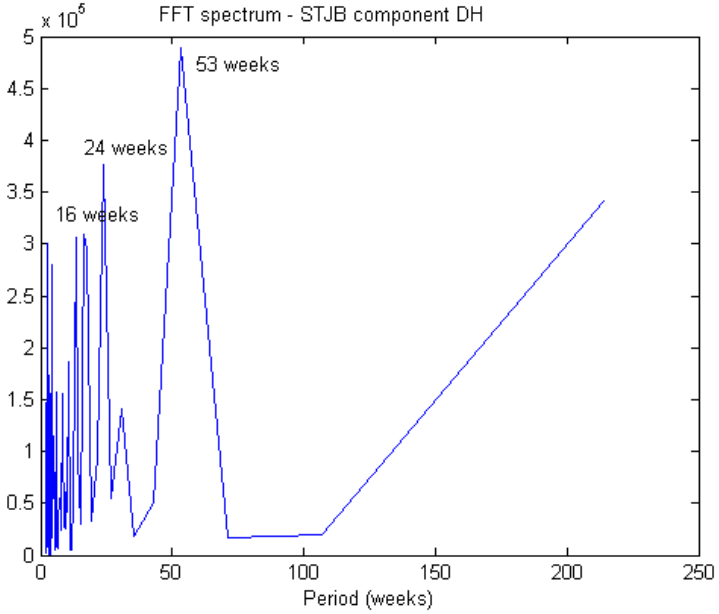
Data span	East	North	Up
1999.8-2004.1	25 mm	23 mm	18 mm
1999.8-2002.6	25 mm	25 mm	19 mm
2002.7-2004.1	19 mm	11 mm	13 mm

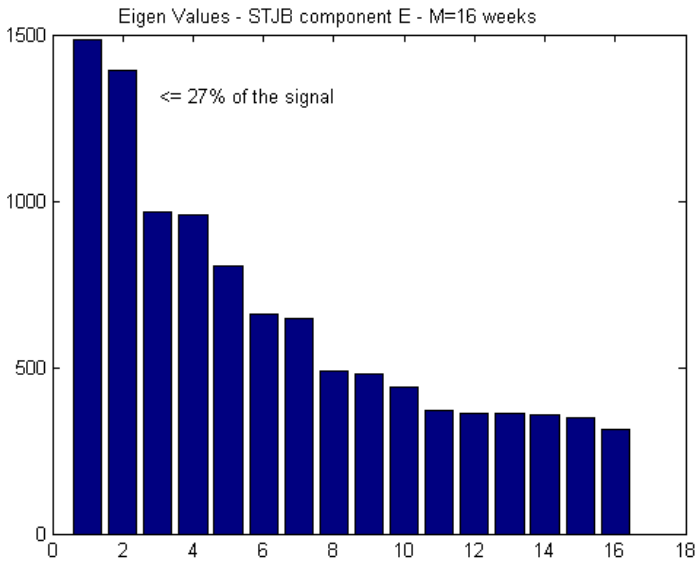


D/IGN-JPL STJB series

FFT spectrum of non-linear motion

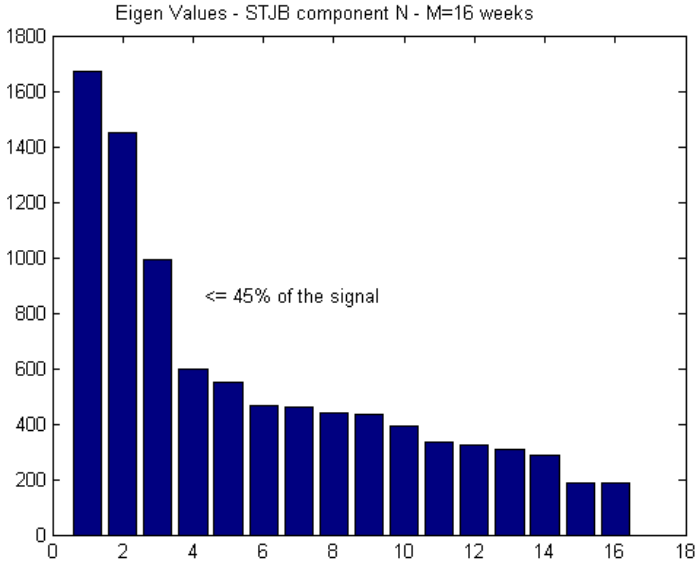


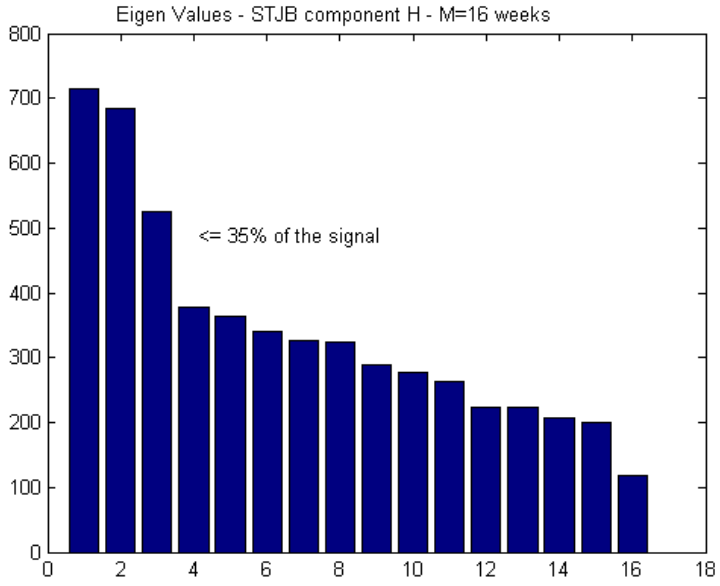




D/IGN-JPL STJB series

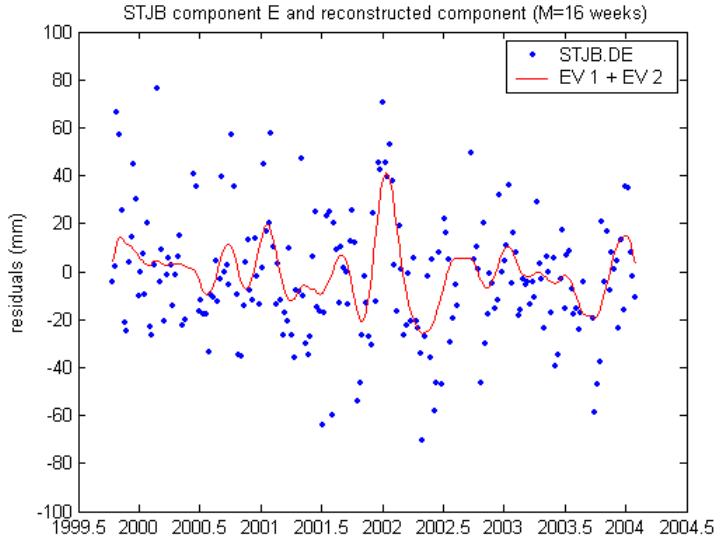
The largest signal eigen values, for maximum delay of 16 weeks (112 days)

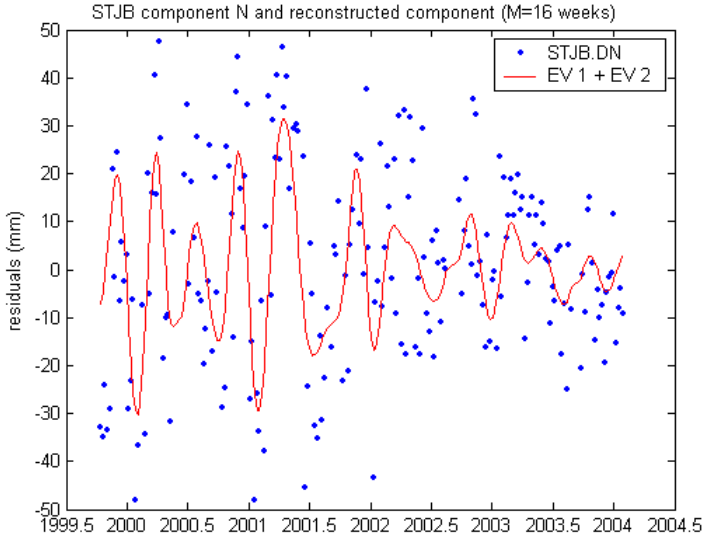


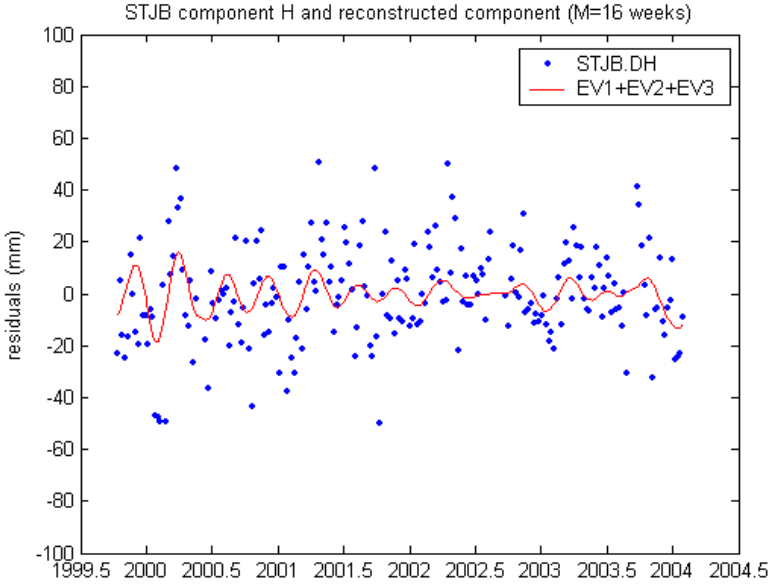


D/IGN-JPL STJB series

The reconstructed signal







Summary

STJB coordinates signal characteristics (1999.8-2004.1)

- linear slope not constant over
- large pseudo annual oscillation in the East (10 cm peak-to-peak) around 2002.0
- ~110-140-d oscillations in all components, particularly large (5 cm peak-to-peak) in North < 2000

Possible changes around September 2002:

- apparent change of slope in North and Up components, maybe not exceptionnal
- improved short term stability, especially North (impact of additional satellites?)
- the change in Up seen in early 2003 seems to be only a normal short term irregularity.