

ILRS Combination Products



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The ILRS ACs and CCs activity

The ILRS Analysis Community has been developing, since several years, global and very accurate geodetic products, covering different data periods with different issue frequencies and latencies.



The ILRS operational official products

	arc length	latency	SSC	EOP
“pos+eop” weekly	7day	4-10 day	1/week	1/day
“pos+eop” daily	7day	2-8 day	1/week	1/day

ILRS Weekly solution

Since 2004, **each Wednesday**, the primary and the back-up ILRS CCs generate two sets of combined solutions computed along different combination strategies. The SLR data acquired (Lageos1/2, Etalon1/2) during a 7-day period (Sunday-Saturday) are processed by the ACs and made available to the CCs within Tuesday.

ILRS Daily solution

Since 2008, similarly, **each day N**, a combined SSC/EOP solution is generated using the SLR data acquired during a 7-day period covering (N-8,N-2)

The ILRS combination products

	EOP/SSC weekly	EOP/SSC daily	ITRF	SW	SLRF
ASI ILRSA	Jun 04	Feb 08	ITRF2005 Dec 05 1993-2005 ITRF2008 Aug 09 1983-2008	COGEOS <i>Loose Constrained Solution Combination</i>	SLRF2005 Jul 07
DGFI ILRSB	Jun 04 – Nov 10	Feb 08 - Nov 10	ITRF2005 Dec 05 1993-2005 ITRF2008 Aug 09 1983-2008	DOGS_AS <i>Rigorous Variance Component Estimation</i>	
JCET ILRSB	Dec 10	Dec 10	-	DOGS_AS <i>Rigorous Variance Component Estimation</i>	SLRF2008 Jun 11

The ILRS AC operational contributions

	EOP/SSC weekly	EOP/SSC daily	SP3c L/E weekly	SW
ASI	Nov 03	Feb 08	May 08	GEODYNII /SOLVE
BKG	May 05	Feb 08	May 08	UTOPIA /SOLVE BERNESE (Jun 10)
DGFI	Nov 03 no Jul 10 – Aug 11	-	Jun 08 no Jul 10 – Aug 11	DOGS_OC /DOGS_CS
GA	May 07	-	Aug 08	GEODYNII /SOLVE
GFZ	Nov 03	Feb 08	Sep 08 no E1/E2	EPOSOC
GRGS	Dec 07	Mar 09	Jun 08 no E1/E2	INS/MATLO
JCET	Jan 04	Feb 08	-	GEODYNII /SOLVE
NSGF	Nov 03	Feb 08	-	SATAN
ESA	Sep 10	Nov 10	-	NAPEOS

The ILRS data processing flow

ASI

BKG

DGFI

ESA

GA

GFZ

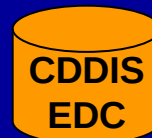
GRGS

JCET

NSGF

ILRS ACs

- The official ILRS AC weekly/long term solutions and the pre-operational daily solutions are combined by ASI and JCET CCs
- Solutions contain SSC and daily EOP, using Lageos and Etalon data, according to the ILRS/AWG guidelines



ASI
ILRSA solution

JCET
ILRSB solution

Database
Data&Solutions

ILRS CCs

The quality of the final product

The final product quality depends on different factors, such as:

data analysis

- Conventions adopted
- Application/estimation of system biases
- Satellite Center of Mass correction
- Data coverage
- SW

combination

- Balance in the contribution of all the ACs solutions
- Hidden constraints/looseness
- Outlier editing, which affects the iterative computation of the solution scaling factors in the combination process

The 'looseness' issue - remarks

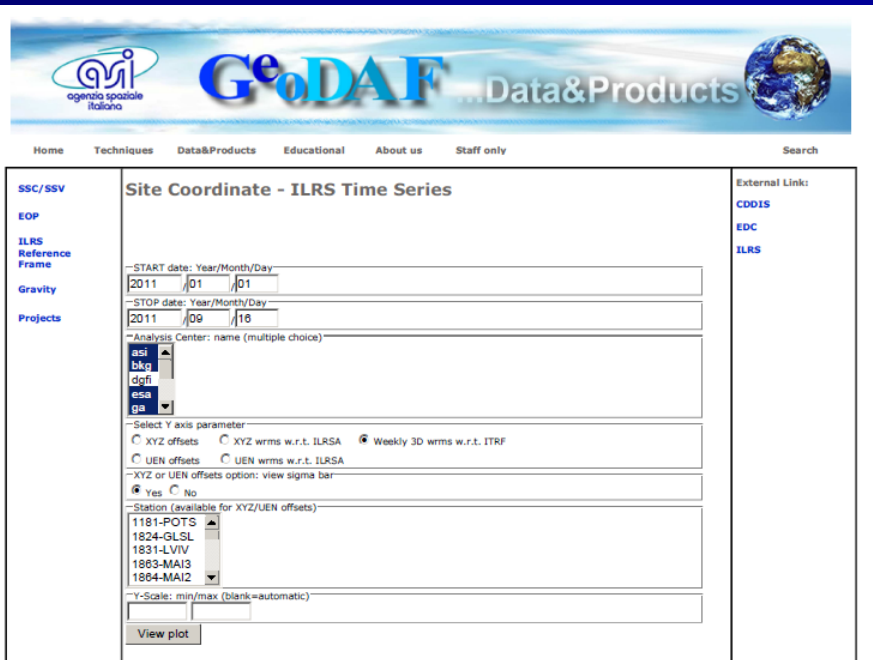
A preliminary verification of the looseness level of the incoming solutions is necessary: the provided covariance matrix of each solution is projected into the Helmert parameter covariance and the uncertainty of the 3 rotation parameters is verified.

If an AC solution time series shows an overall, unsatisfactorily, looseness level on one or more rotation component (due e.g. to hidden constraints), a loosening quantity should be added and the Helmert covariance matrix is projected back into the solution covariance.

Attention should be paid to the final combined solution covariance: a verification of its aptness to (e.g.) following inter-technique combination step is performed and eventual corrective actions undertaken.

Monitoring the quality of the combination operational product

- Product report (statistics of residuals wrt reference values)
- User can also access
http://geodaf.mt.asi.it/ilrs_weekly.html
http://geodesy.jcet.umbc.edu/ILRS_QCQA
to visualise interactively parameters in a selected time span



GeDAF Data&Products

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SSC/SSV
EOP
ILRS Reference Frame
Gravity
Projects

Site Coordinate - ILRS Time Series

External Link:
CDDIS
EDC
ILRS

START date: Year/Month/Day
2011/01/01

STOP date: Year/Month/Day
2011/09/16

Analysis Center: name (multiple choice)
asi
bkg
dafi
esa
ga

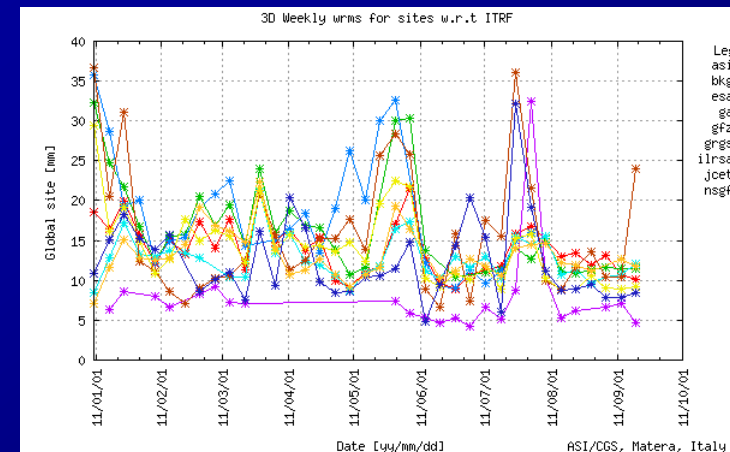
Select Y axis parameter
☐ XYZ offsets ☐ XYZ wrms w.r.t. ILRS ☒ Weekly 3D wrms w.r.t. ITRF
☐ UEN offsets ☐ UEN wrms w.r.t. ILRS

XYZ or UEN offsets option: view sigma bar
☒ Yes ☐ No

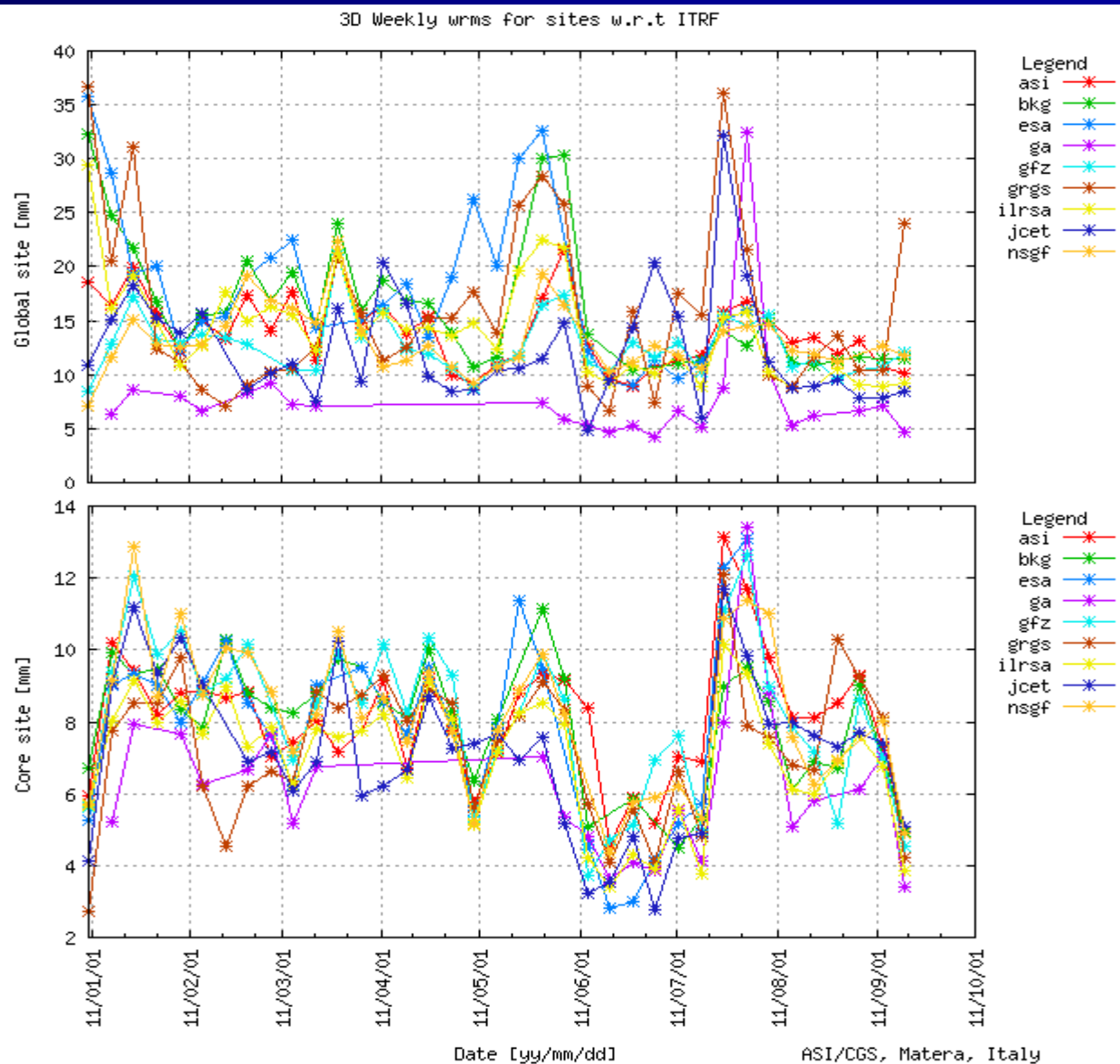
Station (available for XYZ/UEN offsets)
1181-POTS
1824-GUSL
1831-LVIV
1863-MAI3
1864-MAI2

Y-Scale: min/max (blank=automatic)

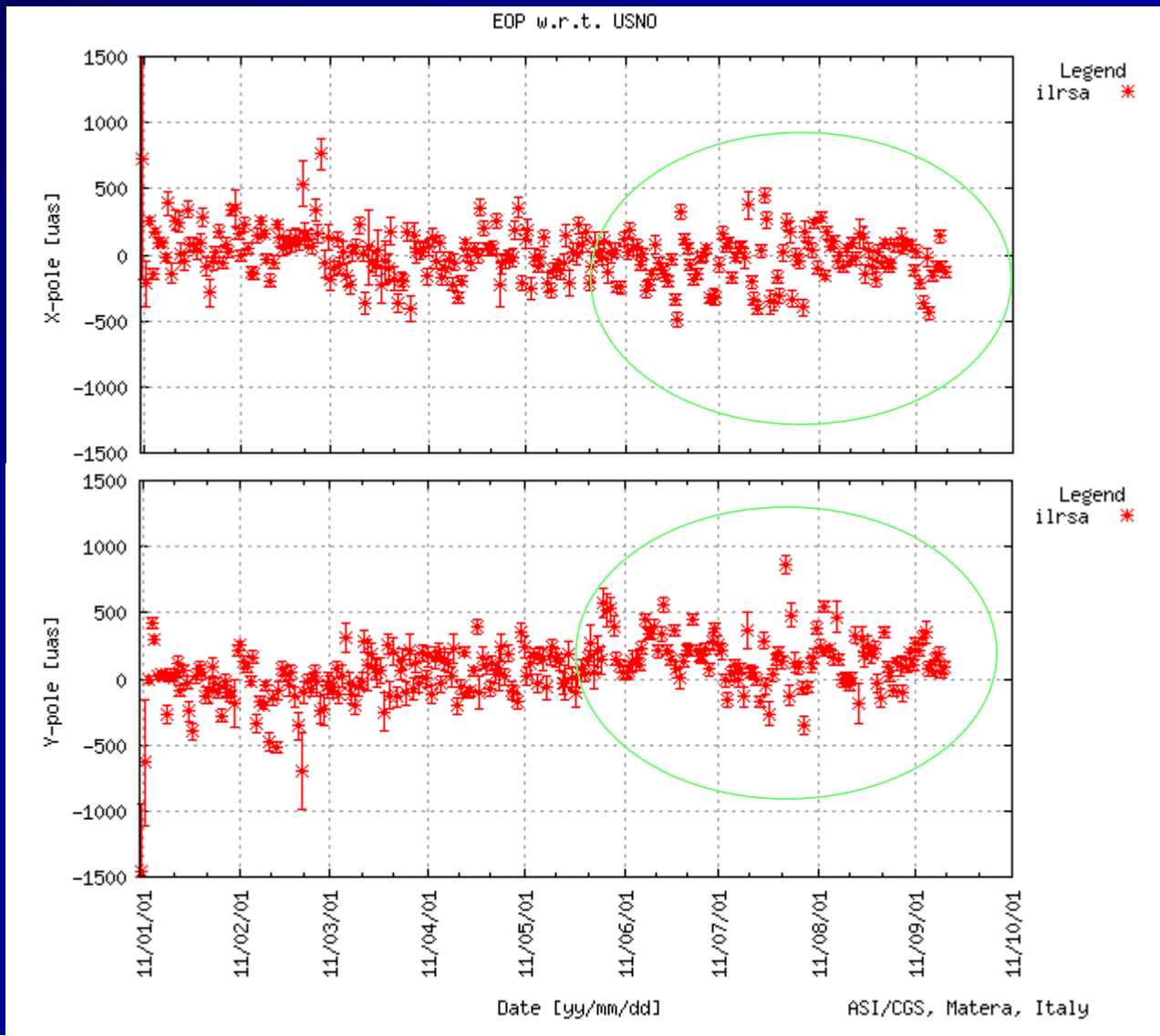
View plot



3d SSC WRMS w.r.t. ITRF

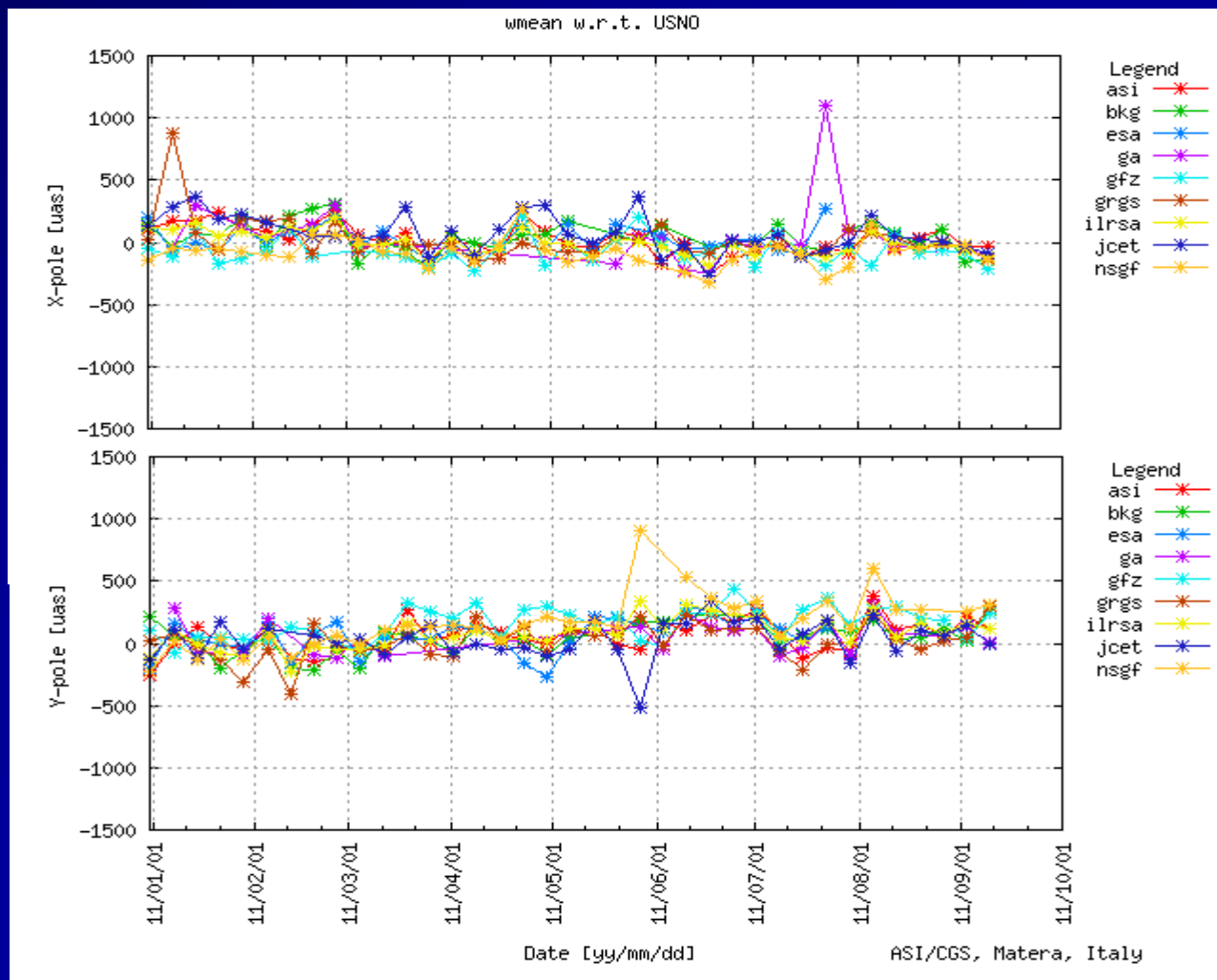


EOP residuals w.r.t. USNO EOP

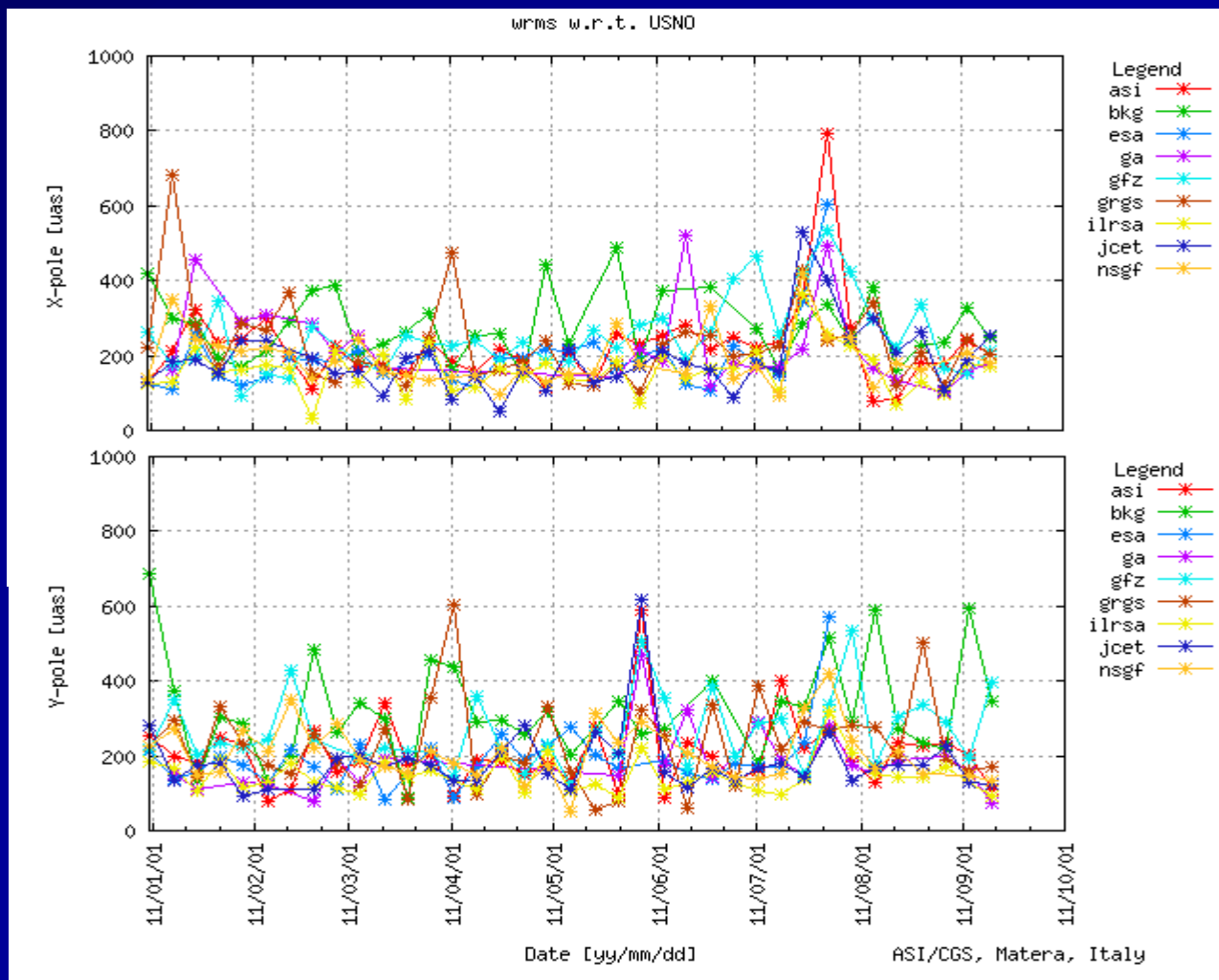


ITRF2008

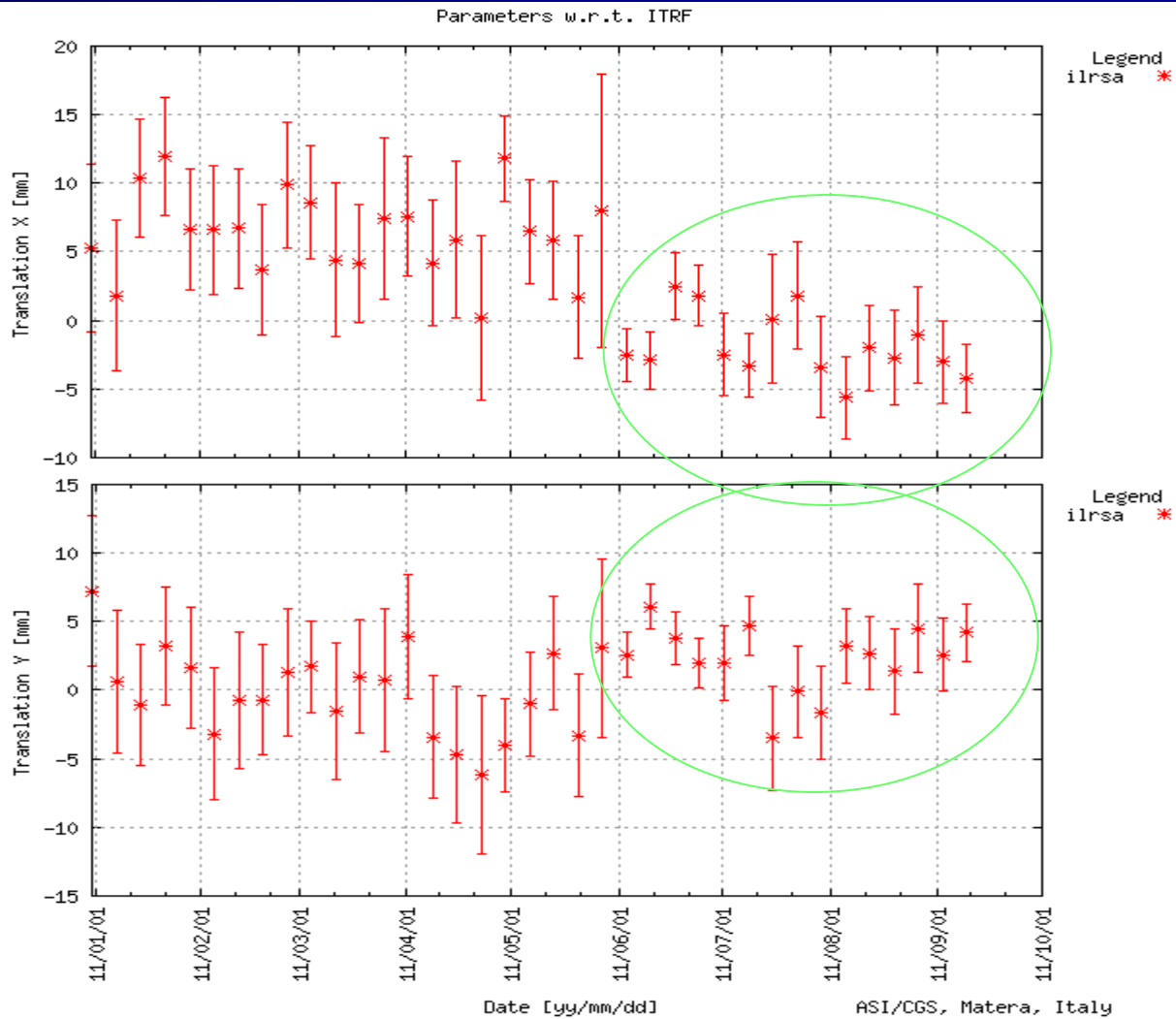
EOP residuals w.r.t. USNO EOP



EOP residuals w.r.t. USNO EOP



Translations w.r.t. ITRFXX

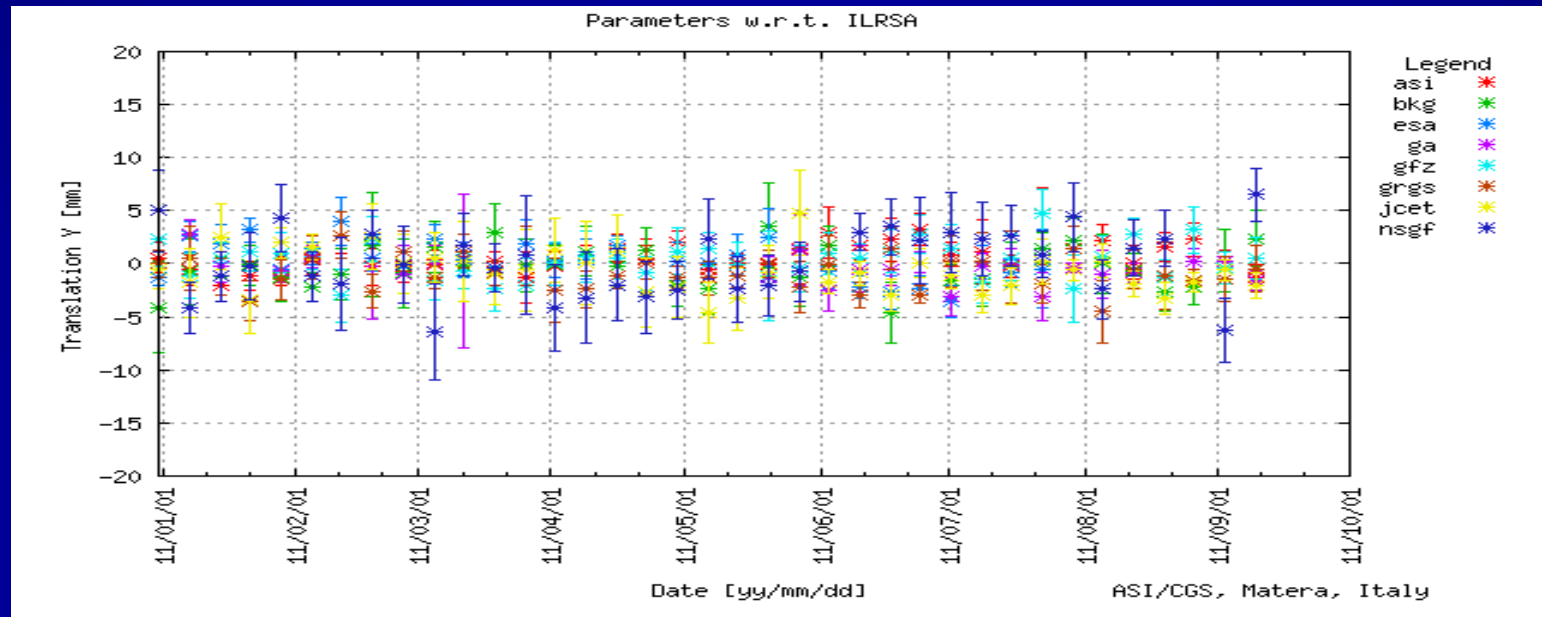


ITRF2008

Consistency of the contributing solutions

A major issue in the combination is the consistency among contributing solutions, to be monitored carefully.

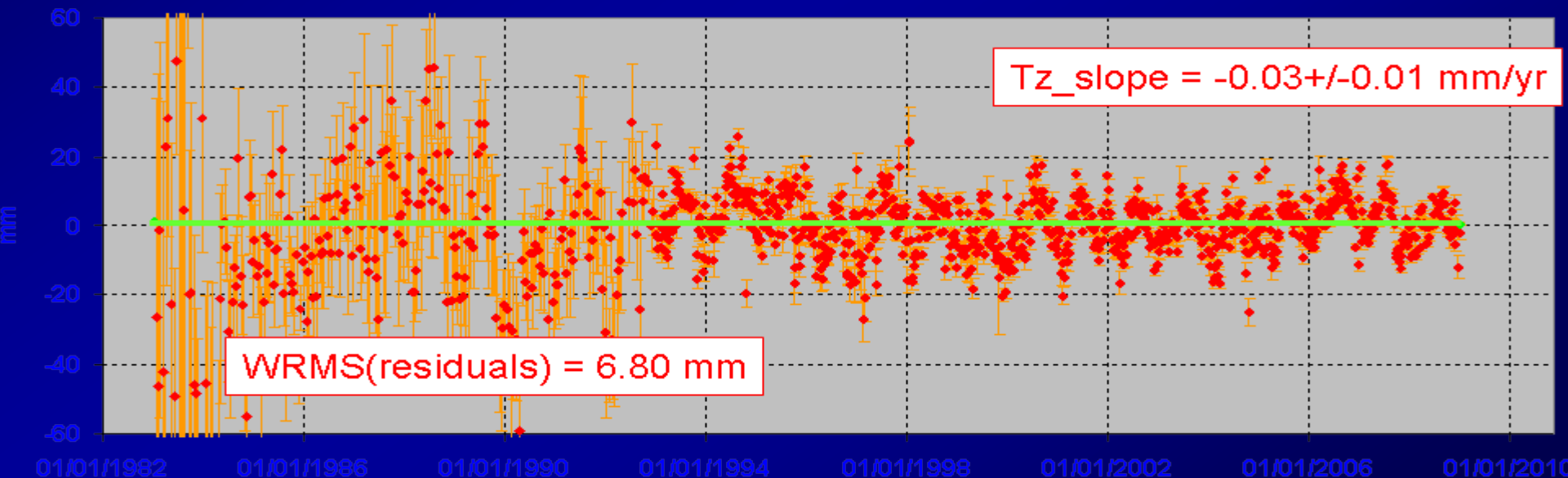
It impacts the quality of the final combined products as the **inconsistencies** (different application/estimation of system bias, existence of hidden constraints not traceable in the SINEX file, different conventions applied,...) might not be removed in the combination step. In particular, different treatment of **station biases** may cause incorrect and not physically interpretable coordinates estimation in the combined solution.



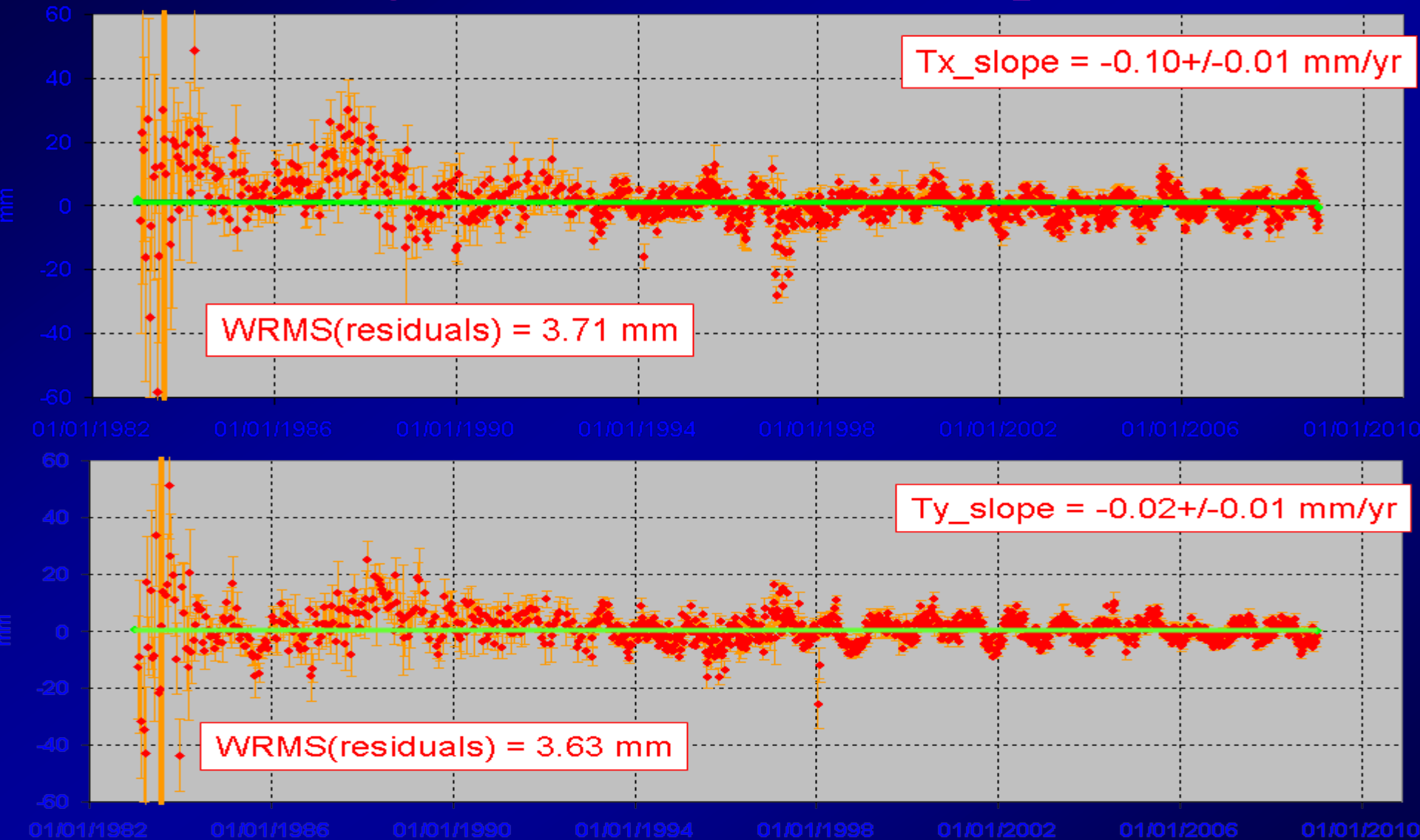
The long term combination products

Individual solutions consistency reflects in less noisy and more stable long term parameter series (e.g. Helmert translations) from the combined products, as the **ITRF2008 ILRS contribution** w.r.t. previous contributions.

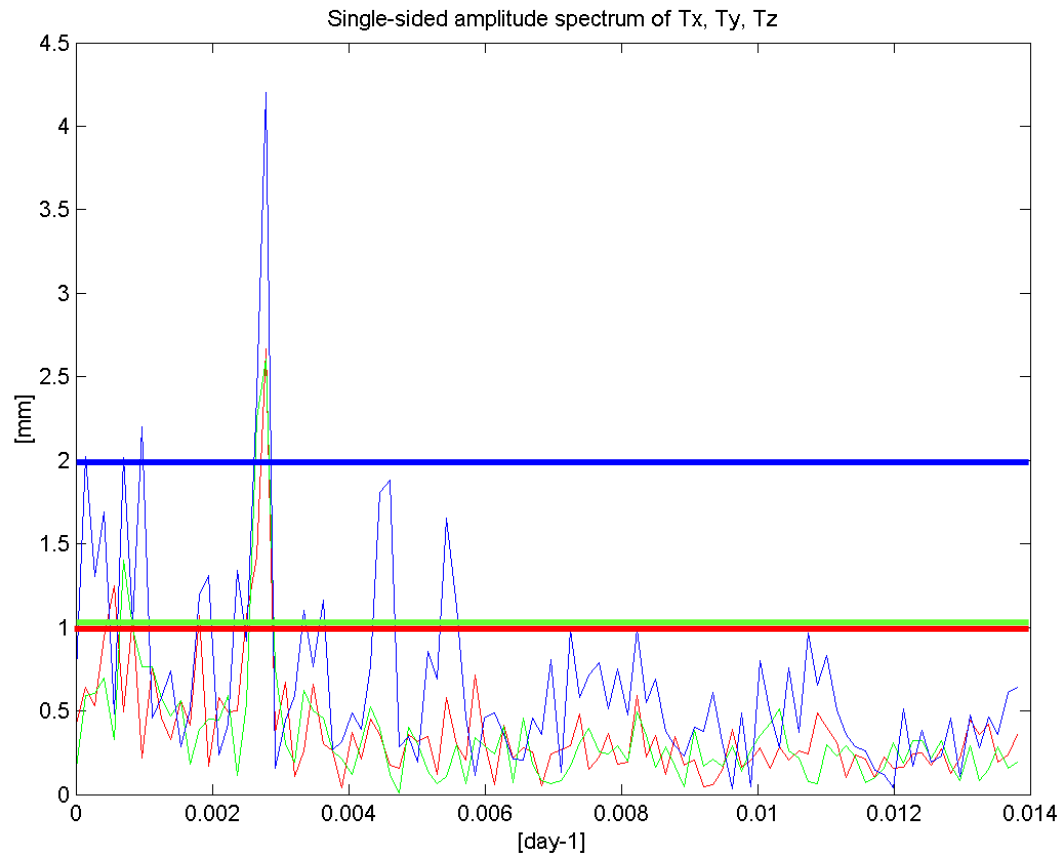
The detrended series, 1993 onwards, show clearly annual periodic signals, with amplitude of 2-3 mm order.



The long term combination products



The long term combination products



Final remarks

- Several ILRS operational combination products are available to the users (CDDIS, EDC) providing SSC/EOP parameters at daily/weekly issue frequency.
 - The ACs and CCs production flow will be soon updated to include geopotential low degree coefficients and satellite orbit state vectors.
 - The quality of the combination products depends on several factors, a key one is the individual solutions consistency, influenced by the correct data handling.
 - Tools to monitor the quality of the products are available; the quality of the operational combination products has allowed to produce ILRS long term combination products to contribute to the latest ITRF construction.
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