3036

Two-fold Quality Assessment of Global SLR Data

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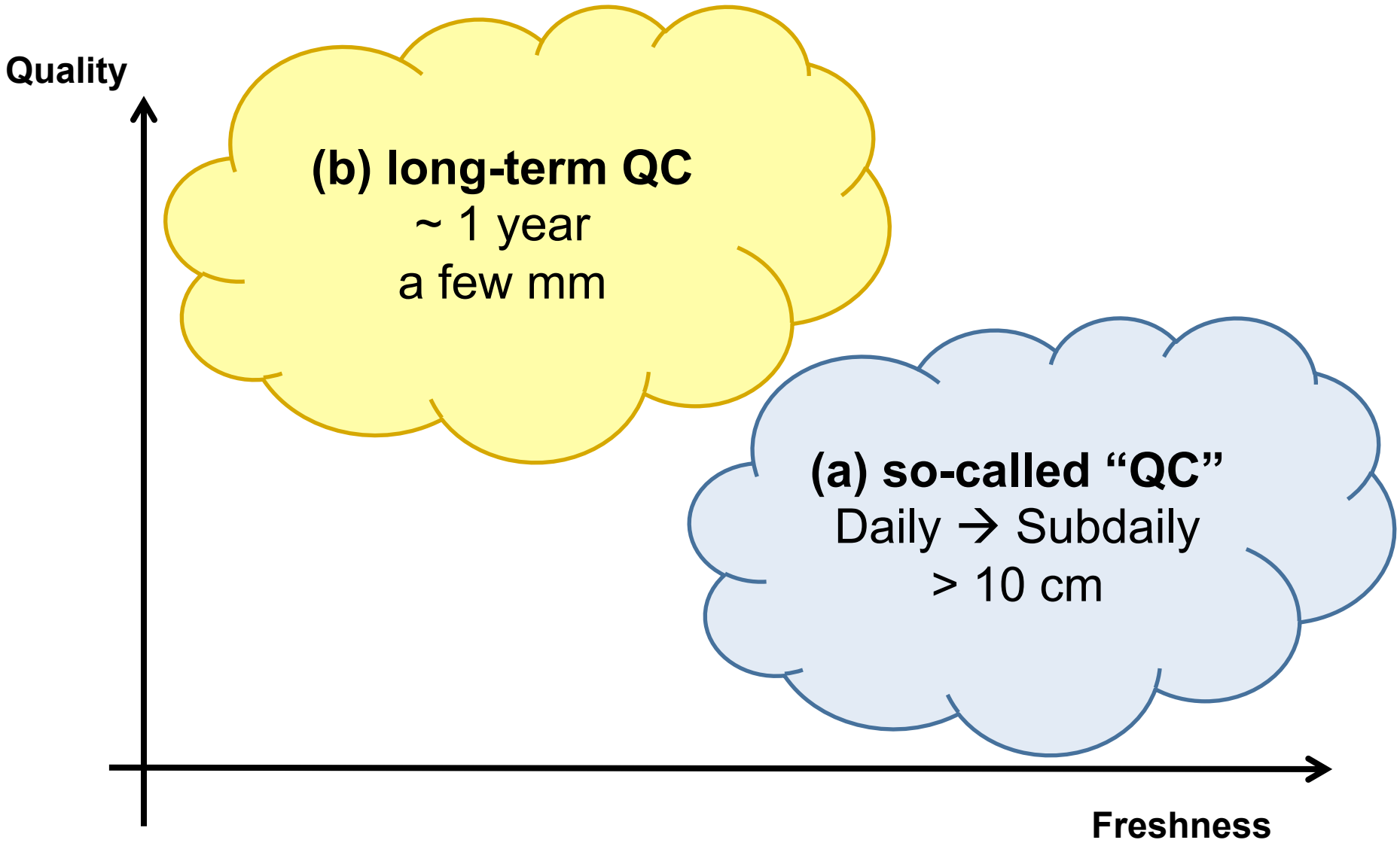
Two-fold?


Quality
(b) long-term QC
~ 1 year
a few mm
(a) so-called "QC"
Daily → Subdaily
> 10 cm
Freshness

Two-fold QC

(a) Fresh (but less precise)

So-called "QC". 1 to 2 weeks span.

Pass-by-pass biases derived from POD residuals.

HIT-U: 6-hourly report being issued. Auto-detection & notification implemented. SARAL added. NEW!!

Effective way to quickly find large-scale (> 10 cm) errors.

(b) Precise (but less fresh)

Long-term analysis (~ 1 year).

Already demonstrated with intensity and calibration (2005-06). NEW!!

Wrt new components.

Effective way to find systematic errors at a mm level.

[v2] Multi-satellite bias ...

geo.science.hit-u.ac.jp/slr/bias/

よく見るページ Firefox を使いこなそう Import to Mendeley

Geoscience Hitotsubashi

Multi-Satellite Bias Analysis Report v2

for Worldwide Satellite Laser Ranging Stations

being updated every 6 hours!

Latest Analysis Report: >> from 06h UTC, 29 Sep 2014 to 06h UTC, 13 Oct 2014 (updated 08:14 UTC, 13 Oct 2014)

Stations with high productivity

sat	orbit fit WRMS in mm	# pass/# NP	1st site(ID)	# pass/# NP	2nd site(ID)	# pass/# NP	3rd site(ID)	# pass/# NP
Lageos-1	11	481 / 4069	Yarragadee (7090)	51/532	Mt Stromlo (7825)	50/493	Changchun (7237)	31/161
Lageos-2	11	313 / 3389	Yarragadee (7090)	47/725	Mt Stromlo (7825)	43/533	Matera (7941)	25/298
Etalon-1	13	73 / 421	Yarragadee (7090)	10/73	Changchun (7237)	8/26	Matera (7941)	6/72
Etalon-2	12	59 / 371	Yarragadee (7090)	13/101	Mt Stromlo (7825)	11/39	Zimmerwald (7810)	6/62
Ajisai	22	537 / 6239	Yarragadee (7090)	72/1185	Mt Stromlo (7825)	66/733	Changchun (7237)	48/322
Lares	16	323 / 3306	Yarragadee (7090)	45/763	Changchun (7237)	41/243	Mt Stromlo (7825)	32/327
Starlette	18	372 / 3532	Yarragadee (7090)	59/742	Mt Stromlo (7825)	59/641	Changchun (7237)	36/181
Stella	27	227 / 1863	Yarragadee (7090)	34/396	Mt Stromlo (7825)	30/258	Changchun (7237)	26/128

and more satellites (GNSS and LEO) are included in the reports!!

Archive: (each covers 14 days from the date) 2013 2012 v1: Year 2011 2010 2009 2008 2007 2006 2005

Sep 2014	Aug 2014	Jul 2014	Jun 2014	May 2014	Apr 2014	Mar 2014	Feb 2014	Jan 2014
29 (00 06)	31 (00 06 12 18)	31 (00 06 12 18)	30 (00 06 12 18)	31 (00 06 12 18)	30 (00 06 12 18)	31 (00 06 12 18)	28 (00 06 12 18)	31 (00 06 12 18)
28 (00 06 12 18)	30 (00 06 12)							
27 (00 06 12 18)	29 (00 06 12)							
26 (00 06 12 18)	28 (00 06 12)							
25 (00 06 12 18)	27 (00 06 12)							
24 (00 06 12 18)	26 (00 06 12)							

http://geo.science.hit-u.ac.jp/slr/bias/

```
 AJI1 7090 2014/10/13 03:50   8      -0 (     5 )       0.1 (    3.1 )     4   0 /  1
#
#  7105 = WASHINGTON
# sat site       date  time dur   rb mm   error        tb us    error    prec bad tota
 JAS2 7105 2014/09/30 17:20   3     -42 (     5 )       12.0 (    2.4 )     1   0 /  1
 LAG2 7105 2014/09/30 17:25   6     -20 (     4 )   -------.- ( ----.- )     1   0 /
 STRL 7105 2014/09/30 17:35  11     -23 (     4 )        2.7 (    0.9 )     3   0 /  2
 STEL 7105 2014/09/30 18:29   6       3 (     5 )        6.4 (    1.2 )     2   0 /  1
 LARS 7105 2014/09/30 18:36  11     -14 (     4 )       -1.5 (    1.4 )     3   0 /  2
 LAG1 7105 2014/10/01 00:03  23      -7 (     2 )       -0.3 (    3.2 )     3   0 /
 GL29 7105 2014/10/01 00:38   2      12 (     9 )   -------.- ( ----.- )     2   0 /
 LAG2 7105 2014/10/01 23:18  16       5 (     3 )       -8.7 (    5.9 )     1   0 /
 GL09 7105 2014/10/02 01:33   3     -20 (     8 )   -------.- ( ----.- )     3   0 /
 LAG1 7105 2014/10/02 02:09  40      -6 (     1 )        3.0 (    0.8 )     2   0 /  2
 AJI1 7105 2014/10/02 02:38   1      12 (    14 )   -------.- ( ----.- )     8   0 /
 ETA1 7105 2014/10/02 03:19  52     -12 (     9 )   -------.- ( ----.- )     6   0 /
 AJI1 7105 2014/10/02 04:33   9      23 (     4 )        1.3 (    1.2 )     1   0 /  2
 LAG1 7105 2014/10/02 05:40  34      -1 (     2 )       -1.2 (    1.1 )     1   0 /  1
 JAS2 7105 2014/10/02 06:16  11       3 (     3 )        1.4 (    0.7 )     2   0 /  4
 STEL 7105 2014/10/02 06:19   0     -25 (    14 )   -------.- ( ----.- )     5   0 /
 LARS 7105 2014/10/02 06:28   6      -8 (     6 )       -1.8 (    2.8 )     3   0 /  1
 AJI1 7105 2014/10/02 06:35  14       7 (     3 )        2.1 (    0.9 )     2   0 /  3
 STEL 7105 2014/10/02 07:57   4       1 (     4 )        5.8 (    1.2 )     1   0 /  1
 AJI1 7105 2014/10/02 08:46   6     -25 (    11 )        9.4 (    3.2 )     1   0 /  1
```

Two-fold QC

(a) Fresh (but less precise)

- So-called "QC". 1 to 2 weeks span.
- Pass-by-pass biases derived from POD residuals.
- HIT-U: 6-hourly report being issued. Auto-detection & notification implemented. SARAL added. NEW!!
- Effective way to quickly find large-scale (> 10 cm) errors.

(b) Precise (but less fresh)

ILRS Global Performance Card falls into this category. See Torrence's poster.

- Long-term analysis (~ 1 year).
- Already demonstrated with intensity and calibration (2005-06). NEW!!
- Wrt new components.
- Effective way to find systematic errors at a mm level.

QC (b): Sorting parameters

Test #1:
Single-shot returns per NP bin

Test #2:
Single-shot RMS in a NP bin

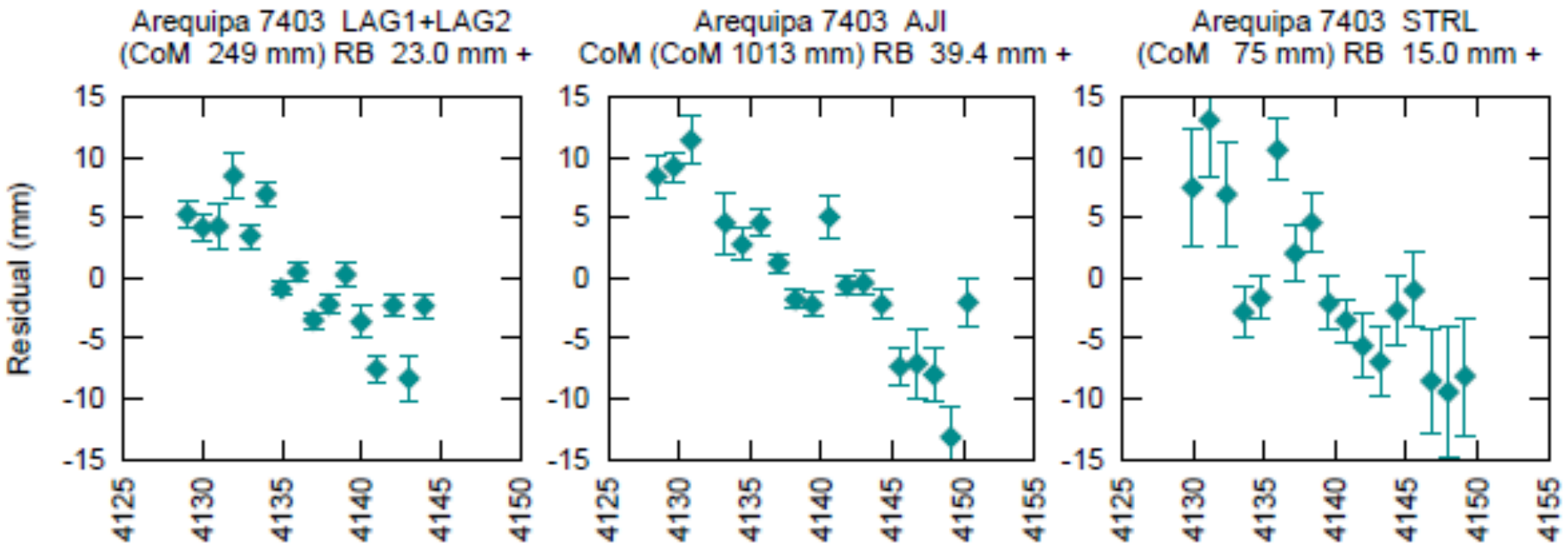
Test #3:
System delay (calibration)

Test #4:
Time to the nearest calibration

Test #5:
Range rate

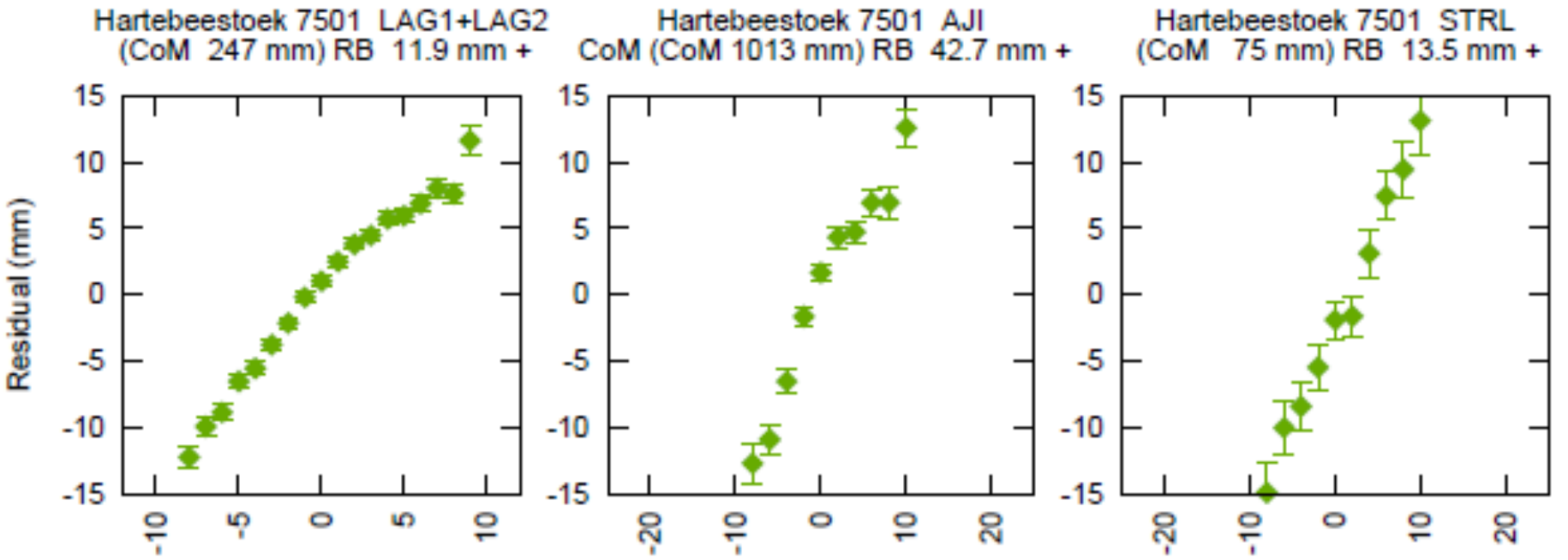
Test #6:
Time of day

Test #3:
System delay (calibration)



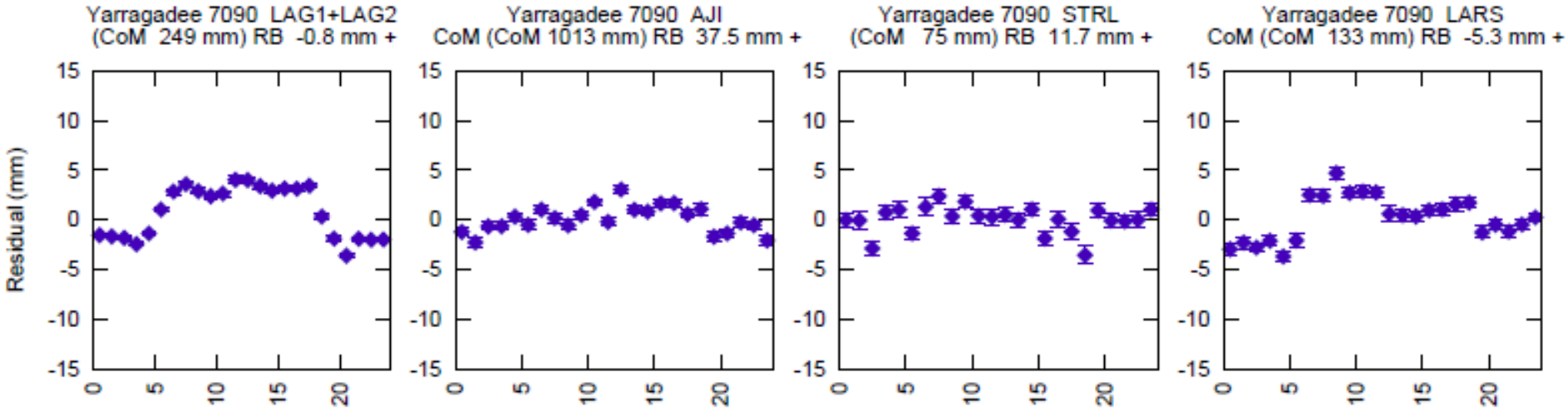
Calibration not working properly

Test #5:
Range rate



Time bias (> a few μs) suspected.

Test #6:
Time of day



Day/Night range difference?

Visit our poster &
Attend the clinic session

Station-by-station assessment available

> 1000 charts in total! (To be placed on the web later)

Various systematic trends (possible errors) detected.

There is a risk of false alarm. ← POD is not perfect.

Station-Analyst interaction

Enjoy the afternoon session!

3141

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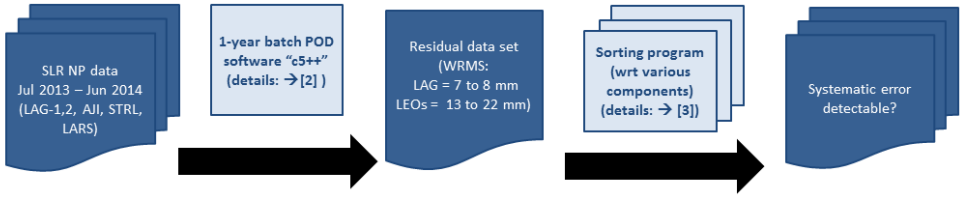
Systematic Range Error 2013-2014

Toshimichi Otsubo Hitotsubashi University, Japan (Email: t.otsubo@r.hit-u.ac.jp)

[1] Residual Analysis: Procedure Overview



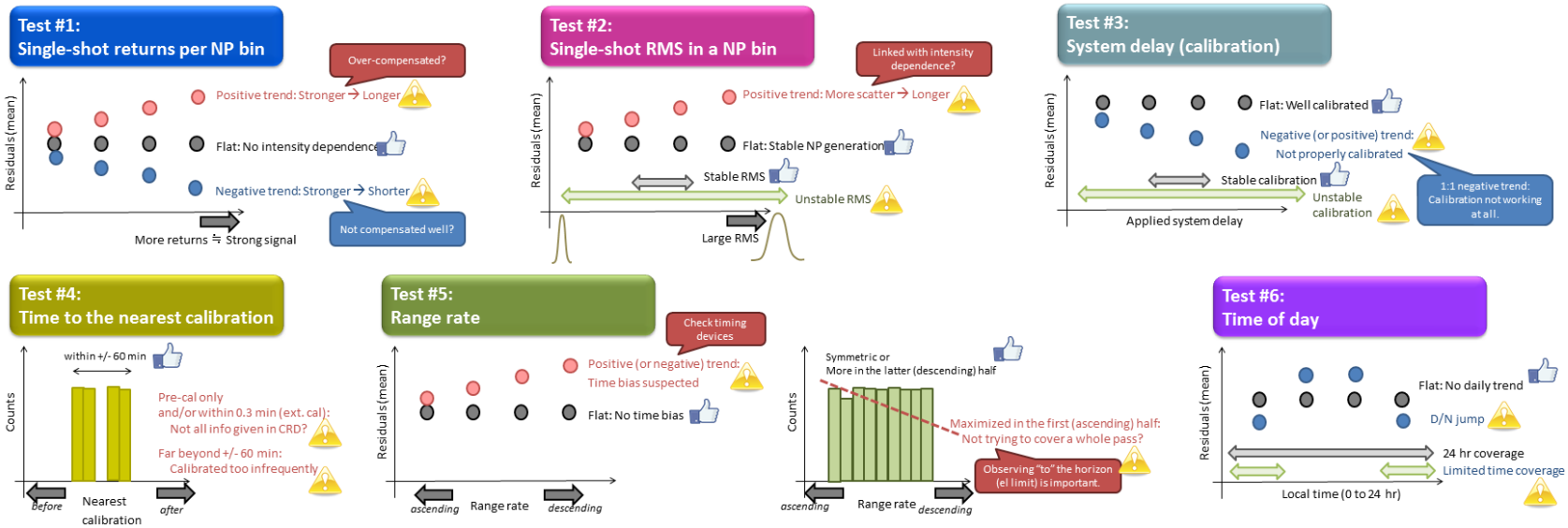
[2] POD Analysis Settings

Different from the 6-hourly QC analysis

Software "c5++"

- 5 satellites (LAG1+2, AJI, STRL, LARES). One-year batch.
- Orbit: 5-day arc for LAGEOS-1 and -2. 3-day arc for LEOs.
- Station-dependent CoM correction for LAG1+2 & AJI.
- Acceleration parameters: Gravity field 4x4 as 1-year common params, and 5 empirical params twice per arc.
- Station coordinates: all solved for with loose constraints. Velocity fixed to SLRF2008.
- Range bias: solved for per station per satellite types ("LAG1+2", "AJI", "STRL", "LARES")

[3] Sorting Procedures and Checklist



[4] Station-by-station diagnosis (more than 1000 charts!)

Please do not take them way until the end of Friday's clinic session.

Find your station's charts below!

- We recommend the representatives of each station to review the observation procedure or hardware especially if a comment tag is attached.
- Note that the post-fit residuals are the mixture of the measurement error at a station and the model error in our orbit computation. **There is a risk of false alarm.**

World Top 12 in data yield (total passes > 3500)

(after SLR Global Performance Report Card; see Torrence's poster in this workshop)

Yarragadee (7090), Changchun (7237), Zimmerwald (7810), Wettzell (8834), Graz (7839),

#13 to #25 (total passes > 1600)

San Juan (7406), Potsdam (7841), Arequipa (7403), Grasse (7845), Haleakala (7119),