Since 1998

Multi-Satellite Daily Bias Report: How to Read and Handle it

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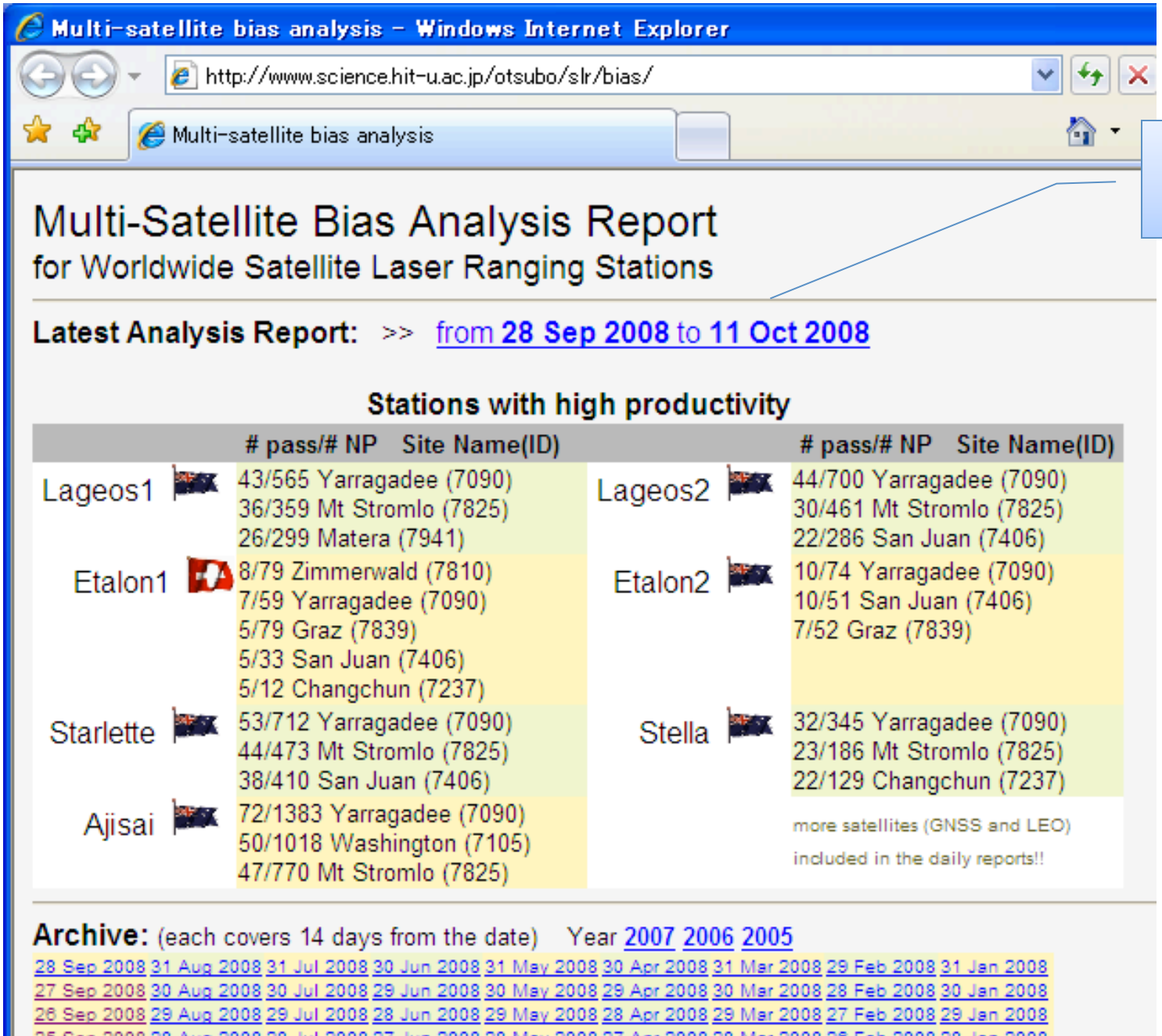
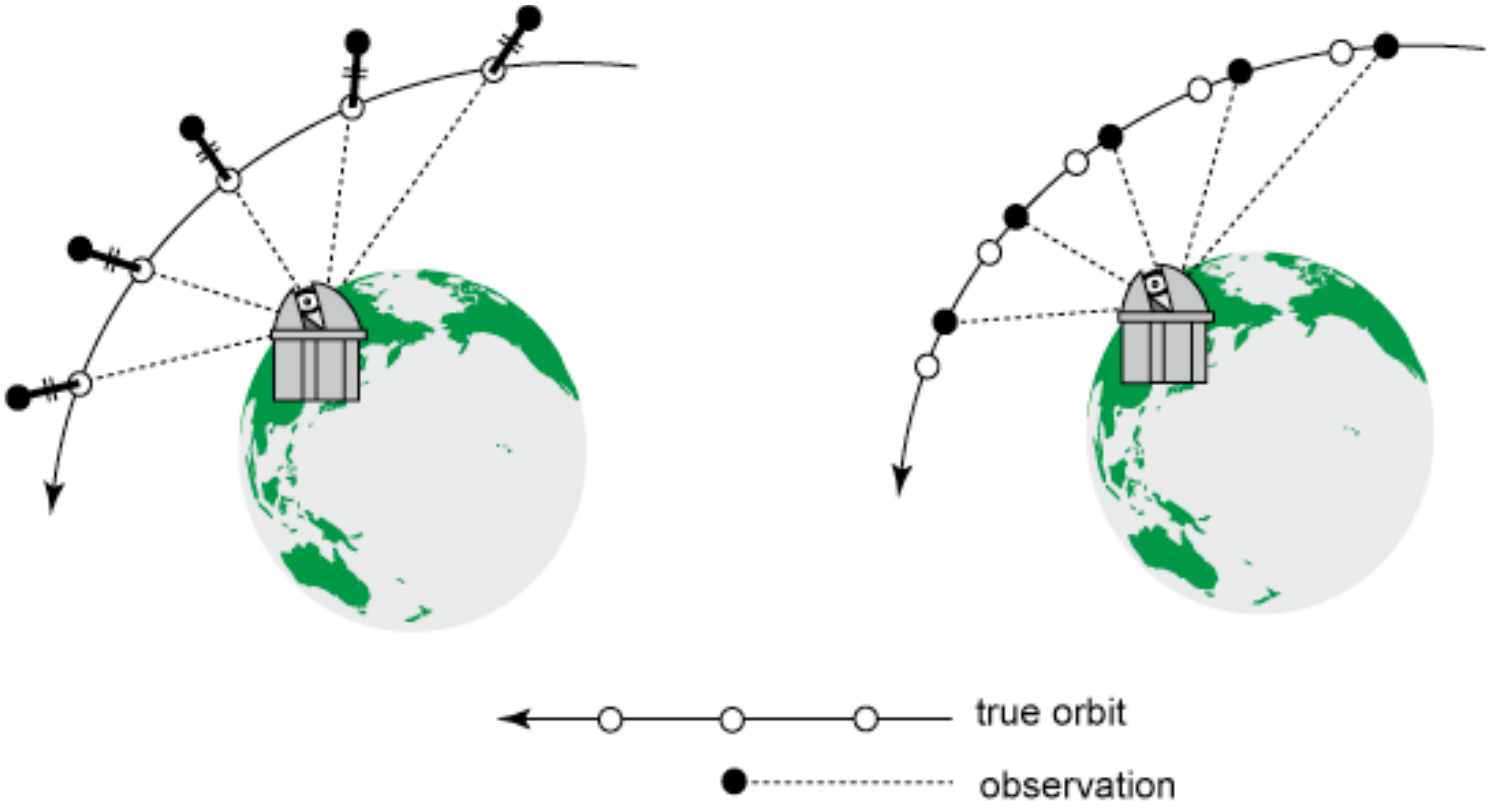
16th International Workshop on Laser Ranging, Poznan, 13-17 Oct,

URL: http://www.science.hit-u.ac.jp/otsubo/slr/bias



Click

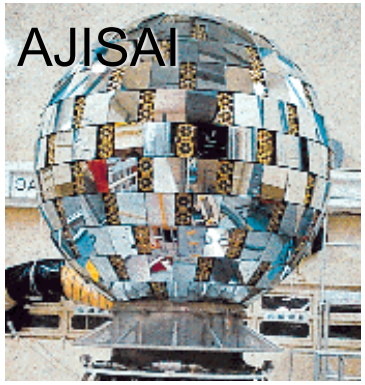
Range bias & time bias

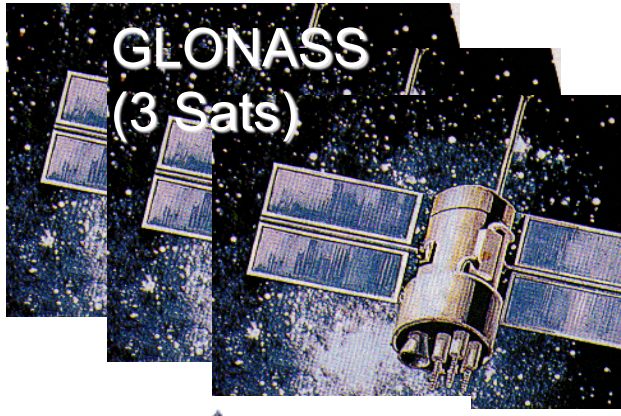


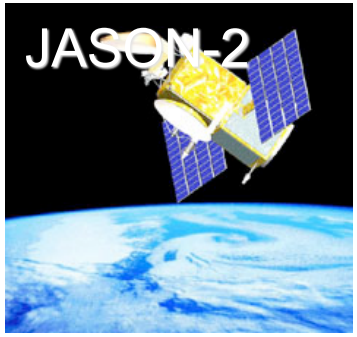

```
# 7811 = BOROWIEC
# sat site date       time dur  rb mm error      tb us error  prec bad tot
 JAS2 7811 2008/09/13 00:35  1      6 (  7 ) --------.- ( --.- )  2 0 / 4
 LAG1 7811 2008/09/13 02:17 15     -1 ( 11 )     -24.6 ( 13.1 ) 16 0 / 9
```

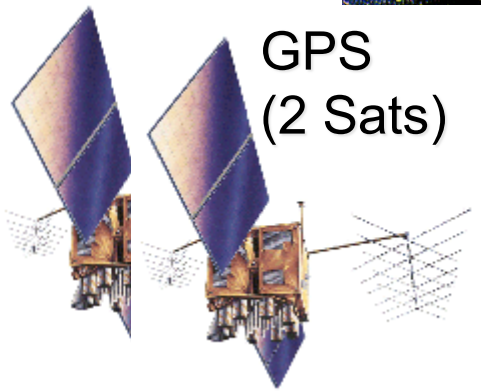
See the past proceedings papers on the analysis itself.

16 satellites being analised









Satellite pictures: © ILRS Web

Why Multi-Satellite?

Low and High Satellites

- (**LAGEOS -1, -2** +) **Ajisai, Starlette, Stella, JASON-1, -2, ERS-2, ENVISAT, ETALON-1, -2, GPS & GLONASS**

  (some of them sometimes dropped from the report because of a lack of observations, a bad fit of orbit, etc.)

- Make problems easily identified.

  LAGEOS observations NOT required.

  Time span of the problematic passes clearly seen.

  Frequency bias detectable.

  LEO-only or HEO-only problems detectable.

- Are not precisely determined compared to LAGEOS, but still useful for QC.

  Do not judge from just one pass.

NiCT

Daily Schedule for QC Analysis

- Automated Daily Procedure
  - Midnight, JST: Data download from CDDIS, EDC and USNO. File format arrangement, etc.
  - 6.30 am JST: Orbit determination (and orbit generation for tomorrow's analysis).
  - 9 to 10 am JST (=0 to 1h UT): Pass-by-pass residual analysis.
  - Upload the report card.
  - Update the webpage.
  - Checked by humans (not everyday).

When we find large biases…

Human Check :

- Is the bias large enough? Is it surely 'their' problem?
- Is the problem continuous, not a one-pass event?
- Has the problem already been solved?
- Who is a contact point of the station?

Then,

Hitotsubashi Univ

SLR Station

E-mail

Hello ABC station,
It seems your laser observations …
(Glad if you give me a reply!)

Since Oct Last Year
E-mail
(copy)

ILRS Task Force
[1]

Obvious biases reported to stations: 2008

[Sep, 2008] 1 or 2 or 3 RB ← laser multipulse

[Sep, 2008] < 2 m RB ← calibration (human) error.

[Jul, 2008] 1.2 km RB ← calibration error. System testing.

[Jul, 2008] 200 ms TB ← ??.

[Jun-Jul, 2008] 132 m RB ← ??.

[Jun, 2008] -20 ms TB ← hardware & software problem.

[Jun, 2008] 10 ms TB ← software (?)

[Apr, 2008] Non-existing station ID ← human error.

[Feb, 2008] Atm pressure error ← wire problem.

[Feb, 2008] 0.5 to 1.7 km RB (Freq bias?) ← ??

[Jan-Feb, 2008] 1 day TB (Wrong Day) ← ??

[Jan, 2008] 3 m RB ← laser multipulse.

[Jan, 2008] 18.6 ms TB ← event timer.

[Jan, 2008] < 2 m TB (LEO Only) ← ??

Great improvement in 10 years.

Quick feedback → Shortening error periods.

DIY for sub-cm accuracy

QC at Station
(NP generation stage)

Pass-by-pass QC
from ACs/AACs

Long-term sub-cm QC
through Collaboration

Worry about cm or sub-cm systematic error?

– ACs do not know what your error source would be.

Observer, Time since System Activation, Room Temperature, Signal Intensity, Optical Configuration, and much more!!

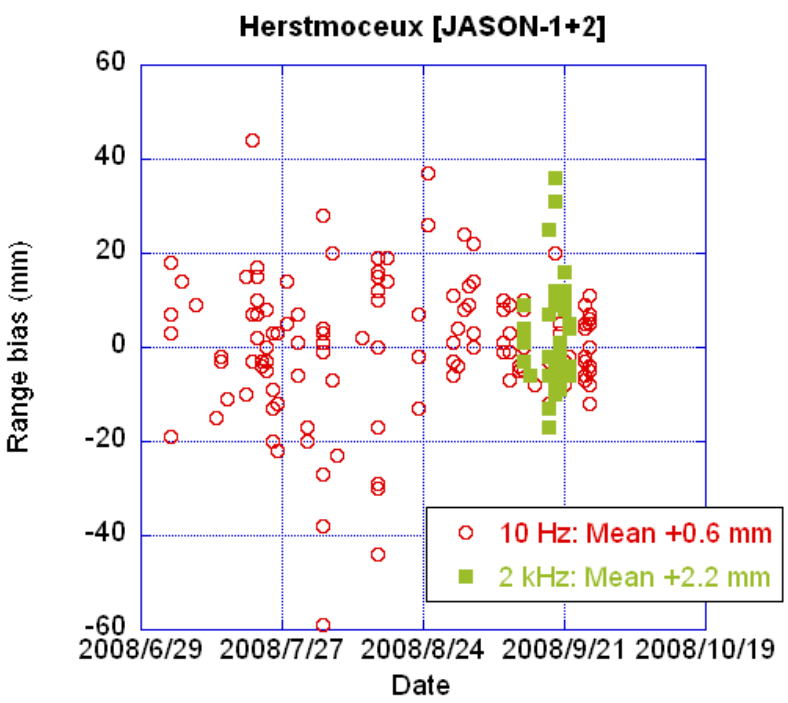
NiCT

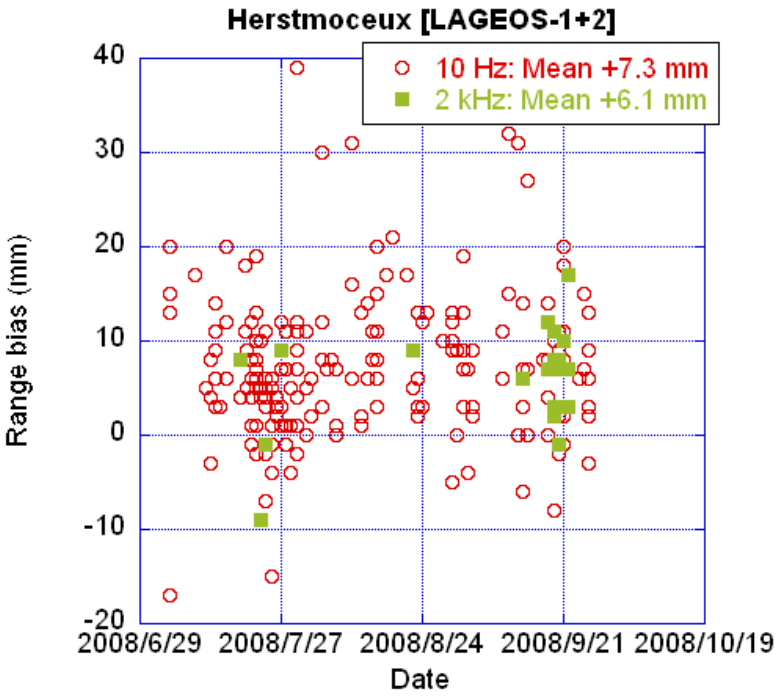
DIY: An Example

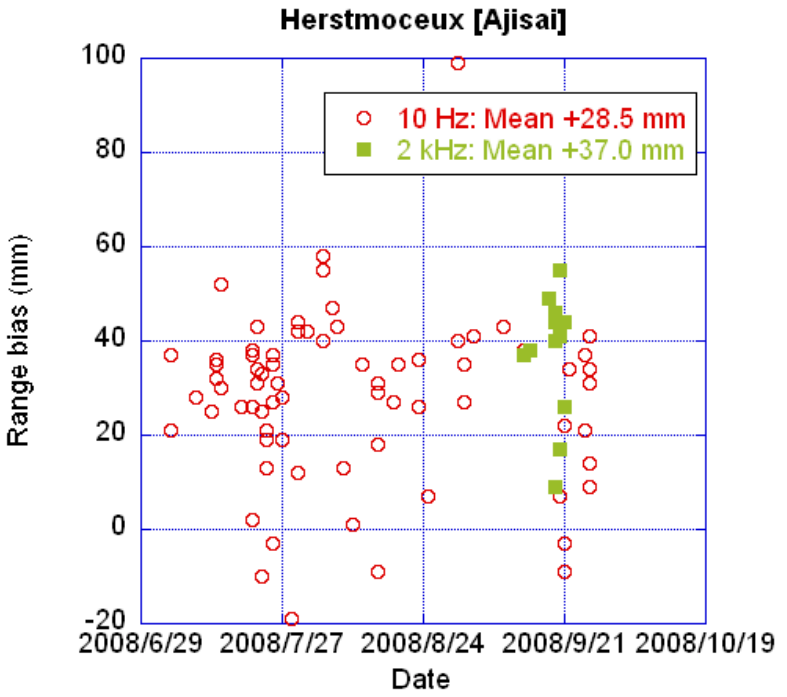
10-Hz* vs *2-kHz at Herstmonceux

- **SCI = 6: 10(+) Hz**
- **SCI = 7: 2 kHz**

→ Extract "Range bias" from daily reports (easy spreadsheet job)







Summary & Future works

Almost 10 Years' Continuous Run! CRL→NICT→HIT-U

- Powerful tool for detecting various type of problems.
- Many thanks to regular/occasional worldwide users!

Communications between stations and ACs

- Some E-mail address on ILRS Webpages was obsolete.
- Face-to-face workshop is important (thanks Stanislaw!).

Future works

- Better TRF (SLRF2008? Our own updates?)
- Shorter delay (24 hrs to a few hrs?).

Want to delete data? Yes, you can, with CRD.

- Some cases (wrong day, wrong station ID, etc) are NOT correctable/recoverable with the current framework.
- CRD: Set "Data Quality Alert Indicator" = "2".

Leap Second on 1 Jan 2009 !!

Last time: 1 Jan 2006

Stations

- Perfect job last time!
- 1 or 2 second time bias (even 1-day, 1-year time bias) seen in the past.
- Check the procedure after you go back home.

(ACs)

- Check the software. Handling of UT1-UTC is tricky.