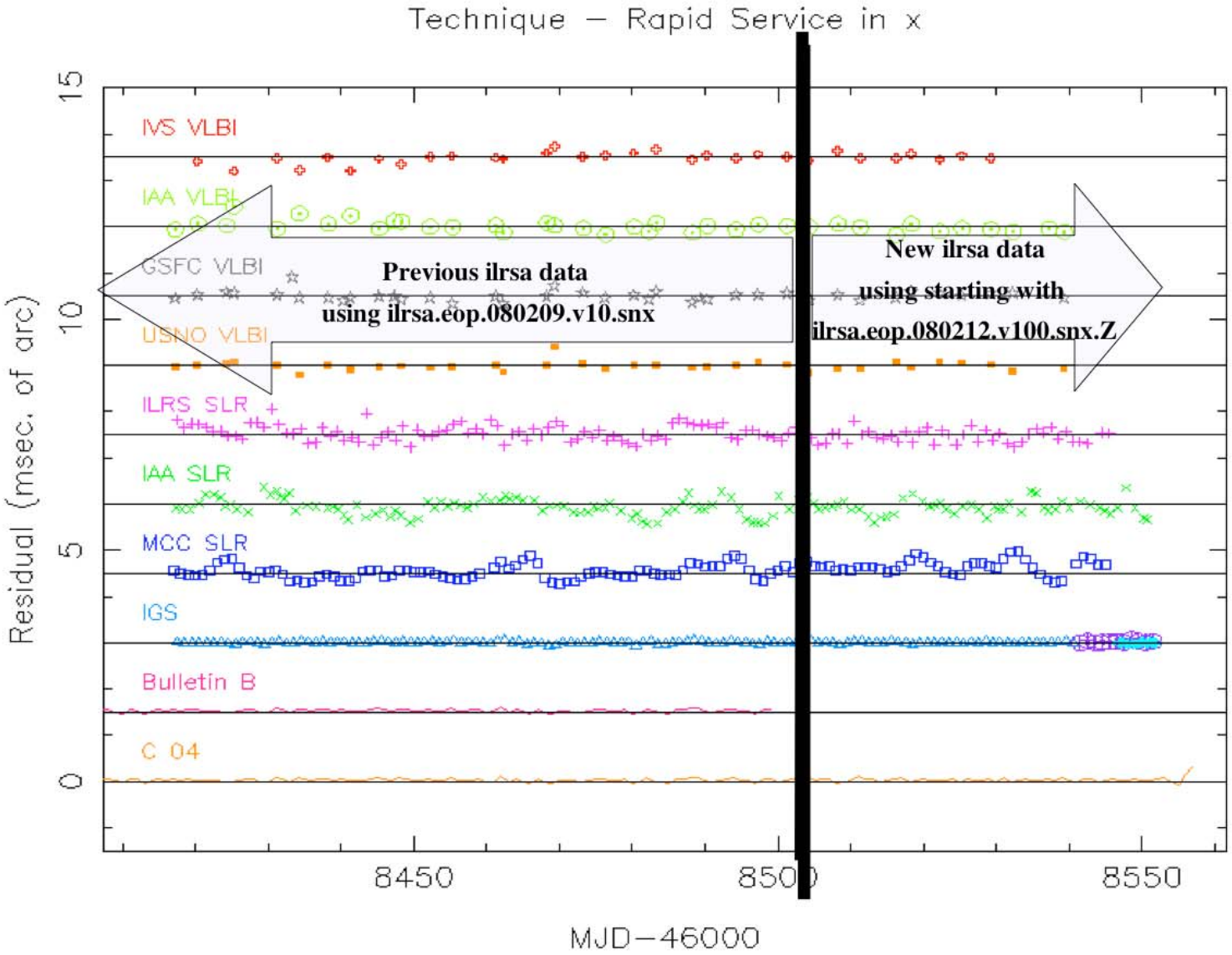
# ILRS NEWS

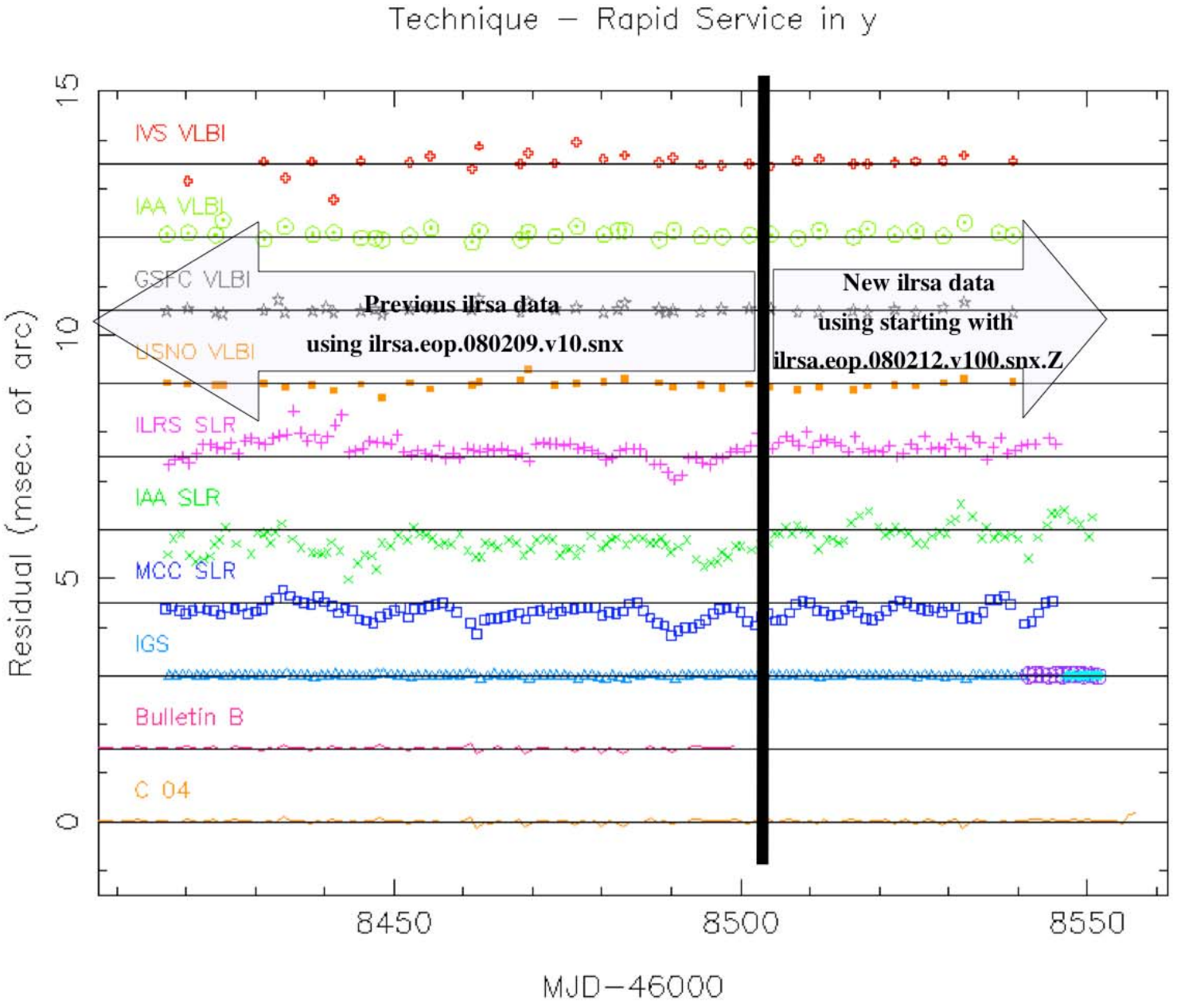
- GPS Campaign to track NEOL GPS-35 & -36 – *ongoing*
- Upcoming Launches:
  - **GIOVE-B** **April 27, 2008**
  - **OSTM/JASON-2** **June 2008**
  - **GOCE** **Summer/Fall 2008**
- LARES Mission approved by ASI (February 2008), launch 2009 (VEGA)
- SET Call for calibration issued – *first response for participation from Beijing*
- A "station status" service is nearly in place: http://aiuli3.unibe.ch:8000/slr/daystatus.y08
- Meetings of interest to the ILRS:
  - EGU meetings in Vienna – April 12 – 18:
    - **AWG (TUW,** April 12, 9 am - 6 pm**)**
    - **ILRS DF&P (TUW,** April 14, 3-5 pm**)**
    - **ILRS GB (TUW,** April 14, 5-8 pm**)**
    - **GGOS WG of GN&C (TUW,** April 16, 6-9 pm)
  - **IAG/FIGS Congress/Lisbon, Portugal – May 12 – 15, 2008**
  - **AOGS/Busan, S. Korea – June 16 – 20, 2008**
  - **GGEO2008/Chania, Crete, Greece – June 23 – 27, 2008**

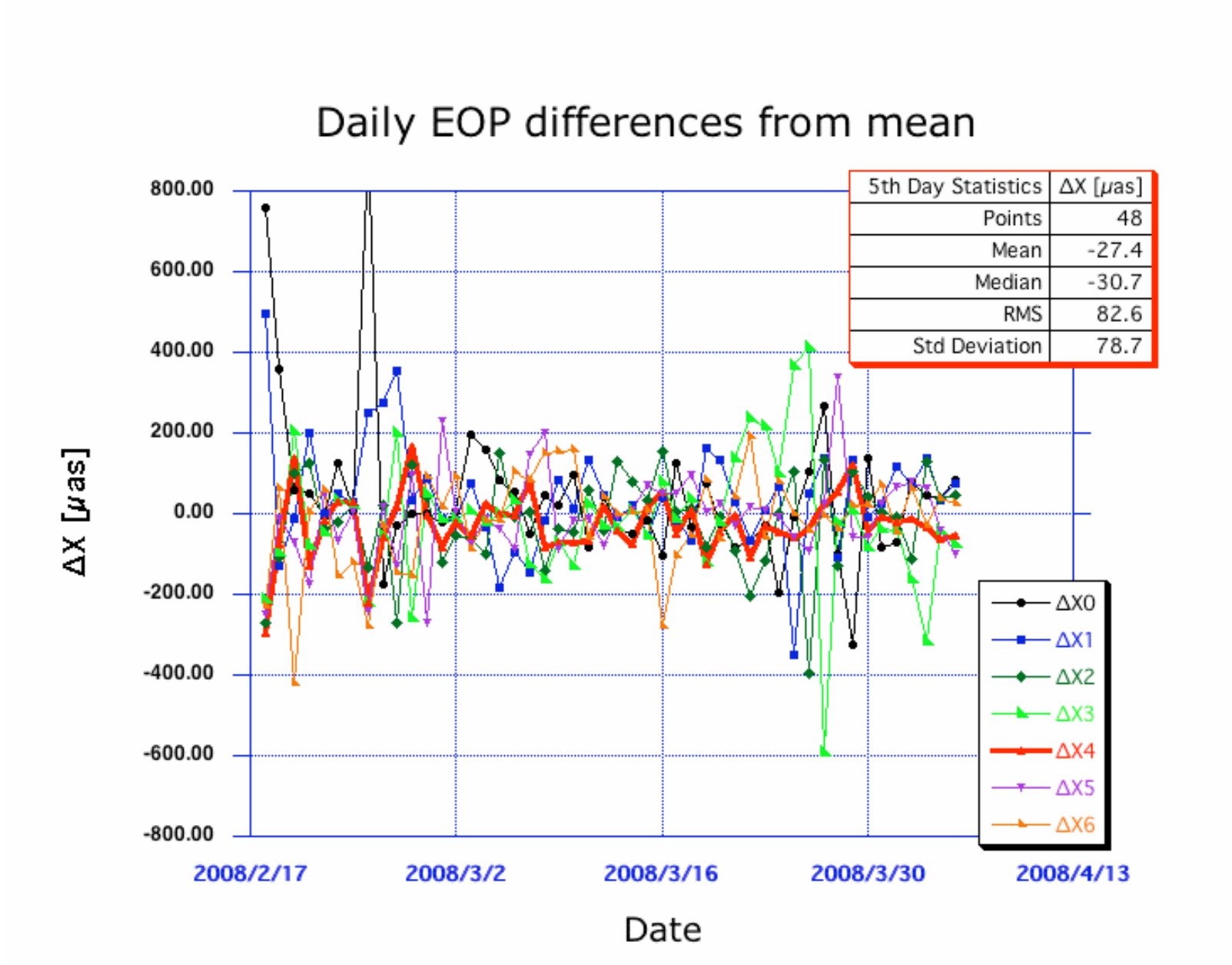
## DAILY EOP PRODUCT

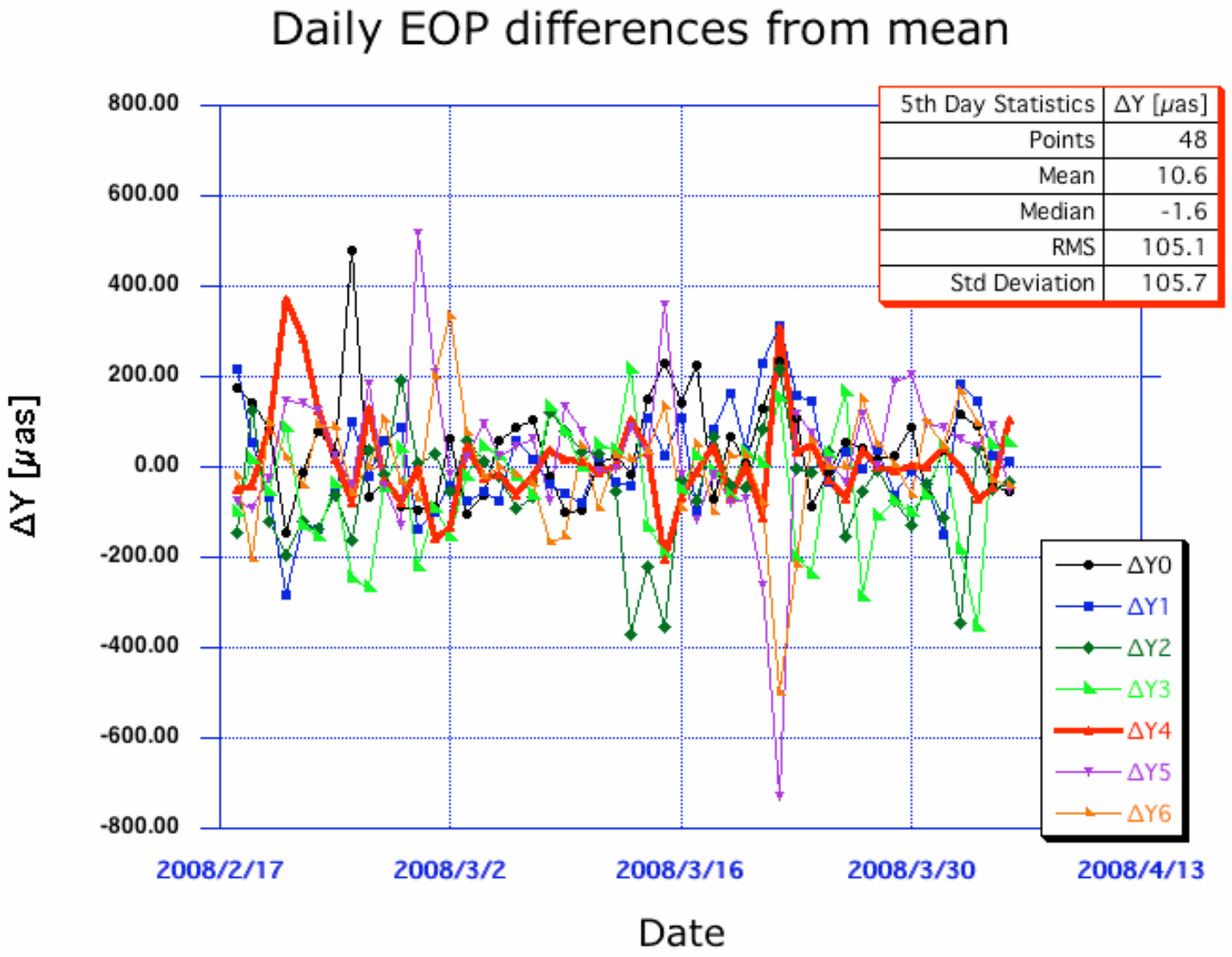
- ASI, BKG, GFZ, JCET and NSGF Contributing regularly since mid-February 2008
- NEOS has provided some preliminary evaluation results wrt to IERS EOP
- Internal precision (repeatability) analysis shows that we can deliver Polar motion to ~ 80-100 μas and LOD to ~ 45 μts
- We need more ACs to contribute and we also need to ensure that all of the contributing ACs use the correct standards and conventions (2003)

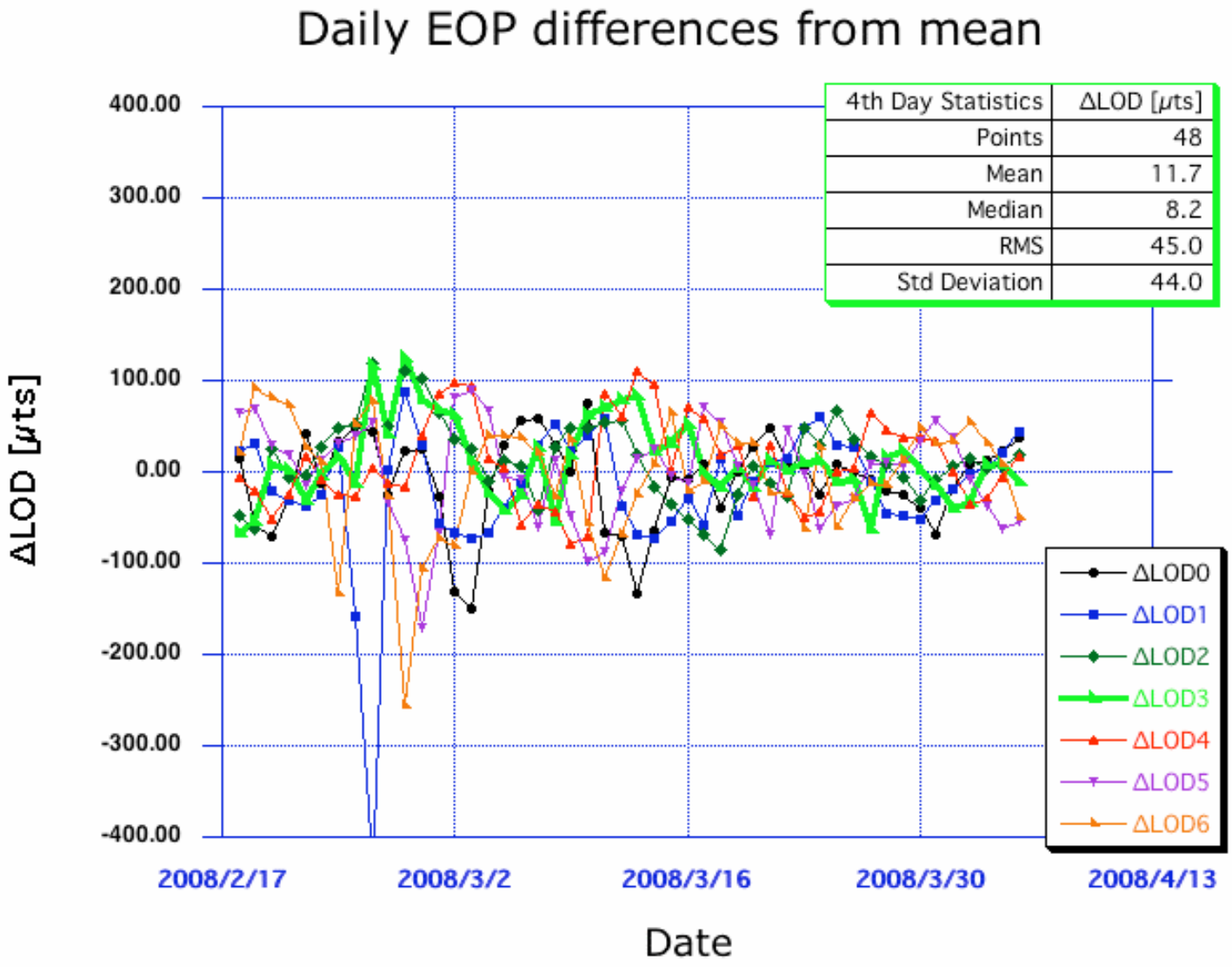
Shift of 3 in data




Technique – Rapid Service in y
Residual (msec. of arc)
15
10
5
0
IVS VLBI
IAA VLBI
GSFC VLBI
USNO VLBI
ILRS SLR
IAA SLR
MCC SLR
IGS
Bulletín B
C 04
Previous ilrsa data
using ilrsa.eop.080209.v10.snx
New ilrsa data
using starting with
ilrsa.eop.080212.v100.snx.Z
8450
8500
8550
MJD−46000


Daily EOP differences from mean
5th Day Statistics
ΔX [μas]
Points
48
Mean
-27.4
Median
-30.7
RMS
82.6
Std Deviation
78.7
800.00
600.00
400.00
200.00
0.00
-200.00
-400.00
-600.00
-800.00
ΔX [μas]
2008/2/17
2008/3/2
2008/3/16
2008/3/30
2008/4/13
Date
ΔX0
ΔX1
ΔX2
ΔX3
ΔX4
ΔX5
ΔX6


Daily EOP differences from mean
5th Day Statistics
ΔY [μas]
Points
48
Mean
10.6
Median
-1.6
RMS
105.1
Std Deviation
105.7
800.00
600.00
400.00
200.00
0.00
-200.00
-400.00
-600.00
-800.00
ΔY [μas]
ΔY0
ΔY1
ΔY2
ΔY3
ΔY4
ΔY5
ΔY6
2008/2/17
2008/3/2
2008/3/16
2008/3/30
2008/4/13
Date


Daily EOP differences from mean
4th Day Statistics | ΔLOD [μts]
Points | 48
Mean | 11.7
Median | 8.2
RMS | 45.0
Std Deviation | 44.0
400.00
300.00
200.00
100.00
0.00
-100.00
-200.00
-300.00
-400.00
ΔLOD [μts]
2008/2/17
2008/3/2
2008/3/16
2008/3/30
2008/4/13
Date
ΔLOD0
ΔLOD1
ΔLOD2
ΔLOD3
ΔLOD4
ΔLOD5
ΔLOD6

# Unified Analysis Workshop 2007 Action Items

| | | | |
|---|---|---|---|
| 5 | **SINEX Extension of Parameterization / Naming:** | | |
| 5a | SINEX Proposal 2 will be distributed to all interested groups. The new version of SINEX should exclusively use new names. Old names are still supported for all older SINEX versions. | IERS ACoo | 10-DEC-07 |
| **5b** | **Feedback of groups until** | **All** | 18-FEB-08 |
| **5c** | **Distribution of final SINEX version description** | IERS ACoo | 25-FEB-08 |
| 5d | Make a distinction between SINEX files for combination purposes and other purposes in the file name → convention. Proposal by Axel Nothnagel. | Nothnagel | **NO NEWS**<br>10-DEC-07<br>**2 PROPOSALS** |
| 6 | **Atmospheric Loading:** | | |
| **6a** | **Reference pressure for atmospheric loading:** Johannes Böhm checks the deviations of GPT and ISO standard from a correct mean pressure field. | Böhm | 31-JAN-08 |
| **6b** | **Correction of atmospheric loading on the weekly, daily or on observation level? Check IERS WS 2007 recommendation. Böhm, Tesmer, van Dam, MacMillan, Pavlis to perform tests to assess the difference between application on the obs. and SINEX level (daily/weekly).** | Van Dam | 31-MAR-08<br>**NO NEWS** |
| 8 | **Generation of daily SINEX files:** | | |
| **8a** | Generation of daily SINEX files by VLBI (intensive sessions) and by GPS (rapid solutions). ACs are encouraged to submit daily SINEX files containing site coordinates, EOPs based on their rapid solutions. 24-hour data interval for GPS. **ILRS/IDS will discuss how they could contribute.** | IVS, IGS | 01-MAR-08 |
| 8b | Intra-technique combination of daily SINEX files as a pilot phase | Ferland, Nothnagel | 01-JUL-08 |
| 8c | Combination of daily SINEX files by interested groups as a pilot phase based on individual ACs | GFZ, OP, (IGN), (IGGB) | 01-JUL-08 |
| 9 | **Benchmarking of diverse models in the software packages**, that are common to all techniques. Which models should be checked? Put together a list with priorities. Technique-specific effects should be checked by technique services, common models should be checked on the IERS/GGOS level. Use UAW exploder. | Tim Springer | 15-JAN-08<br>**NO NEWS** |

| | | | |
|---|---|---|---|
| 10 | **Work towards a representation of parameters by piece-wise linear offsets (instead of offsets and rates):** | **Services**, IERS | **NO NEWS** |
| 10a | Generate SINEX files for the test period of CONT'05 with piece-wise linear ERPs (using the new SINEX format version) and, if possible, with the old representation (offsets and drifts) | ACs: CODE, ESA, DGFI, IGGB, … | 01-JUL-08 |
| 10b | ITRF CCs and other combination groups test the combination based on the new representation | ITRF CC, others | 01-OCT-08 |
| 10c | A priori representation of the ERPs: ACs should converge to a unique representation (interpolation) of the a priori ERP values as a linear function (linear interpolation) between the vertices. Further discussion by e-mail (UAW). | IERS ACoo, ACs | 01-OCT-08 |
| 11 | **Parameterization for ITRF20xx generation:** | | For the next generation of SINEX time series for ITRF (ca. end 2008) |
| 11a | 1) Add quasar coordinates to the SINEX files | IVS | |
| 11b | 2) All techniques should include polar motion rates in the SINEX files | All Services | |
| **11c** | **3) Low-degree harmonics of the gravity field from SLR (degree/order 2)** | **ILRS** | |
| 12 | **Modeling standards for next ITRF generation:** | **Services** | See AI 11 |
| **12c** | **1) FES2004 or GOT4.7b are recommended as ocean tide model for site displacements (Note: new values should be downloaded because of a model update of FES2004)** | All Services | |
| **12d** | **2) Atmospheric loading should be reconsidered after the tests by van Dam et al.** | | |
| 12e | 3) Consistency with gravity (FES2004 etc.) should be considered as well. | IGS ACoo | |
| 12f | Check consistency of the above options with the IGS reprocessing options. | IGS ACoo | |
| 13 | **Documentation of AC modeling and parameterization standards:** | | |
| 13a | Technique-specific forms (a template) are provided by IVS, IGS, **ILRS**, IDS. (ask Hermann Drewes about his activity here as GGOS WG Chair !!) | IVS, IGS, ILRS, IDS, CBs | 20-DEC-07 |
| 13b | Generation of a unified form, if not already done by H. Drewes (check also standards sheet by GGOS-D for completeness) and distribution to all ACs | IERS CB | 15-JAN-08 |
| 13c | Forms filled and returned by all ACs | **All ACs** | 15-FEB-08 |

| | | | |
|---|---|---|---|
| **21** | **Meteo data equipment/instrumentation coordinator, technique-independent → to be discuss a the next meeting of the GGOS Infrastructure WG** | **Pearlman** | 12-DEC-07 |
| **Recommendations** | | | |
| **24** | **A clear distinction should be made between a solution (SINEX) as input for combination and an optimum solution of a specific technique: for the combination work the parameterization and time resolution of the most sensitive technique has to be used by ALL ACs. Therefore, it might be necessary to generate two types of solutions.** | **All Services** | |
| **25a**<br>**25b** | **Investigate the reason for cut-off angle dependent effects and elevation-dependent weighting.**<br>**ACs should freeze their selection of processing options and models between two reprocessing activities** | IVS, IGS, IDS, **ILRS**<br>IVS, IGS, IDS, **ILRS** | |
| **26** | **Continuous monitoring of the range biases by ILRS** | **ILRS** | |
| **30** | **Further studies are required to understand the bias between SLR and microwave GPS orbits** | IGS, **ILRS** | |
| **32** | **Study the influence of the arc length and orbit constraints on geocenter estimates** | IGS, IDS, **ILRS** | |

## Proposal for a SINEX file name convention across techniques (small and capital letters are allowed)

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## Proposal 1

**yyyy_doy_ntm_zz_aaaxxxxx.SNX**

where
yyyy = year and
doy = date when observation data used starts
n = number of days included, 1 for 1 day, 7 full week, 9 for fraction of day
t = technique, P = GNSS, L = SLR, M = LLR, R = VLBI, D = DORIS,
C = combined, I = Integrated, Q = Satellite Co-location,
T = local ties
m = type of primary content, C = covariances, D = normal equations with datum fixed, F = normal equations with datum free
zz = Session name or other technique specific identifier
aaa = Analysis center code
xxxxx = "solution" identifier

examples:
**2007_273_1DC_NN_JPL2007a.SNX**
**2005_199_9RF_XA_iaa2006b.SNX**

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## Proposal 2

**yydoy_ntm_zz_aaaxxxxx.SNX**

where
yy = year and
doy = date when observation data used starts
n = number of days included, 1 for 1 day, 7 full week, 9 for fraction of day
t = technique, P = GNSS, L = SLR, M = LLR, R = VLBI, D = DORIS,
C = combined, I = Integrated, Q = Satellite Co-location,
T = local ties
m = type of primary content, C = covariances, D = normal equations
with datum fixed, F = normal equations with datum free
zz = Session name or other technique specific identifier
aaa = Analysis center code
xxxxx = "solution" identifier

examples:
**07273_1DC_NN_JPL2007a.SNX**
**05199_9RF_XA_iaa2006b.SNX**

**Comment to both proposals:**

Most of the ACs have 4-5-character long identifiers and we will try to artificially stuff these (as we do now too!) into 3 characters, which will make identification difficult and eventually ambiguous, especially for outsiders. On the other hand, a solution for a specific interval (1 day, 1 week, etc.) will easily be identified by a 2-digit year designator and a letter code, e.g. 08D, and I cannot think of anyone releasing more than 26 versions of such a file.

Why not swap the fields to:

**aaaaa = Analysis center code**
**xxx = "solution" identifier**

**yyyy_doy_ntm_zz_aaaaaxxx.SNX**

or

**yy_doy_ntm_zz_aaaaaxxx.SNX**

# GPS 35 & 36 SLR Tracking Campaign 2008

The GPS-35 and -36 satellites will soon be decommissioned. They will continue to operate for a while, but they will not be used in the GPS navigation complex. These are the only GPS satellites that have retroreflectors and this may be our last chance to acquire a good set of GPS data for long-term studies, system comparisons, and reference frame support.

The ILRS Governing Board has approved an intensive tracking campaign on GPS-35 and -36 running from March 25 through May 31. The priority on GPS-35 and -36 will be raised to follow the Lageos Satellites. Pass segments should be 15 minutes (3 normal points) with 3 segments spread out over the pass to the extent possible.

Viewing schedules show that nighttime passes will be visible for GPS-35 in Europe, Saudi Arabia, South Africa, Eastern Australia, Tahiti and the Western US during this period.

Nighttime passes for GPS-36 should be visible from Asia, South America, Australia and Eastern US.

**Courtesy Mark Davis**

# SLR Tracking of GPS
## Misclosures to
# IGS ULTRA RAPID
## 2007 - 07-APR-2008

| Site | G35 and G36 # Obs. | MEAN (meters) | Std. Dev. |
|---|---|---|---|
| Beijing | 15 | 0.0003 | 0.0667 |
| Chang Chun | 96 | -0.0165 | 0.0524 |
| Tanegashima (GUTS) | 116 | 0.0162 | 0.0556 |
| Koganei - Toyko | 51 | -0.0161 | 0.0392 |
| Mt Stromlo | 129 | -0.0065 | 0.0292 |
| **Yarragadee** | **672** | **-0.0273** | **0.0343** |
| GGAO | 15 | -0.0124 | 0.0363 |
| Mon Pk | 8 | -0.0206 | 0.0423 |
| **San Juan** | **729** | **0.0171** | **0.0235** |
| TIGO | 52 | -0.0169 | 0.0287 |
| Graz | 193 | -0.0161 | 0.0256 |
| NERC | 98 | 0.0053 | 0.0374 |
| Katsively | 7 | -0.0579 | 0.0656 |
| Riyadh | 87 | 0.0111 | 0.0133 |
| Wettzell | 44 | 0.0066 | 0.0218 |
| **G35 - whole network** | **1034** | **-0.0102** | **0.0411** |
| **G36 - whole network** | **1264** | **0.0024** | **0.0346** |

**Author: Oscar Brogdon, HTSI / NASA SLR**

# GPS Weekly Tracking Report

Received **24-MAR-2008 - 07-APR-2008**

| Sat | Station | PAD_ID | Wave | ALL Passes | **All Norm Points** | 31-MAR-2008 07-APR-2008 Passes | 31-MAR-2008 07-APR-2008 Norm Points |
|---|---|---|---|---|---|---|---|
| GPS-36 | Yarragad | 7090 | 5320 | 12 | 50 | 6 | 24 |
| GPS-36 | Greenbel | 7105 | 5320 | 1 | 2 | | |
| GPS-35 | Monument | 7110 | 5320 | 1 | 3 | | |
| GPS-36 | Beijing | 7249 | 5320 | 1 | 3 | | |
| GPS-35 | Tokyo | 7308 | 5320 | 2 | 9 | 1 | 6 |
| GPS-35 | Tanegash | 7358 | 5320 | 7 | 39 | 4 | 28 |
| GPS-36 | Tanegash | 7358 | 5320 | 5 | 36 | 3 | 27 |
| **GPS-36** | **San Juan** | **7406** | **5321** | **19** | **101** | **12** | **61** |
| GPS-36 | Mt Strom | 7825 | 5320 | 3 | 19 | 3 | 19 |
| GPS-35 | Riyadh | 7832 | 5320 | 8 | 44 | 4 | 21 |
| GPS-35 | Graz | 7839 | 5320 | 4 | 43 | 1 | 12 |
| GPS-36 | Graz | 7839 | 5320 | 1 | 2 | | |
| GPS-35 | Herstmon | 7840 | 5320 | 4 | 12 | 2 | 8 |
| | | | | **68** | **363** | **36** | **206** |

Over the last two weeks

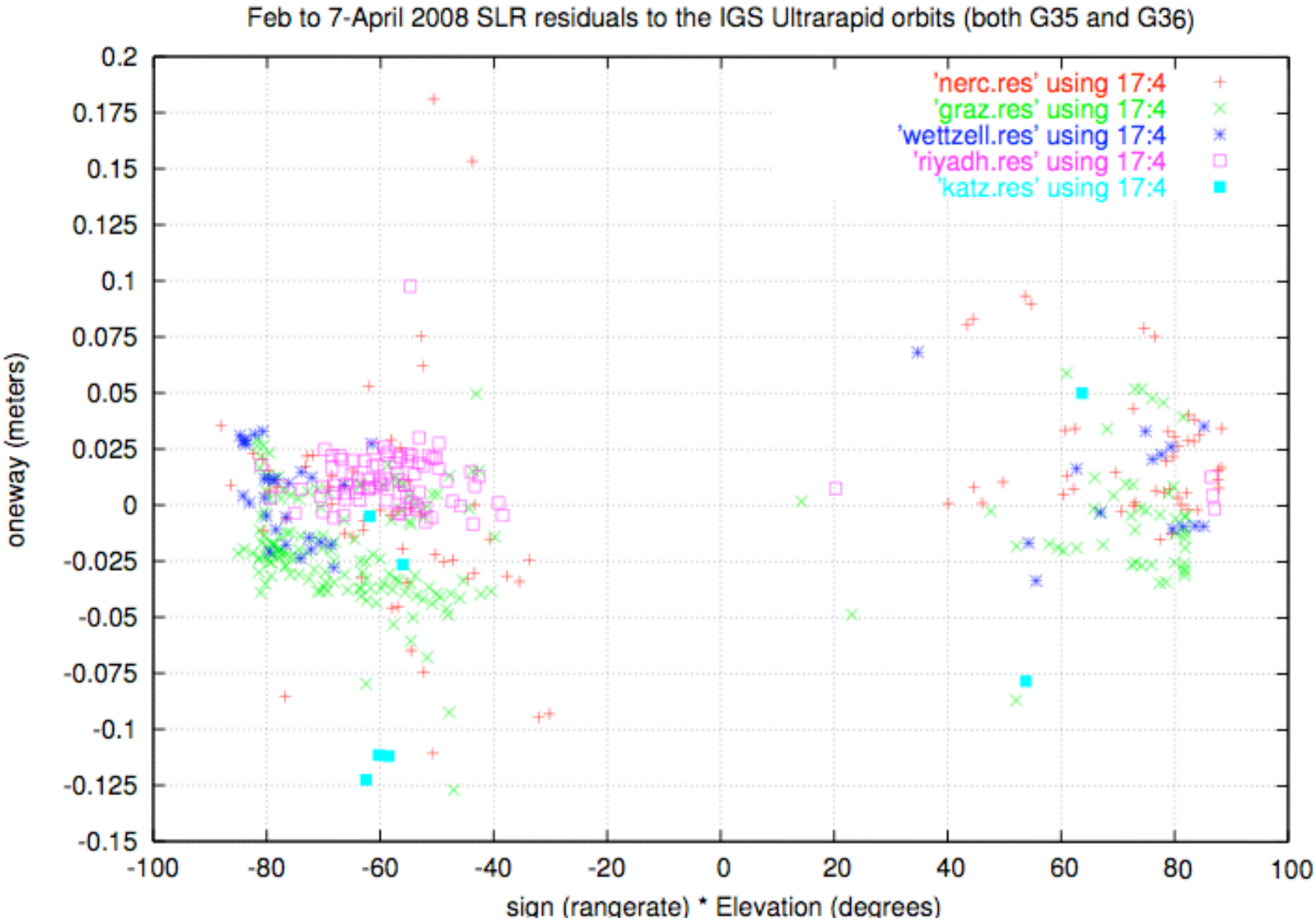
We have improved our yield on GPS 35 & 36 (combined)

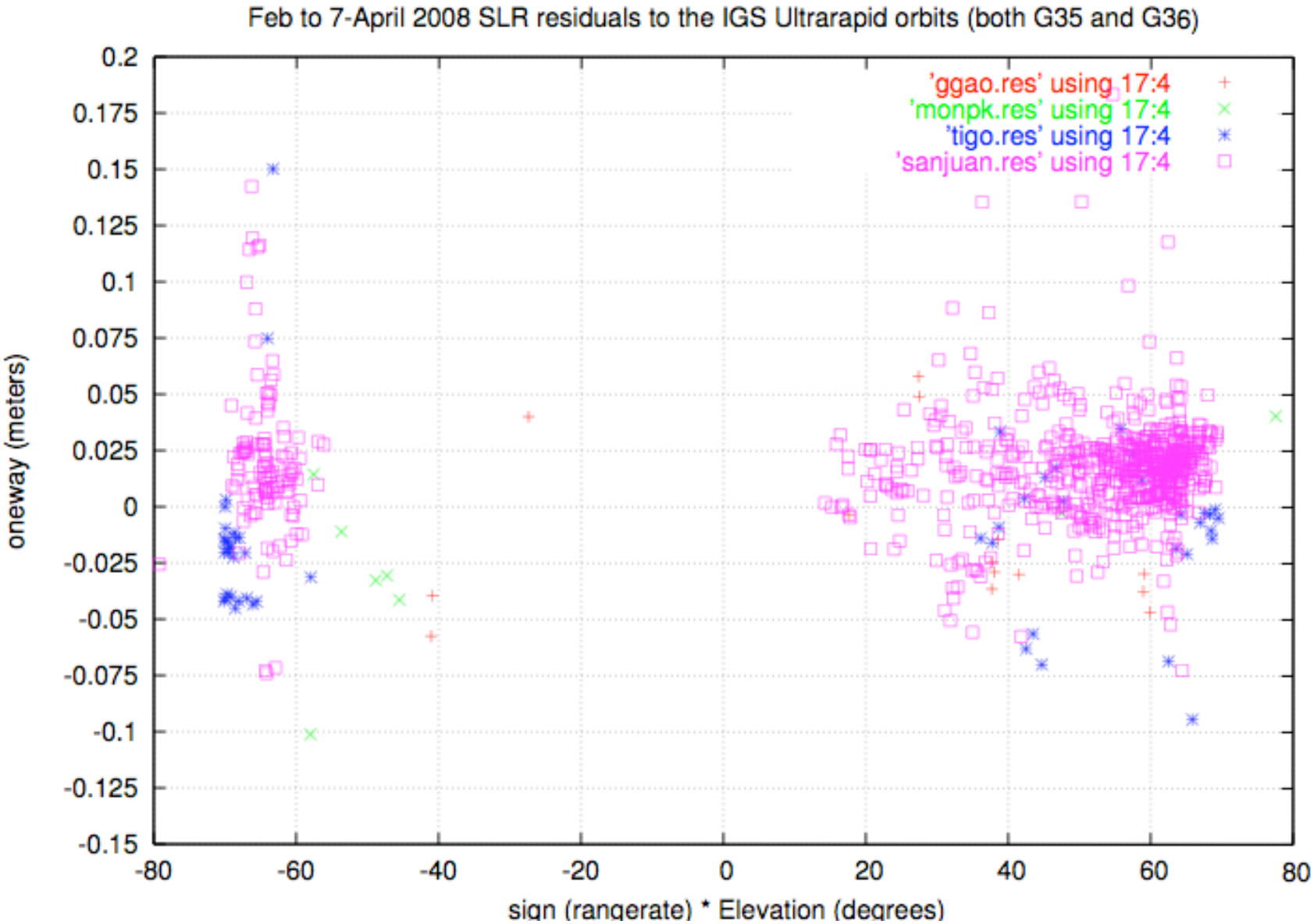
Going from

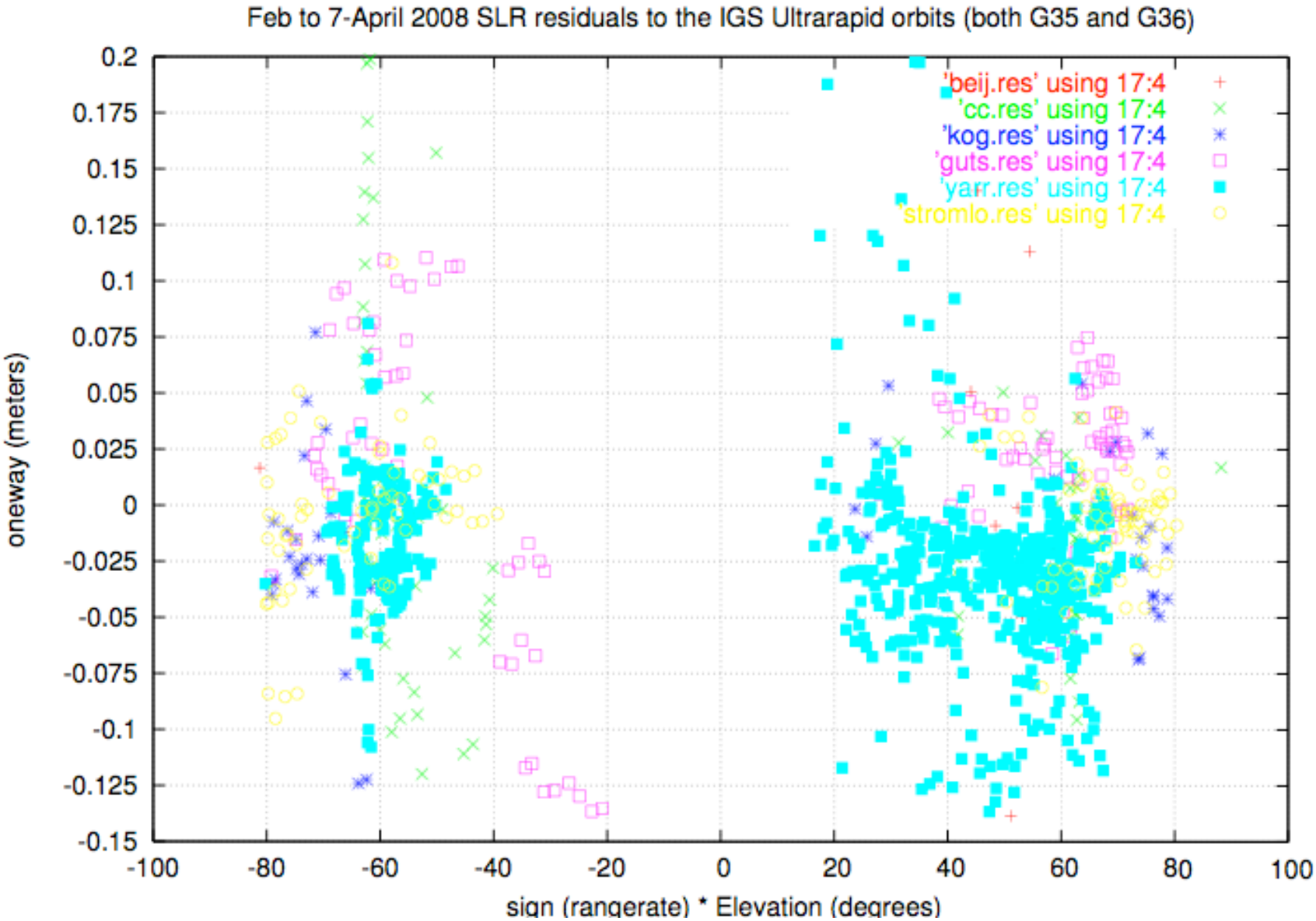
**6 Ranges per day on average**

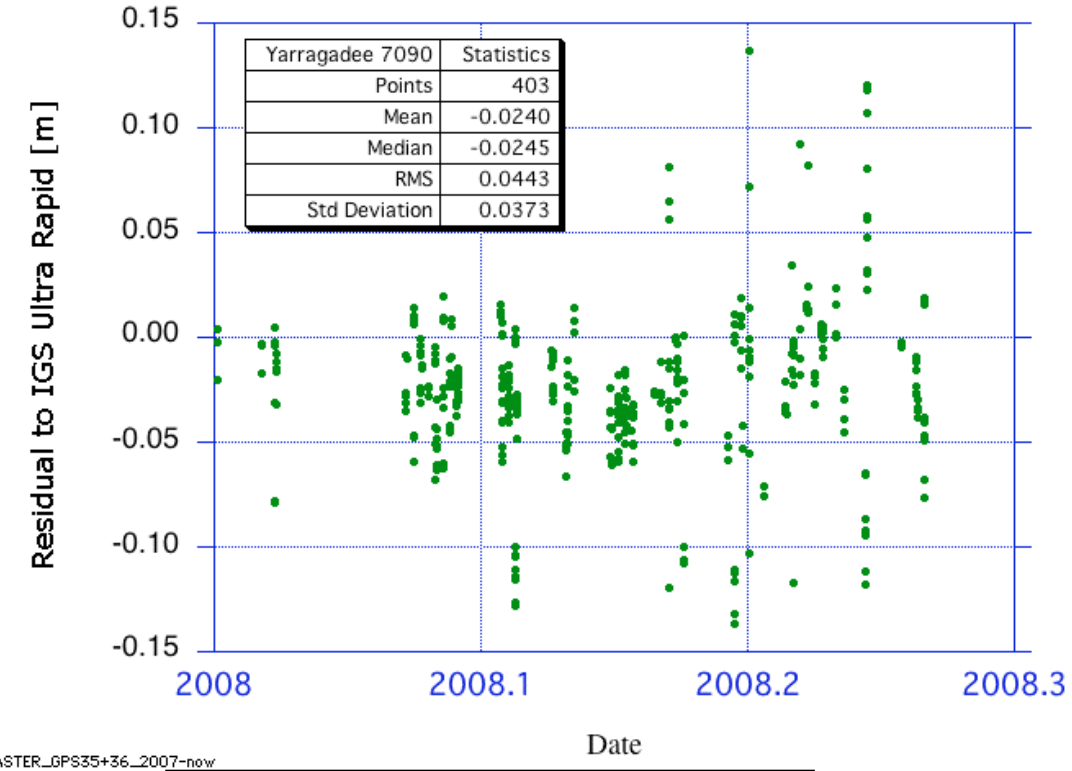
to

# 26 Ranges/day on average


Feb to 7-April 2008 SLR residuals to the IGS Ultrarapid orbits (both G35 and G36)
'nerc.res' using 17:4
'graz.res' using 17:4
'wettzell.res' using 17:4
'riyadh.res' using 17:4
'katz.res' using 17:4
oneway (meters)
0.2
0.175
0.15
0.125
0.1
0.075
0.05
0.025
0
-0.025
-0.05
-0.075
-0.1
-0.125
-0.15
-100
-80
-60
-40
-20
0
20
40
60
80
100
sign (rangerate) * Elevation (degrees)

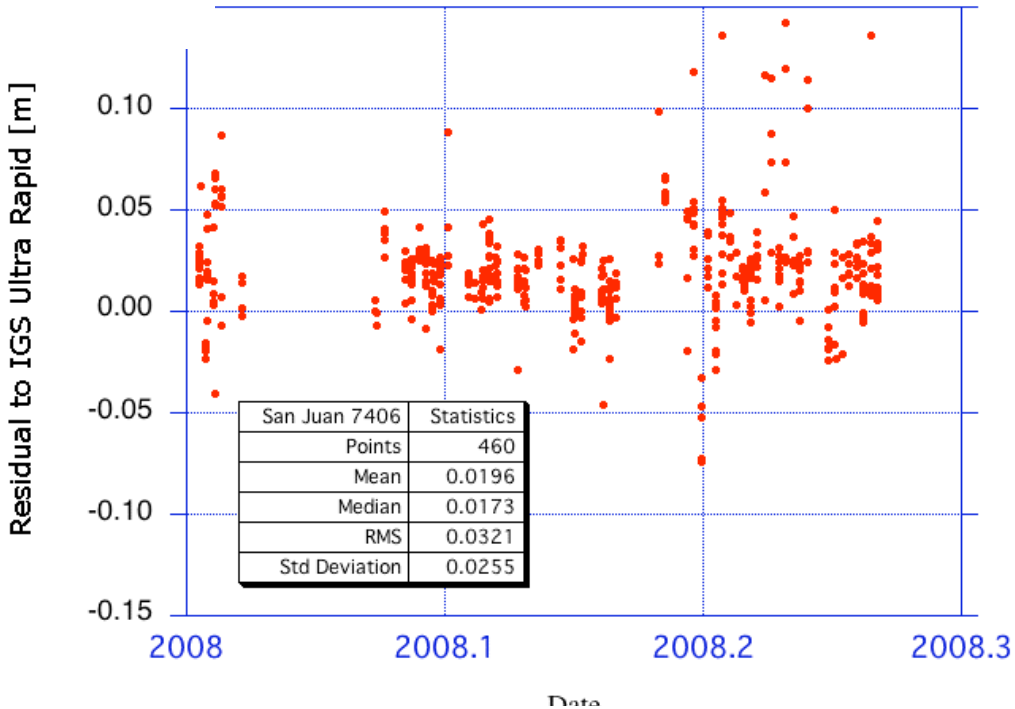

Feb to 7-April 2008 SLR residuals to the IGS Ultrarapid orbits (both G35 and G36)
'ggao.res' using 17:4
'monpk.res' using 17:4
'tigo.res' using 17:4
'sanjuan.res' using 17:4
oneway (meters)
0.2
0.175
0.15
0.125
0.1
0.075
0.05
0.025
0
-0.025
-0.05
-0.075
-0.1
-0.125
-0.15
-80
-60
-40
-20
0
20
40
60
80
sign (rangerate) * Elevation (degrees)


Feb to 7-April 2008 SLR residuals to the IGS Ultrarapid orbits (both G35 and G36)
'beij.res' using 17:4
'cc.res' using 17:4
'kog.res' using 17:4
'guts.res' using 17:4
'yarr.res' using 17:4
'stromlo.res' using 17:4
oneway (meters)
0.2
0.175
0.15
0.125
0.1
0.075
0.05
0.025
0
-0.025
-0.05
-0.075
-0.1
-0.125
-0.15
-100
-80
-60
-40
-20
0
20
40
60
80
100
sign (rangerate) * Elevation (degrees)




**Yarragadee 7090**

**San Juan 7406**



# CRD Data Format – The new ILRS Standard Format for **all** ILRS data

A draft timetable for CRD format implementation is as follows:

- **April '08** - We will request that all stations begin to make the conversion to the new format as soon as possible. We will also request that they send in both formats of the data for data validation. Once a system's data are validated by the **Analysis Working Group**, they will no longer be required to send in both formats.
- **Sept '08** - The Data Centers should be archiving data regularly. As of this date, the Operations Centers (EDC, HTSI) will convert all data that is NOT yet in the CRD format for a parallel delivery to the Data Centers. If a station's data has been validated, and they are only sending in CRD data, then the Operations Center will convert to normal point data for parallel delivery.
- **April '09** - By this date, we will expect that ALL ILRS systems will be sending in CRD data format.
- **January '10** - The Operations Centers will cease converting data to the old normal point format, and will only deliver CRD data to the Data Centers."

Note that the first item calls for the **AWG** to verify that the CRD data agrees with the old data for each station. We feel it is important that the network and analysts feel confident that the CRD data is not materially different from the old data, but is the **AWG** or a subset willing to take on this task?

MLRS CRD data at: http://cddis.gsfc.nasa.gov/pub/slr/data/npt_crd/.

# STATION STATUS REPORT PAGE

http://aiuli3.unibe.ch:8000/slr/daystatus.y08

| DOY | Date | BURF | CONL | HERL | MATM | POT3 | SFEL | TEST | WETL | YARL | ZIML |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 071 | 11-Mar-2008 | OUT | OUT | OPER | | OPER | OPER | | OPER | OPER | DOWN |
| 072 | 12-Mar-2008 | OPER | OPER | OPER | OPER | OPER | OPER | | OPER | OPER | DOWN |
| 073 | 13-Mar-2008 | OPER | OPER | OPER | OPER | OPER | OPER | | OPER | OPER | DOWN |
| 074 | 14-Mar-2008 | OPER | OUT | OUT | OPER | OPER | OPER | | OUT | OPER | DOWN |
| 075 | 15-Mar-2008 | OPER | OPER | OUT | | OUT | OPER | | OPER | OPER | DOWN |
| 076 | 16-Mar-2008 | OPER | OPER | OUT | | OPER | OPER | | OPER | OPER | DOWN |
| 077 | 17-Mar-2008 | OPER | OPER | OUT | OPER | OPER | OPER | OUT | OUT | OPER | DOWN |
| 078 | 18-Mar-2008 | OPER | OPER | OPER | OPER | OPER | OPER | OUT | OPER | OPER | OPER |
| 079 | 19-Mar-2008 | OUT | OPER | OPER | OPER | OPER | OPER | | OPER | OPER | DOWN |
| 080 | 20-Mar-2008 | OPER | OPER | OPER | OPER | OPER | OUT | | OPER | OPER | DOWN |
| 081 | 21-Mar-2008 | OPER | OPER | OPER | OPER | OUT | | | OPER | OPER | DOWN |
| 082 | 22-Mar-2008 | OPER | OPER | OPER | OUT | OUT | | | OPER | OPER | OPER |
| 083 | 23-Mar-2008 | OPER | OPER | OPER | | OPER | | | OPER | OPER | OPER |
| 084 | 24-Mar-2008 | OPER | OPER | OPER | OPER | OPER | OPER | | OPER | OPER | DOWN |
| 085 | 25-Mar-2008 | OPER | OPER | OPER | OPER | OPER | OPER | | OPER | OPER | DOWN |
| 086 | 26-Mar-2008 | OPER | OPER | OPER | | OPER | OPER | | OPER | OPER | DOWN |
| 087 | 27-Mar-2008 | OPER | OPER | OPER | OPER | OPER | OPER | | OPER | OPER | OPER |
| 088 | 28-Mar-2008 | OPER | OPER | OPER | OPER | OPER | OPER | | OPER | OPER | DOWN |
| 089 | 29-Mar-2008 | OPER | OPER | OPER | | OPER | OPER | | OPER | OPER | OPER |
| 090 | 30-Mar-2008 | OPER | OPER | OPER | | OPER | OPER | | OPER | OUT | DOWN |
| 091 | 31-Mar-2008 | OPER | OPER | OPER | OPER | OPER | OPER | | OPER | OPER | DOWN |
| 092 | 01-Apr-2008 | OUT | OPER | OPER | OPER | OPER | OPER | | OPER | OPER | DOWN |
| 093 | 02-Apr-2008 | OUT | OPER | OPER | OPER | OPER | OPER | | OPER | OPER | DOWN |
| 094 | 03-Apr-2008 | OPER | OPER | OPER | OUT | OPER | OPER | | OPER | OPER | DOWN |
| 095 | 04-Apr-2008 | OPER | OPER | OPER | | OPER | OPER | | OPER | OPER | OPER |

# Dubious Local Ties as results from the ITRF2005 computation (All techniques)

Dubious means disagreement between Local Survey and Space Geodesy Estimates
Sites listed where discrepancy is larger than ~10 mm

| Site Name | Vector | Sigma used in ITRF2005 (mm) | Magnitude of Discrepancy (mm) | Comments (*) |
|---|---|---|---|---|
| REYKJAVIK | GPS-DORIS | 20 | 20 | |
| **BOROWIEC** | **GPS-SLR** | 15 | 25 | |
| YUZHNO-SAKHALINS | GPS-DORIS | 15 | 20 | |
| ZIMMERWALD | **GPS-SLR** | 10 | 15 | SLR Range Bias ? |
| **HERSTMONCEUX** | **GPS-SLR** | 3.3 | 10 | **Tie to be re-measured by IGN 2008** |
| **SAN FERNANDO** | **GPS-SLR** | 3 | 50 | SLR ?GPS ? Tie ? |
| **MADRID** | **GPS-VLBI** | 10 | 30 | GPS ? |
| **SHANGHAI** | **GPS-VLBI** | 4 | 10 | VLBI ? |
| **BEIJING** | GPS-SLR | 10 | 20 | SLR ? |
| WUHAN | GPS-SLR | 10 | 20 | SLR ? |
| LHASA | GPS-SLR | 20 | 15 | SLR ? |
| CIBINONG | GPS-DORIS | 20 | 30 | GPS ? |
| MAHE ISLAND | GPS-DORIS | 22 | 70 | |
| FAIRBANKS | DORIS-GPS | 4 | 15 | EQ ? |
| **KAUAI** | **GPS-VLBI** | 9 | 10 | GPS ? |
| KAUAI | GPS-DORIS | 9 | 15 | |
| WESTFORD | GPS-VLBI | 20 | 20 | GPS ? |
| MAUI-Haleakala | **GPS-SLR** | 3 | 9 | |
| **PIETOWN** | **GPS-VLBI** | 9 | 10 | |
| RIO GRANDE | GPS-DORIS | 8 | 20 | |
| **FORTALEZA** | **GPS-VLBI** | 30 | 30 | GPS ? |
| CACHOEIRA PAULIS | GPS-DORIS | 15 | 20 | |
| EASTER ISLAND | GPS-SLR | 35 | 20 | |
| CONCEPCION | GPS-SLR-VLBI | 15 | 15 | |
| THULE | GPS-DORIS | 15 | 25 | |
| **YARAGADEE** | **GPS-SLR** | 7 | 10 | |
| GUAM | GPS-DORIS | 30 | 40 | |
| SYOWA | GPS-VLBI-DORIS | 30 | 40 | |
| **O'HIGGINS** | **GPS-VLBI** | 60 | 40 | |
| **TAHITI** | **GPS-SLR** | 3 | 10 | **Tie Re-measured (IGN 2007)** |

## Missing Ties (All techniques)

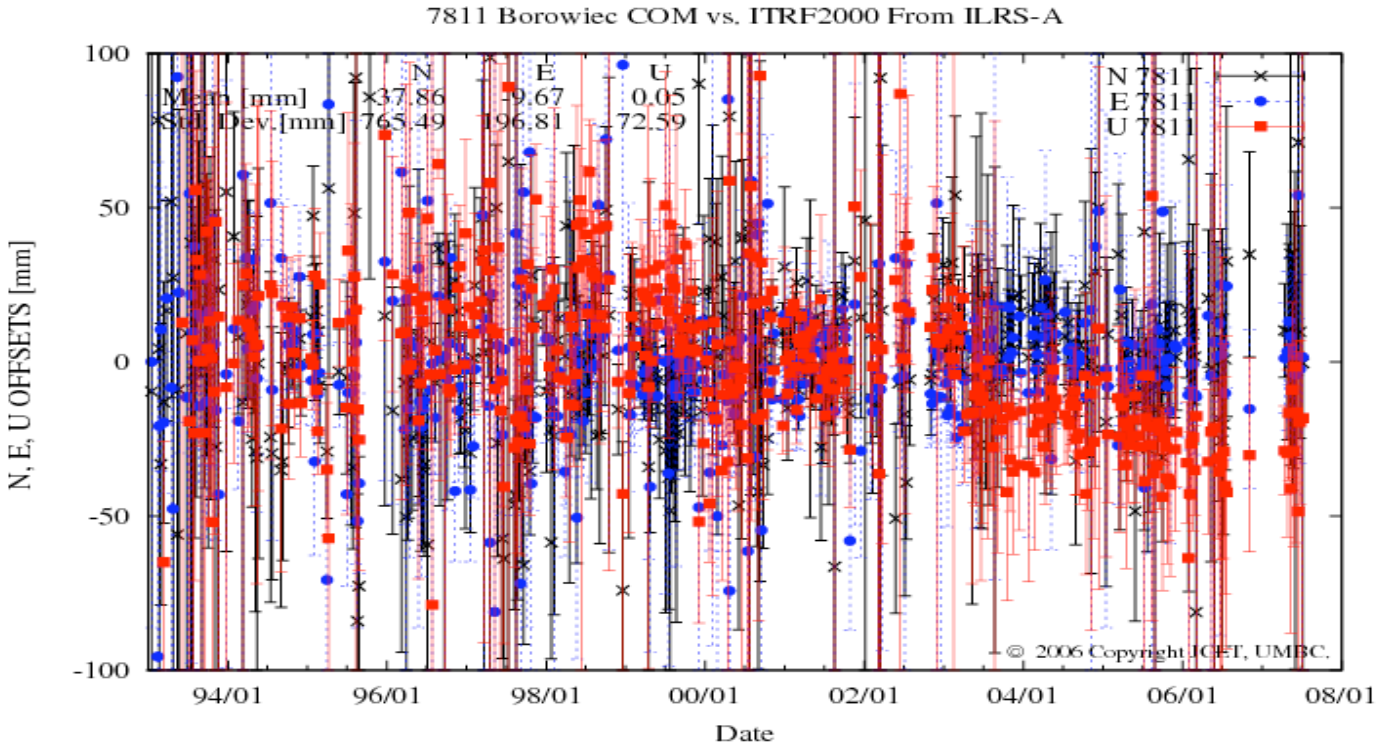
| Site | Techniques | Comments |
|---|---|---|
| **Ryiadh-Solar-Villlage** | **GPS-SLR** | |
| **URUMQI** | GPS-VLBI-SLR | |
| **SIMEIS-Katzively** | SLR-VLBI | |
| **KUNMING** | SLR-GPS | SLR ? |
| **MIZUSAWA** | **GPS-VLBI** | |
| **BREWSTER** | **GPS-VLBI** | |

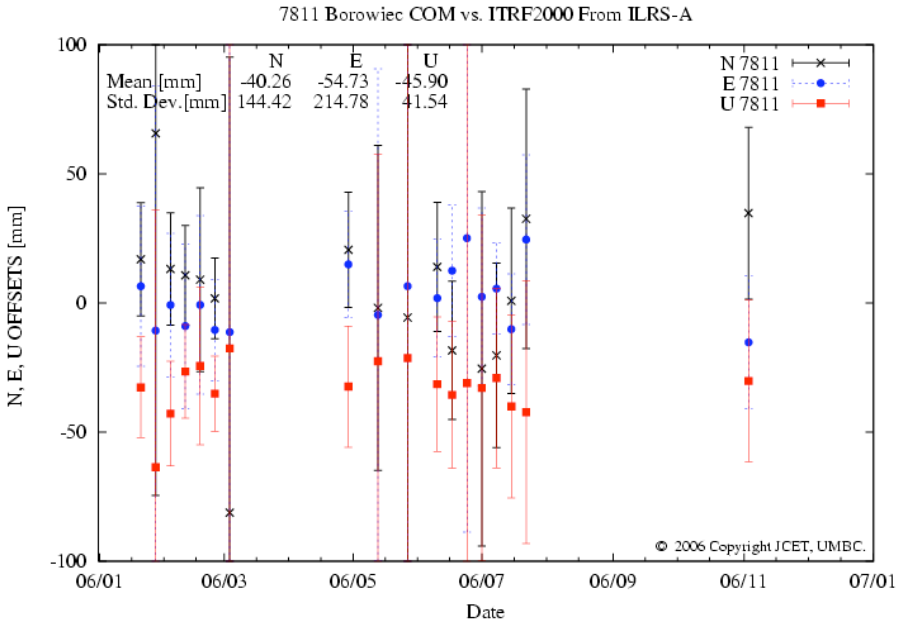
## Dubious Local Ties as results from the ITRF2005 computation (SLR Cases)

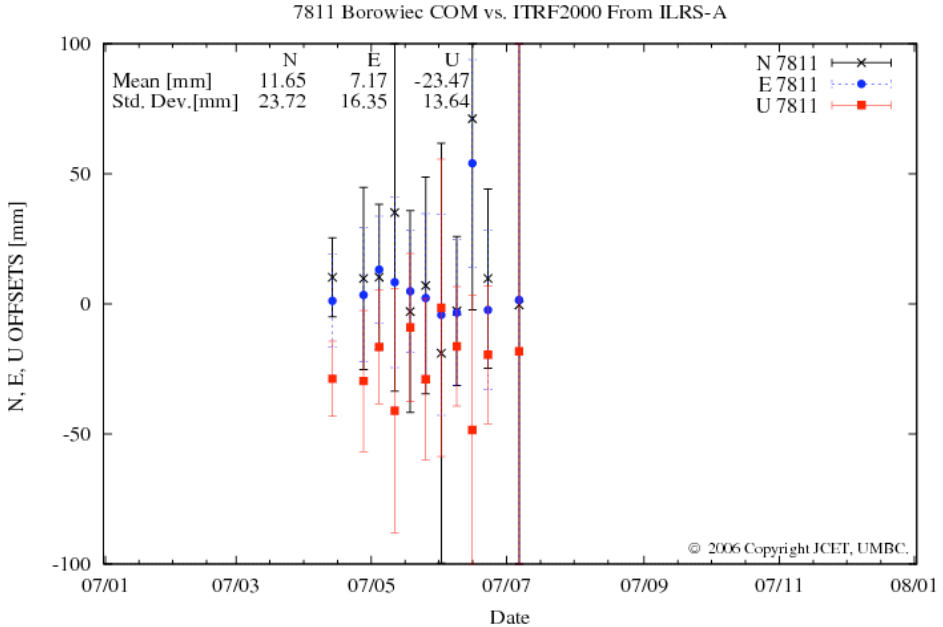
| Site Name | Vector | Sigma used in ITRF2005 (mm) | Magnitude of Discrepancy (mm) | Comments (*) |
|---|---|---|---|---|
| **BOROWIEC** | **GPS-SLR** | 15 | 25 | **NOISY SITE/REEVALUATE** |
| ZIMMERWALD | **GPS-SLR** | 10 | 15 | SLR Range Bias ? **REEVALUATE** |
| **HERSTMONCEUX** | **GPS-SLR** | 3.3 | 10 | **Tie to be re-measured by IGN 2008** |
| **SAN FERNANDO** | **GPS-SLR** | 3 | 50 | SLR ? GPS ? Tie ? **RIOA?** |
| **BEIJING** | GPS-SLR | 10 | 20 | SLR ? **REEVALUATE** |
| WUHAN | GPS-SLR | 10 | 20 | SLR ? - Poor SLR site |
| LHASA | GPS-SLR | 20 | 15 | SLR ? - Poor SLR site |
| MAUI-Haleakala | **GPS-SLR** | 3 | 9 | **OLD SLR SITE GONE** |
| EASTER ISLAND | GPS-SLR | 35 | 20 | Old SLR site… |
| CONCEPCION | GPS-SLR-VLBI | 15 | 15 | **BKG ?** |
| **YARAGADEE** | **GPS-SLR** | 7 | 10 | GPS antenna pier uplift? |
| **TAHITI** | **GPS-SLR** | 3 | 10 | **Tie Re-measured (IGN 2007) ΔX of -14 mm** |

## Missing Ties Involving SLR

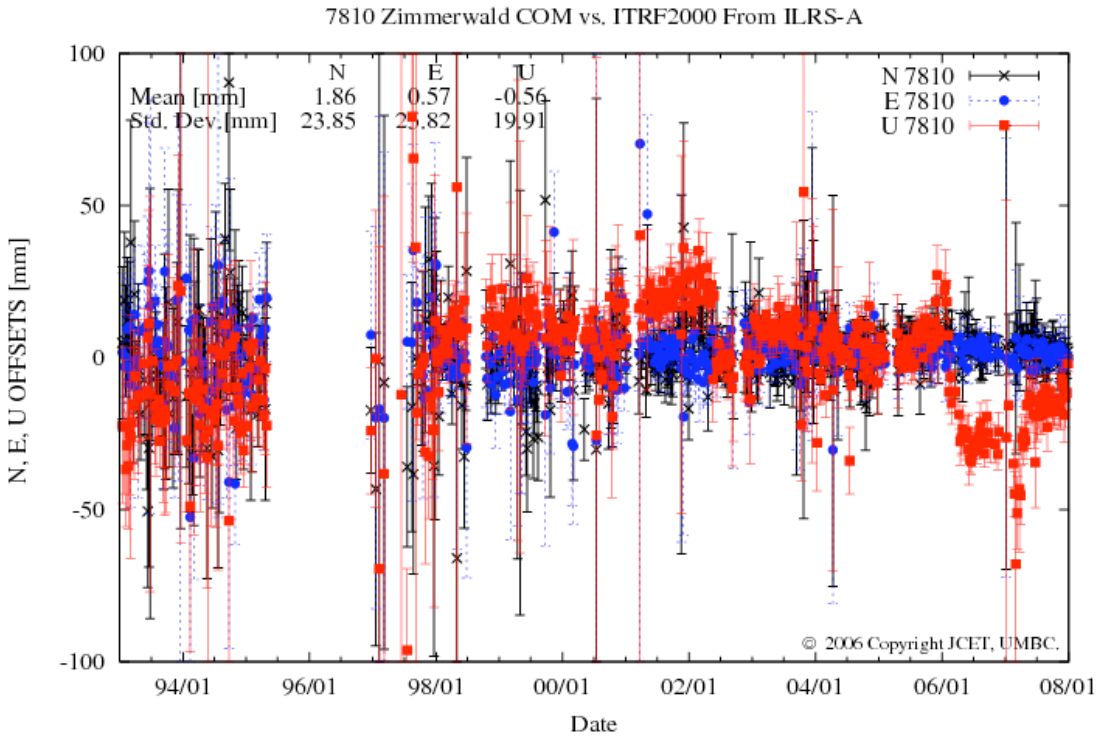
| Site | Techniques | Comments |
|---|---|---|
| Ryiadh-Solar-Villlage | GPS-SLR | **KACST?** |
| URUMQI | GPS-VLBI-SLR | Poor SLR site |
| SIMEIS-Katzively | SLR-VLBI | Poor SLR site |
| KUNMING | SLR-GPS | SLR ? - Poor SLR site |


7811 Borowiec COM vs. ITRF2000 From ILRS-A
N E U
Mean [mm] 37.86 -9.67 0.05
Std. Dev.[mm] 765.49 196.81 72.59
N 7811
E 7811
U 7811
© 2006 Copyright JCET, UMBC.
N, E, U OFFSETS [mm]
Date
100
50
0
-50
-100
94/01
96/01
98/01
00/01
02/01
04/01
06/01
08/01

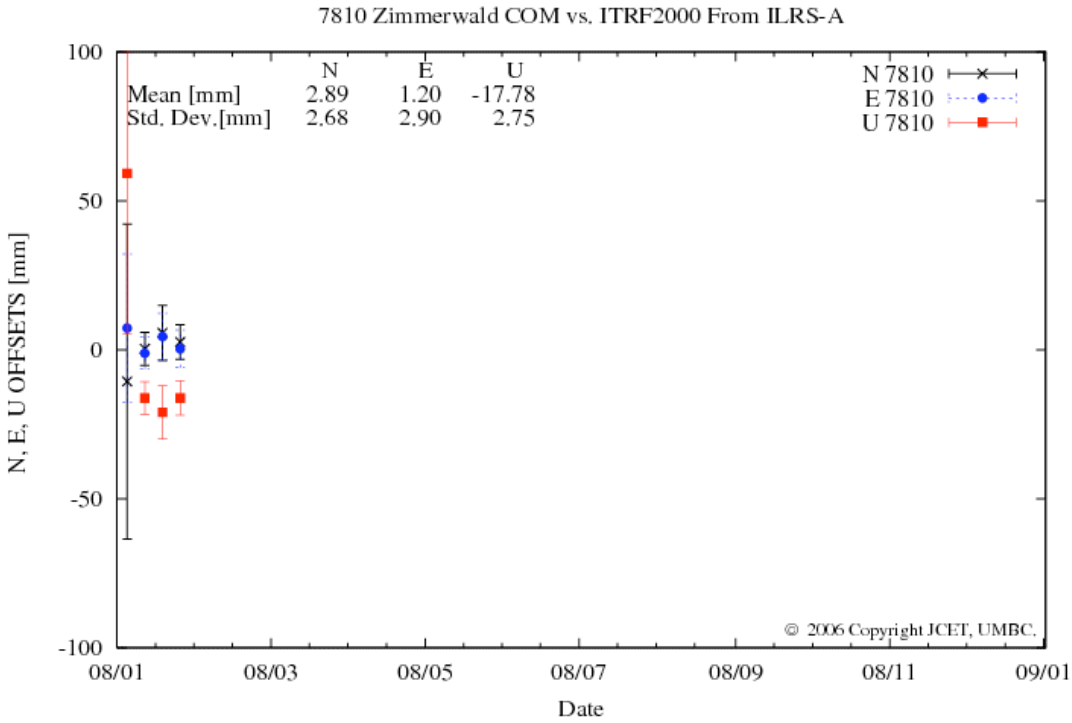

7811 Borowiec COM vs. ITRF2000 From ILRS-A
N E U
Mean [mm] -40.26 -54.73 -45.90
Std. Dev.[mm] 144.42 214.78 41.54
N 7811
E 7811
U 7811
© 2006 Copyright JCET, UMBC.
N, E, U OFFSETS [mm]
Date
100
50
0
-50
-100
06/01
06/03
06/05
06/07
06/09
06/11
07/01


7811 Borowiec COM vs. ITRF2000 From ILRS-A
N E U
Mean [mm] 11.65 7.17 -23.47
Std. Dev.[mm] 23.72 16.35 13.64
N 7811
E 7811
U 7811
© 2006 Copyright JCET, UMBC.
N, E, U OFFSETS [mm]
Date
100
50
0
-50
-100
07/01
07/03
07/05
07/07
07/09
07/11
08/01

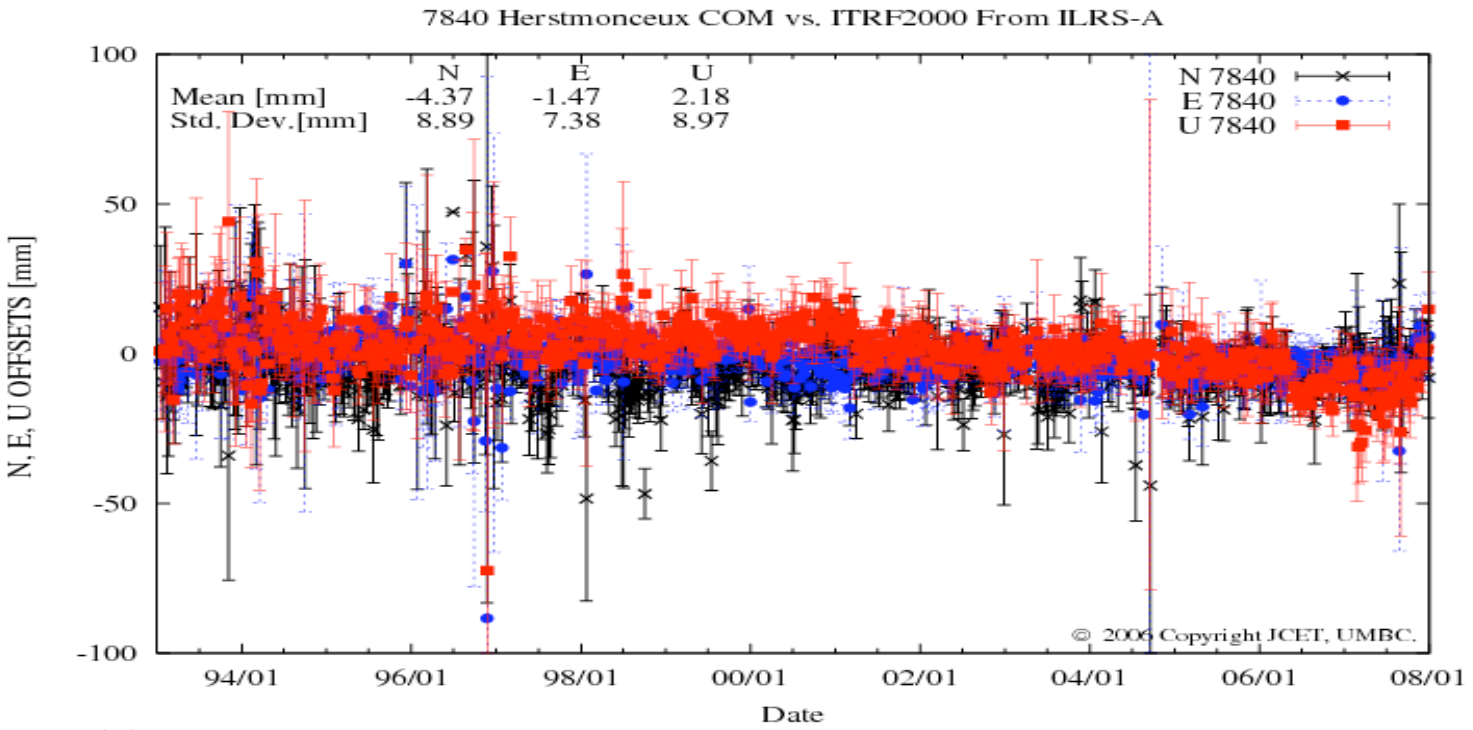
07/12/07




08/01/14




08/04/05

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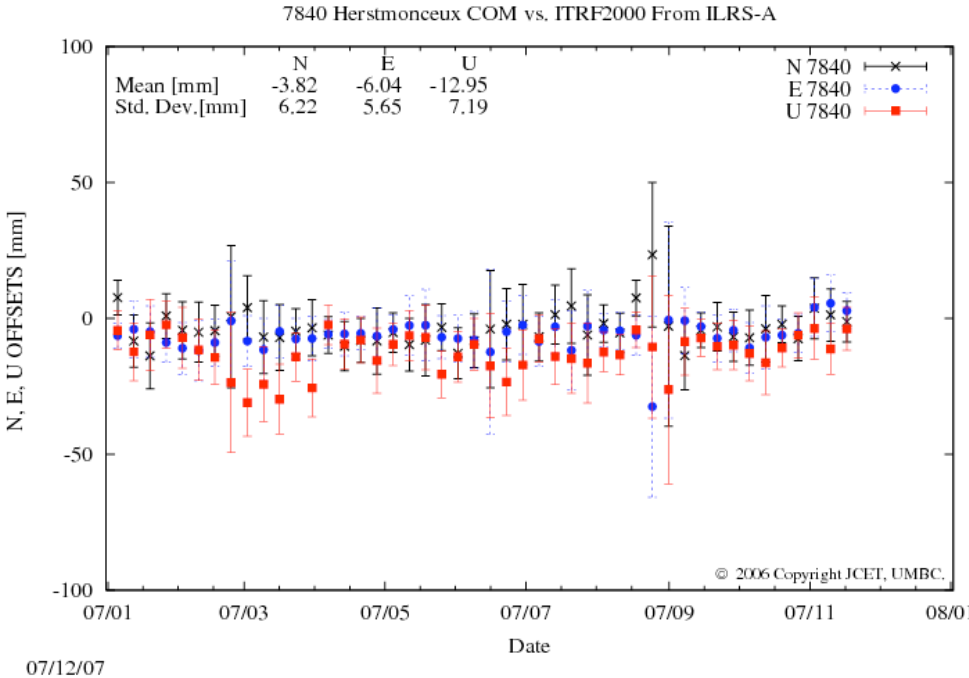
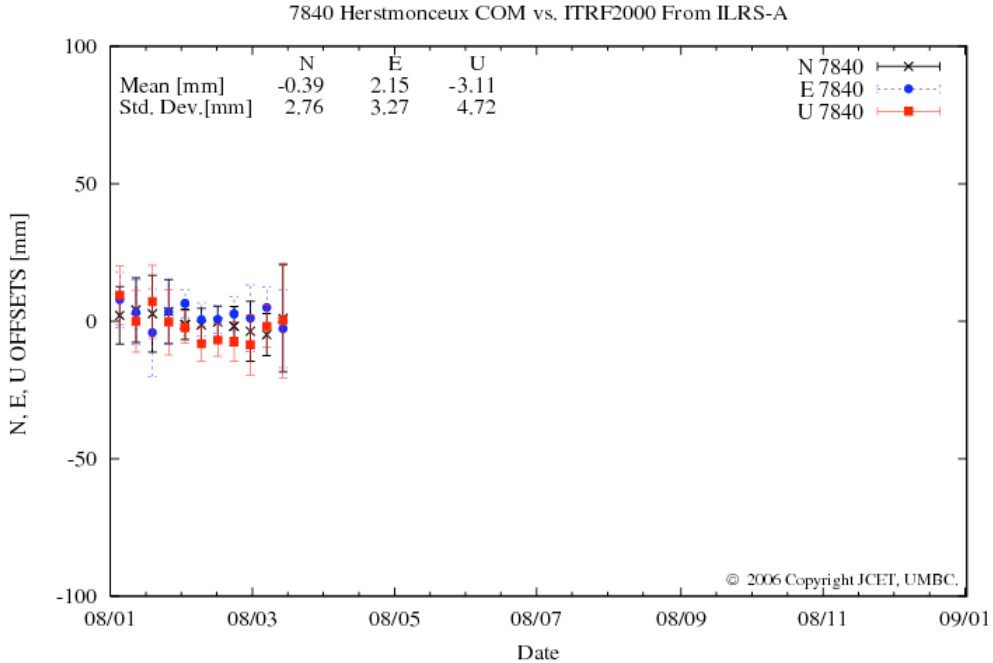



07/12/07

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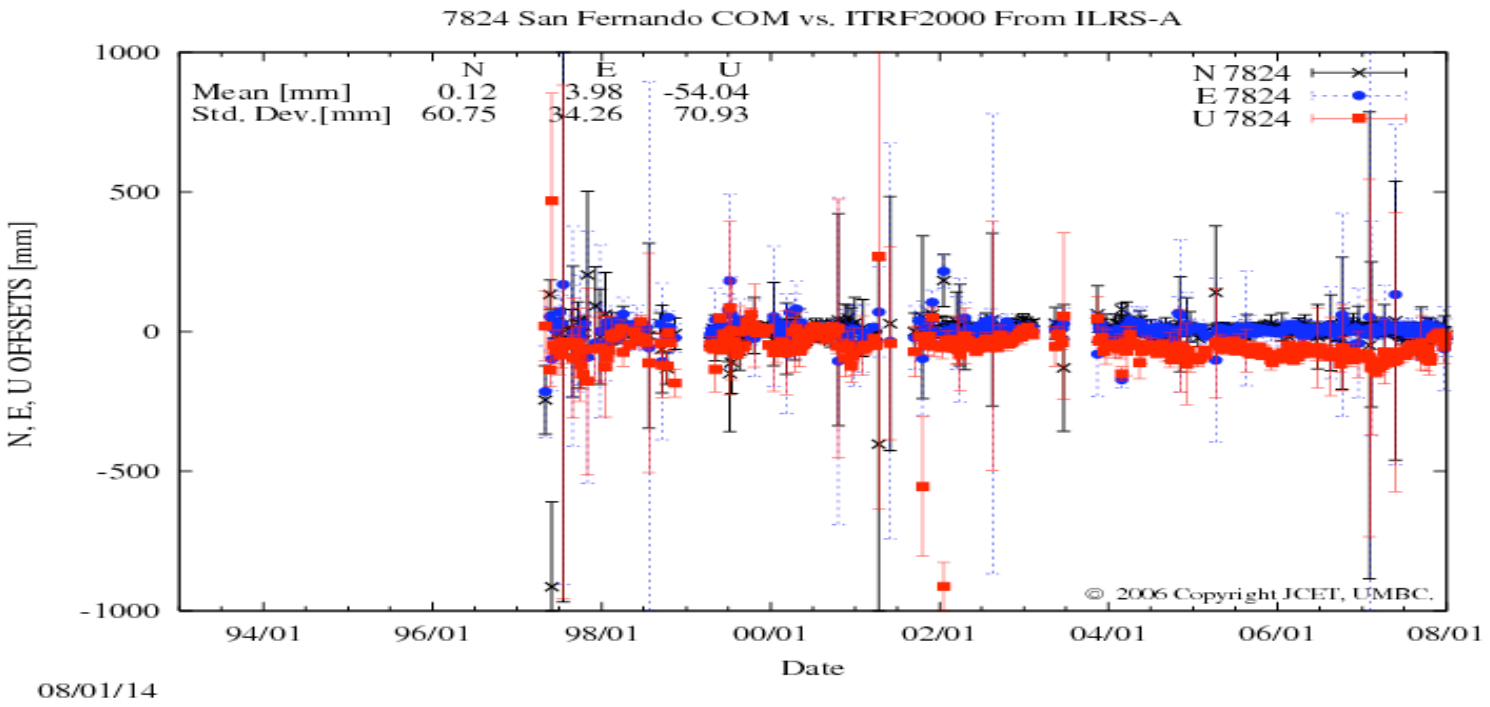
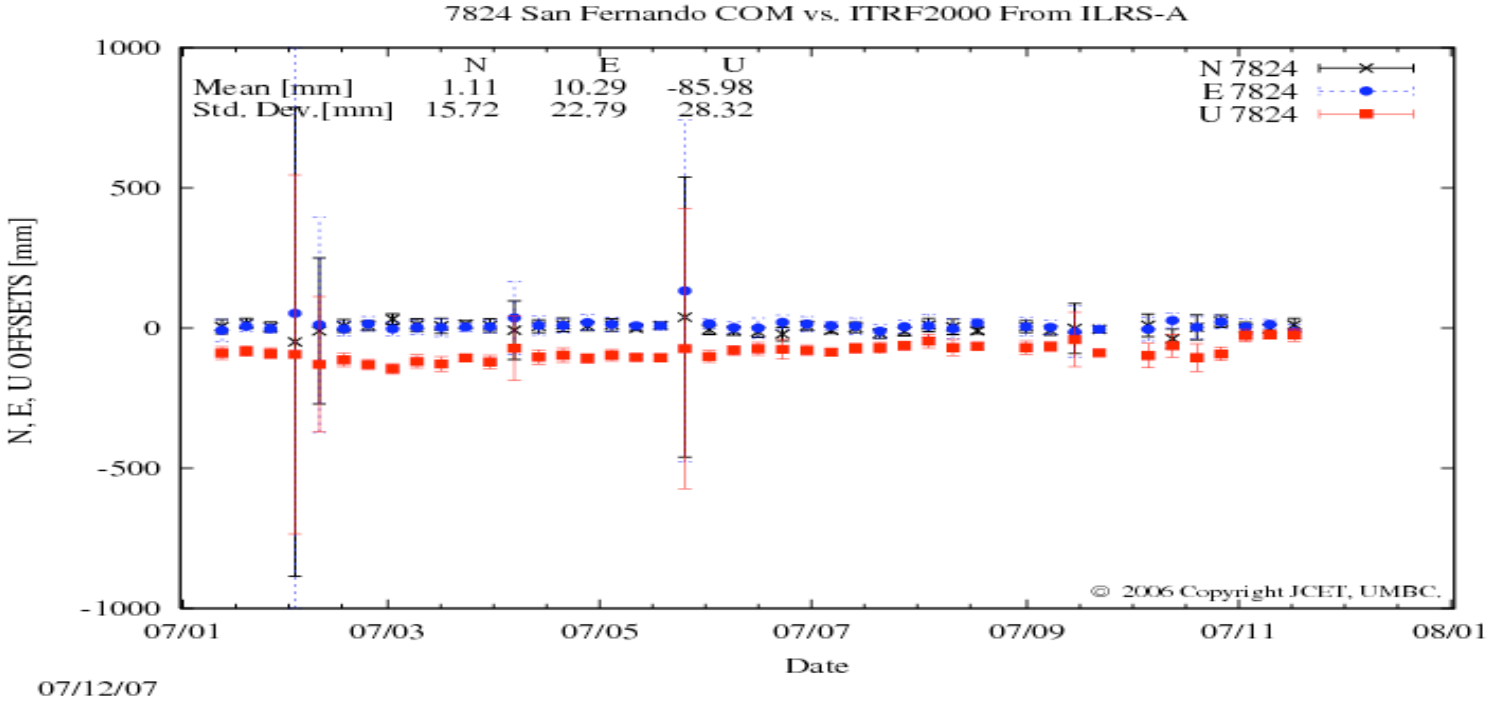
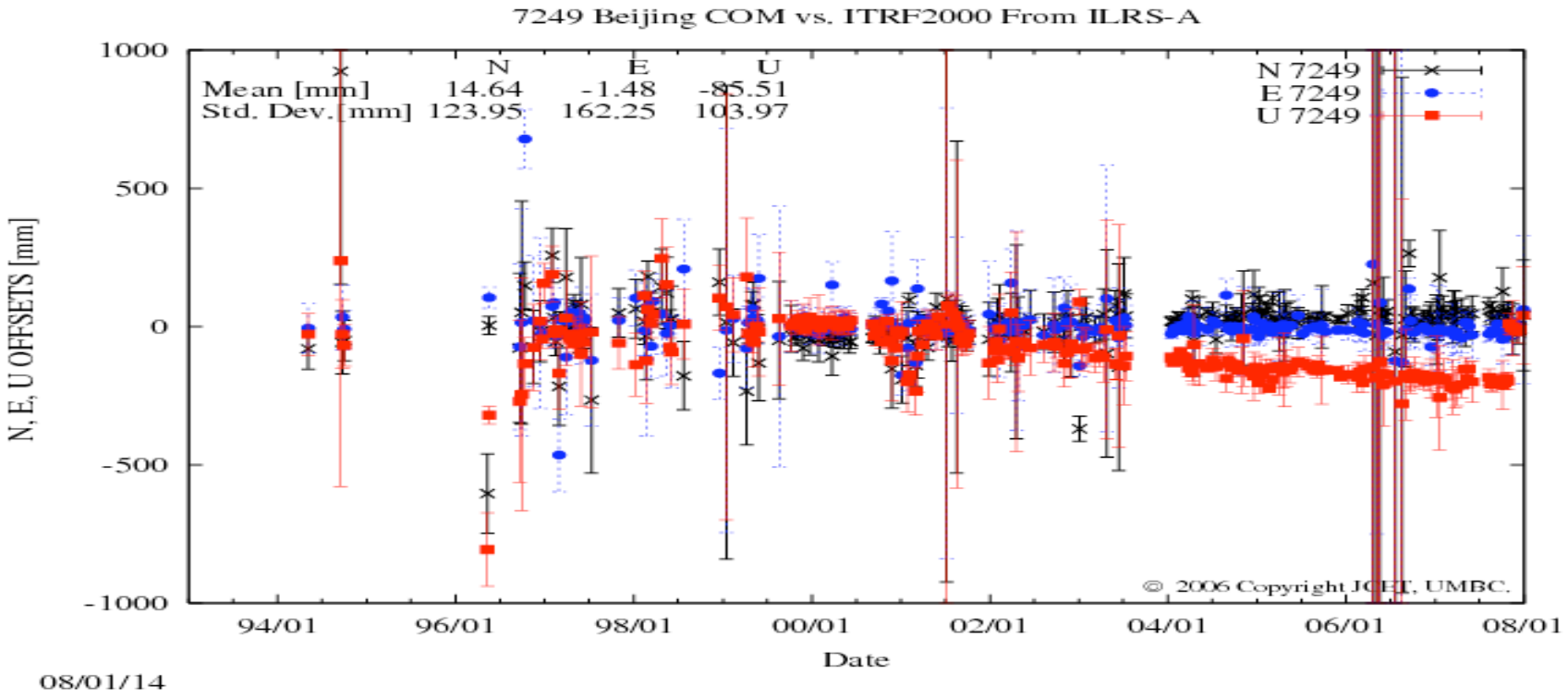



08/01/14




07/12/07


7249 Beijing COM vs. ITRF2000 From ILRS-A
N E U
Mean [mm] 14.64 -1.48 -85.51
Std. Dev.[mm] 123.95 162.25 103.97
N 7249
E 7249
U 7249
1000
500
0
-500
-1000
N, E, U OFFSETS [mm]
94/01
96/01
98/01
00/01
02/01
04/01
06/01
08/01
Date
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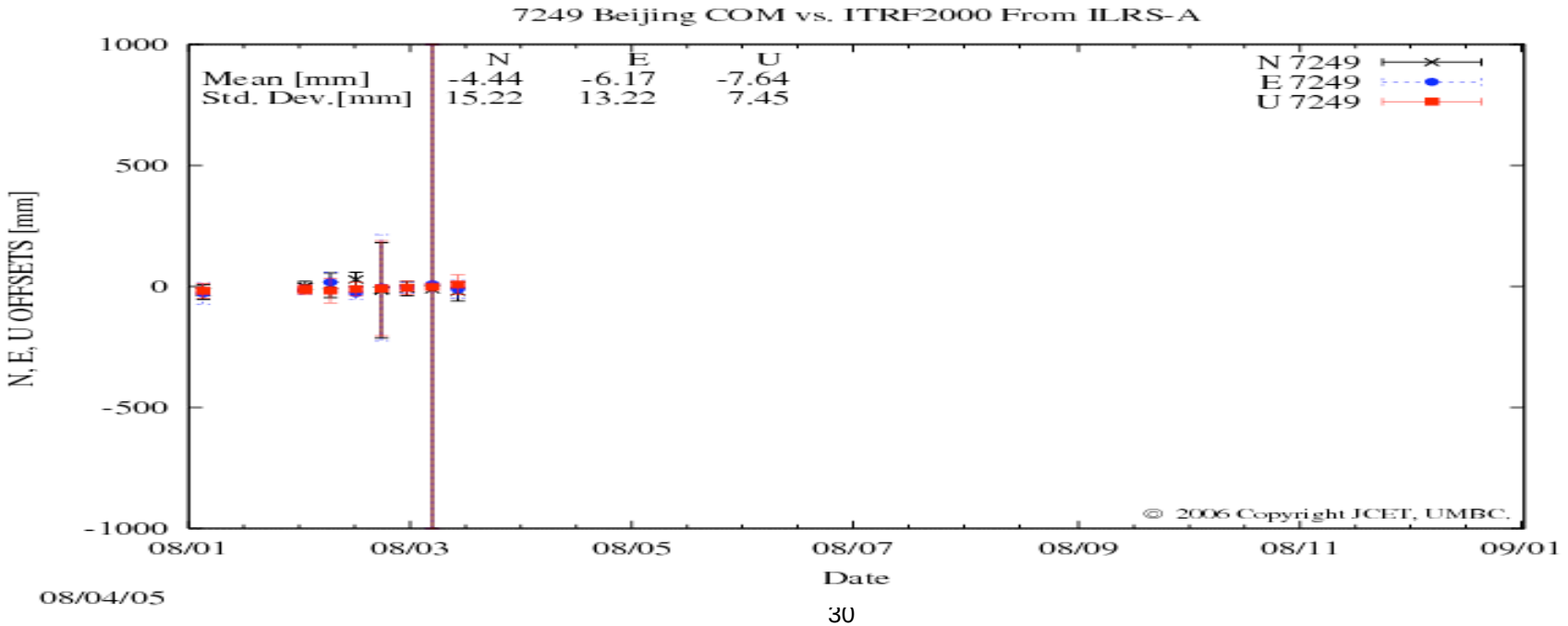
08/01/14


7249 Beijing COM vs. ITRF2000 From ILRS-A
N E U
Mean [mm] -4.44 -6.17 -7.64
Std. Dev.[mm] 15.22 13.22 7.45
N 7249
E 7249
U 7249
1000
500
0
-500
-1000
N, E, U OFFSETS [mm]
08/01
08/03
08/05
08/07
08/09
08/11
09/01
Date
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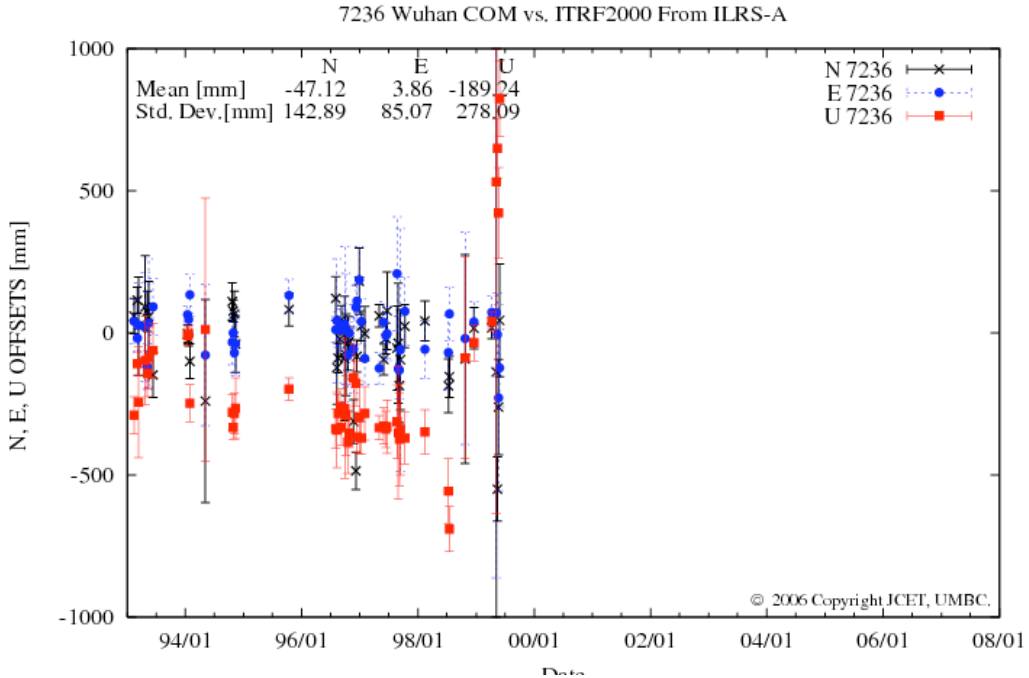
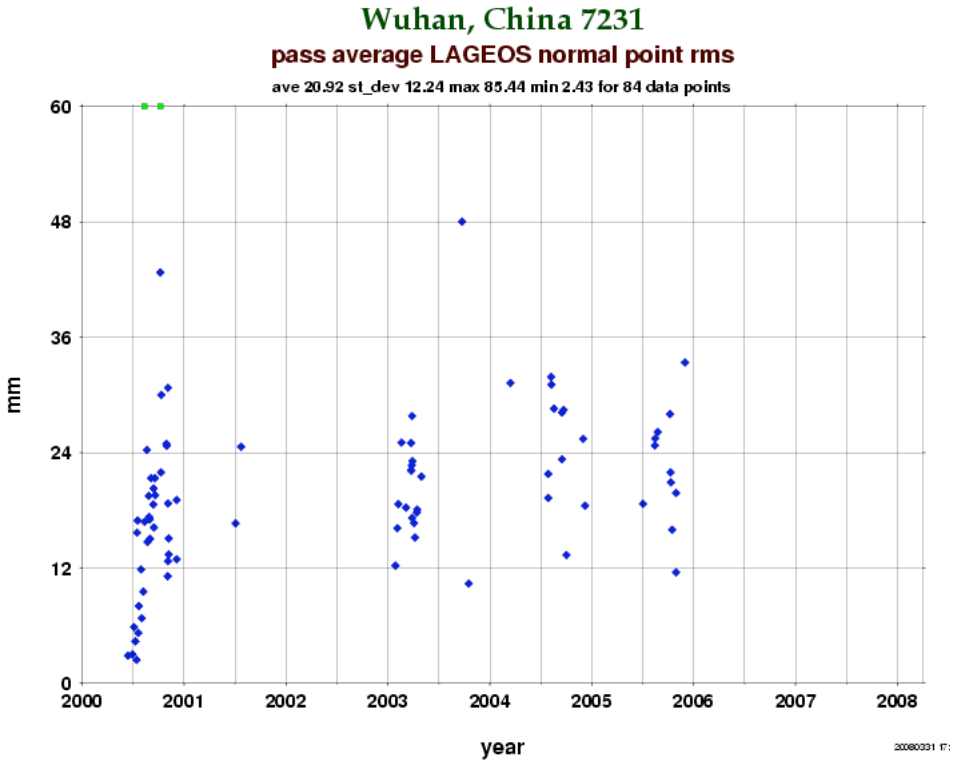
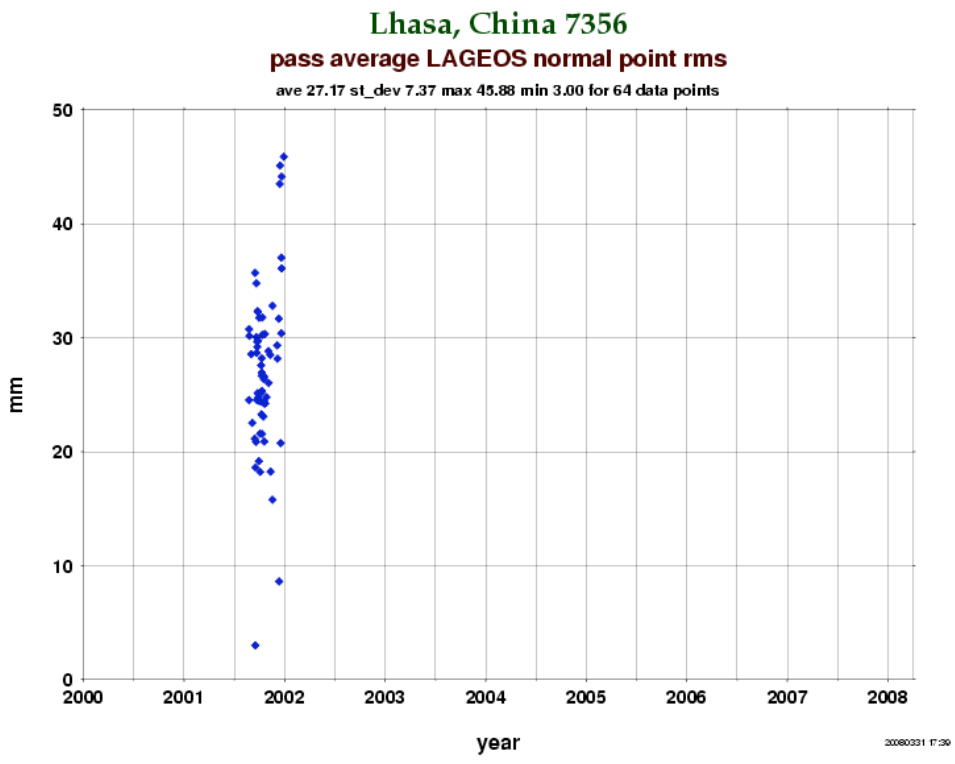
08/04/05


7236 Wuhan COM vs. ITRF2000 From ILRS-A
N E U
Mean [mm] -47.12 3.86 -189.24
Std. Dev.[mm] 142.89 85.07 278.09
N 7236
E 7236
U 7236
N, E, U OFFSETS [mm]
1000
500
0
-500
-1000
94/01
96/01
98/01
00/01
02/01
04/01
06/01
08/01
© 2006 Copyright JCET, UMBC.


Wuhan, China 7231
pass average LAGEOS normal point rms
ave 20.92 st_dev 12.24 max 85.44 min 2.43 for 84 data points
mm
year
60
48
36
24
12
0
2000
2001
2002
2003
2004
2005
2006
2007
2008


Lhasa, China 7356
pass average LAGEOS normal point rms
ave 27.17 st_dev 7.37 max 45.88 min 3.00 for 64 data points
mm
year
50
40
30
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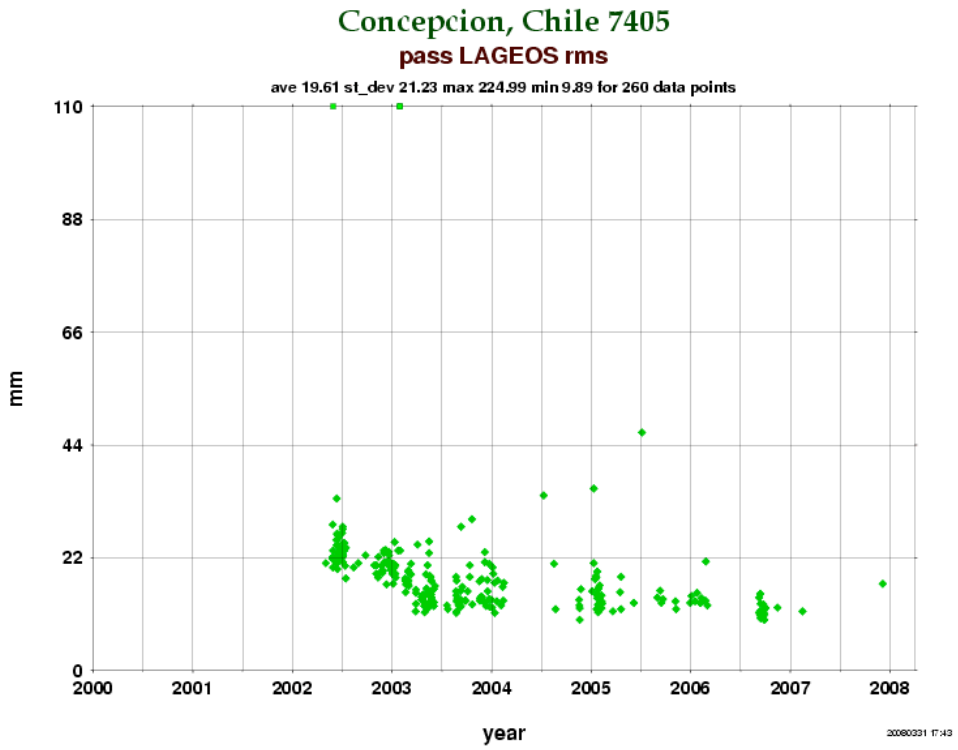
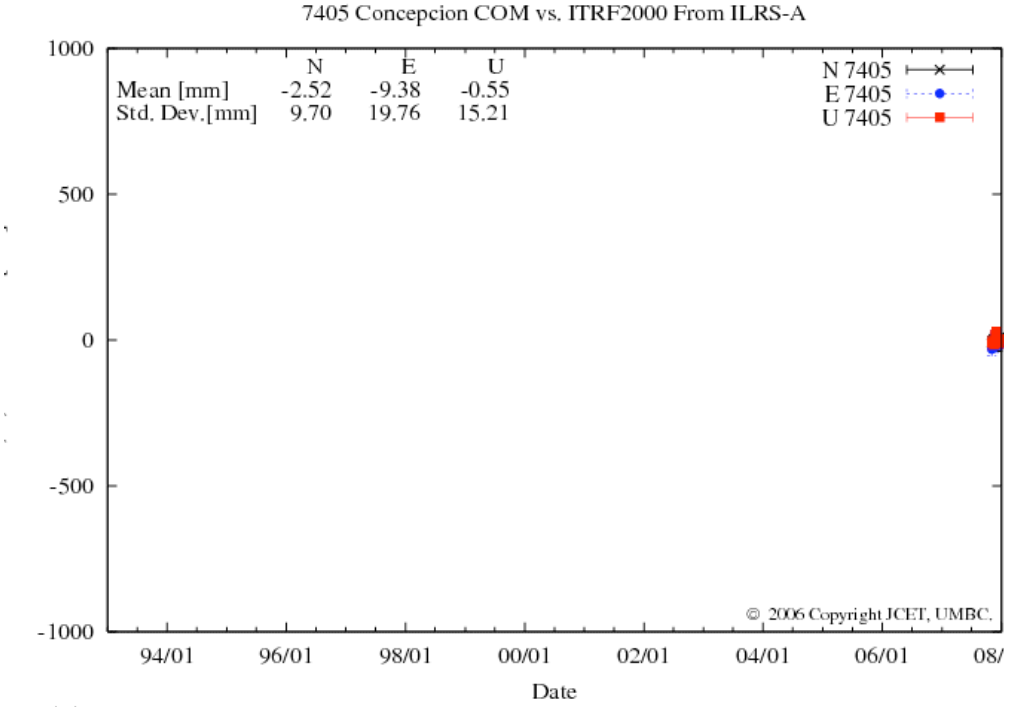
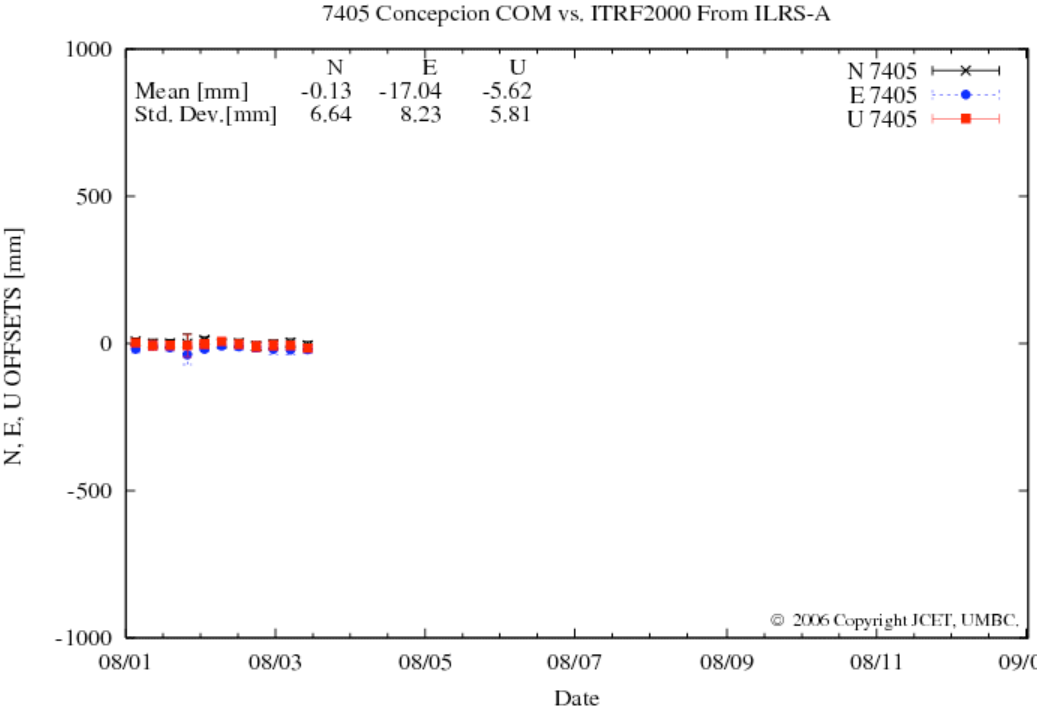
0
2000
2001
2002
2003
2004
2005
2006
2007
2008



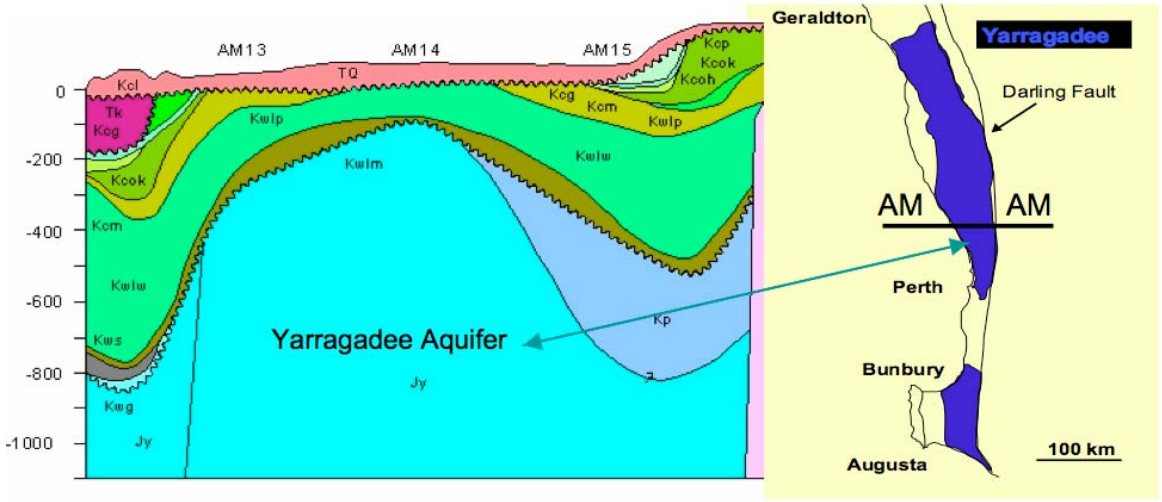

08/01/14



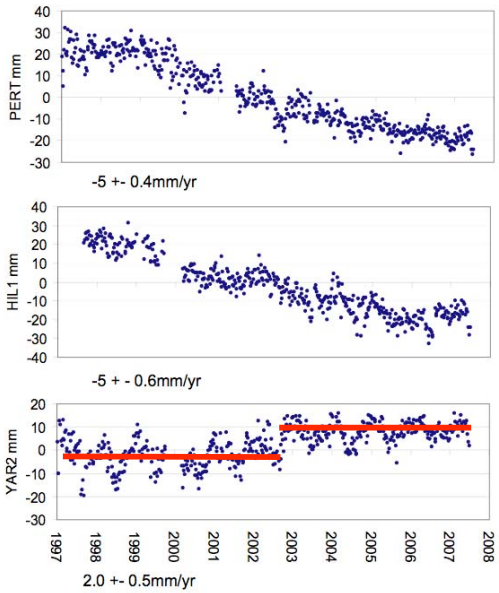

08/04/05

# Yarragadee-Perth area investigation from GA and Water Dept. of Australia

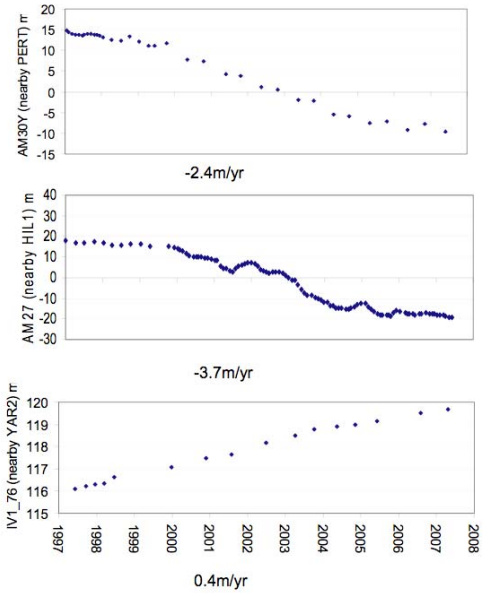
*Minghai Jia, Pauline English* - Geoscience Australia
*Philip Commander* - Department of Water, Western Australia

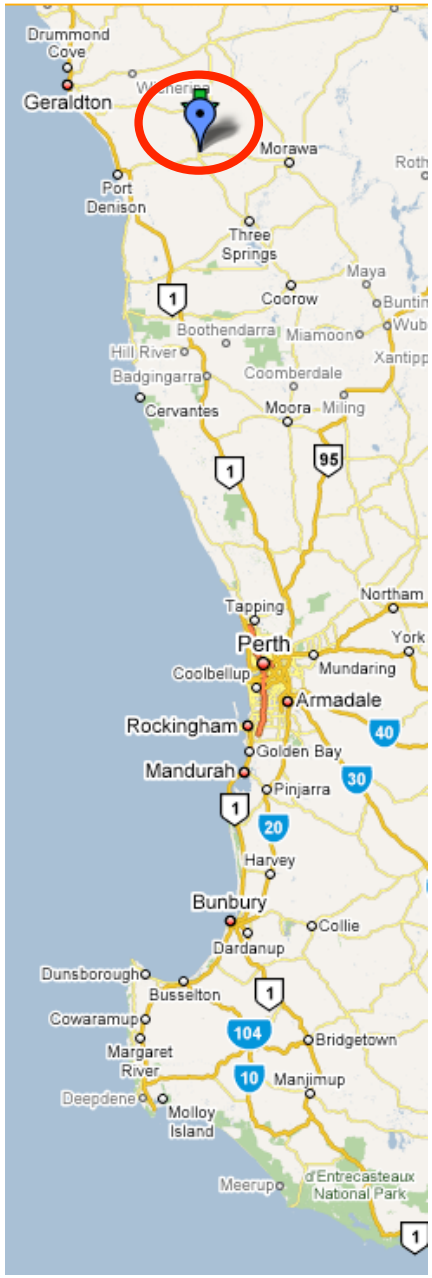


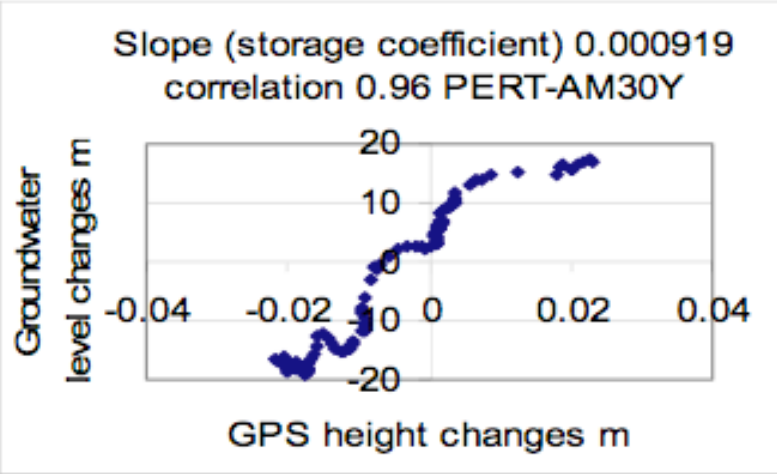

## HEIGHT CHANGE

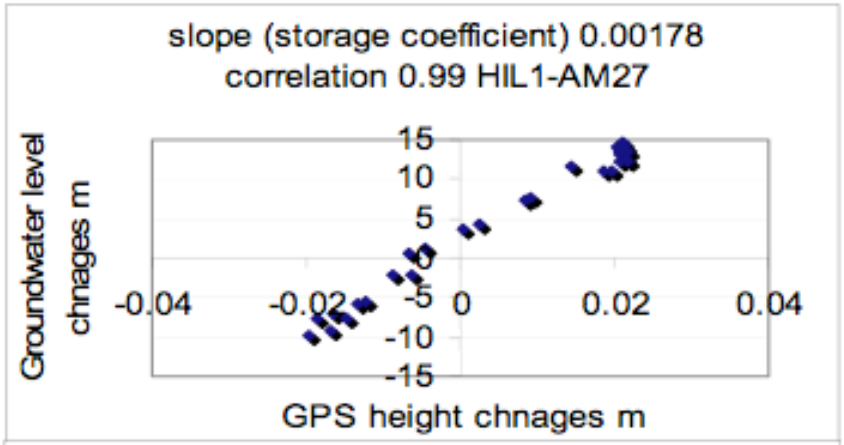



## WATERTABLE CHANGE

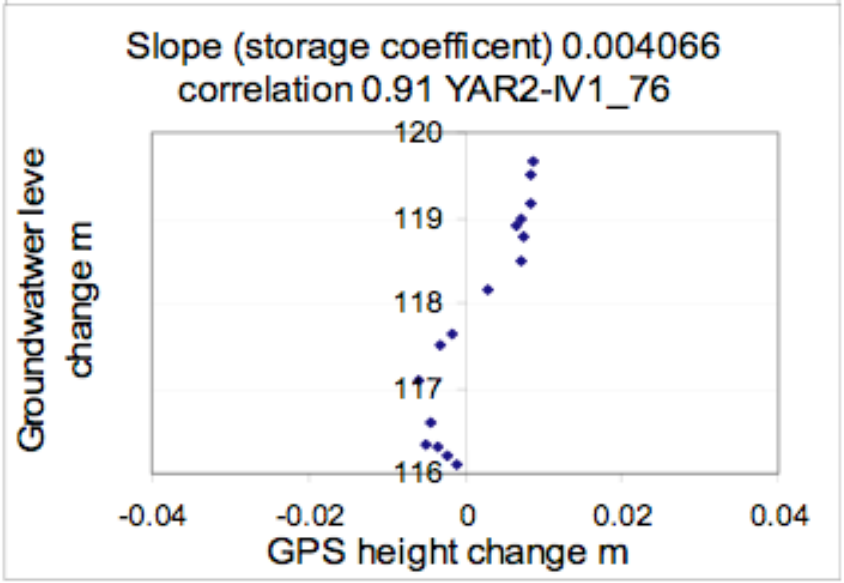





The slopes (storage coefficients) estimated using the least squares method are 0.000919, 0.00178 and 0.004066 for pairs PERT-AM30Y, HIL1-AM27 and YAR2-IV1_76 respectively. The correlations are 0.96, 0.99 and 0.91 for the three pairs. The correlations are almost linear.



## SLR Discontinuities, Biases, Edits, etc. file

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%=SNX 2.0i DGF 07:017:00000 ALL 93:001:00000 00:000:00000 L 00000 2
*-------------------------------------------------------------------------------
+FILE/REFERENCE
 CONTACT            Horst Mueller <mueller@dgfi.badw.de>
 CONTACT            Rolf Koenig <koenigr@gfz-potsdam.de>
-FILE/REFERENCE
*-------------------------------------------------------------------------------
+FILE/COMMENT
 This file sets up a SLR discontinuity file
 in parallel to those already available and subject to
 updates in the IGS and IVS community.
 SOLUTION/DISCONTINUITY
 ----------------------
 Confirmed and Probable
 Commonly used models for time series analysis are:
 "M" Models codes for coordinates time series analysis:
      P = Position
      V = Velocity
      A = Annual Periodicity
      S = Semi-Annual Periodicity
      E = Exponential Decay
  "A" Axis modeled:
      E,N,U = East, North, Up
      X,Y,Z = Geocentric XYZ
      -     = 3D
SOLUTION/DATAHANDLING
 ---------------------
 "M" Models codes:
      X = Exclude/delete data
      R = Estimation of range bias recommended
      C = Target signature bias, Center-of-mass correction different to standard
      S = Stanford ET bias, BIAS in millimeter to be added to all one-way ranges
```

```
-FILE/COMMENT
*------------------------------------------------------------------------------
+INPUT/ACKNOWLEDGMENTS
*AGY _____________FULL_DESCRIPTION_____________________________________________
 DGF Deutsches Geodaetisches Forschungsinstitut (DGFI), Munich, Germany
 GFZ GeoForschungsZentrum Potsdam (GFZ), Potsdam, Germany
     + Several individuals.
-INPUT/ACKNOWLEDGMENTS
*------------------------------------------------------------------------------
+SITE/ID
*Code Pt __Domes__ T _Station Description__ _Longitude_ _Latitude__ _Height
 1824  A 12356S001 L Kiev                    30 29 46.0  50 21 47.9   212.9
 1864  A 12340S002 L Maidanak                66 56 35.1  38 41 05.6  2713.6
 1868  A 12341S001 L Komsomolsk             136 44 37.7  50 41 40.6   269.4
 1884  A 12302S002 L Riga                     24 03 32.6  56 56 54.7    31.3
 1893  A 12341S001 L Katsively               33 58 32.5  44 23  3.8    43.9
 7210  A 40445M001 L Maui                    203 44 38.7  20 42 26.0   3068.
 7105  A 40451M105 L Greenbelt               283 10 20.3  39  1 14.2    19.2
 7231  A 21602S004 L Wuhan                   114 29 22.9  30 30 52.9    86.5
 7237  A 21611S001 L Changchun               125 26 36.4  43 47 25.8   274.2
 7249  A 21601S004 L Beijing, old Laser      115 53 31.3  39 36 24.9    81.7
 7343  A 21601m002 L Beijing (TROS)          115 53 31.6  39 36 27.4    75.2
 7403  A 42202M005 L Arequipa                288 10 32.0 -16 27 55.2  2488.9
 7406  A 41508S003 L San Juan, Argentina     291 22 36.5 -31 30 31.3   728.0
 7604  A 10004M002 L Brest                     4 30 13.8  48 24 28.3   104.8
 7810  B 14001S007 L Zimmerwald                7 27 54.7  46 52 38.0   951.3
 7811  A 12205S001 L Borowiec                 17 04 28.5  52 16 37.1   122.7
 7820  A 21609S002 L Kunming                 102 47 50.7  25  1 47.9  1993.0
 7824  B 13402S007 L San Fernando            353 47 40.8  36 27 54.9    98.3
 7830  A 12617M002 L Chania                   24  4 14.0  35 31 59.0   160.3
 7831  A 30101S001 L Helwan                   31 20 33.7  29 51 32.4   131.9
 7835  A 10002S001 L Grasse                    6 55 16.0  43 45 16.8  1322.8
 7836  A 14106S009 L Potsdam                  13  3 53.6  52 22 48.1   133.5
 7838  A 21726S001 L Simosato                135 56 13.3  33 34 39.6   101.6
```

```
 7839  A 11001S002 L Graz                     15 29 36.0  47 04 01.6   539.4
 7840  A 13212S001 L Herstmonceux                20 10.0  50 52 02.5    75.4
 7841  A 14106S011 L Potsdam                  13  3 41.2  52 22 58.8   127.3
 7848  A 10077M002 L Ajaccio                   8 45 45.7  41 55 38.6    96.8
 8834  A 14201S018 L Wettzell                 12 52 40.8  49 08 39.9   665.4
-SITE/ID
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+SOLUTION/DISCONTINUITY
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 7210  A    1 L 00:000:00000 94:020:00000 P -
 7210  A    2 L 94:020:00000 00:001:00000 P -
 7210  A    3 L 00:001:00000 00:000:00000 P -
 7403  A    1 L 00:000:00000 01:175:73994 P - Arequipa Earthquake
 7403  A    2 L 01:175:73994 01:219:00000 P - Post seismic
 7403  A    3 L 01:219:00000 01:255:00000 P - Post seismic
 7403  A    4 L 01:255:00000 02:237:00000 P - Post seismic
 7403  A    5 L 02:237:00000 00:000:00000 P -
 7811  A    1 L 00:000:00000 94:001:00000 P -
 7811  A    2 L 94:001:00000 00:000:00000 P -
 7835  A    1 L 00:000:00000 97:146:00000 P -
 7835  A    2 L 97:146:00000 97:293:00000 P -
 7835  A    3 L 97:293:00000 00:000:00000 P -
 7838  A    1 L 00:000:00000 04:249:00000 P -
 7838  A    2 L 04:249:00000 00:000:00000 P -
 7839  A    1 L 00:000:00000 96:274:00000 P -
 7839  A    2 L 96:274:00000 00:000:00000 P -
 8834  A    1 L 00:000:00000 97:001:00000 P -
 8834  A    2 L 97:001:00000 00:000:00000 P -
-SOLUTION/DISCONTINUITY
*------------------------------------------------------------------------------
+SOLUTION/DATAHANDLING
*CODE PT SOLN T _DATA_START_ __DATA_END__ M ____BIAS _________COMMENTS___________
 1824  A    1 L 99:314:00000 00:000:00000 S     16.0 Add to all one-way ranges
 1864  A    1 L 93:001:00000 00:000:00000 R
```

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 1868  A    1 L 93:001:00000 00:000:00000 R
 1884  A    1 L 93:001:00000 00:000:00000 R
 1893  A    1 L 98:171:00000 00:000:00000 S     10.0 Add to all one-way ranges
 7105  A    1 L 06:336:18000 06:342:10800 X          Time unit failure
 7210  A    1 L 93:001:00000 00:000:00000 R
 7231  A    1 L 99:001:00000 00:000:00000 S     10.0 Add to all one-way ranges
 7237  A    1 L 93:001:00000 00:000:00000 R
 7249  A    1 L 01:020:00000 00:000:00000 S     22.0 Add to all one-way ranges
 7343  A    1 L 00:032:00000 00:000:00000 S     10.0 Add to all one-way ranges
 7406  A    1 L 06:020:00000 00:000:00000 S     10.0 Add to all one-way ranges
 7810  B    1 L 97:001:00000 00:000:00000 S     11.0 Add to all one-way ranges
 7810  B    1 L 93:001:00000 00:000:00000 R          For infrared wavelngth only
 7811  A    1 L 93:001:00000 94:001:00000 R
 7811  A    1 L 02:127:00000 00:000:00000 S      9.0 Add to all one-way ranges
 7820  A    1 L 98:140:00000 00:000:00000 S     19.0 Add to all one-way ranges
 7824  A    1 L 01:222:00000 00:000:00000 S      8.0 Add to all one-way ranges
 7830  A    1 L 03:091:00000 03:274:00000 S      6.0 Add to all one-way ranges
 7831  A    1 L 99:135:00000 00:000:00000 S     10.0 Add to all one-way ranges
 7835  A    1 L 95:244:00000 05:213:00000 S      3.0 Add to all one-way ranges
 7835  A    1 L 93:001:00000 98:001:00000 R
 7836  A    1 L 92:129:00000 00:000:00000 S     10.0 Add to all one-way ranges
 7838  A    1 L 04:183:00000 00:000:00000 S      9.0 Add to all one-way ranges
 7839  A    1 L 93:001:00000 96:274:00000 R
 7840  A    1 L 93:001:00000 00:000:00000 C          245 mm CoM for LAGEOS1/-2
 7840  A    1 L 93:001:00000 94:274:00000 R          Stanford Counter problems
 7840  A    1 L 93:001:00000 02:032:00000 S     18.5 Add to all one-way ranges
 7840  A    1 L 02:032:00000 00:000:00000 S      8.5 Add to all one-way ranges
 7841  A    1 L 01:201:00000 04:050:00000 S     10.0 Add to all one-way ranges
 7848  A    1 L 02:091:00000 02:274:00000 S      8.0 Add to all one-way ranges
 8834  A    1 L 93:001:00000 97:001:00000 R
-SOLUTION/DATAHANDLING
*-------------------------------------------------------------
%ENDSNX
```

```
+BIAS/EPOCHS     SLR DATA PROBLEM FILE PROPOSED by V. Husson in 2003
*
*   Last modified -  14 July 2003
*       by V. Husson/ILRS Central Bureau (back then :-)
*
* ILRS Point Codes are:
*
*   L1: LAGEOS-1
*   L2: LAGEOS-2
*   LC: LAGEOS Combined
*   E1: Etalon-1
*   E2: Etalon-2
*   EC: Etalon Combined
*   --: Wildcard (applies to all satellites, LEO, LAGEOS, and high)
*
*
* ILRS Observation Bias Codes are:
*
*   R: range bias
*   T: time bias
*   P: pressure bias
*   S: scale bias
*   X: blunder, please edit
*
*
* The Solution Number Code is used to reflect the release flag
* of the data (byte 48 of the normal point data record)
*
* Note: 1) The Mean Epoch field was intentially left blank.
*       2) An entry with a Bias Code of 'X' will NOT have a corresponding
*          entry in the SOLUTION/APRIORI BLOCK, because this data is to
*          edited. Conversely, an entry with a bias code other than 'X'
*          will have a corresponding entry in the SOLUTION/APRIORI BLOCK.
```

```
*        1         2         3         4         5         6         7         8
*2345678901234567890123456789012345678901234567890123456789012345678901234567890
*-------------------------------------------------------------------------------
*SITE PT SOLN T _DATA_START_ __DATA_END__ _MEAN_EPOCH_
*
 1864 --    0 P 90:270:00000 00:359:00000
 1864 L1    0 X 99:170:58920 99:170:62520
 1864 --    0 X 02:070:00000 02:101:00000
 1868 L1    0 X 99:313:41160 99:313:44760
 1868 L2    0 X 99:313:47520 99:313:51120
 1868 L2    0 R 99:319:36120 99:319:39720
 1868 L1    0 R 99:319:61080 99:319:64680
 1868 L2    0 R 99:319:65460 99:319:69060
 1884 L2    0 X 99:128:71280 99:128:74880
 7105 L2    0 P 99:138:73380 99:138:76980
 7105 L2    0 X 99:141:68416 99:141:68418
 7105 L2    0 X 99:156:03150 99:156:03152
 7105 L2    0 X 99:158:03021 99:158:03023
 7105 L1    0 P 99:159:20580 99:159:24180
 7105 L1    0 P 99:191:15720 99:191:16444
 7105 L1    0 X 99:191:16805 99:191:16807
 7105 L2    0 P 99:192:51720 99:192:52927
 7105 L2    0 X 99:192:53055 99:192:53057
 7210 L1    0 T 99:183:31980 99:183:33200
 7210 L1    0 T 99:188:19860 99:188:20070
 7210 L2    0 T 99:189:07380 99:189:08330
 7210 L2    0 X 99:189:08584 99:189:08585
 7210 L1    0 T 99:189:27900 99:189:29300
```

```
-BIAS/EPOCHS
*
*
+SOLUTION/APRIORI
*
* SOLUTION/APRIORI entries will have a corresponding entry
* in the BIAS/EPOCHS Block. The Point Codes, Solution Number
* and start epoch should exactly match the corresponding entries
* in the SOLUTION/APRIORI Block.
*
*
* ILRS Parameters Types are:
*
*   RBIAS: range bias
*   TBIAS: time bias
*   SBIAS: scale bias
*   PBIAS: pressure bias
*   ZBIAS: tropospheric bias (zenith)
*
*
* ILRS Point Codes are:
*
*   L1: LAGEOS-1
*   L2: LAGEOS-2
*   LC: LAGEOS Combined
*   E1: Etalon-1
*   E2: Etalon-2
*   EC: Etalon Combined
*   --: Wildcard (apply to all satellites, LEO, LAGEOS, and high)
*
*
* The Solution Number Code is used to reflect the release flag
* of the data (byte 48 of the normal point data record)
*
```

```
*
* ILRS Parameter Units are:
*
*    m: meters
*   mb: millibars
*   ms: milliseconds
*   us: microseconds
*  mas: milli-arc-seconds
*  ppb: parts per billion
*
*
* Note: 1) Parameter Index is intentionally left blank
*       2) The Constraint Code has been set to "0", which implies a
*          fixed/tight constraint for the bias.
*       3) To apply the data correction subtract the correction field
*          (i.e. apriori bias) from the corresponding normal point
*          (NP) field
*
*             e.g. Corrected Range = NP Range - Range Bias
*                  Corrected Epoch = Epoch - Time Bias
*                  Corrected Pressure = NP Pressure - Pressure Bias
*
*       4) The uncertainity in the apriori bias value is in the column
*          Apriori Standard Deviation.
*
*
*        1         2         3         4         5         6         7         8
*2345678901234567890123456789012345678901234567890123456789012345678901234567890
*-------------------------------------------------------------------------------
*INDEX _TYPE_ CODE PT SOLN _REF_EPOCH__ UNIT S __ESTIMATED VALUE____ __STD_DEV__
       PBIAS  1864 --    0 90:270:00000 mb   0 -.680000000000000E+01 .100000E+01
       RBIAS  1868 L2    0 99:319:36120 m    0 0.150000000000000E+01 .150000E-01
       TBIAS  7105 --    0 99:067:41720 ms   0 -.201500000000000E+00 .500000E-03
       PBIAS  7105 L2    0 99:138:73380 mb   0 0.560000000000000E+01 .100000E+01
```

## DGFI/GFZ PROPOSAL:

```
+SOLUTION/DATAHANDLING
*CODE PT SOLN T _DATA_START_ __DATA_END__ M ____BIAS ________COMMENTS___________
 1824  A    1 L 99:314:00000 00:000:00000 S     16.0 Add to all one-way ranges
 1864  A    1 L 93:001:00000 00:000:00000 R
 7840  A    1 L 93:001:00000 00:000:00000 C          245 mm CoM for LAGEOS1/-2
 7105  A    1 L 06:336:18000 06:342:10800 X          Time unit failure
```

## VH-modified PROPOSAL:

```
*INDEX _TYPE_ CODE PT SOLN _REF_EPOCH__ UNIT S __ESTIMATED VALUE____ __STD_DEV__
       PBIAS  1864 --    0 90:270:00000 mb   0 -.680000000000000E+01 .100000E+01
       RBIAS  1868 L2    0 99:319:36120 m    0 0.150000000000000E+01 .150000E-01
       TBIAS  7105 --    0 99:067:41720 ms   0 -.201500000000000E+00 .500000E-03
       PBIAS  7105 L1    0 99:138:73380 mb   0 0.560000000000000E+01 .100000E+01
       SBIAS  7210 --    0 90:049:41720 ppb  0 -.809273589426100E+01 .500000E-03
```

## FUSED VERSION PROPOSAL:

```
*        1         2         3         4         5         6         7         8
*2345678901234567890123456789012345678901234567890123456789012345678901234567890
+SOLUTION/DATAHANDLING
*CODE PT UNIT T _DATA_START_ __DATA_END__ M __E-VALUE___ STD_DEV_ ___COMMENTS___
 1864 -- mb   S 99:314:00000 00:000:00000 P -.680000E+01 .100E+01 Wrong Cal
 1868 L2 m    A 93:001:00000 00:000:00000 R 0.150000E+01 .150E-01 See 1993.12345
 7840 -- m    M 93:001:00000 00:000:00000 C 0.245000E+01 .200E-02 LAGEOS1/-2
 7105 L1 -    E 06:336:18000 06:342:10800 X 0.000000E+00 .000E+00 T-unit failed
 7210 -- ppb  A 90:049:41720 90:342:10800 S -.809274E+01 .500E-03 HOLLAS scale-b
 7105 -- ms   E 99:067:41720 99:097:41720 T -.201500E+00 .500E-03 Sec. time Unit
```

**T-CODES:** S = Station-supplied/determined
A = Analysis-supplied/determined *(1993.12345 refers to Rpt.)*
M = Model-supplied/determined
E = Engineering-supplied/determined

```
*******************************************************************************
SLR Electronic Report      Wed Apr  9 15:15:07 CEST 2008        Message No. 9469
*******************************************************************************
Author: Werner Gurtner
Subject: ILRS Combined Range Bias Report 09-Apr-2008
```

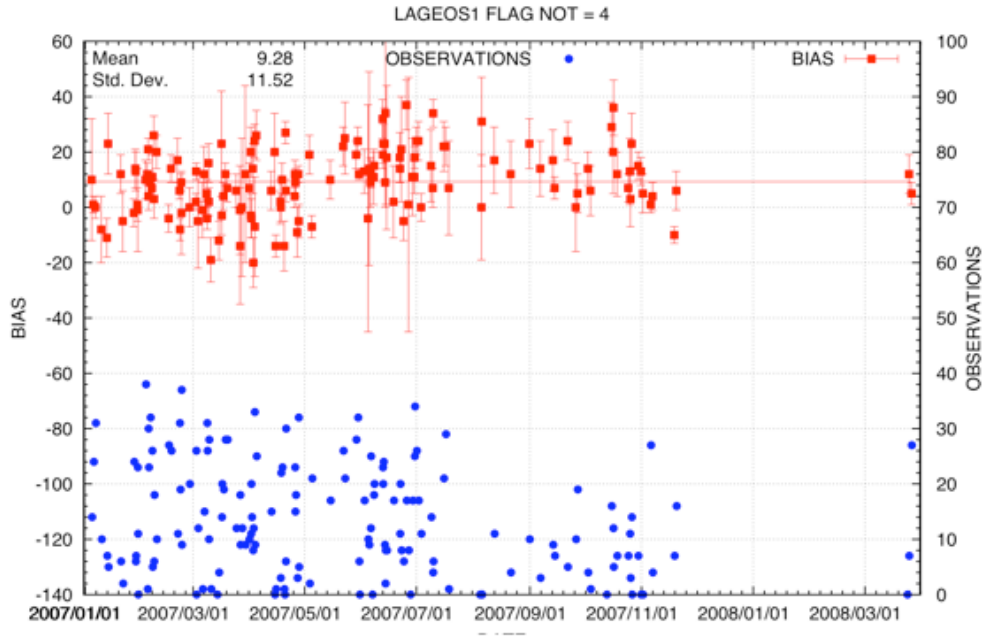
## ILRS Combined Range Bias Report 1

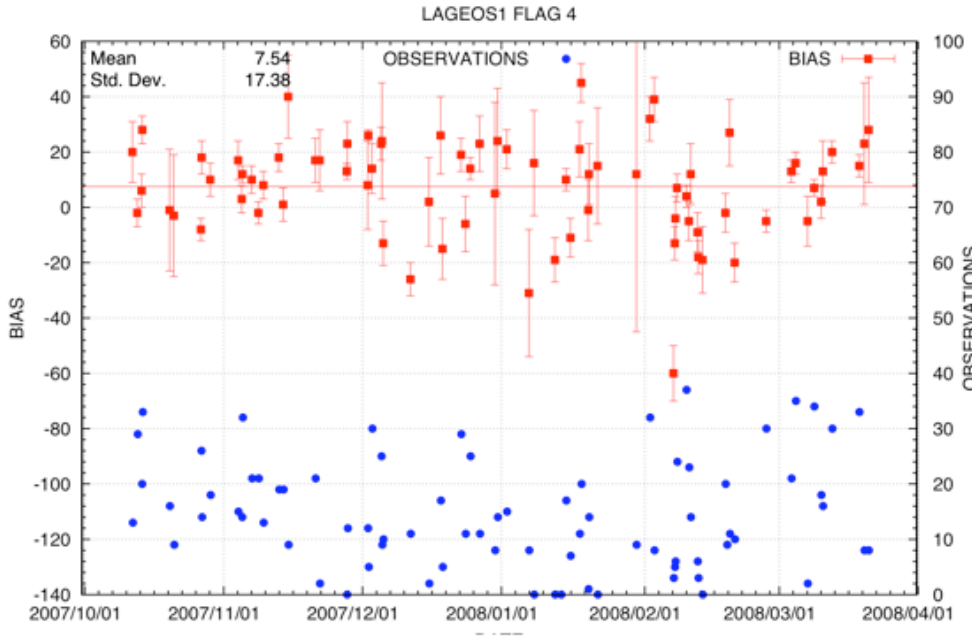
2008-03-26 00:00 UT - 2008-04-09 00:00 UT

Compiled by: SLR Observatory Zimmerwald
Date : 2008-04-09 12:30 UT
E-Mail : Werner.Gurtner@aiub.unibe.ch

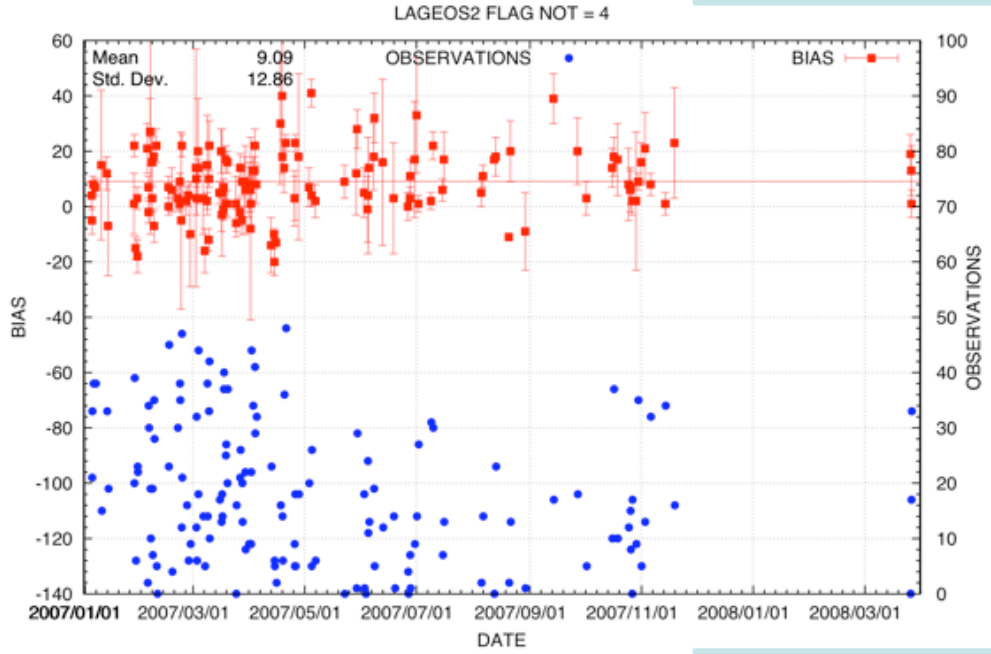
| No. | Site | Location | wl | DGFI | | MCC | | HIT-U | | SAO | | JCET | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | rb | pr | rb | pr | rb | pr | rb | pr | rb | pr |
| 1873 | SIML | Simeiz | 532 | -51 | 13 | 38 | 70 | -93 | 91 | -13 | 49 | 93 | 8 |
| 1893 | KTZL | Katzively | 532 | -21 | 10 | | | -172 | 9 | | | -177 | 8 |
| 7080 | MDOL | McDonald | 532 | 12 | 4 | 11 | 3 | 6 | 3 | 7 | 3 | 2 | 4 |
| 7090 | YARL | Yarragadee | 532 | 6 | 2 | 0 | 2 | 2 | 1 | -6 | 1 | 7 | 3 |
| 7105 | GODL | Greenbelt | 532 | 2 | 4 | | | 2 | 2 | | | 0 | 3 |
| 7110 | MONL | Monument Peak | 532 | -4 | 3 | 0 | 3 | 4 | 3 | -4 | 3 | -4 | 4 |
| 7119 | HA4T | Haleakala | 532 | 6 | 3 | 0 | 3 | 8 | 2 | -5 | 3 | 8 | 4 |
| 7249 | BEIL | Beijing | 532 | 15 | 7 | 1 | 7 | 0 | 6 | 55 | 5 | 17 | 6 |
| 7308 | KOGC | Koganei | 532 | 33 | 2 | 62 | 2 | 26 | 2 | 31 | 1 | 14 | 3 |
| 7358 | GMSL | Tanegashima | 532 | 40 | 2 | | | 49 | 1 | -79 | 6 | 41 | 4 |
| 7405 | CONL | Concepcion | 847 | -4 | 4 | -29 | 3 | -55 | 2 | -24 | 3 | -35 | 4 |
| 7406 | SANJ | San Juan | 532 | 0 | 6 | 4 | 3 | 0 | 2 | -3 | 3 | 8 | 4 |
| 7501 | HARL | Hartebeesthoek | 532 | 13 | 2 | 4 | 9 | 13 | 3 | -34 | 2 | 3 | 8 |
| 7820 | KUNL | Kunming | 532 | -519 | 7 | | | 117 | 8 | | | 125 | 8 |
| 7824 | SFEL | San Fernando | 532 | -14 | 3 | -42 | 4 | -16 | 2 | 1 | 4 | -15 | 3 |
| 7825 | STL3 | Mt Stromlo | 532 | 3 | 3 | -13 | 3 | -2 | 2 | -7 | 2 | 1 | 3 |
| 7832 | RIYL | Riyadh | 532 | 18 | 3 | -21 | 3 | 16 | 2 | -32 | 3 | 26 | 3 |
| 7839 | GRZL | Graz | 532 | 0 | 1 | -6 | 1 | -8 | 1 | 0 | 1 | 0 | 2 |
| 7840 | HERL | Herstmonceux | 532 | 12 | 1 | 7 | 2 | 13 | 1 | 13 | 2 | 9 | 2 |
| 7841 | POT3 | Potsdam | 532 | 4 | 7 | -3 | 5 | -9 | 5 | | | 0 | 6 |
| 7941 | MATM | Matera | 532 | -5 | 2 | 18 | 2 | -4 | 2 | 18 | 1 | 5 | 3 |
| 8834 | WETL | Wettzell | 532 | 1 | 3 | -2 | 3 | 3 | 3 | -17 | 2 | 5 | 3 |

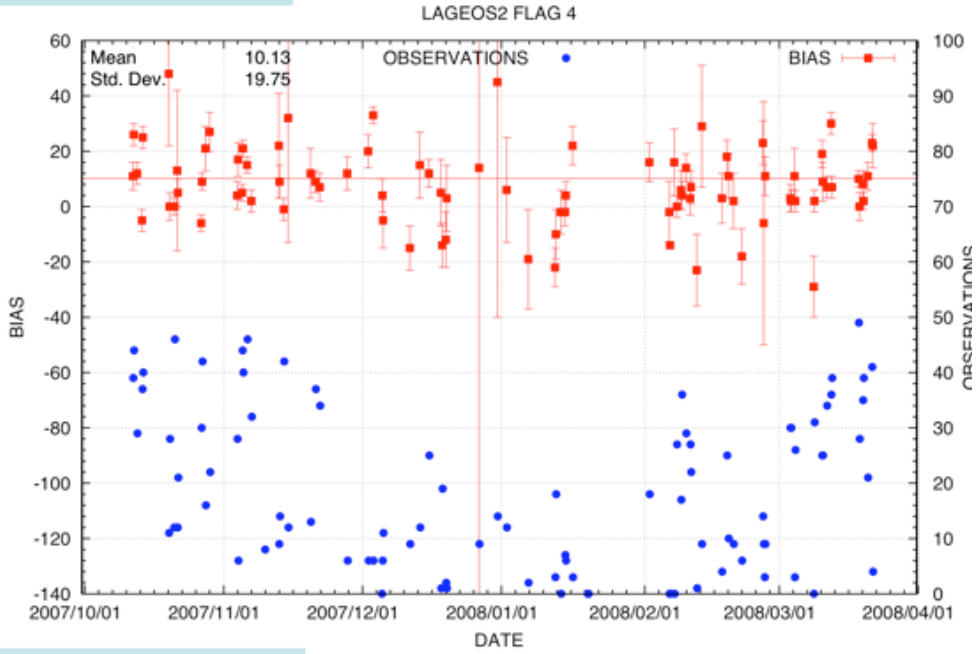
# MLRS 7080 MCP Bias




$Rb^{L1}$ wrt Old MCP ≈-1.7 mm




$Rb^{L2}$ wrt Old MCP ≈+1.0 mm