ASI AC&CC report

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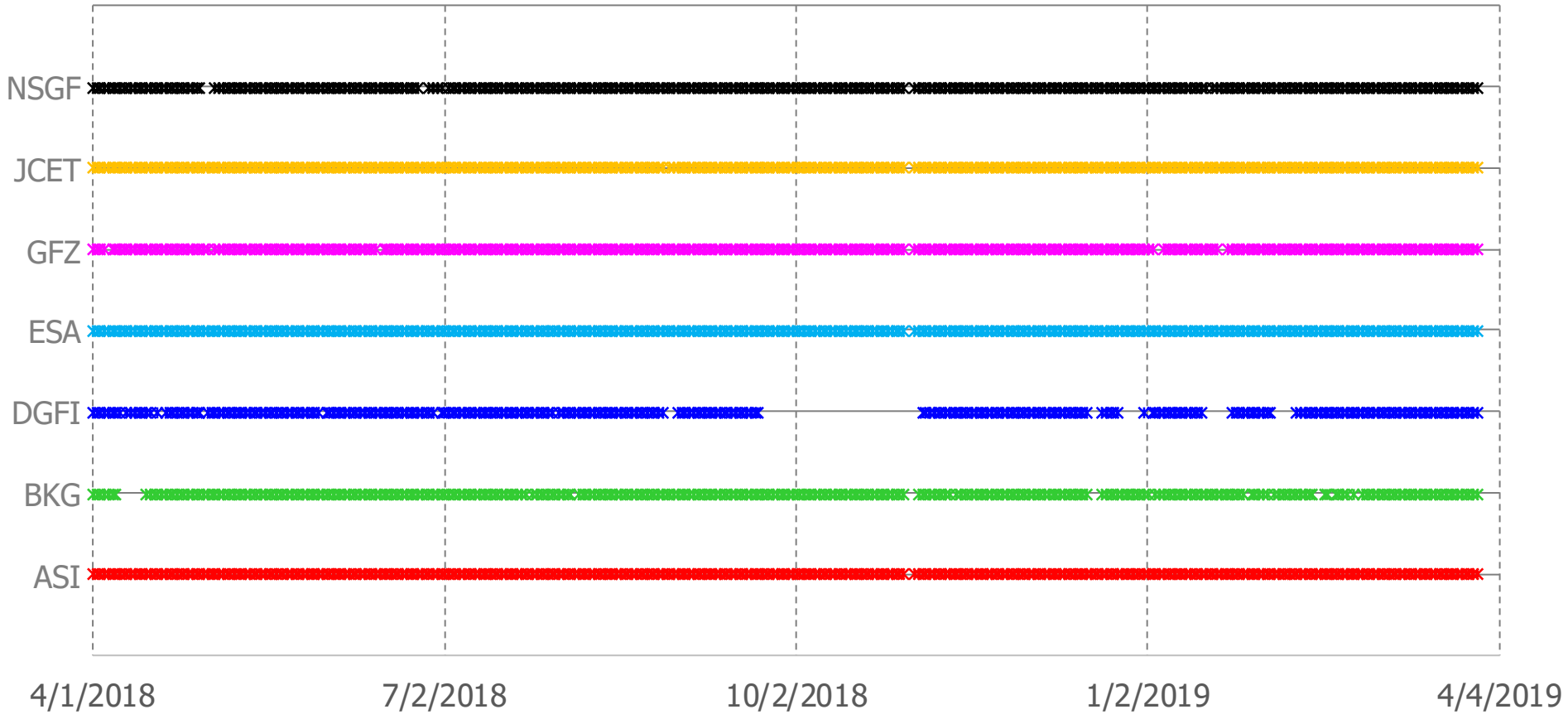
ILRS ASC Meeting, April 6th 2019, Vienna

Activities since last ASC meeting

- ACs performance check
  - Data submissions
  - 3D wrms of the residuals w.r.t. SLRF (daily and weekly)
  - Scale factor
  - Geocenter motion
  - LOD
  - Combination scale factor
  - Orbits: RMS of residuals w.r.t. combination
  - ILRS ACs orbit agreement

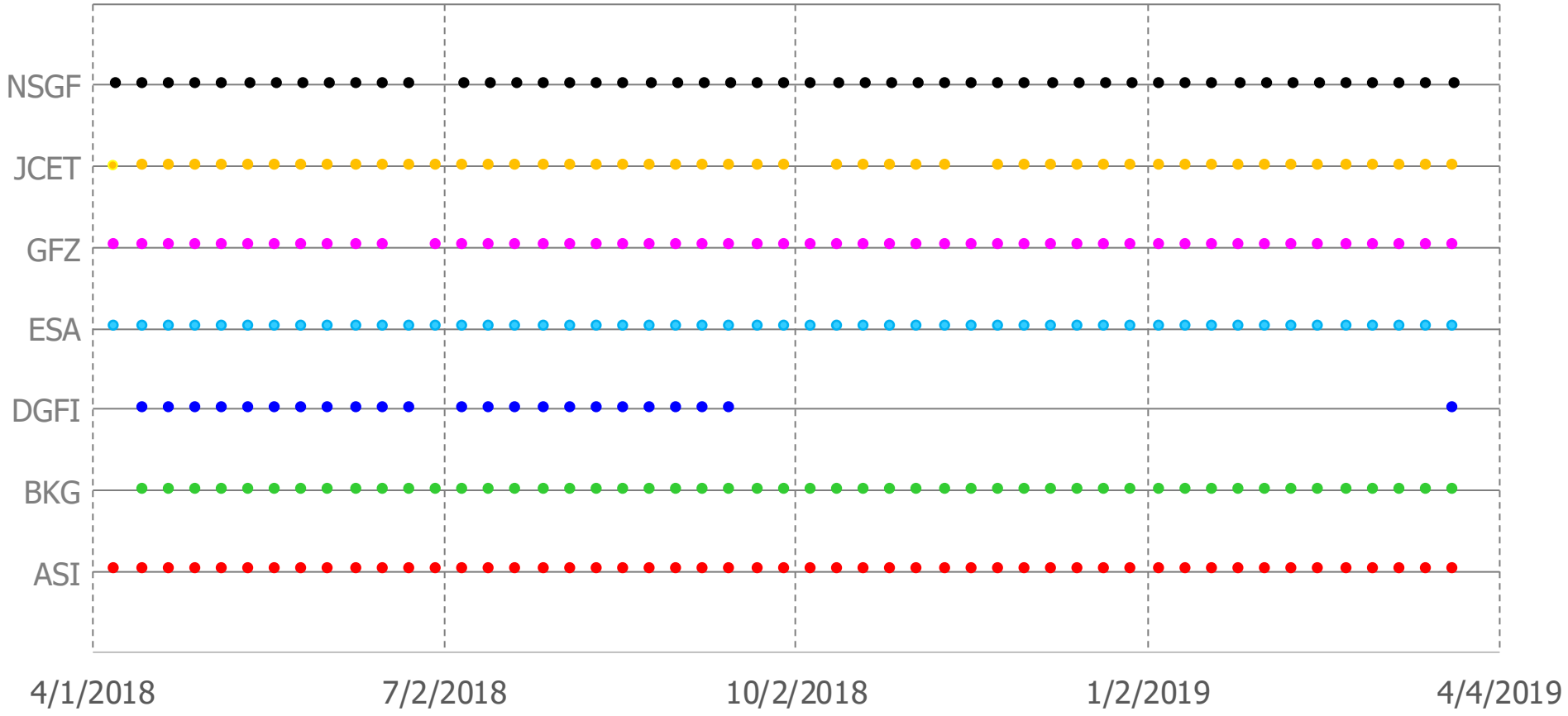
Data submissions

Daily (v170) ACs time series



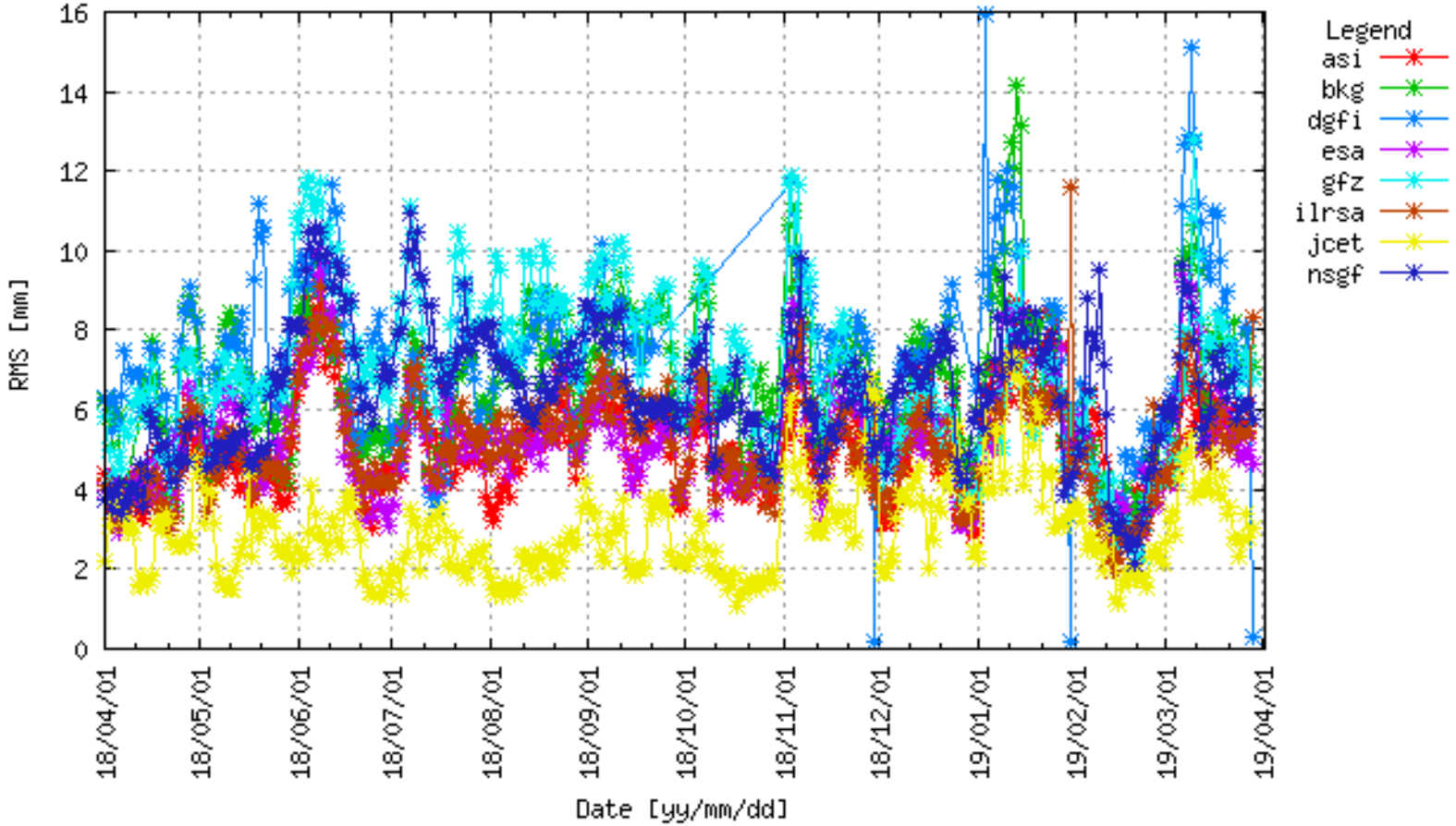
Data submissions

Weekly (v70) ACs time series



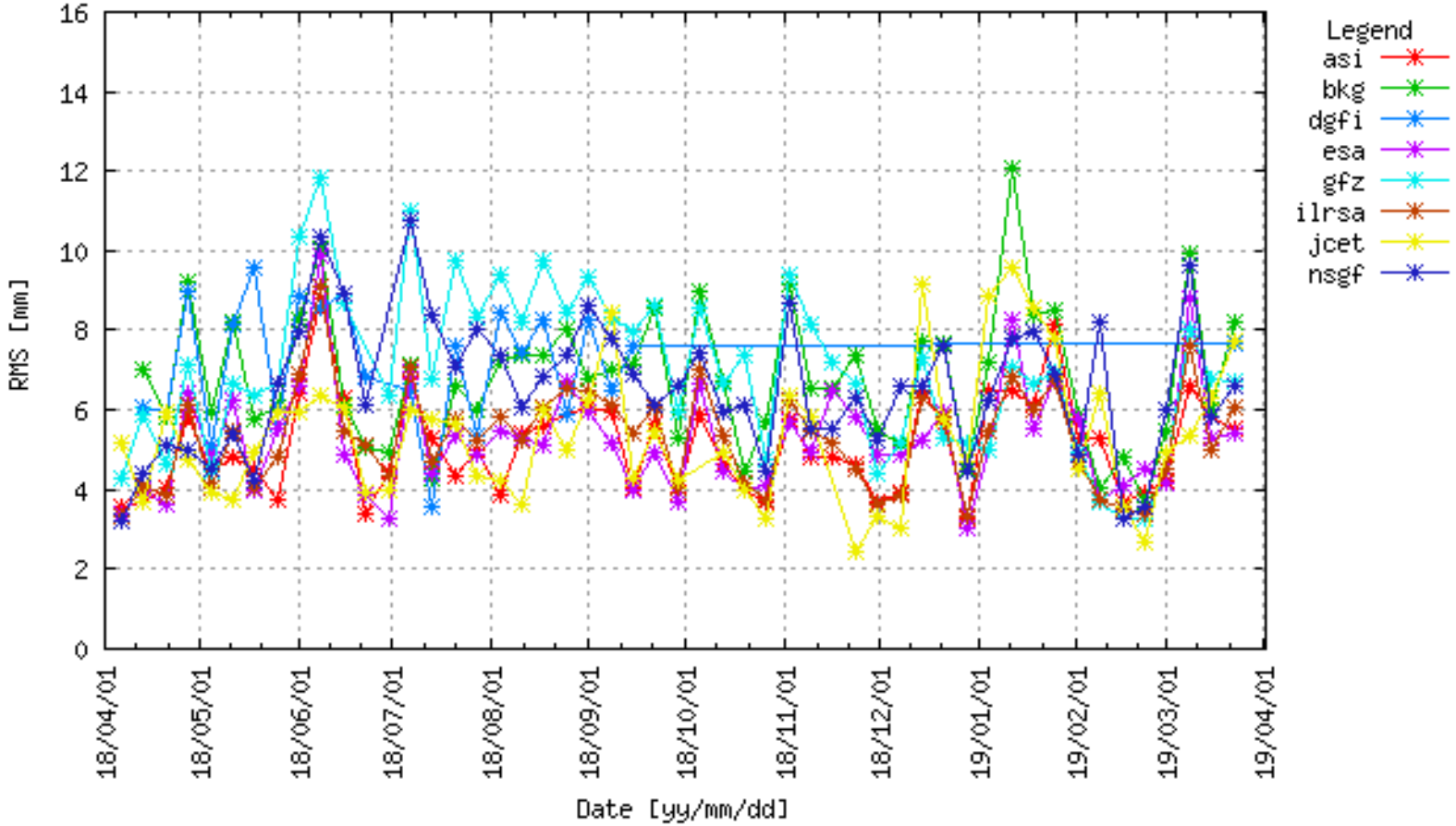
Stations Coordinates from Daily solutions

3D wrms of the residuals w.r.t. SLRF2014
CORE SITES

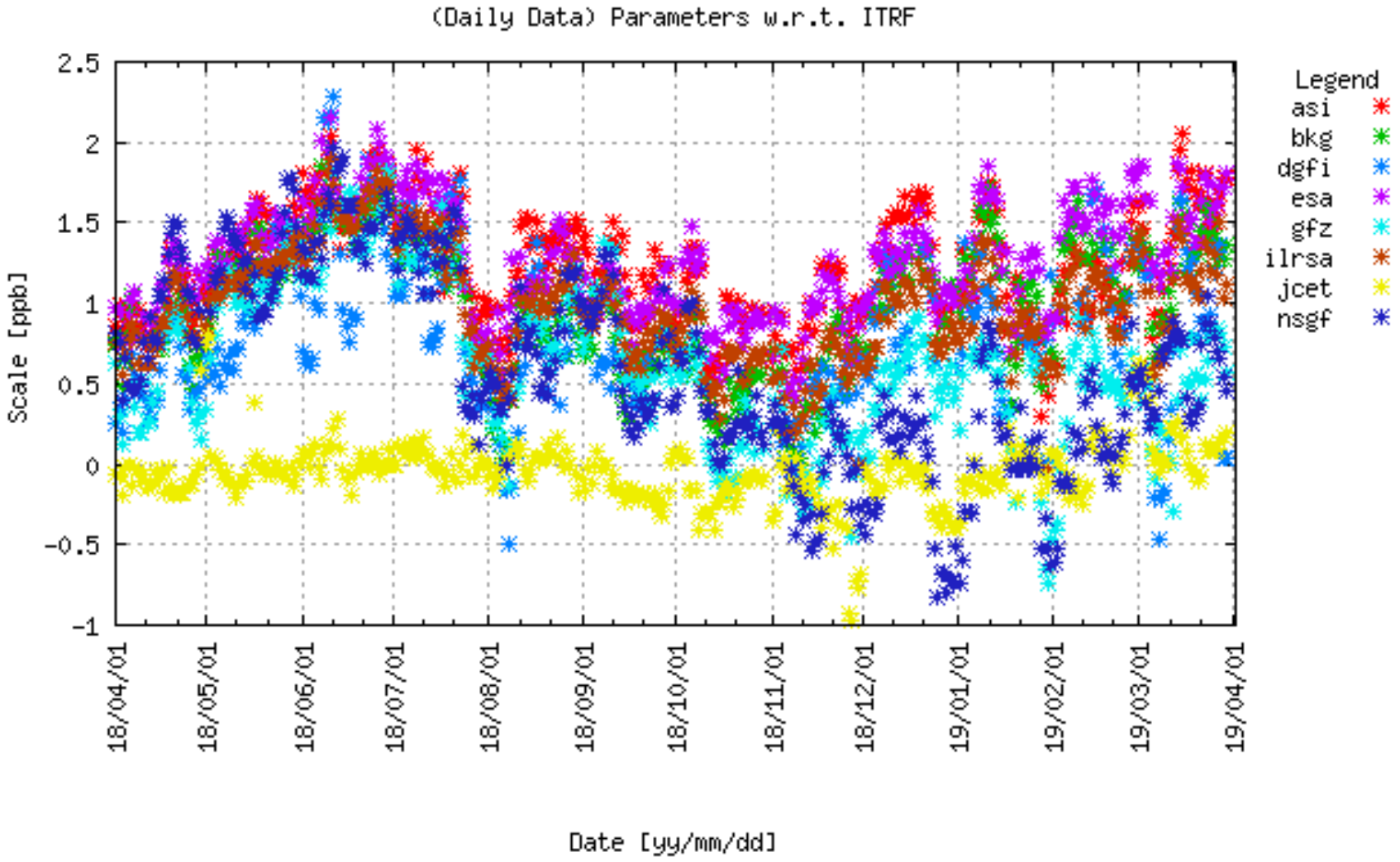


Stations Coordinates from Weekly solutions

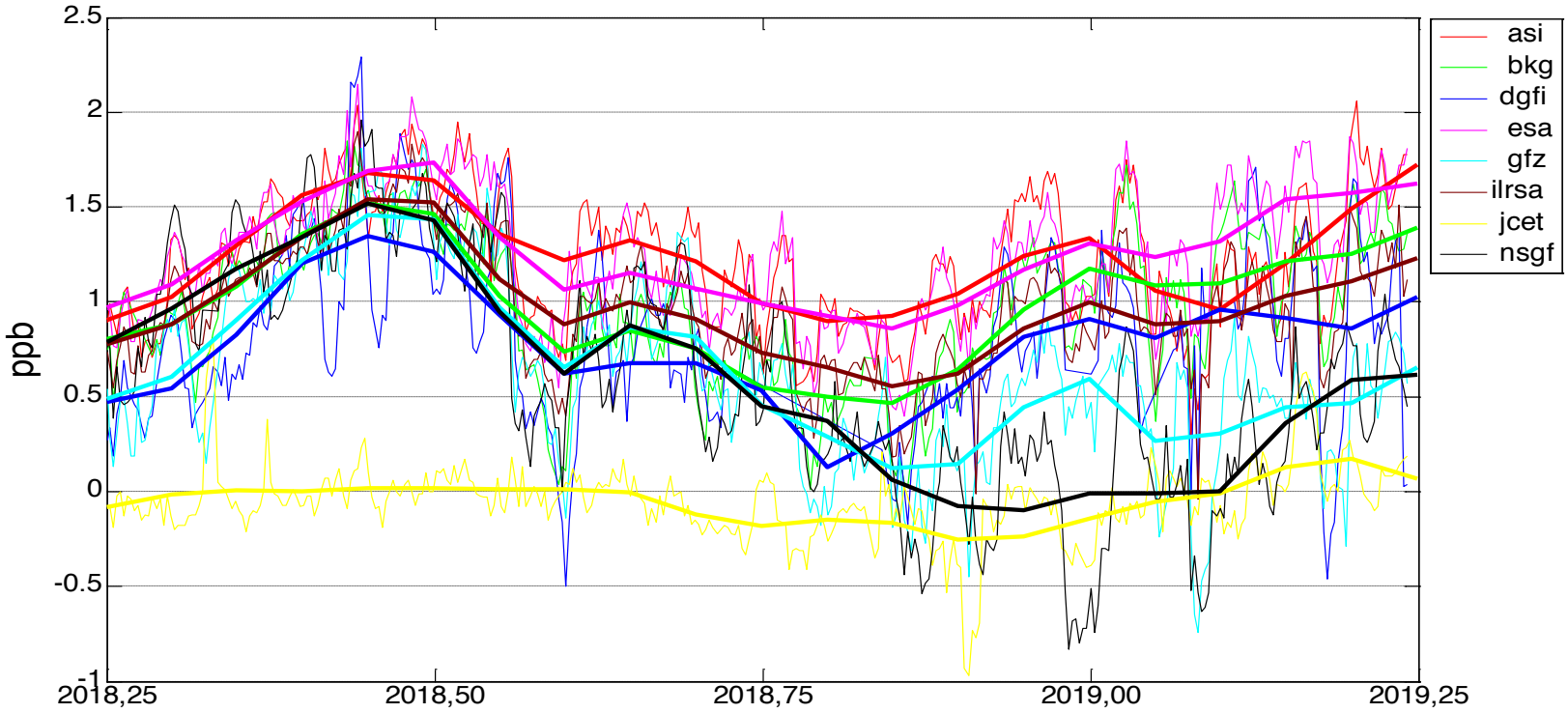
3D wrms of the residuals w.r.t. SLRF2014
CORE SITES



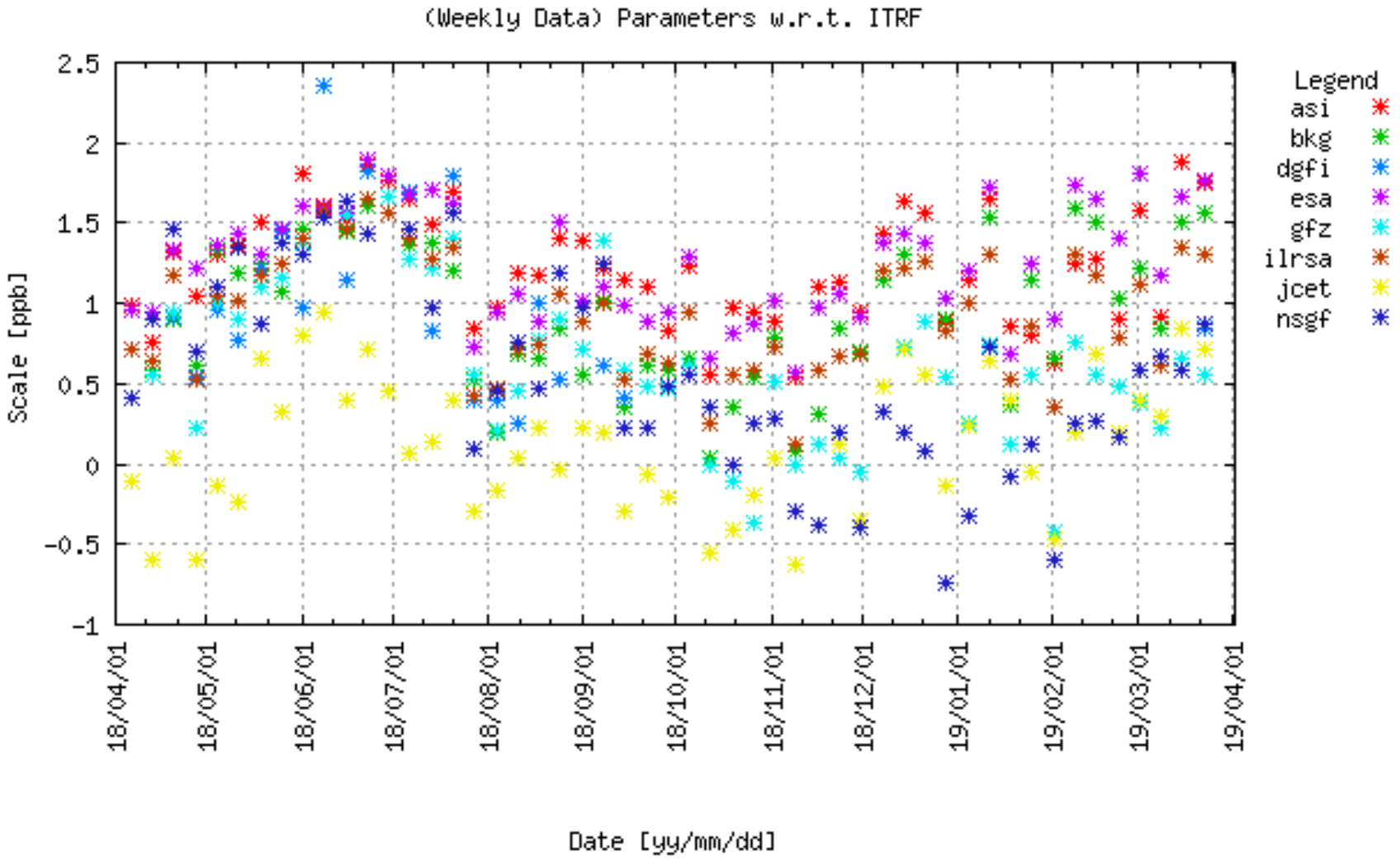
Scale from daily solutions



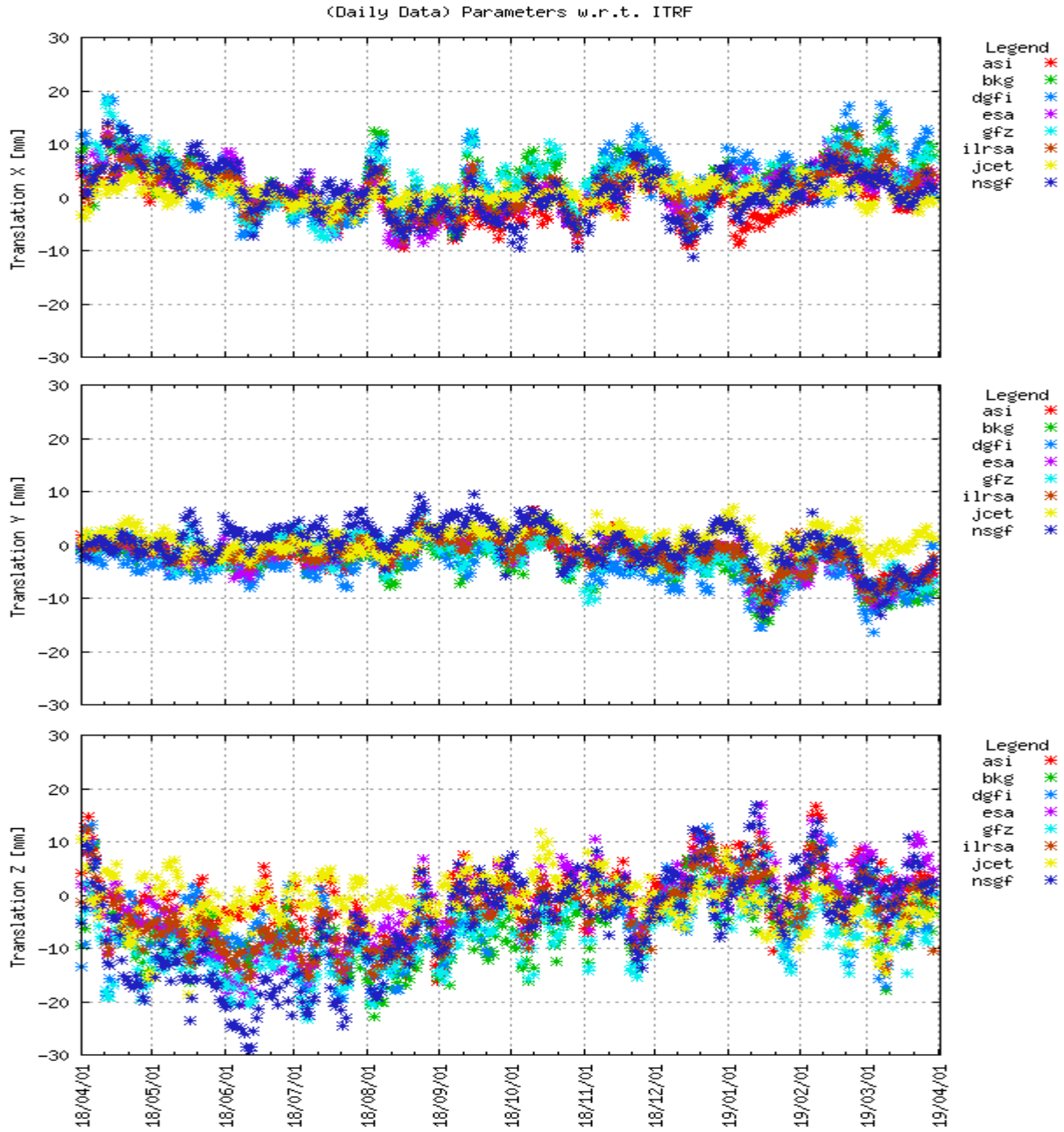
Scale from daily solutions (trend lines)



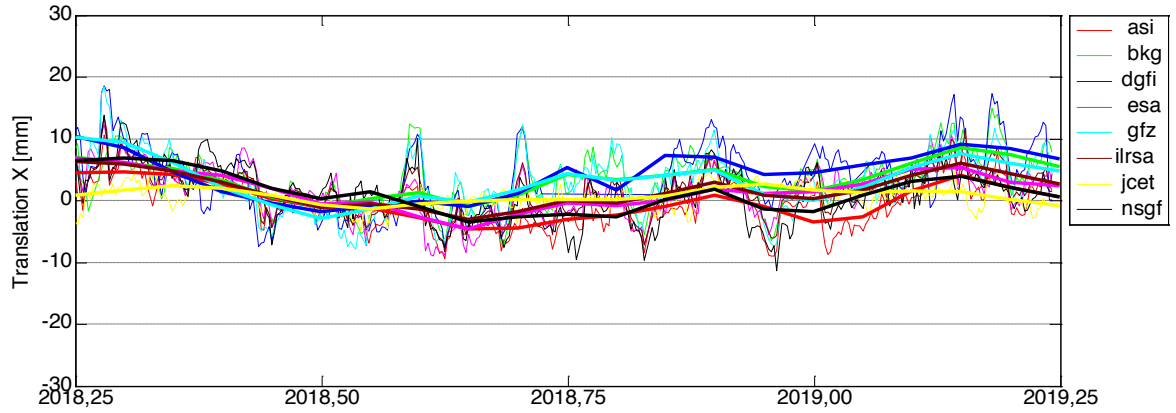
Scale from weekly solutions

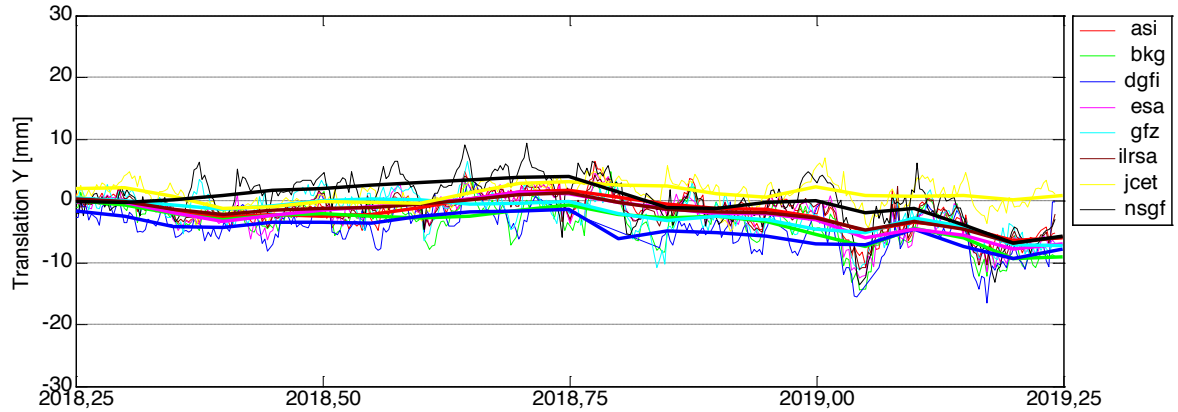


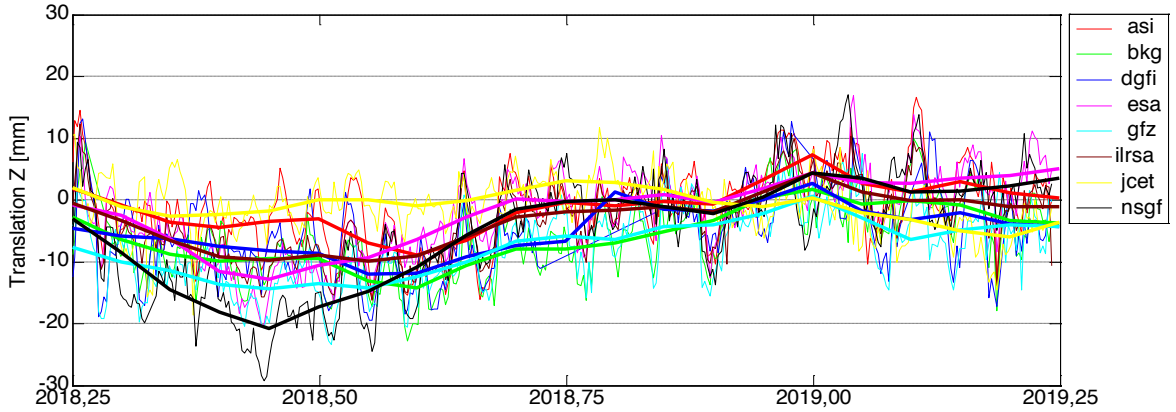
Geocenter motion from daily solutions



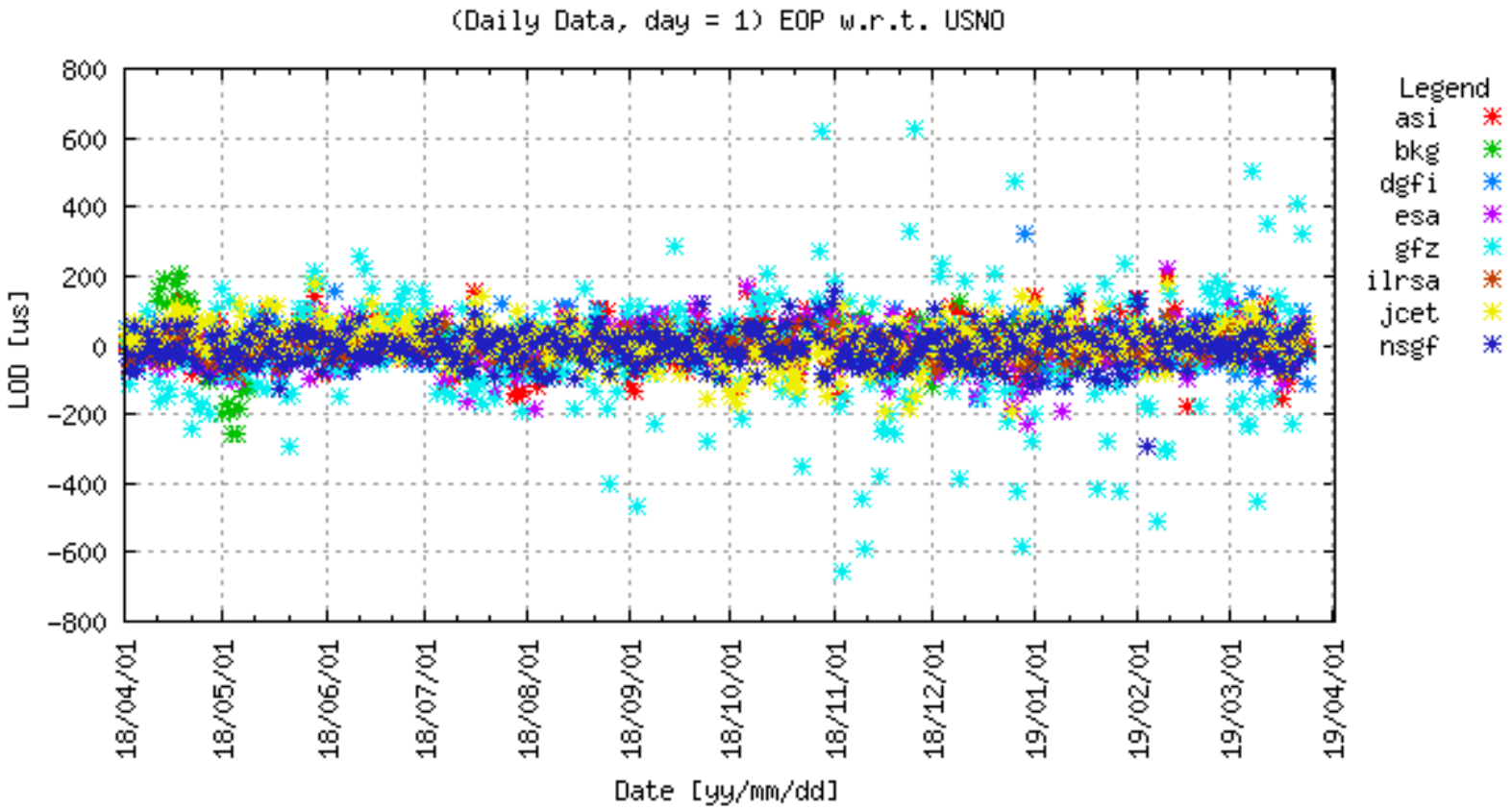
Geocenter motion from daily solutions (trend lines)



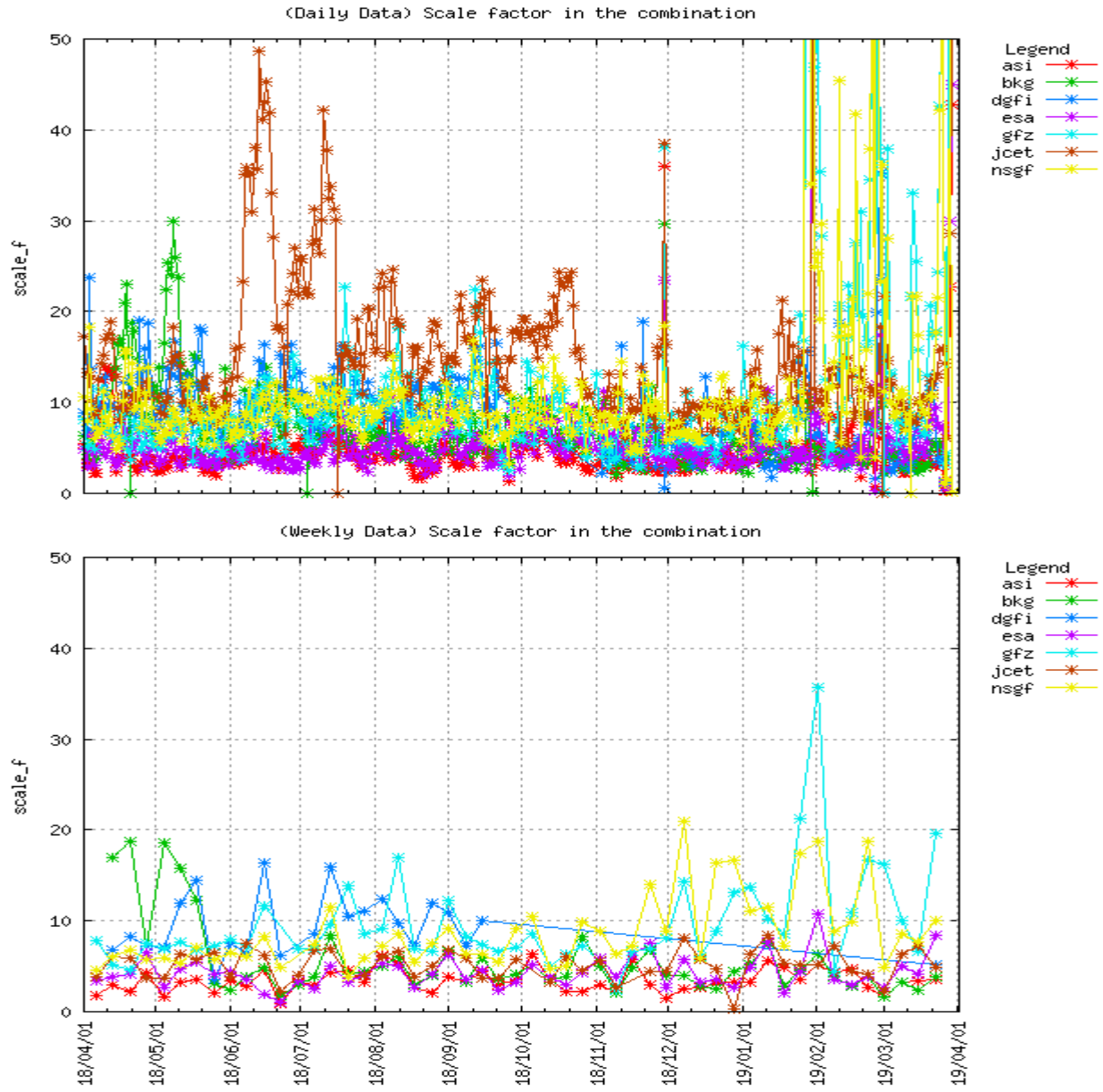




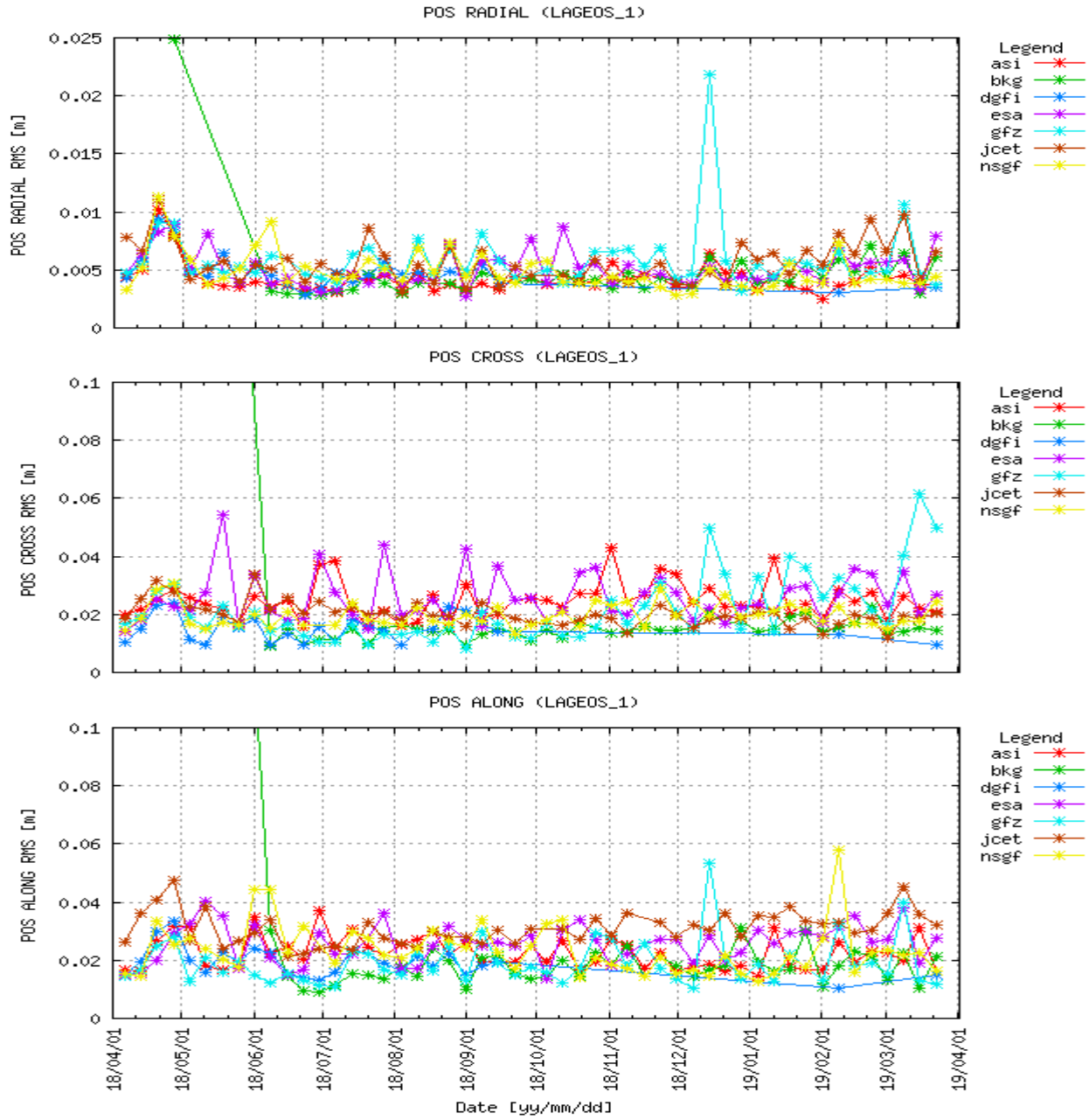
LOD from daily solutions



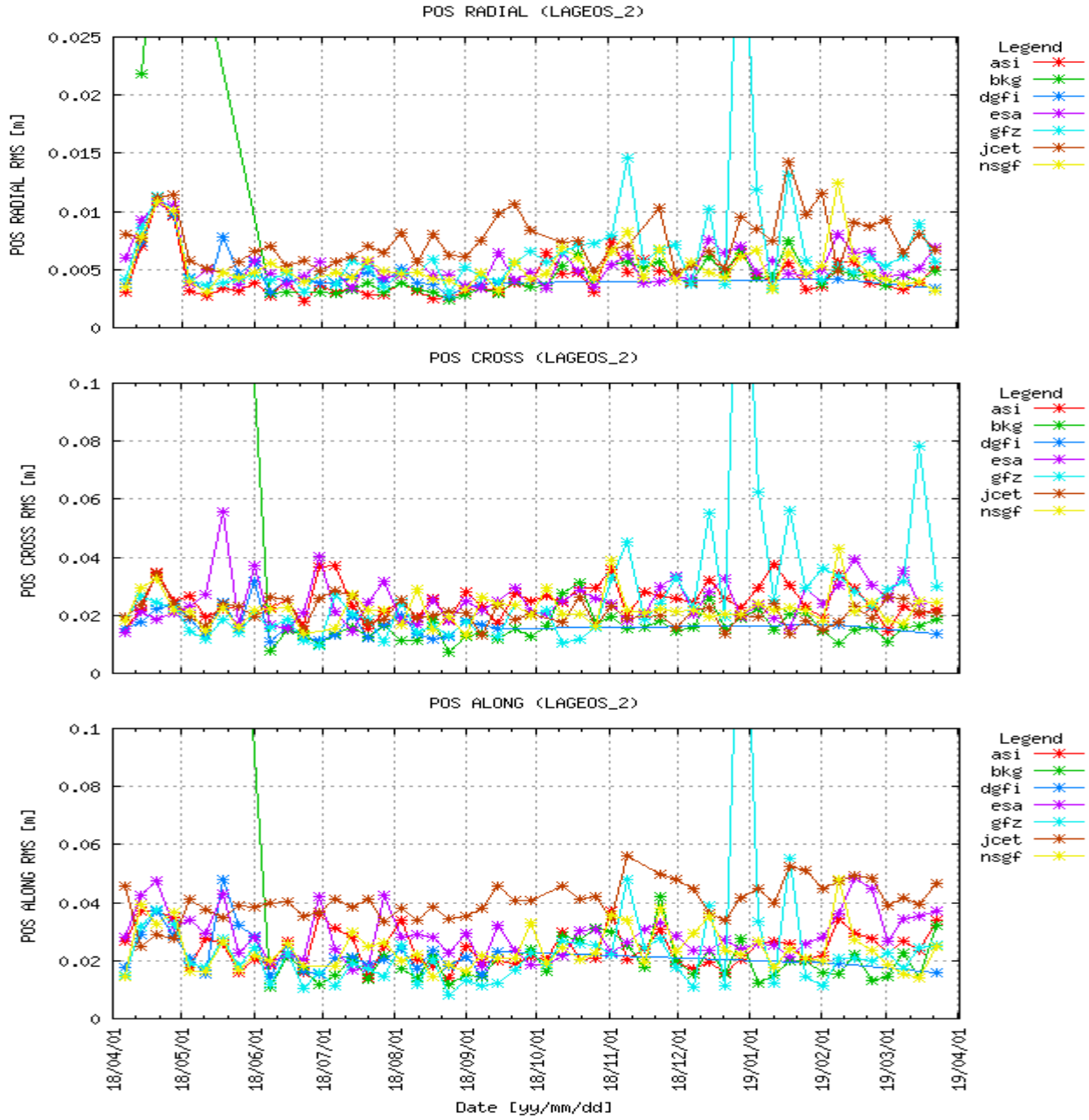
Combination scale factor



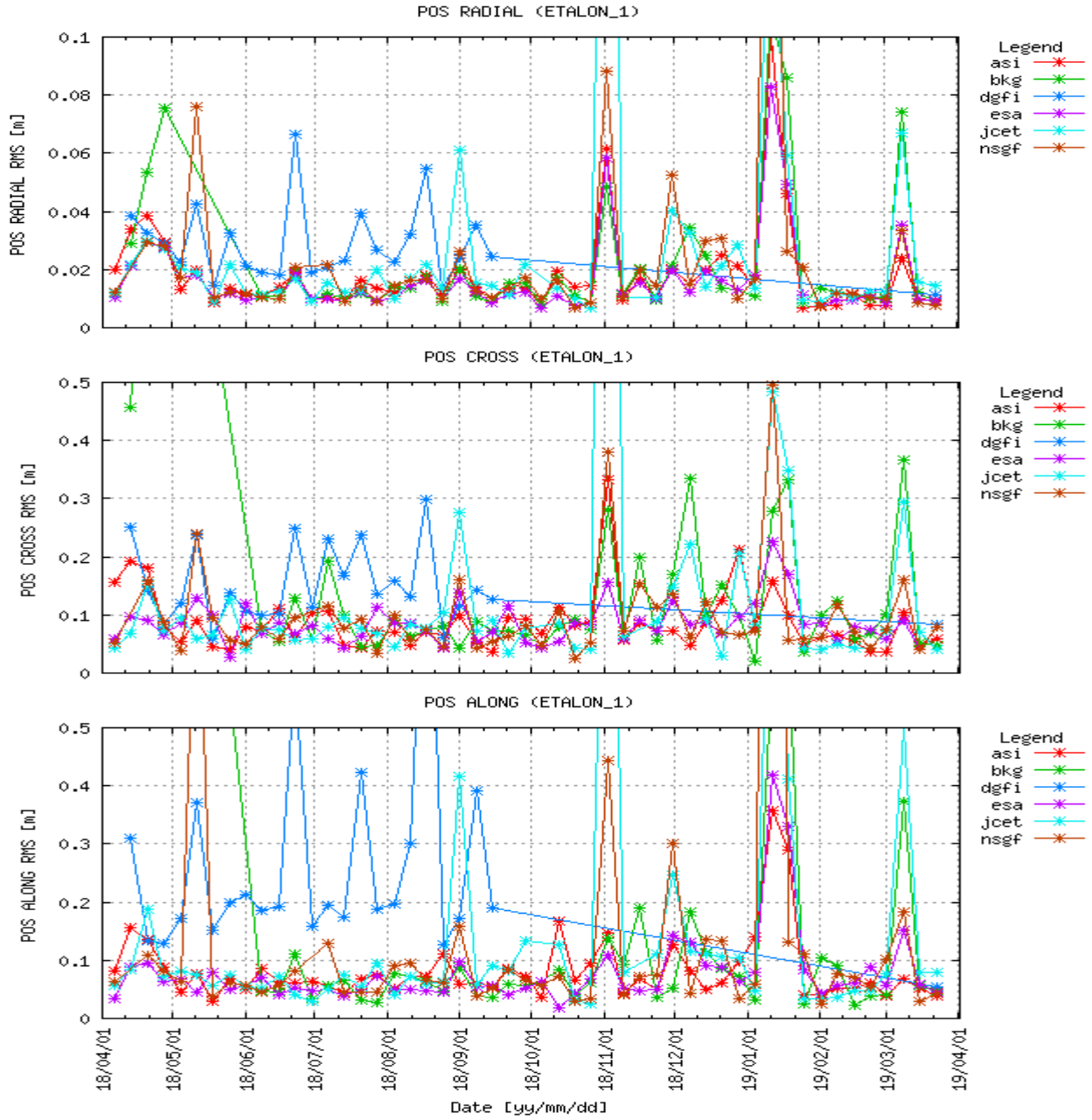
LAGEOS1 orbits – RMS of residuals w.r.t. combination



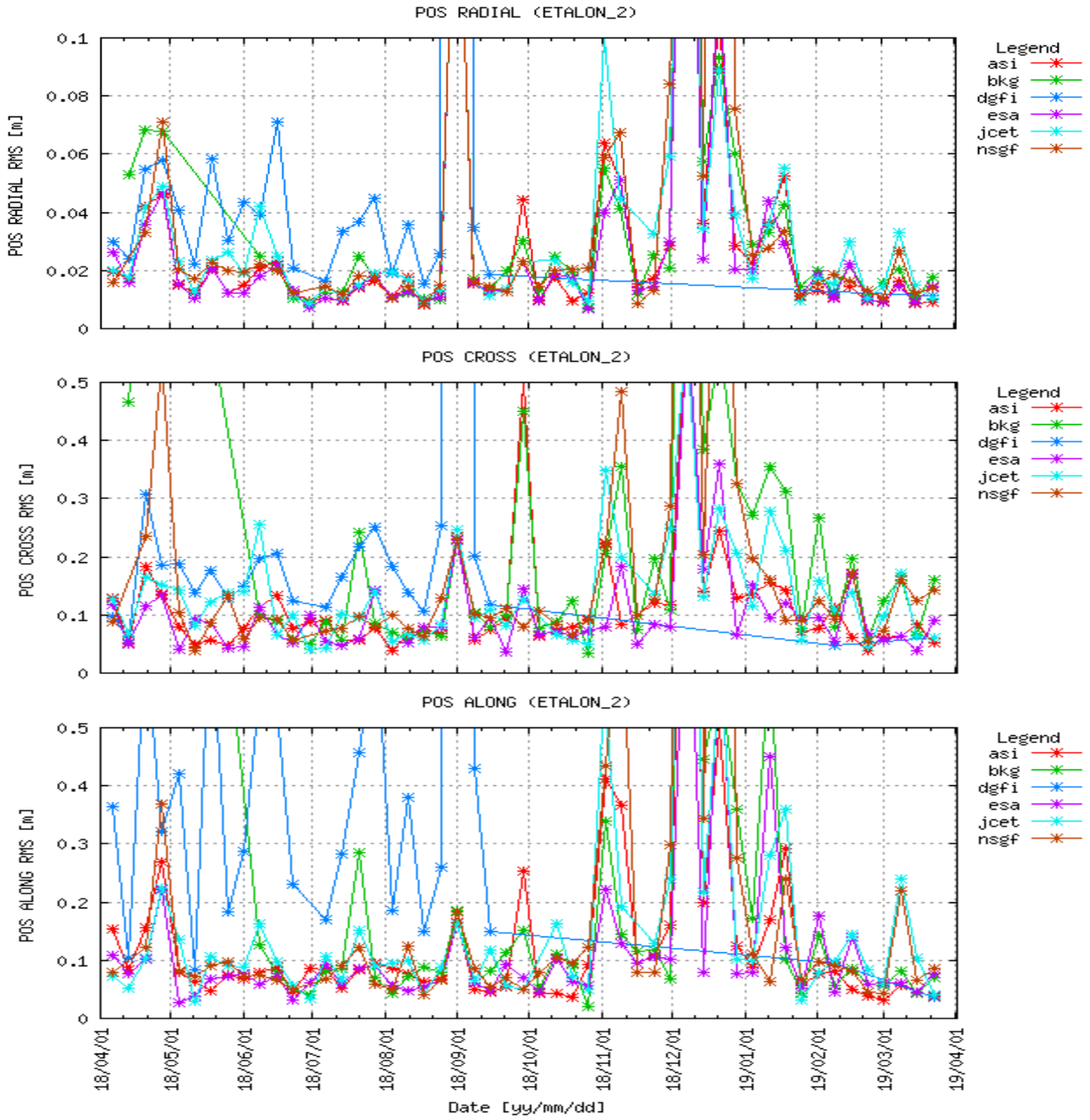
LAGEOS2 orbits – RMS of residuals w.r.t. combination



ETALON1 orbits – RMS of residuals w.r.t. combination



ETALON2 orbits – RMS of residuals w.r.t. combination

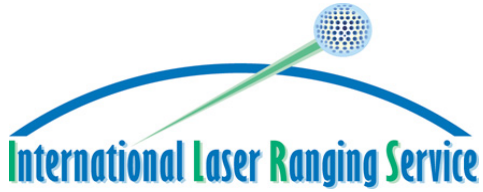


ILRS ACs orbit agreement

Satellite	Radial [mm]	Cross-track [mm]	Along-track [mm]
LAGEOS1	5	22	25
LAGEOS2	6	24	28
ETALON1	18 17*	93 89*	93 82*
ETALON2	24 24*	114 112*	117 106*

Mean RMS over the period 2018/04/01-2019/03/31

* DGFI not included



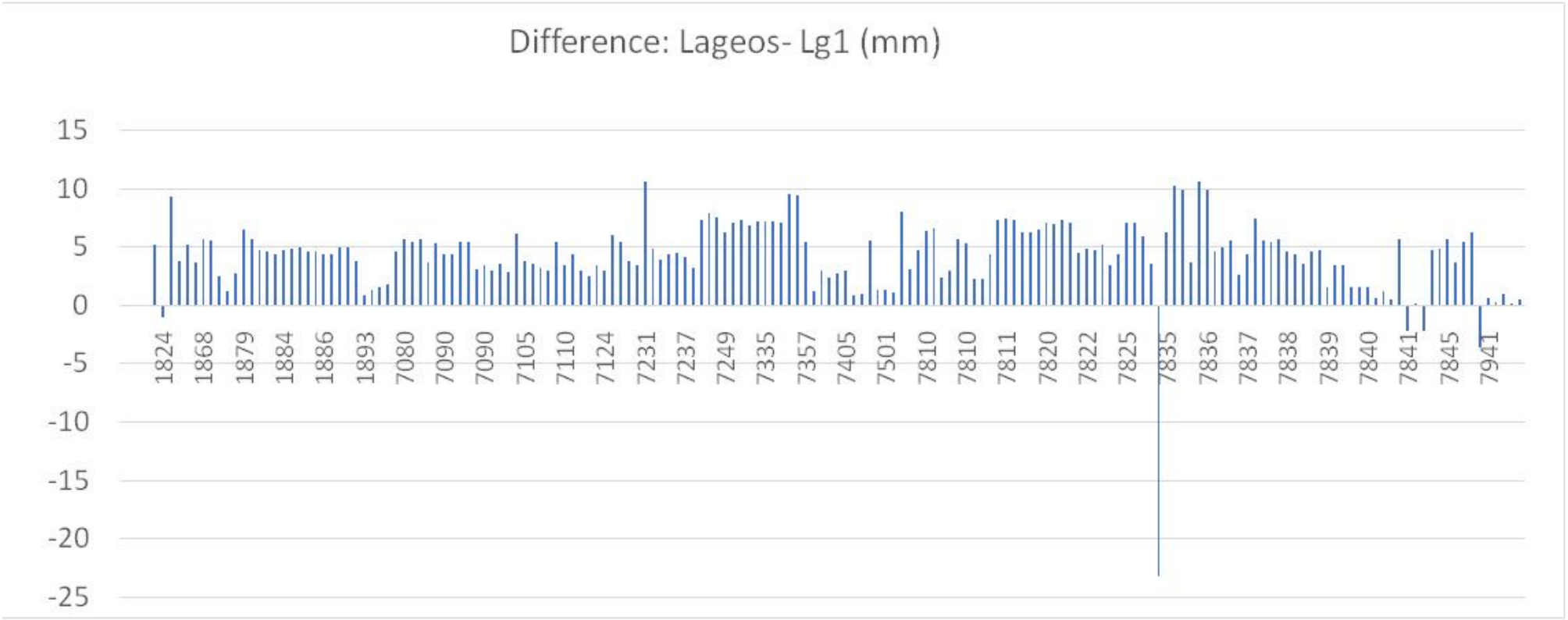
e-geos
AN ASI / TELESPAZIO COMPANY

ASI
Agenzia Spaziale Italiana

Grazie

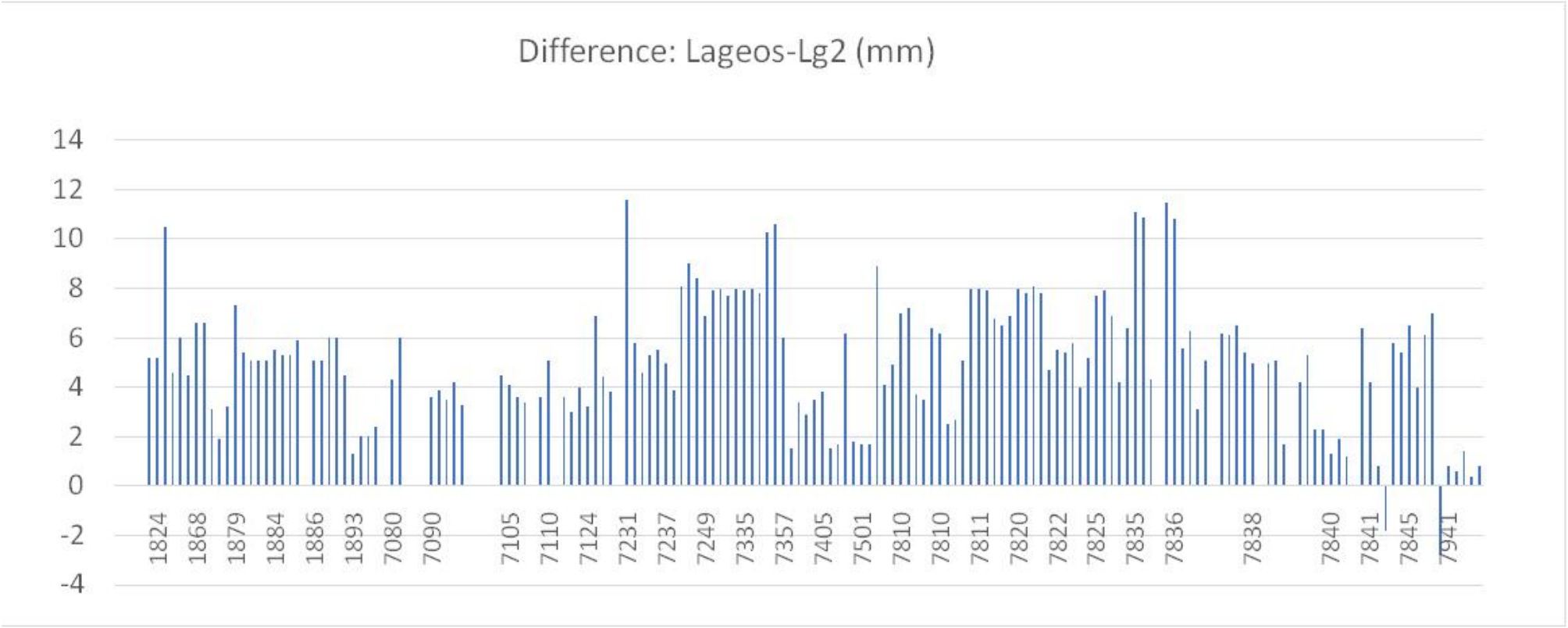
Thank You

CoM file comparison : LAGEOS

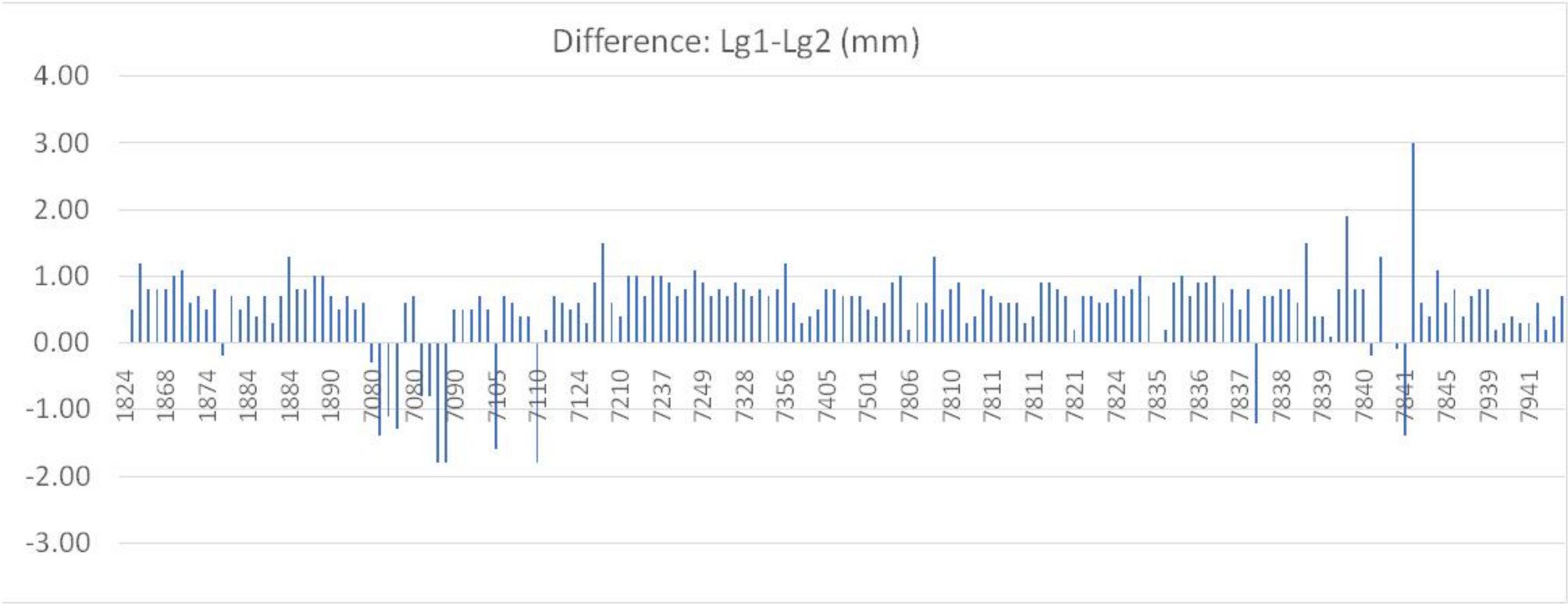


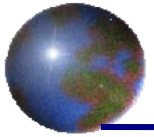
7835 01/05/1976 21/03/1983 **276.1**

CoM file comparison : LAGEOS2



CoM file comparison : LAGEOS-LAGEOS2





CoM file comparison : LAGEOS stations

Station ONLY in File "Lageos"

ID Station	Start Date	End Date	Value
1181	01/07/1981	01/09/1991	**253.1**
7130	18/5/1998	1/3/2006	**249**
7829	20/3/2007	31/12/2050	**250**
7846	31/3/1986	1/9/1995	**254**
7846	1/9/1995	31/12/2050	**251**

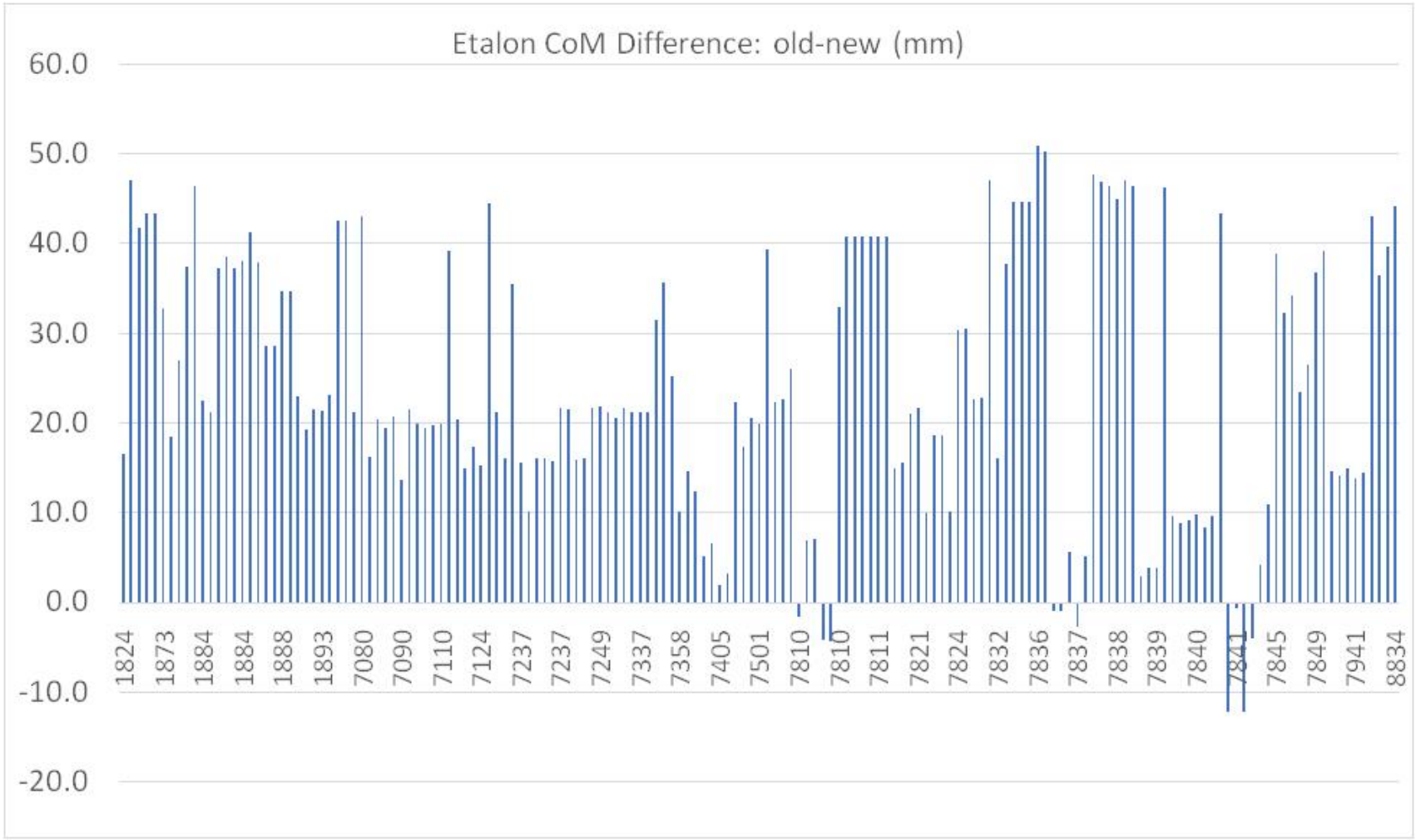
Station ONLY in File "Lg1"

ID Station	Start Date	End Date	Value
1891	23/07/2013	01/01/2050	**243.3**
1953	01/01/1985	01/06/1993	**270.6**
1953	01/06/1993	01/01/1996	**243.0**
7343	01/02/2000	01/11/2000	**241.6**
7359	26/09/2012	01/01/2015	**247.0**
7394	07/08/2015	01/01/2050	**246.8**
7395	11/08/2017	01/01/2050	**245.2**
7407	09/05/2014	01/01/2050	**243.1**
7503	16/12/2016	01/01/2050	**243.0**
7819	09/12/2016	01/01/2050	**245.1**
7827	01/05/2014	11/05/2016	**247.0**
7827	11/05/2016	01/01/2050	**247.0**
7830	30/03/2003	01/11/2003	**245.2**
7843	01/01/1984	01/07/1986	**246.4**
7843	01/07/1986	01/03/1991	**244.2**
7843	01/03/1991	01/01/1996	**244.5**
7843	01/01/1996	01/01/1999	**242.9**
7848	01/09/1996	01/07/2008	**245.1**
7848	01/07/2008	01/01/2050	**245.6**

Station ONLY in File "Lg2"

ID Station	Start Date	End Date	Value
1891	23/07/2013	01/01/2050	**242.3**
1953	01/01/1985	01/06/1993	**269.5**
1953	01/06/1993	01/01/1996	**242.0**
7343	01/02/2000	01/11/2000	**240.4**
7359	26/09/2012	01/01/2015	**246.4**
7394	07/08/2015	01/01/2050	**246.2**
7395	11/08/2017	01/01/2050	**244.4**
7407	09/05/2014	01/01/2050	**242.1**
7503	16/12/2016	01/01/2050	**242.0**
7819	09/12/2016	01/01/2050	**244.4**
7827	01/05/2014	11/05/2016	**246.6**
7827	11/05/2016	01/01/2050	**246.5**
7830	30/03/2003	01/11/2003	**244.5**
7843	01/03/1991	01/01/1996	**244.0**
7843	01/01/1996	01/01/1999	**242.3**
7848	01/09/1996	01/07/2008	**244.5**
7848	01/07/2008	01/01/2050	**245.0**

CoM file comparison : ETALON



CoM file comparison : ETALON stations

ETALON

Station ONLY in File "Etalon"

ID Station	Start Date	End Date	Value
7130	18/05/1998	01/01/2006	603
7829	20/03/2007	31/12/2050	607
7846	31/03/1986	01/09/1995	607
7846	01/09/1995	31/12/2050	574

Station ONLY in File "ET1"

ID Station	Start Date	End Date	Value
1181	01/07/1981	01/09/1991	563.9
1863	01/01/2001	01/01/2005	560.2
1864	01/01/1993	01/01/2009	559.8
1891	23/07/2013	01/01/2050	563.9
1953	01/01/1985	01/06/1993	559.7
1953	01/06/1993	01/01/1996	559.2
7343	01/02/2000	01/11/2000	548.2
7359	26/09/2012	01/01/2015	569.8
7394	07/08/2015	01/01/2050	569.8
7395	11/08/2017	01/01/2050	558.5
7407	09/05/2014	01/01/2050	563.4
7503	16/12/2016	01/01/2050	563.4
7548	05/10/1992	01/01/2003	563.3
7594	01/01/1998	01/01/2001	557.3
7819	09/12/2016	01/01/2050	558.5
7827	01/05/2014	11/05/2016	582.5
7827	11/05/2016	01/01/2050	582.5
7830	30/03/2003	01/11/2003	561.4
7848	01/09/1996	01/07/2008	561.4
7848	01/07/2008	01/01/2050	561.4

DH files

Not used for the SSEM PP

OFFICIAL DH file

1) RB section: RB adopted by the ASC
2) TB section: TB adopted by the ASC
3) Other corrections adopted b the ASC, e.g. pressure corrections
4) Optional corrections, e.g. minor TB
5) Link to the CoM table

Separate LEGACY DH file

1) Van Husson Corrections
2) CDDIS free format corrections
3) Old ASC corrections, sections are added whenever a new model is adopted by the ASC

Federal Agency for Cartography and Geodesy

BKG Report

Daniel Koenig (1), Ulrich Meyer (2), Daniela Thaller (1)

(1) BKG

(2) AIUB

Activities

- PP_SSEM_EC_COM
  - Jose‘s new COM table implemented into Bernese
  - ready for processing
  - to be contributed: LAGEOS+Etalon (2000-2018)
- Geophysical loading models
  - GNSS/SLR reprocessings currently carried out at BKG
- Analysis of PP_SSEM_EC/BKG ongoing
- Trying to derive Etalon orbits for 1993-1999
- LARES as 5th satellite:
  - appropriate POD setup to be clarified
  - development of operational procedure

Contact:

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Deutsches Geodätisches Forschungsinstitut (DGFI-TUM)
Technische Universität München

Status report of the DGFI-TUM ILRS AC

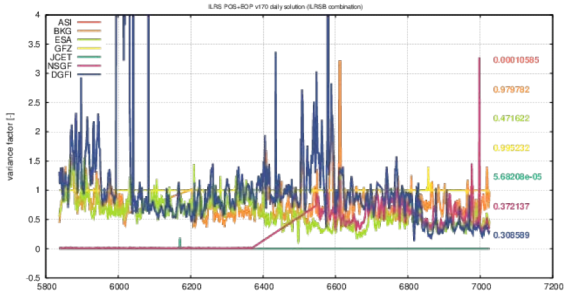
Mathis Bloßfeld and Alexander Kehm

Technische Universität München
Deutsches Geodätisches Forschungsinstitut (DGFI-TUM)

EGU General Assembly 2019 – ILRS Analysis Standing Committee meeting
Vienna, Austria, 2019-04-06

Current status of the ILRS AC

- Development of **DOGS libraries** OC and RI “finished”, CS still ongoing
- OC extended to process DORIS data → initial tests were successful
- Recoding of **ILRS ASC programs finished** (incl. mitigation to new server/system architecture)
- ILRS AC @ DGFI-TUM now fully operational
- Daily report send via Telegram API to operator’s smartphone ;-)



DGFI-TUM v170 solution

- Every daily SINEX file contains **satellite weights** (from VCE) in the COMMENT block

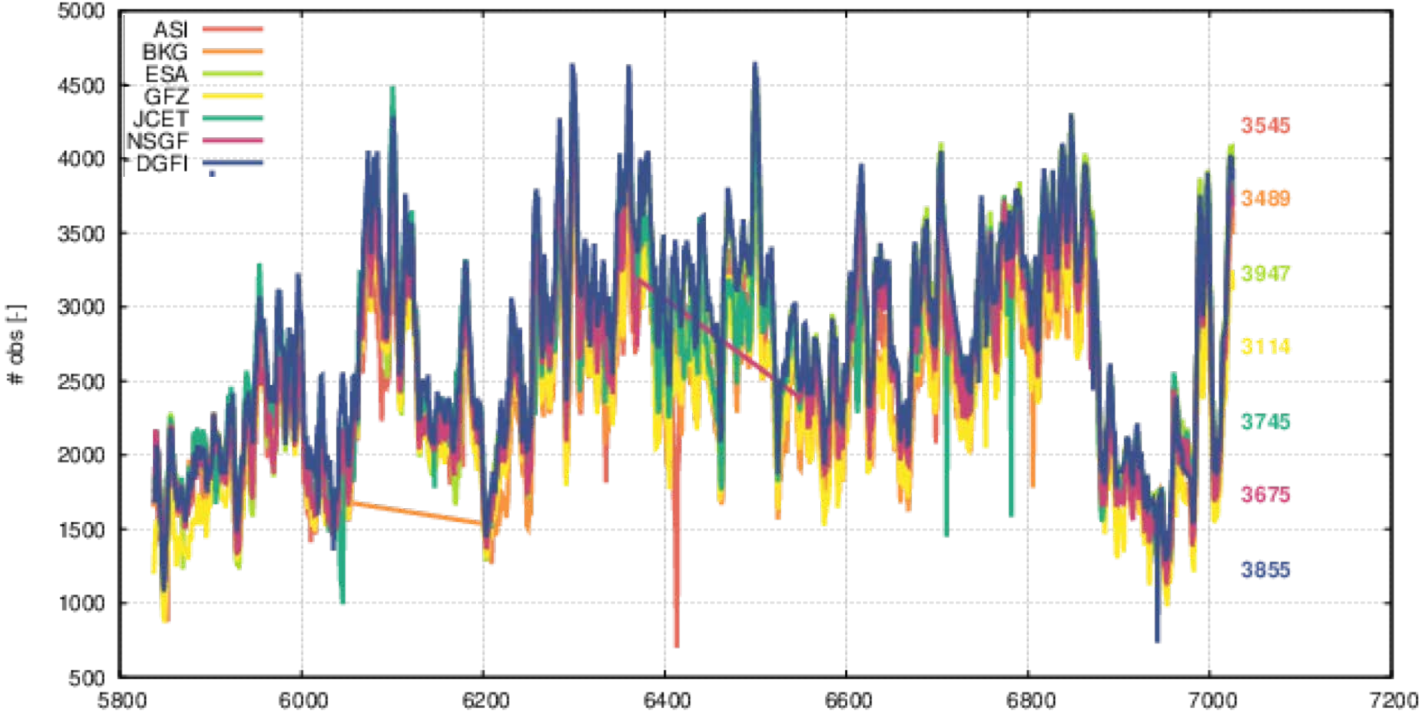
```
weighting of the satellites
- weighting technique              Iterative Variance Component Estimation
                                   (VCE) based on minimum constraintd solutions
  + LAGEOS-1:                      4.689859999106E-01
  + LAGEOS-2:                      8.753647424947E-02
  + Etalon-1:                      0.000000000000E+00
  + Etalon-2:                      2.583778287515E-01
```

- Refined selection of included stations according to ILRS ASC recommendations
  - min. 10 NPs per station and satellite
  - min 2 passes per station and satellite
  - **these selection criteria are not really beneficial for the Etalon satellites!!!**

```
number of observations:
 LA-1/-2 (no. NP >= 10 && no. passes >= 2), ET-1/-2 (no. NP >= 6)
 Stations which not fulfill the minimum observation statistics are neglected
 (induced by brackets in the following table)
 occup no np(LA1) np(LA2) np(ET1) np(ET2) | p(LA1) p(LA2) p(ET1) p(ET2) SINEX?
 18248101     (7)      0        0        0 |     6      7      0      0   NO
 18685901      0      (6)       0        0 |     0     (1)     0      0   NO
 18734901     22      24        0        6 |     9     12      0      2   YES
 18799401     13      17        0      (2) |     3      3      0      1   YES
 18844401     46      60        0        0 |     7      6      0      0   YES
 18869601     20      34        0        0 |     3      3      0      0   YES
 18879701     26      24        0        0 |     5      4      0      0   YES
 18889801     (5)     15        0        0 |     3      5      0      0   YES
 18900901     26      42        0        0 |     6      7      0      0   YES
 18915301     11       0        0        0 |     2      0      0      0   YES
 18931801     37      43        0        0 |     5     10      0      0   YES
 70900513    126     160        0       38 |    17     16      0      2   YES
 71050725    125     156        0      (2) |    10     12      0      1   YES
 71100412     (9)      0        0        0 |   (1)      0      0      0   NO
 71191402     26      22        0        0 |     2      3      0      0   YES
 72371901     90      59        0        7 |    11      7      0      2   YES
 72496102     40      37        0        6 |     8      7      0      2   YES
 73942601     15       0        0        0 |     2      0      0      0   YES
 74072701     (4)     (1)       0      (3) |     2     (1)     0      1   NO
 78106801    270     234        0       67 |    23     18      0      8   YES
 78113802     17      (4)       0        0 |     2     (1)     0      0   YES
 78198201     39      55        0      (3) |    10     13      0      2   YES
 78212801     (9)     (7)       0        0 |   (1)      2      0      0   NO
 78259001      0      23        0        0 |    12      9      0      0   YES
 78272201     90      75        0       17 |    16     19      0      5   YES
 78393402     34      (2)       0      (5) |     5     (1)     0      2   YES
 78403501    203     168        0       17 |    16     13      0      4   YES
 78418701     54      62        0       12 |     7      8      0      2   YES
 78457801     39      21        0       15 |     4      2      0      2   YES
 79417701    135     154        0       22 |    17     15      0      4   YES
 88341001    212     125        0       49 |    24     17      0      8   YES
-FILE/COMMENT
*-------------------------------------------------------------------------------
```

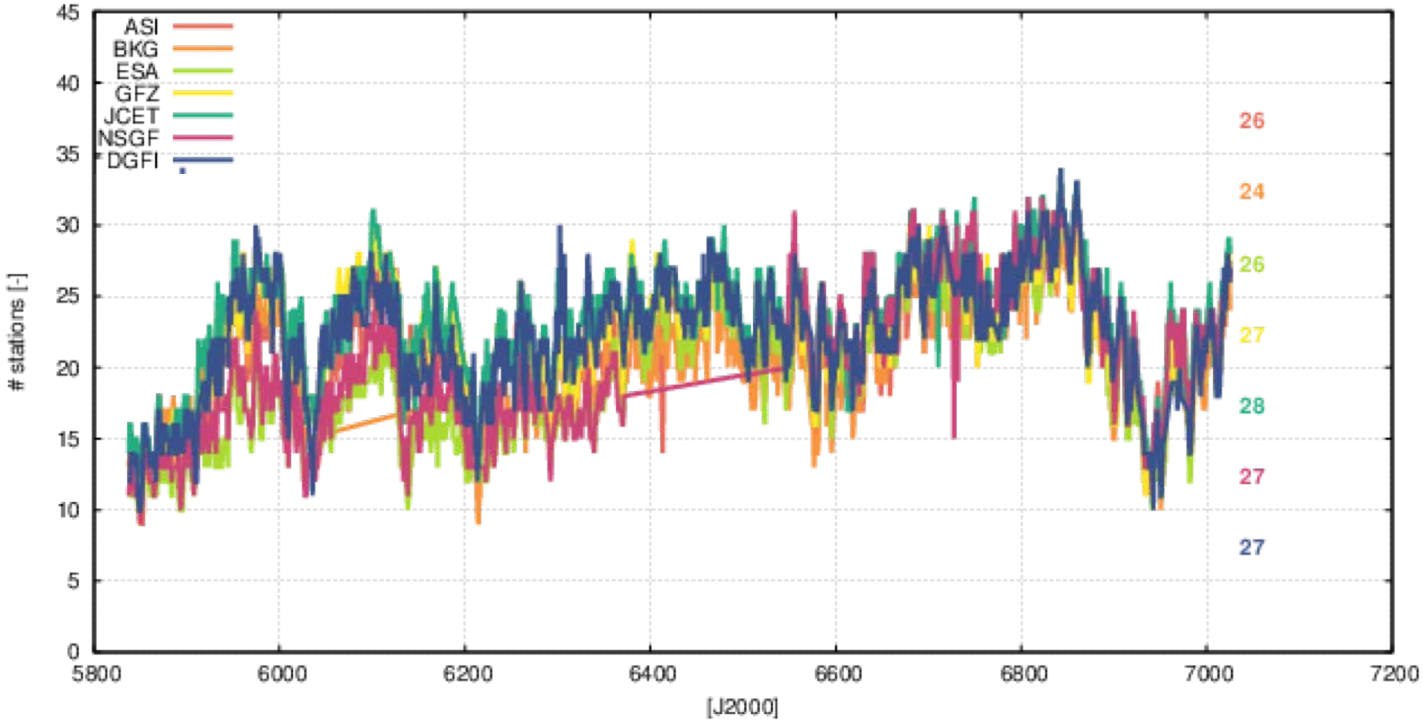
DGFI-TUM v170 solution

- Plots based on ILRSB combination summaries – **number of used observations**



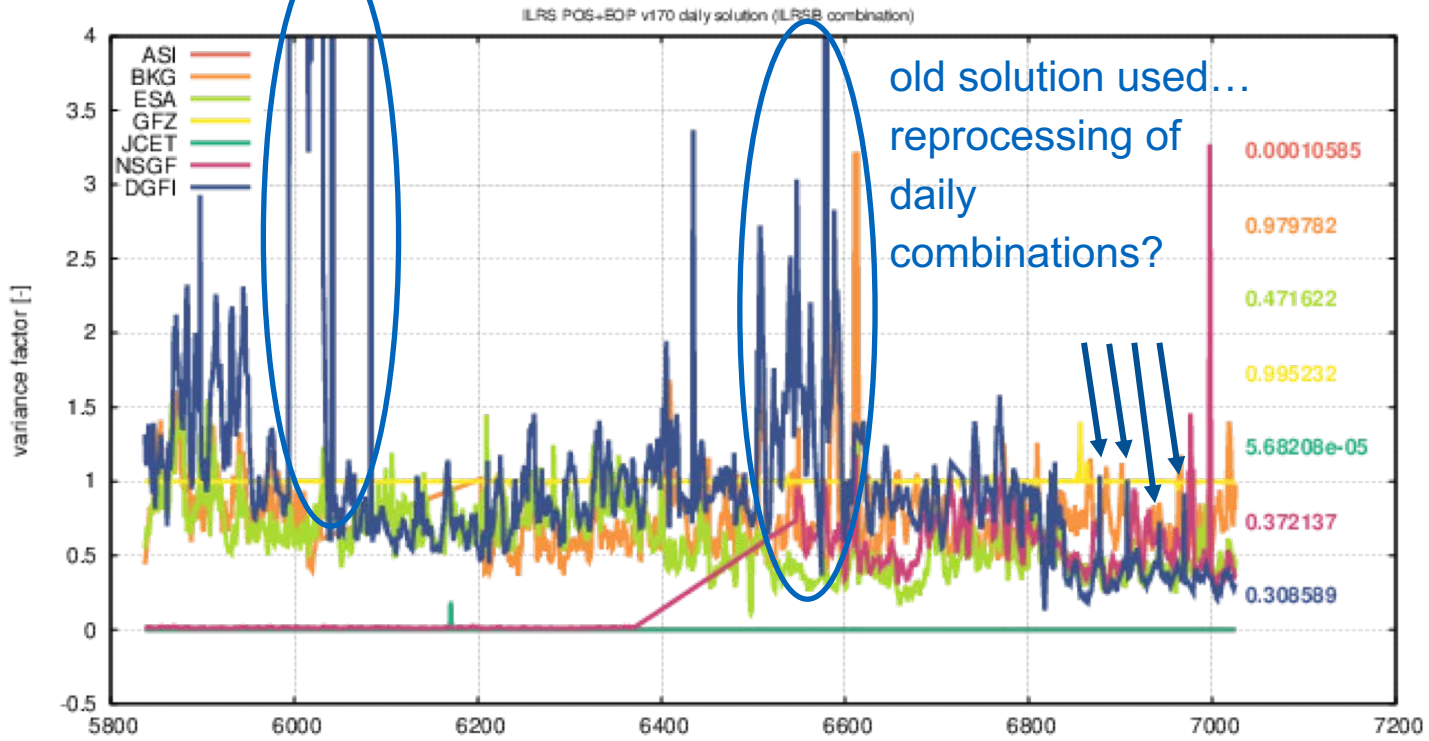
DGFI-TUM v170 solution

- Plots based on ILRSB combination summaries – **number of used stations**



DGFI-TUM v170 solution

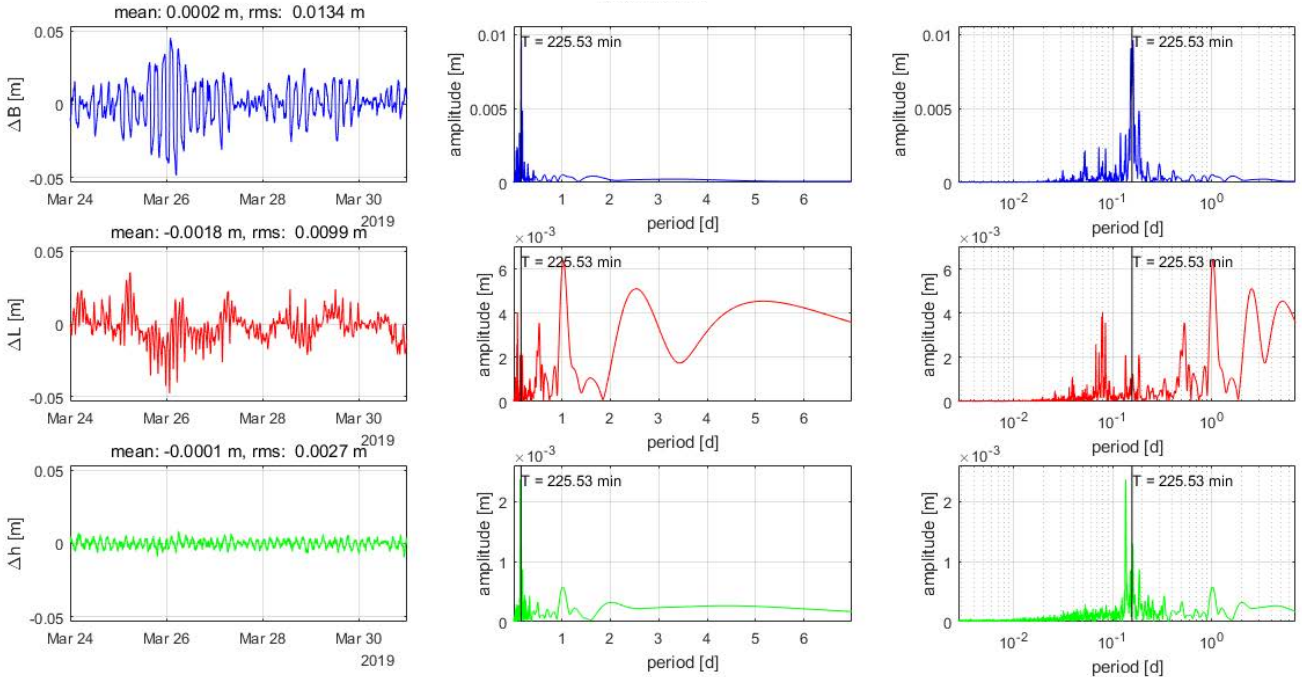
- Plots based on ILRSB combination summaries – **variance factors**



DGFI-TUM v70 solution

- weekly combination every Tuesday (same settings as daily v170 solution used)
- **v70-sp3c**: orbit solutions for LA-1/-2, ET-1/-2 (TRF, EOP fixed)

LA-1: ILRSA vs. DGFI-TUM



DGFI-TUM v230 solution

- reprocessed time series between 1993 and 2019
- most recent CoM data (J. Rodriguez) used
- test files submitted to JCET → multi-color stations were not treated properly → **fixed!!**
- Submission still needed? If yes, we can do this **immediately**…

- Issue from ASC meeting @ Mt. Stromlo
  - **Wettzell pressure bias** → observations already corrected? → ACs must be informed!!

- **Order of reprocessing important!!**

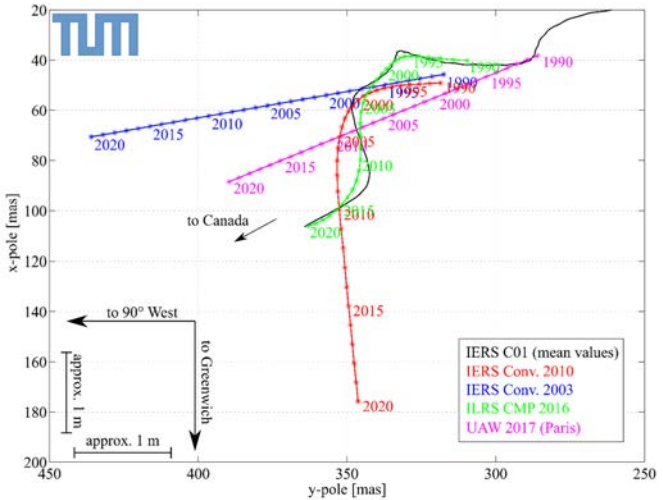
  (1) new CoMs applied → (2) Wettzell obs. replaced → (3) new long-term range biases

GGOS WG HF EOP

- DGFI-TUM is a member of this “ad-hoc” working group (chair: J. Gipson)
- **Reprocessing of 5 years of data done and submitted** to John Gipson two weeks ago...
- After evaluation of the model test scenarios for different techniques, the working group will provide a **recommendation on which model to be used for ITRF2020** reprocessing!!
- Models tested:
  - John Gipson's VLBI tidal model (with and without libration)
  - Tidal correction model by Artz et al (2011 and 2012)
  - Tidal correction model by Desai and Sibois
  - Tidal correction model based on PREM, EOT11a or FES2012 (Hagedoorn, GFZ)
  - IERS2010 tidal correction model
  - Tidal correction model by Mazdak et al.

Other topics

- T2L2
  - Nearly no impact on UT1/LOD at all
  - Only minor impact of T2L2 biases on SLR-only pole coordinates of LA-1/-2, ET-1/-2, larger impact on LARES pole coordinates
- IERS linear pole
  - impact on coordinates depends on **geograph. location**
  - Max. effect: up to **2 mm in 10 yr** in height (e.g. Wettzell)
  - Minor effects in hz-components
  - **!!! Since the ILRS ACs should use the IERS linear pole for ITRF2020, a consistent gravity field model has to be used (see Jean-Michels presentation)!!!**



Final remarks

- ILRS AC @ DGFI-TUM **fully operational** now → v170, v70, v70-sp3c, v230 available
- When to switch to **new CoM, data handling file and long-term mean range biases** in operational mode?
- ILRS data **handling file could be archived at EDC** → Christian/Mathis could be responsible
- **GGOS WG HF-EOP**: DGFI-TUM contributed

- FYI:
  - DTRF2020 will again be corrected for NT-L corrections

Deutsches Geodätisches Forschungsinstitut (DGFI-TUM)
Technische Universität München

Status report of the DGFI-TUM ILRS AC

Mathis Bloßfeld and Alexander Kehm

Technische Universität München
Deutsches Geodätisches Forschungsinstitut (DGFI-TUM)

EGU General Assembly 2019 – ILRS Analysis Standing Committee meeting
Vienna, Austria, 2019-04-06

GFZ AC Report

Rolf König, Margarita Vei

Content

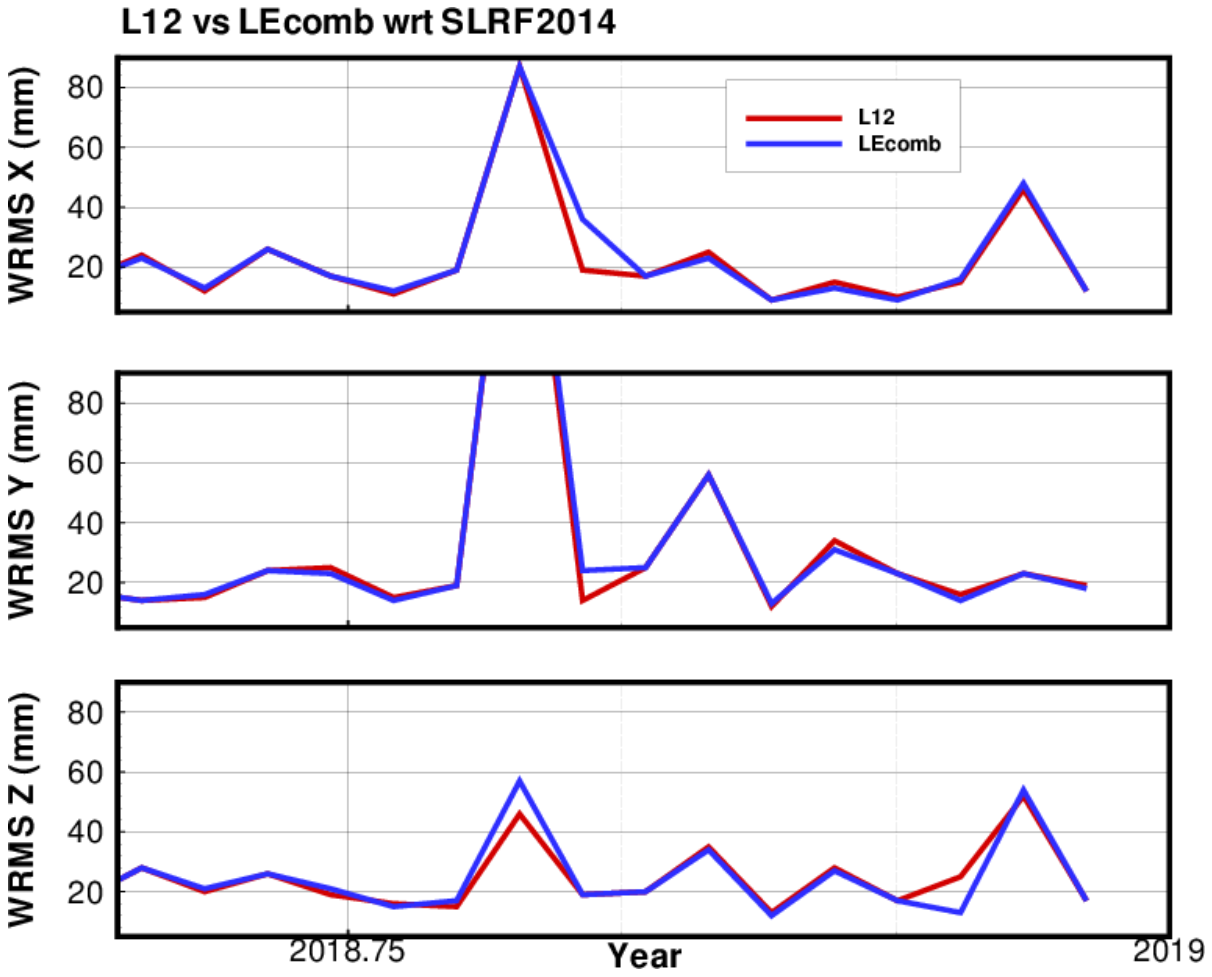
- ETALON processing
- Station Systematic Error Monitoring (SSEM)
- C(2,0) time series from 6 geodetic satellites for GFZ GRACE RL06
- Reanalysis status

ETALON Processing

- Found operational procedure:
  - 1st step: ETALON only processing
  - 2nd step: combination with LAGEOS on the observation level
- Six recent months of combined pos&eop delivered to CCs as standard v71
- ETALON 1993 – 1999 pending
  - Partly longer than 7-day arcs needed
- ETALON 1999 – 2015 processed
  - Partly low quality, standards to be homogenized
- ETALON 2015 onwards is available

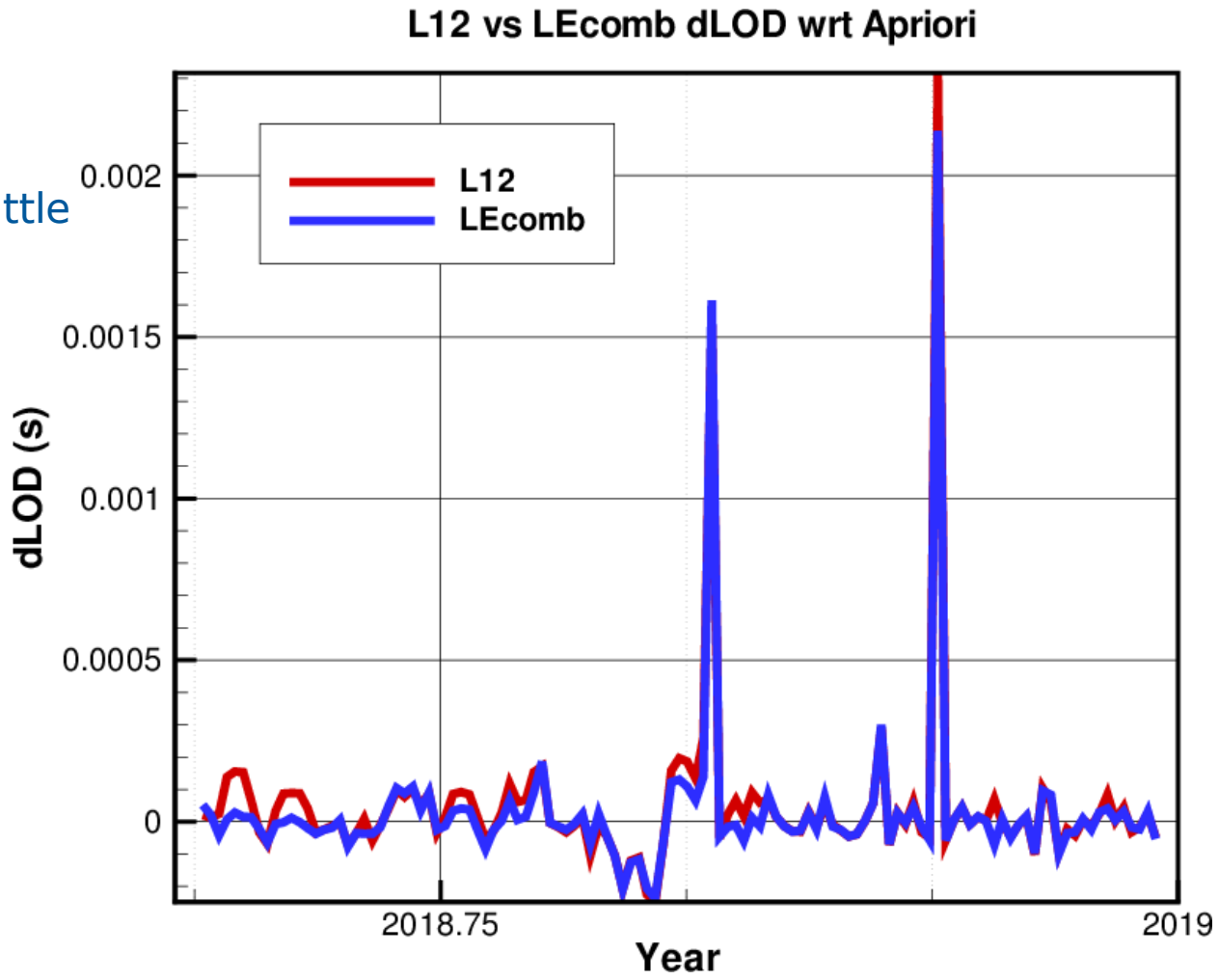
ETALON Validation

- Coordinates
  - Improvements so-so



ETALON Validation

- ERPs
  - are improved, so little



ETALON Resume

- Two weeks (190119 and 190126) checked by ILRSA CC
  - Results similar to the above
- ILRSB CC has not responded so far

- ETALONs seem to have some value despite of sparse tracking and difficult handling in operations
- Once CCs agree, operational pos&eop products will go as the combined ones

Station Systematic Error Monitoring

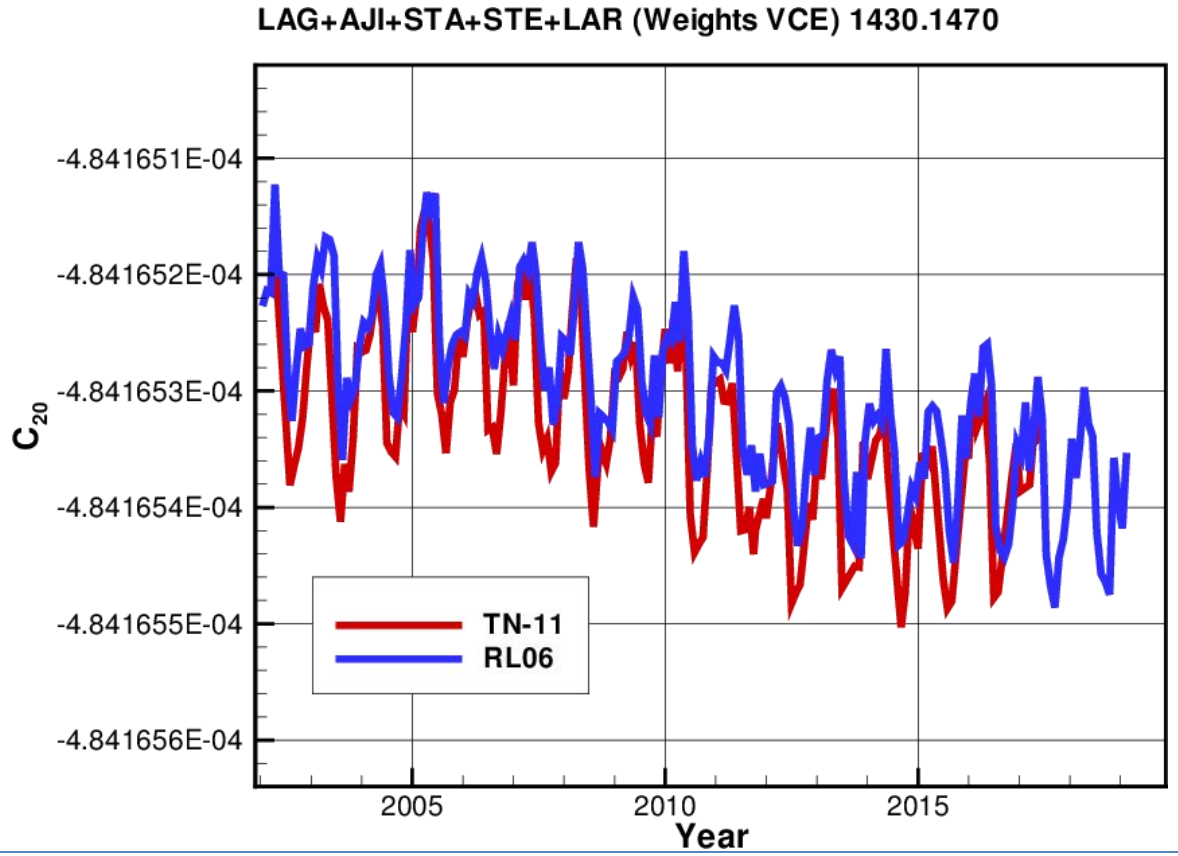
- Implementation of the T2L2 time biases done
- Implementation of the new CoM procedure done
- ETALON processing back to 1993 not finished yet
- LAGEOS only processing has started

C(2,0) Time Series for GRACE

- Replacement C(2,0) for GFZ's GRACE RL06 monthly gravity fields
- Consistent with GFZ GRACE/GRACE-FO RL06 background models
- Based on 6 geodetic satellites:
  - LAGEOS, LAGEOS-2, AJISAI, STARLETTE, STELLA, LARES
- Combination of normal equations via variance component estimation
- Low degrees estimated up to degree/order 5 plus C(6,1) and S(6,1)
- Available from the GravIS portal: gravis.gfz-potsdam.de
  - See poster EGU2019-10455: Dahle, C. et al.: Access to GRACE/GRACE-FO Mass Anomaly Time Series: The GFZ Web Portal GravIS
  - See poster EGU2019-8384: Dill, R. et al.: Seasonal variations in global mean sea level and consequences for the excitation of length-of-day changes

C(2,0) Time Series for GRACE

- Comparison with GRACE TN-11



Reanalysis Status

- Ready to adopt CRD format v2.0
- Ready to adopt the secular mean pole

Roadmap for ITRF2020

ITRS Center

IPGP-IGN, France

ITRF2020: Call for Participation (CfP)

- **Draft circulated among IERS DB Thursday, Dec 06, 2018**
  - **List of suitable model updates in the annex of the CfP**

- **Comments were welcome until January 10, 2019**
  - **No comments received**

- **The CfP is now final & posted at the ITRF Website :**

http://itrf.ign.fr/doc_ITRF/CFP-ITRF2020.pdf

ITRF2020 Inputs by TCs: specific model updates are strongly requested

- **All techniques waiting for the consensus HF-EOP model**
- **IVS: modeling the gravitational deformation for as many antennas as possible, possibly refine the thermal expansion modeling**
- **ILRS: SLR range biases to be estimated/applied**
- **IGS: up to date GNSS force models to be used**
- **IDS: Improve analysis strategy, DORIS-specific model updates : SRP & SAA**

Summary

- General agreement of all techniques regarding proposed effects and model updates to be considered for the reprocessing

- CfP disseminated, available at the ITRF Website:
  - http://itrf.ign.fr/doc_ITRF/CFP-ITRF2020.pdf
- In preparation for ITRF2020, the ITRS Center may
  - Request specific solutions for testing purposes, e.g.
    - SLR range biases estimated
    - New HF-EOP model applied
    - Others TBD
- Follow up by all ACCs of the effects and model updates, with regular report to ITRS and IERS DB

Schedule & time-line

Date	Action
January 10, 2019	Dissemination of the Call for Participation
February 10, 2021	Deadline for solution submissions by Technique Centers. Earlier submissions are welcome
April 2021	First and early results to be shared and discussed with the TCs.
Until end of May, 2021	Inter comparisons of the ITRF CCs solutions
~June, 2021	Preliminary ITRF2020 solution available for evaluation by TCs
Sep-Oct, 2021	Final ITRF2020 solution released by the ITRS Center

Backups

The JCET AC/CC Report to the ILRS ASC

E. C. Pavlis, M. Kuzmicz-Cieslak and K. Evans

EGU2019
Vienna, Austria,
April 6, 2019

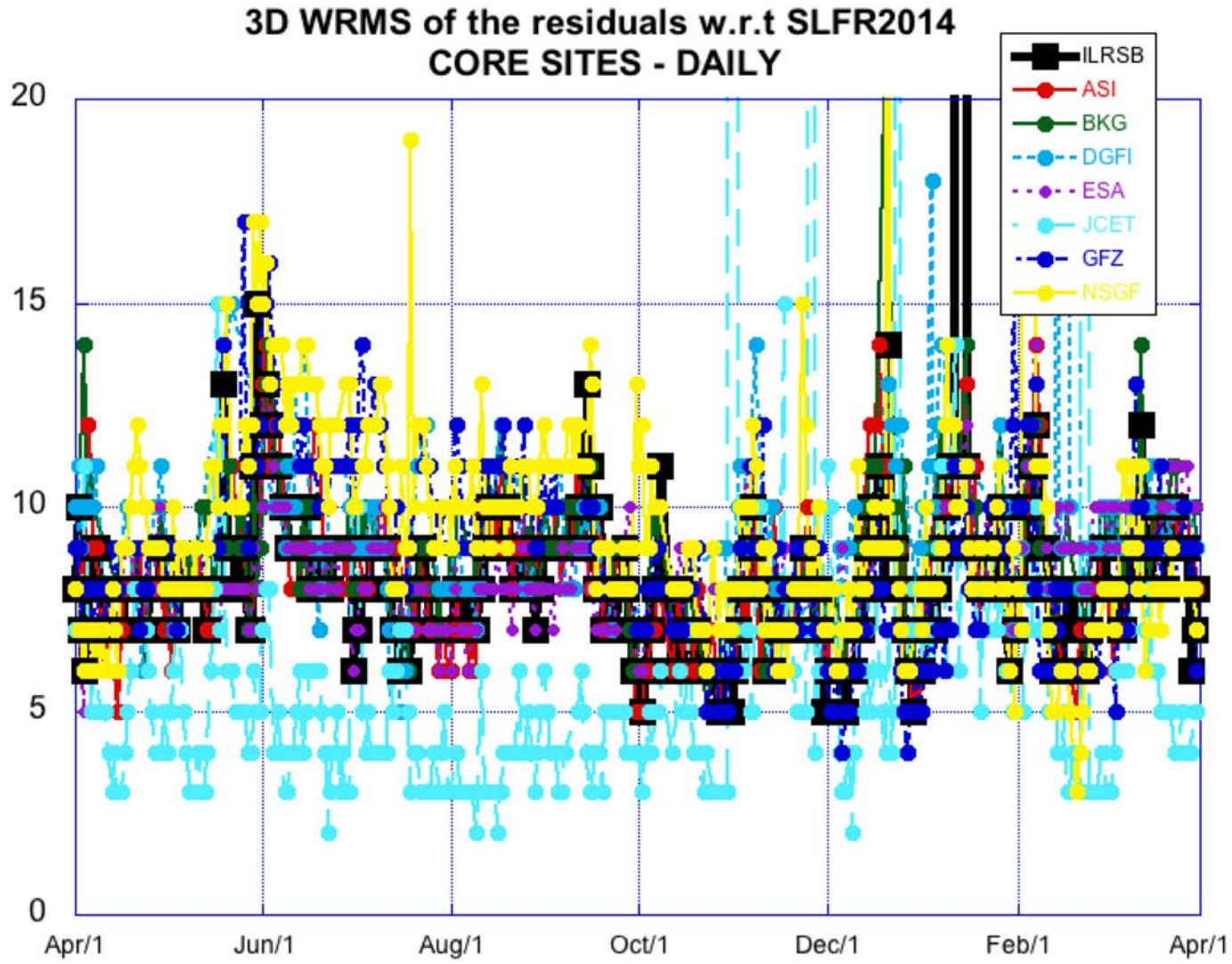
Outline

- Operational Products Status Report
- Station Systematic Error Monitoring Project
- Wettzell (8834) Pressure Bias Error
- DGFI Test Series Examination
- Etalon 1 & 2 Tracking Campaign Plans
- Modeling Updates in view of the ITRF2020 reanalysis
- Planning for the use of SLR @ GNSS data in a future product

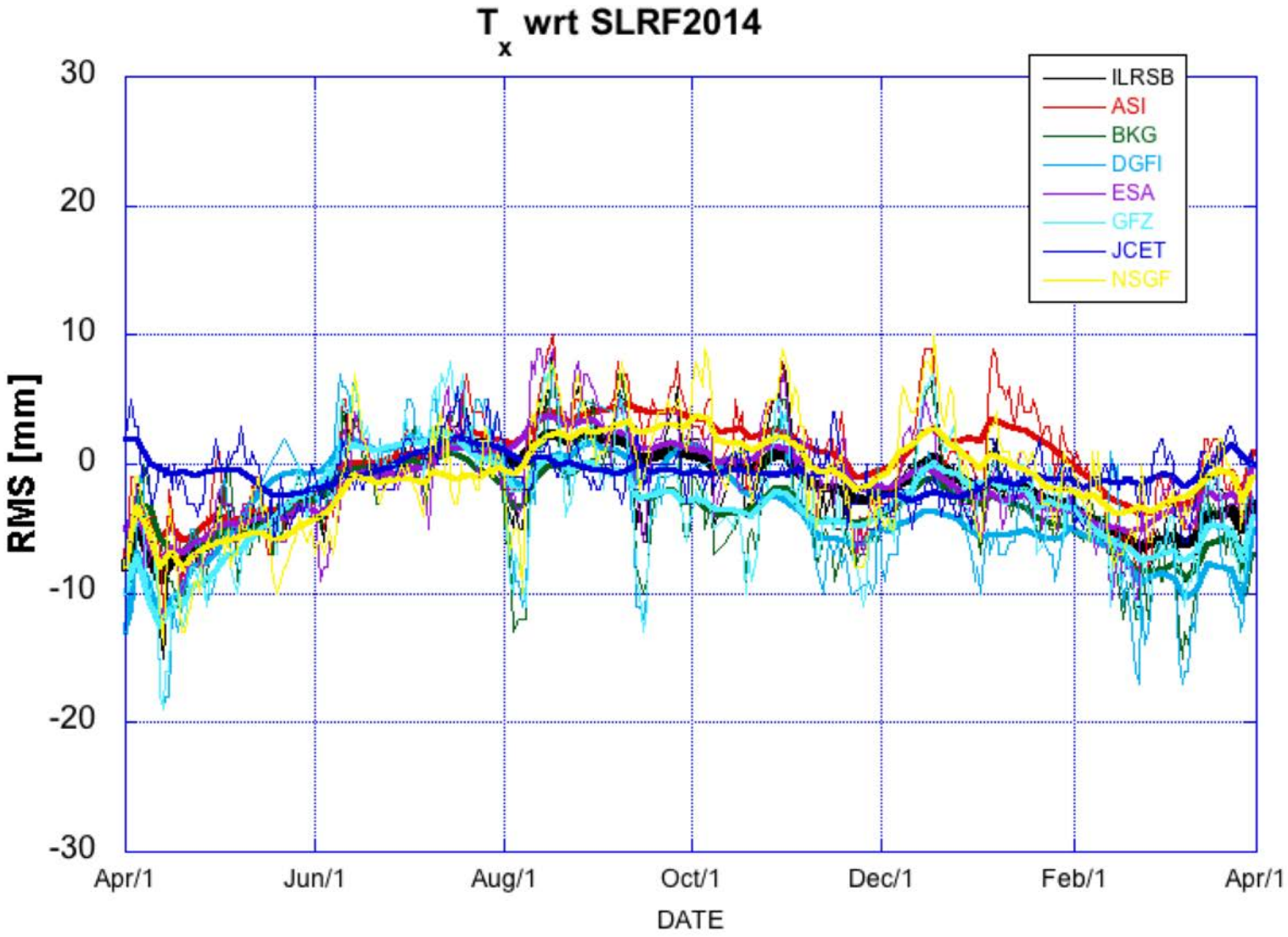
Operational Products Status

- Daily and Weekly series delivered routinely and consistently by six of the eight ACs
- With the routinely contributing ACs down to six-seven, it is important that all ACs make an effort to deliver their contributions regularly, to maintain the quality of our products!
- ACs that do not participate in test PPs and demonstrate their ability to deliver quality products, delay us from wrapping up PPs and moving to the next phase or PP. We need to establish a process to move such cases to the AAC group and move on, until they can recover and come back (GRGS).

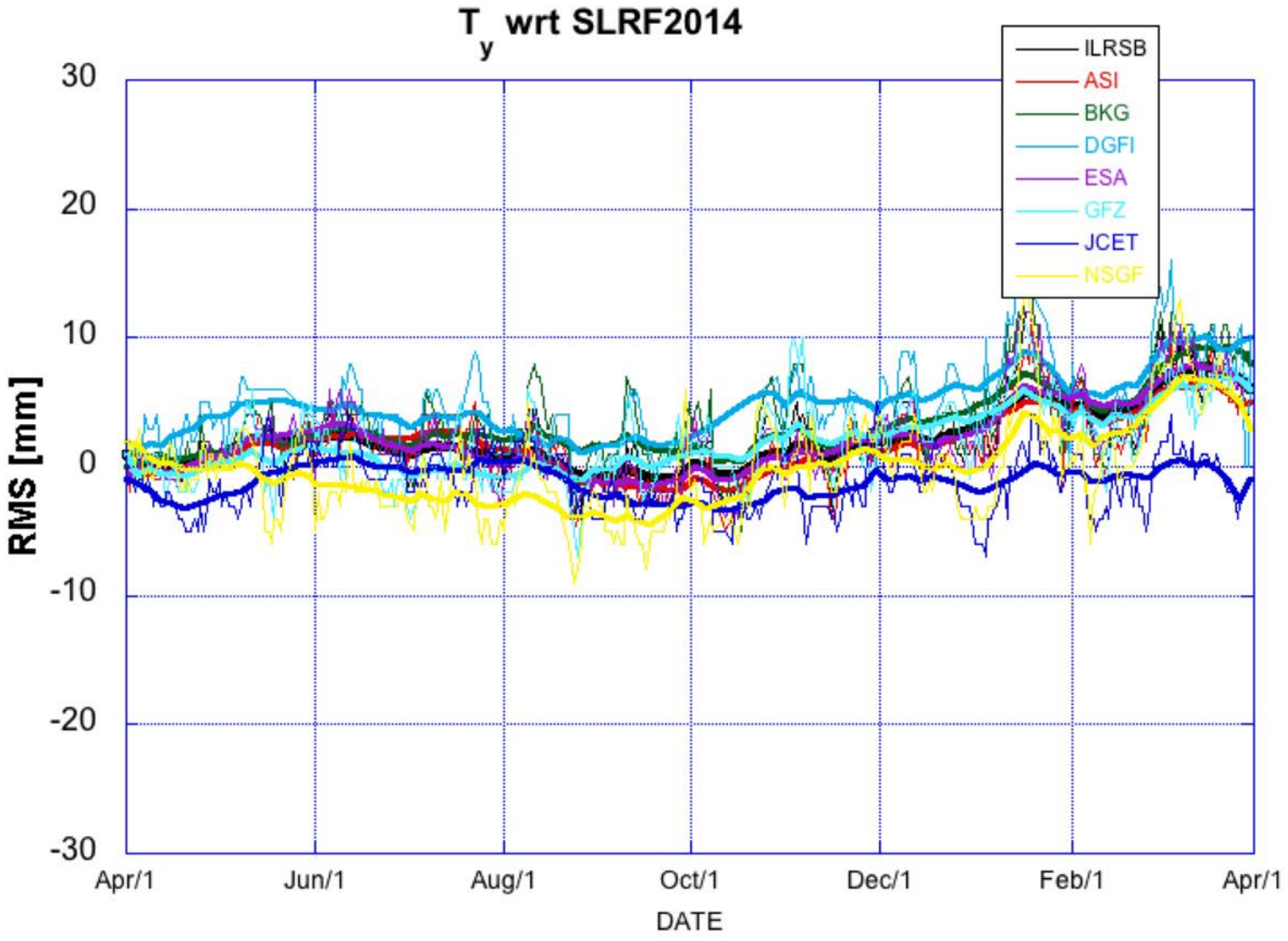
Daily Product Submissions



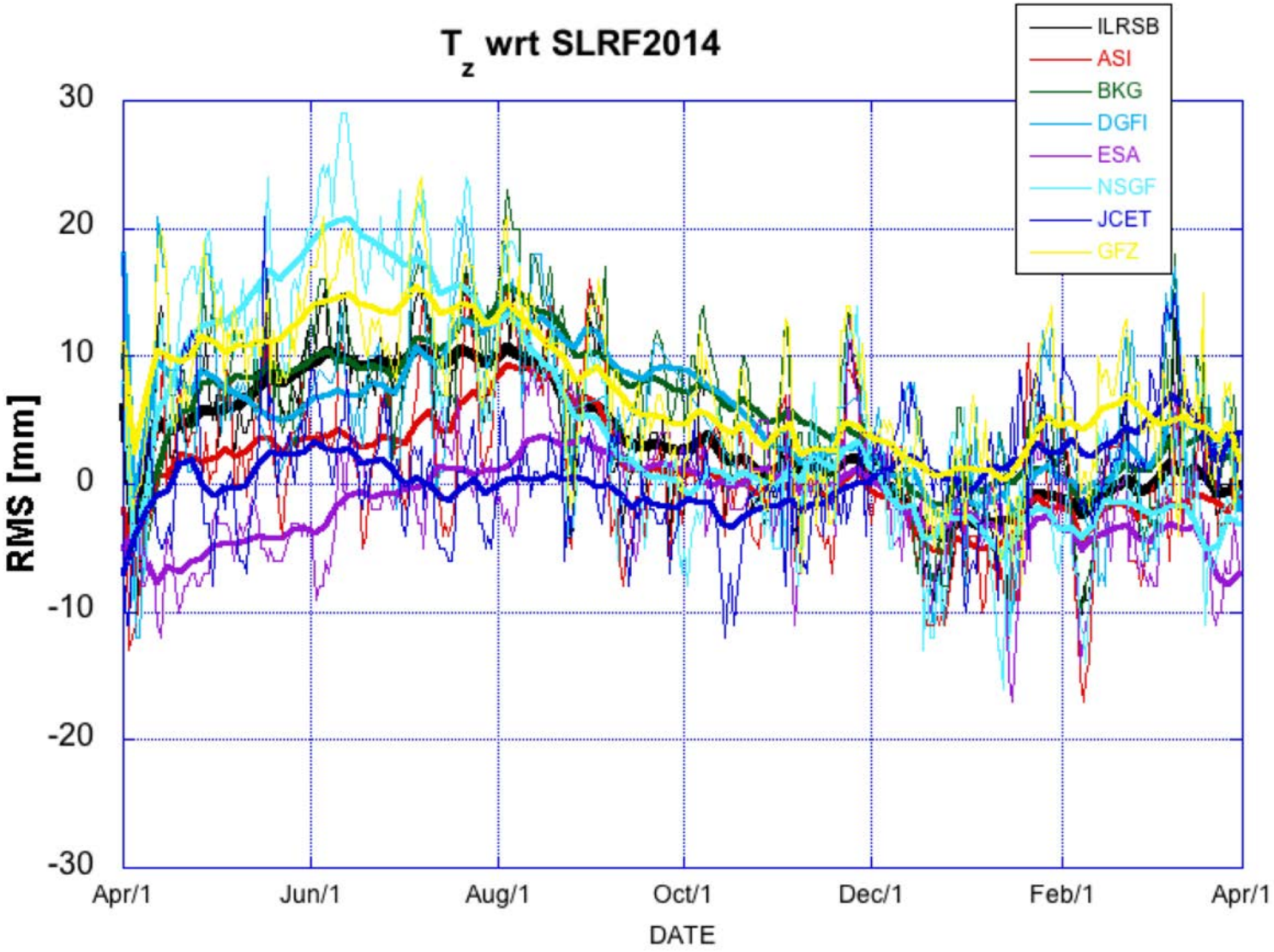
Daily Product Submissions



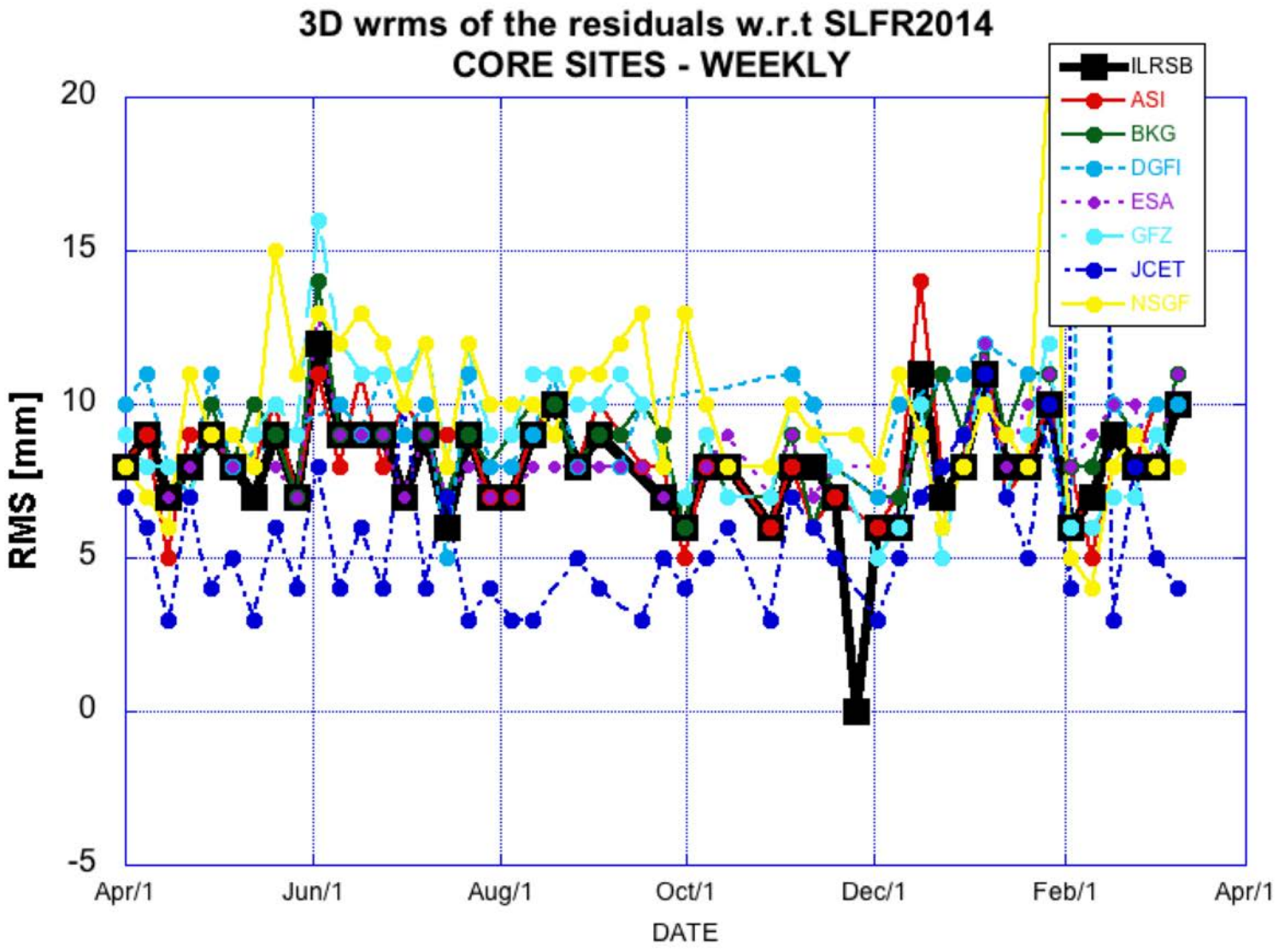
Daily Product Submissions



Daily Product Submissions



Weekly Product Submissions



Currently Quarantined Sites

Quarantine Stations

Station	Code	Site	DC	SOD	DOMES	First Data	Last Data	
1874	MDVS	Mendeleevo 2, Russia	EDC	18748301	12309S003	2012-12-17	2019-04-03	1 day(s)
7080	MDOL	McDonald Observatory, Texas	NASA	70802419	40442M006	1993-06-11	2019-02-12	50 day(s)
7358	GMSL	Tanegashima, Japan	NASA	73588901	21749S001	2004-09-01	2019-04-01	3 day(s)
7395	GEOL	Geochang, Republic of Korea	EDC	73956501	23910S001	0000-00-00	0000-00-00	None day(s)
7816	UROL	Stuttgart, Germany	EDC	78165201	10916S001	0000-00-00	0000-00-00	None day(s)
7824	SFEL	San Fernando, Spain	EDC	78244502	13402S007	1999-04-08	2017-07-01	642 day(s)

- Tow sites (**in RED**) are actively undergoing validation of their data;
- Two “engineering” sites (**above in PURPLE**) that have yet to submit any data (no need for official validation, but may request it if they want to see the quality of their data assessed);
- McDonald is sending data very sporadically
- San Fernando is reaching ”end of operations” phase, so no need to proceed with validation.

Etalon Campaign Project

Status Week #6

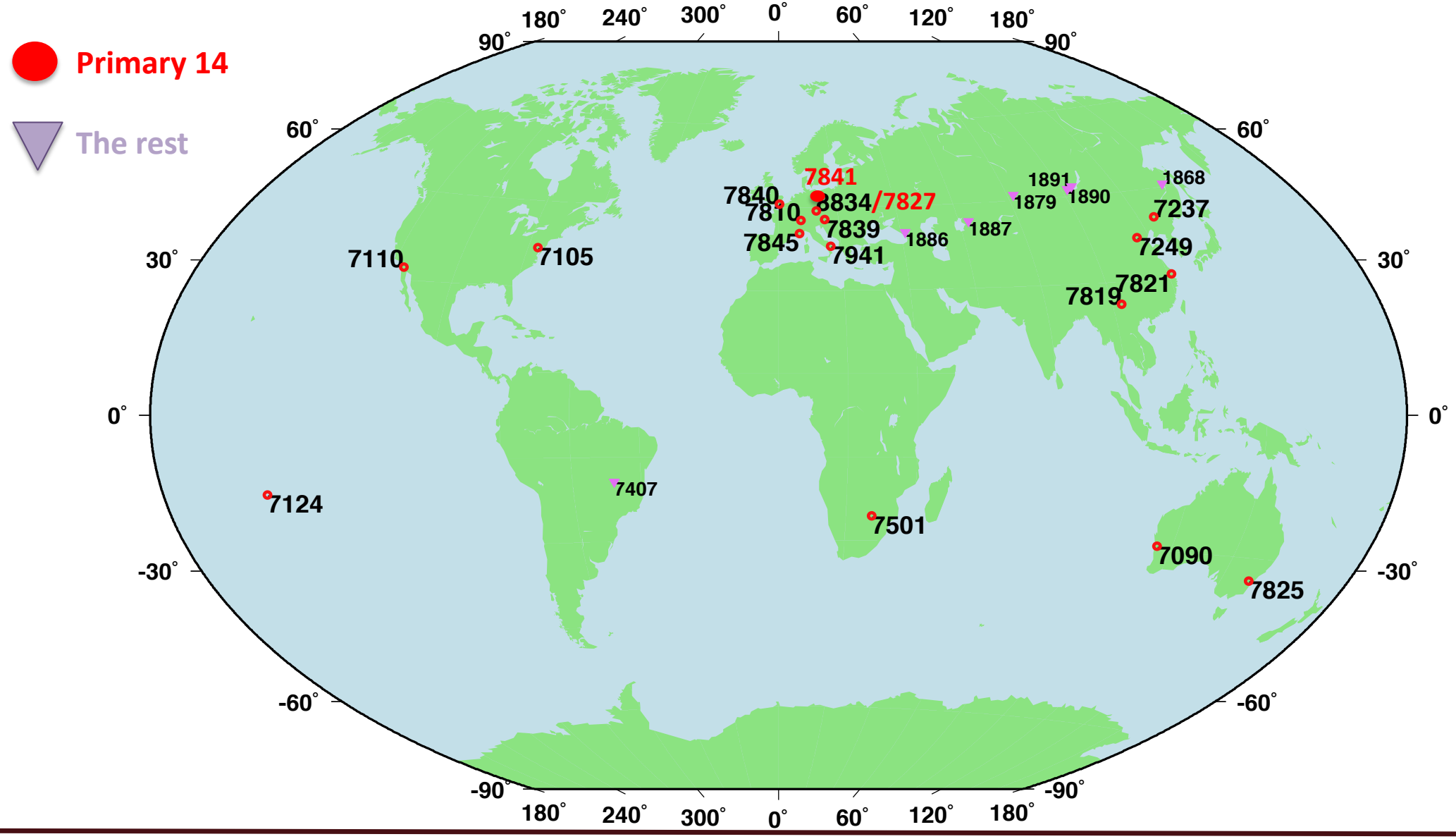
ILRS Network Sites Supporting Etalon Campaign

Site Name	Station ID#
Zimmerwald	7810
Wettzell (WETL)	8834
Yarragadee	7090
Herstmonceux	7840
Matera	7941
Graz	7839
Wettzell (SOSW)	7827
Grasse	7845
Potsdam	7841
Mount Stromlo	7825
Changchun	7237
Shanghai	7821
Beijing	7249
Hartebeesthoek (HARL)	7501
Kunming	7819
Monument Peak	7110
Tahiti	7124
Greenbelt	7105

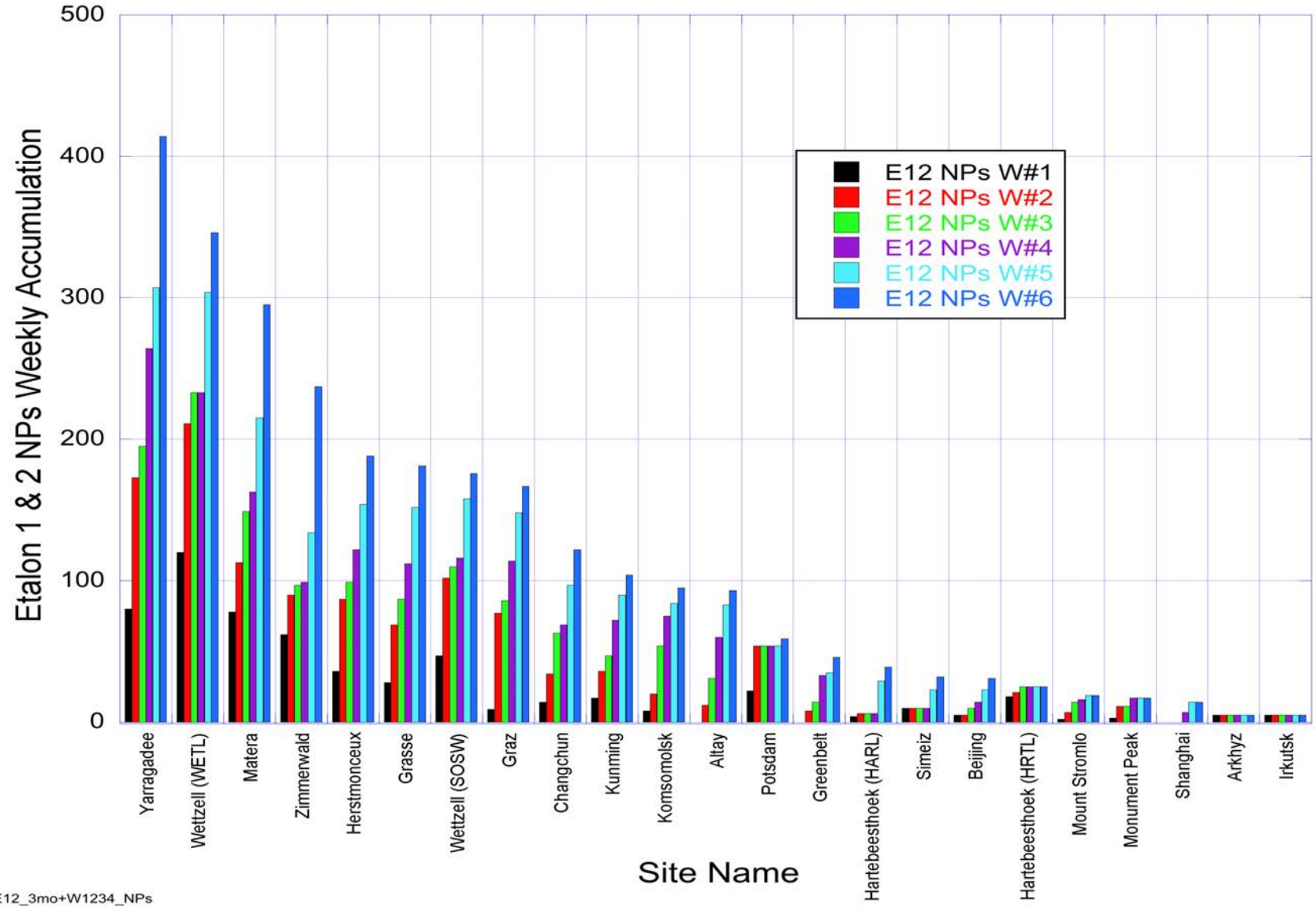
Brasilia	7407
Irkutsk	1891
Altay	1879
Komsomolsk	1868
Badary	1890
Arkhyz	1886
Baikonur	1887

Normal Points		Total	
Site Name	Sta.	Etalon	Netw.
Yarragadee	7090	414	N
Wettzell (WI	8834	346	E
Matera	7941	295	E
Zimmerwald	7810	237	E
Herstmonceu	7840	188	E
Grasse	7845	181	E
Wettzell (SO	7827	176	E
Graz	7839	167	E
Changchun	7237	122	C
Kunming	7819	104	C
Komsomolsk	1868	95	R
Altay	1879	93	R
Potsdam	7841	59	E
Greenbelt	7105	46	N
Hartebeestho	7501	39	N
Simeiz	1873	32	E
Beijing	7249	31	C
Hartebeestho	7503	25	R
Mount Strom	7825	19	O
Monument P	7110	17	N
Shanghai	7821	14	C
Arkhyz	1886	5	R
Irkutsk	1891	5	R
Arequipa	7403	0	N
Badary	1890	0	R
Baikonur	1887	0	R
Borowiec	7811	0	E
Brasilia	7407	0	R
Haleakala	7119	0	N
Katzively	1893	0	E
Kiev	1824	0	E
McDonald	7080	0	N
Mendeleevo	1874	0	R
Riga	1884	0	E
Sejong	7394	0	O
Simosato	7838	0	O
Svetloe	1888	0	R
Tahiti	7124	0	N
Zelenchukska	1889	0	R
Totals:	0	2,710	

Network of Selected Stations (all)

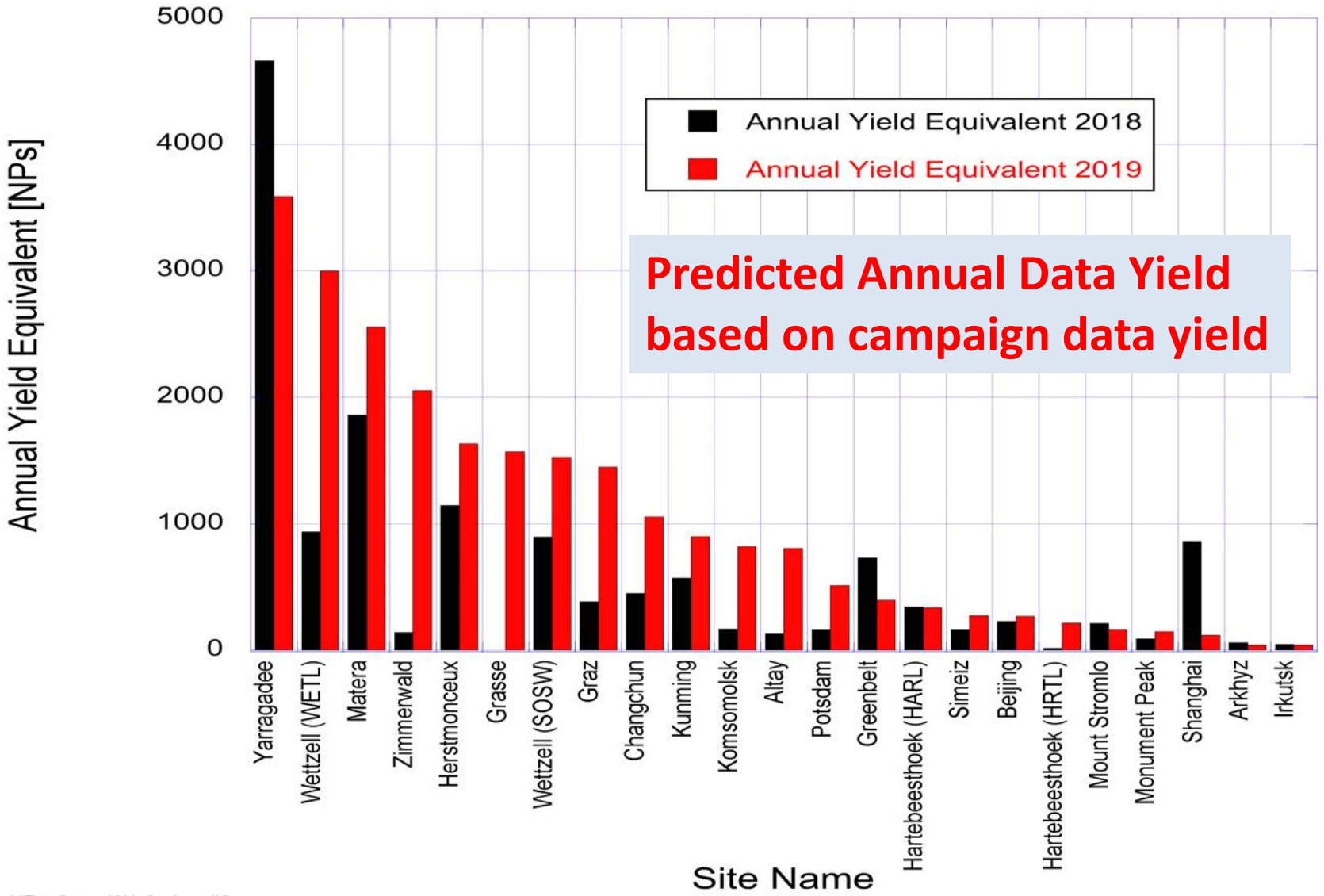


Etalon 1 & 2 Tracking Campaign - NPs



E12_3mo+W1234_NPs

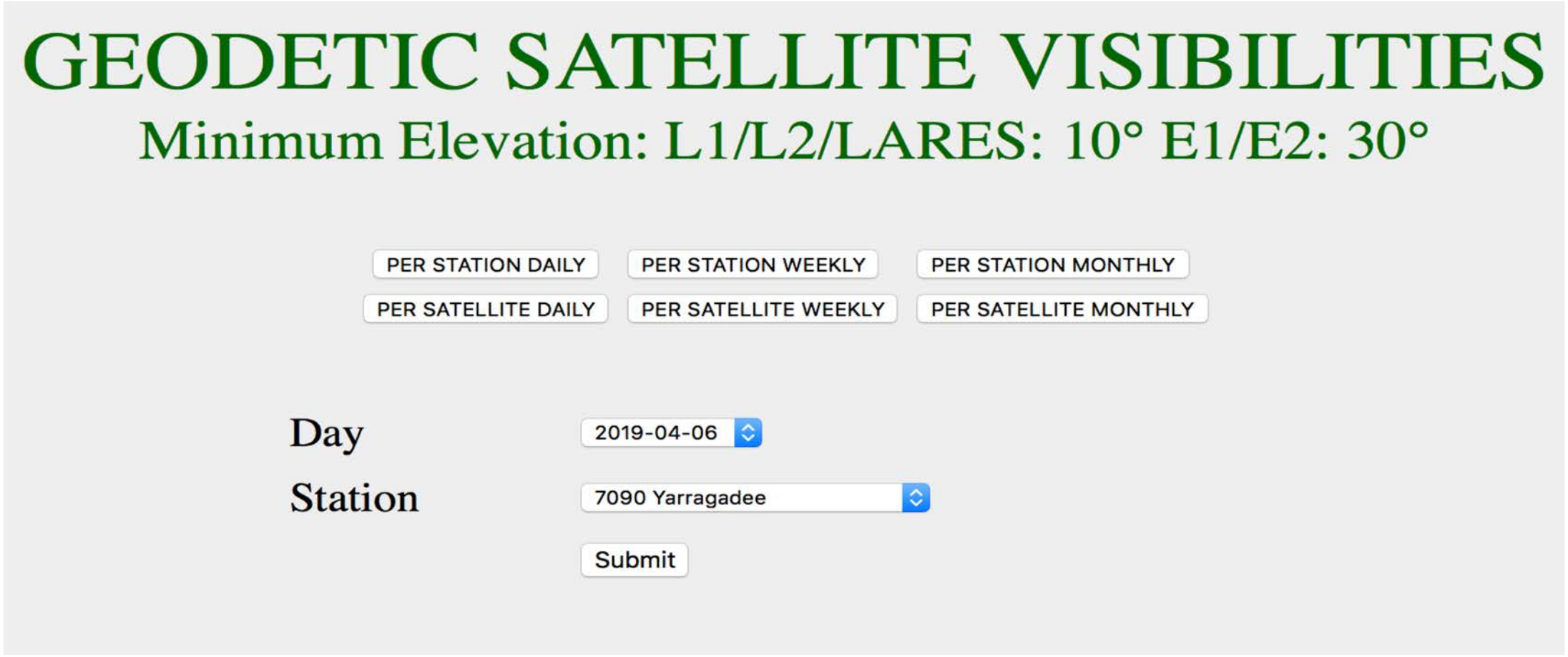
Etalon 1 & 2 Tracking Campaign – Annual Yield



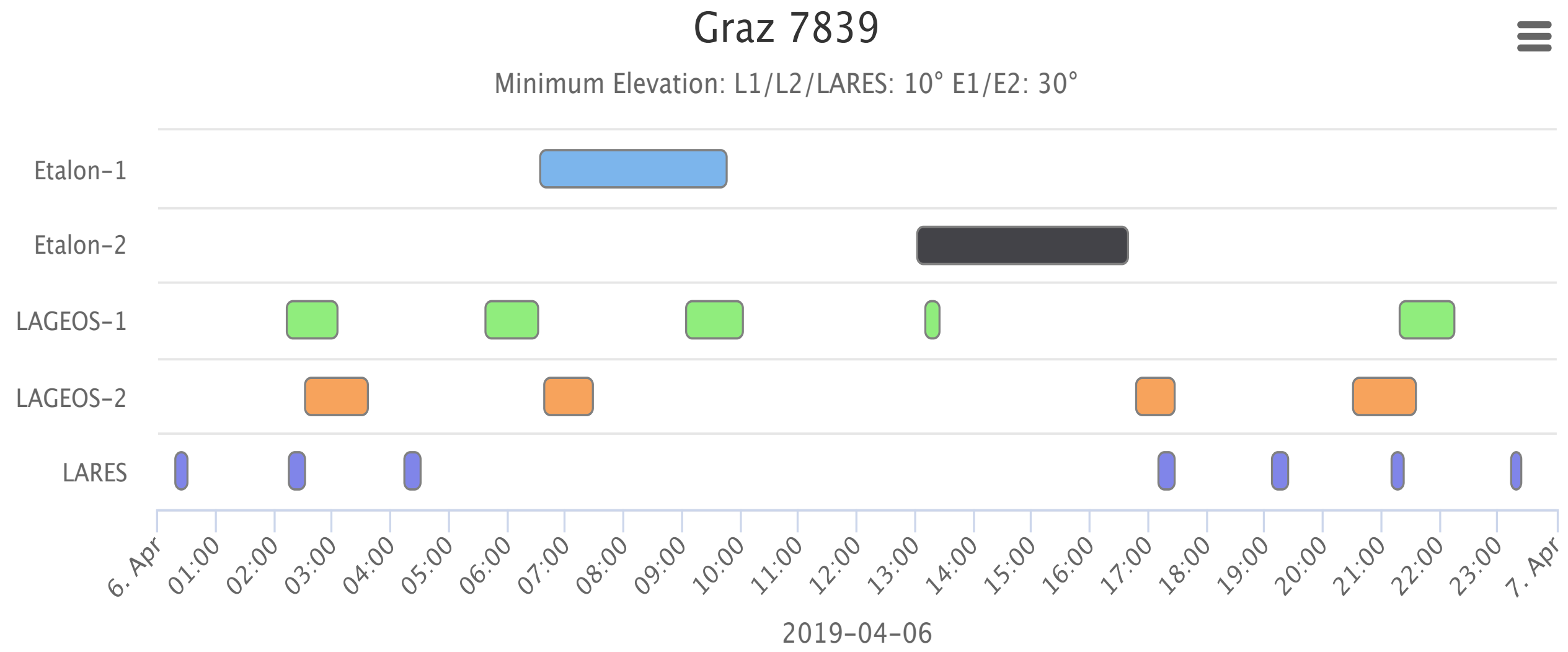
Etalons_NPs_3mo+W1-6_desc#6

Visibility Charts Online Sites

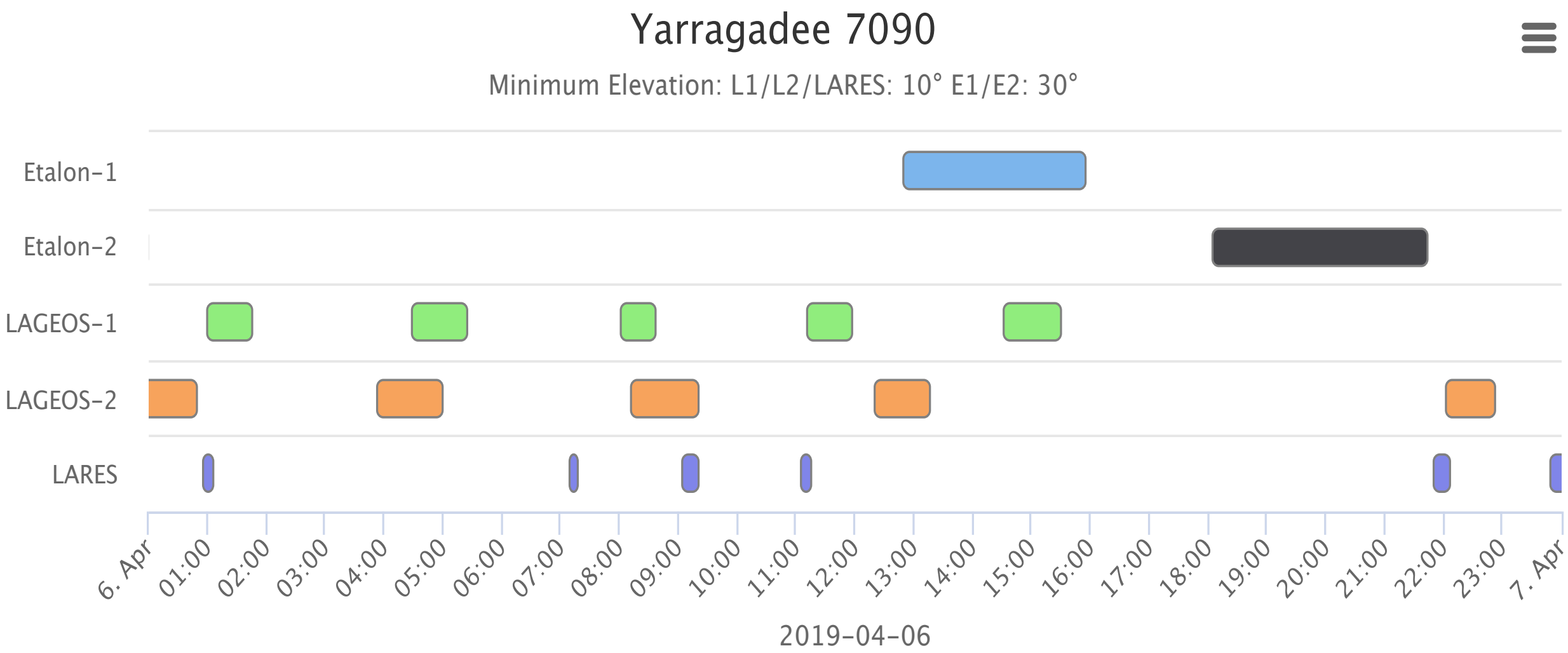
- Geodetic Satellite Targets Site:
  - http://geodesy.jcet.umbc.edu/ALLSTAT10_30/configuration_ALL.php



Station Visibilities for GRAZ 7839 Today



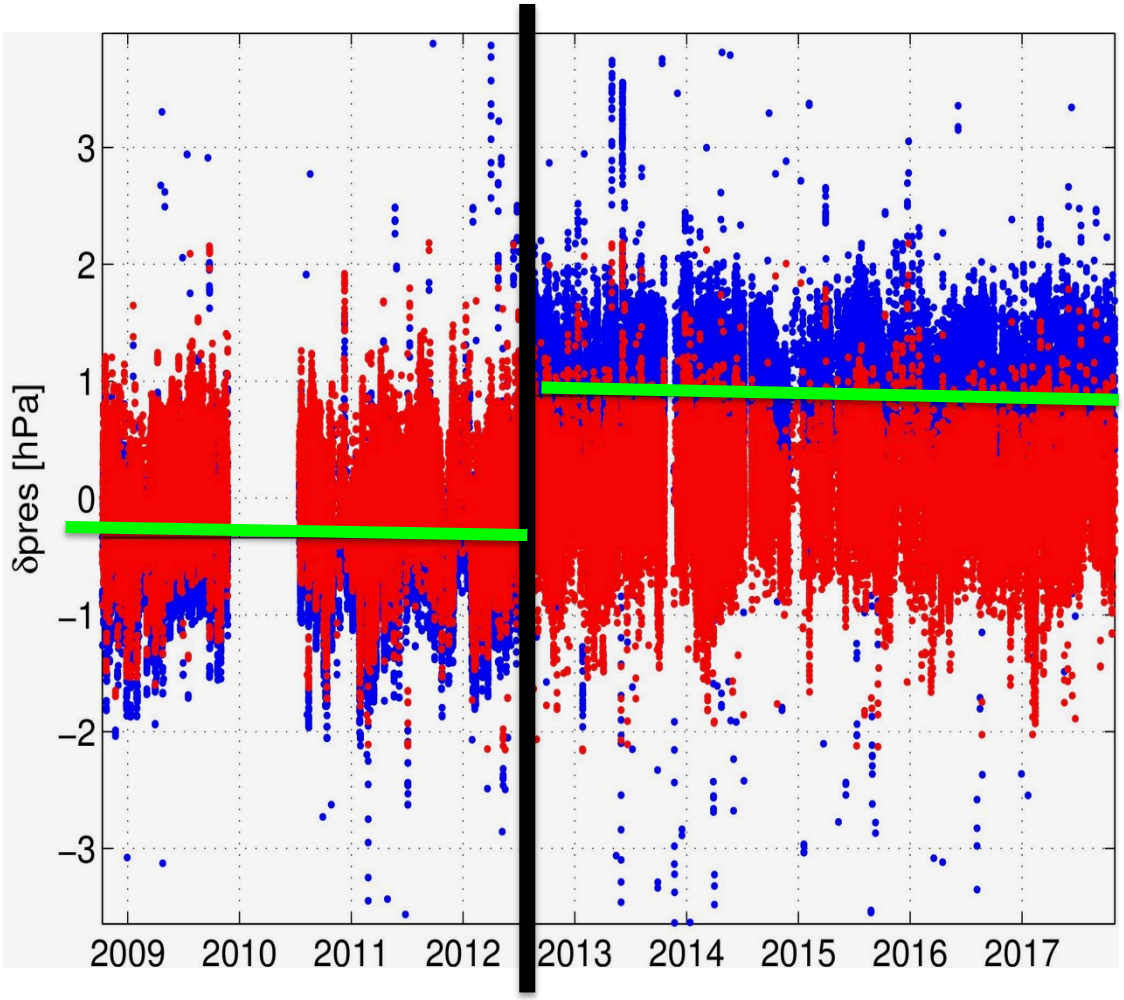
Station Visibilities for Yarragadee 7090 Today

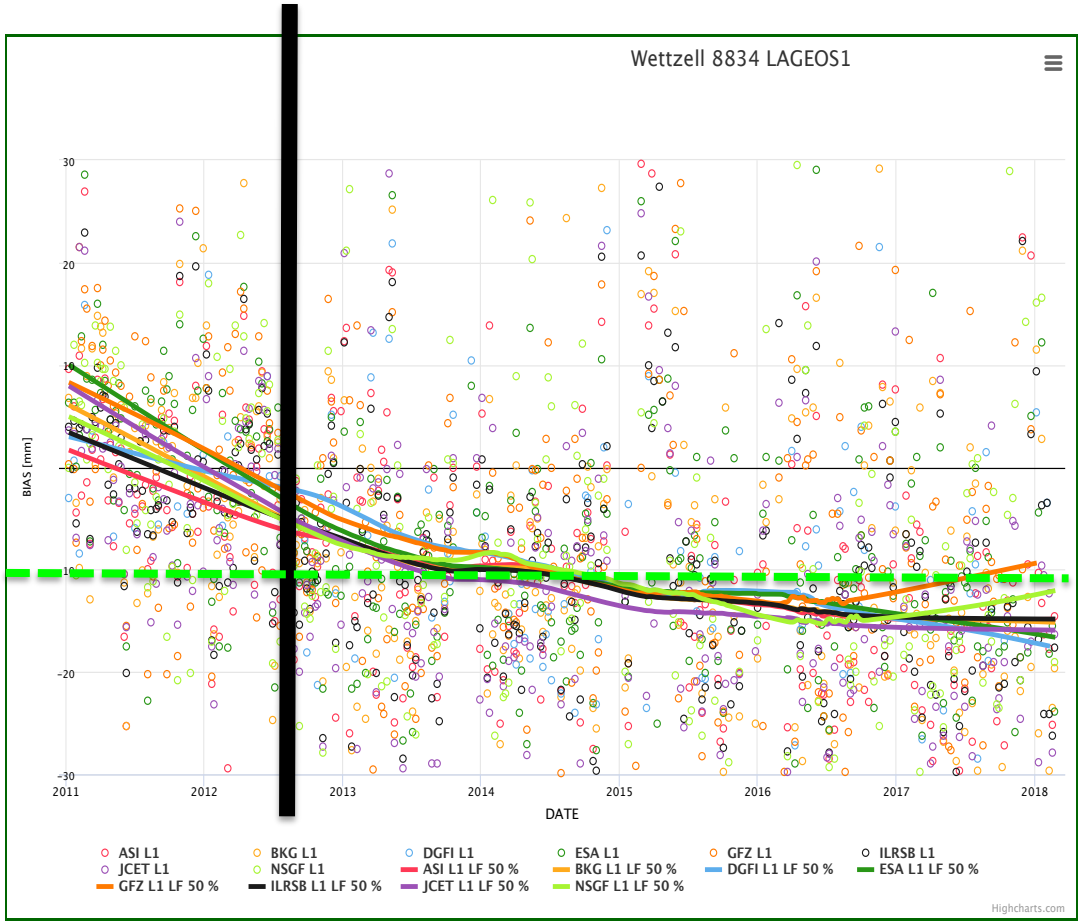


Wettzell (8834) Pressure Bias Error – Status?

Communicated by Rolf König and Ulli Schreiber

Pressure Change wrt a Standard & ASC Observed Bias





The barometer in Wettzell is located in the basement of the legacy VLBI system, where it always has been. In order to reference the SLR measurement to the invariant point of the SLR system, we applied a **1 hPa** offset correction in the ranging program in order to account for the height difference. In 2012 we progressed to a newer system. In the process this offset correction was lost!

Wettzell Pressure Error Correction Process

- A plan to correct and replace the data is being developed, when the station is ready they will contact the DCs to organize the replacement and will notify the ASC and all analysts of the new release and the period covered.
- It is a complicated process due to the fact that once they apply the correction, data from before and after the correction need special attention if they happen to fall in the same arc analyzed.
- We made some proposals to the station which I assume they are considering/evaluating, with no news over the past month.

- At Canberra Ulli stated that his group was working with the DCs on correcting this issue, but no news beyond that, is it completed? When?

DGFI Test SINEXs for the v230 Series – Problem/Status?

DGFI Test v230 Series Examination

- DGFI submitted about 20 WEEKLY SINEXs produced with the new DGFI s/w and asked us to check if they now comply with the new bias-labeling convention we have adopted for multi-color systems;
- At JCET we produced combination products replacing the previous DGFI SINEXs with the new ones;
- We noticed that not all SINEXs were successfully combined, some giving errors and stopping without a combined product being generated.
- After a closer examination of the weeks that did not work as expected we noticed that in the new DGFI approach for these SINEXs they have separated the dual systems throughout the process to TWO DIFFERENT/INDEPENDENT stations!
- That of course is wrong and inconsistent with what we all do. Doing so weakens tremendously the results and it misrepresents physical reality.

DGFI Test v230 Series Examination – cont.

- There is a single system measuring using two different wavelengths, so there is a single set of coordinates involved, although the biases may be different for each path/wavelength.
- Physically one apparatus is measuring and both wavelengths use the same IRP, so the measured ranges refer to the same location which has a unique connection to the accessible points of the site (surveyed points).

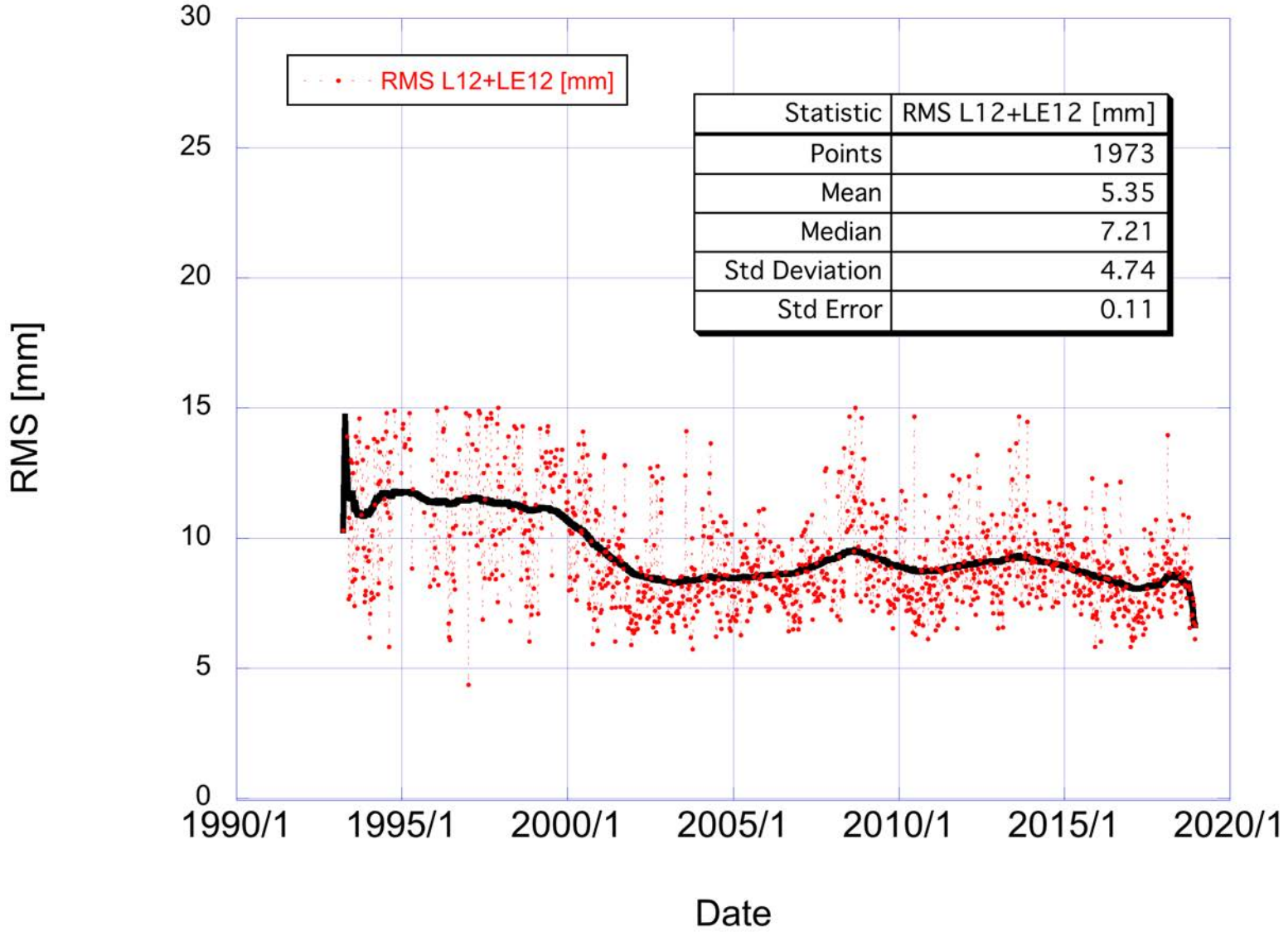
```
%=SNX 2.02 DGF 19:010:30379 DGF 03:131:00584 03:137:85726 L 00151 1 S E

*-------------------------------------------------------------------------------
+SITE/ID
*Code PT Domes____ T Station_description___ Approx_lon_ Approx_lat_ App_h__
 7405  A 41719M001 L Concepci               287  1 31.2 -36 50 34.8   169.8
 7705  A 41719M011 L Concepci               287  1 31.2 -36 50 34.8   169.8

*-------------------------------------------------------------------------------
+SITE/ECCENTRICITY
*Code PT SOLN T Data_Start__ Data_End____ typ Apr --> Benchmark (m)_______
 7405  A    01 L 02:001:00000 04:000:00000 XYZ   0.3090  -1.0100  -1.0330
 7705  A    01 L 02:001:00000 04:000:00000 XYZ   0.3090  -1.0100  -1.0330

*-------------------------------------------------------------------------------
+SOLUTION/EPOCHS
*Code PT SOLN T Data_start__ Data_end____ Mean_epoch__
 7405  A    01 L 03:131:35394 03:137:32998 03:134:34196
 7705  A    01 L 03:136:69736 03:136:71717 03:136:70726

*-------------------------------------------------------------------------------
+BIAS/EPOCHS
*Code PT SOLN B Data_start__ Data_end____ Mean_epoch__
 7405 L1  401 R 03:131:00000 03:138:00000 03:134:43200
 7405 L2  401 R 03:131:00000 03:138:00000 03:134:43200
 7705 L2  801 R 03:131:00000 03:138:00000 03:134:43200

*-------------------------------------------------------------------------------
+SOLUTION/ESTIMATE
*Index|_Type_|CODE|PT|SOLN|_Ref_epoch__|Unit|S|_Estimate_____________|Sigma______
    44 RBIAS  7405 L2 ---- 03:134:43200 m    1  3.28747037394624E-03 1.09004E-02
    45 RBIAS  7705 L2 ---- 03:134:43200 m    1  9.91022997157261E-03 4.18056E-02

   116 STAX   7405  A   01 03:134:43200 m    1  1.49203258272561E+06 5.55943E-01
   117 STAY   7405  A   01 03:134:43200 m    1 -4.88794613146709E+06 2.09145E-01
   118 STAZ   7405  A   01 03:134:43200 m    1 -3.80356601413097E+06 1.48996E-01
   119 STAX   7705  A   01 03:134:43200 m    1  1.49203260667298E+06 1.32855E+00
   120 STAY   7705  A   01 03:134:43200 m    1 -4.88794615001691E+06 2.17429E+00
   121 STAZ   7705  A   01 03:134:43200 m    1 -3.80356599668240E+06 1.02172E+00
```

Station Systematic Error Monitoring-SSEM Project

Station Systematic Error Monitoring-SSEM Project -1

- We reanalyzed all of the 1993-present arcs with new models:
  - New gravity, TVG and ocean tides
  - GGM05C along with new degree-2 series from SLR (UT/CSR series)
  - GOT10.4 ocean tides and Ocean Loading terms
  - New secular pole (gravity series is compatible with new “pole”)
- We need to work on some of the arcs, this is round one
- We see significant improvement at this stage
- We will release to all the usual data sets of the new degree-2 series from SLR (UT/CSR series) for use in the reanalysis (ASAP)

Station Systematic Error Monitoring-SSEM Project -1



Site Selection for the SSEM Project

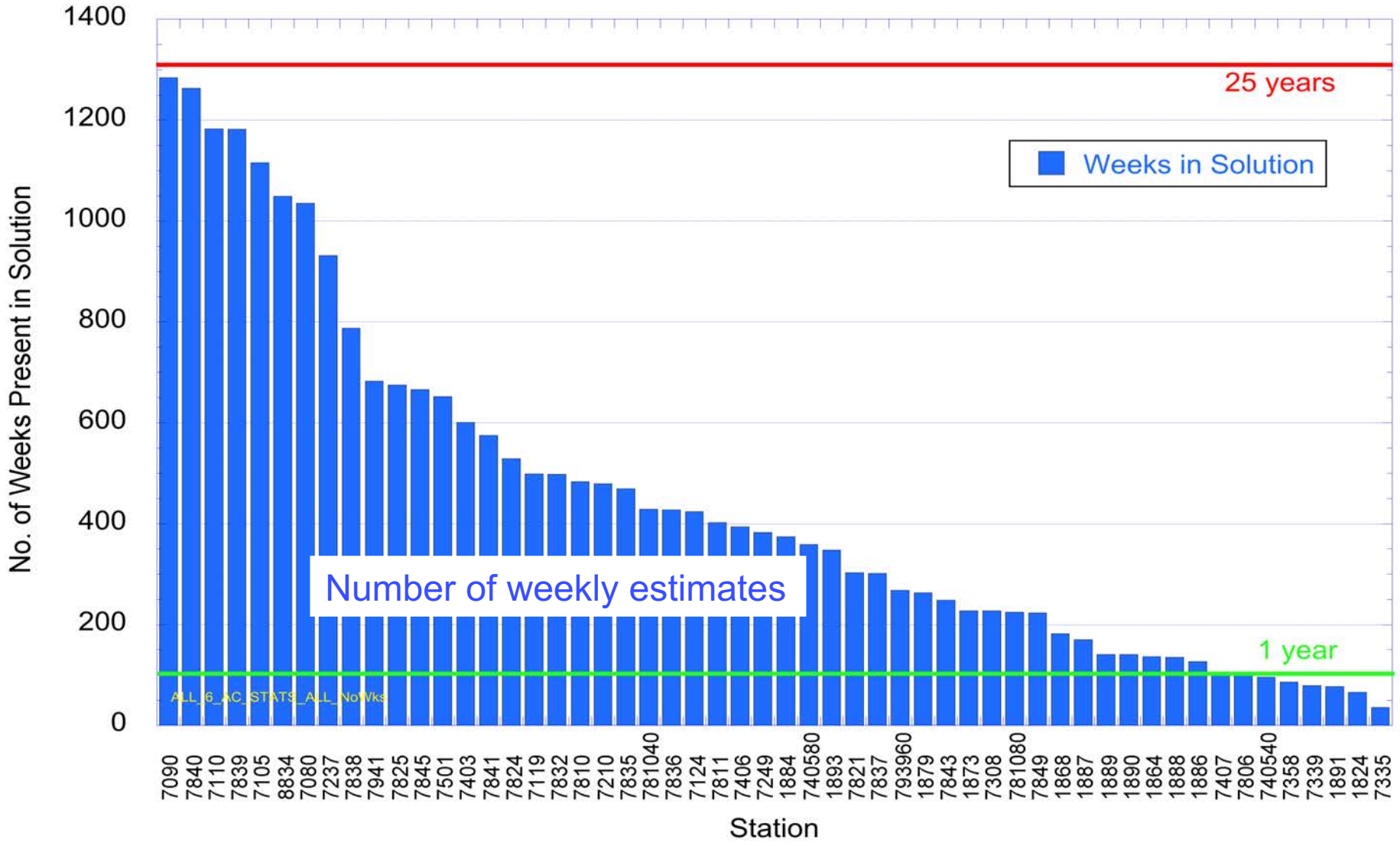
1824 Golosiiv
~~1831 Lviv~~
~~1863 Maidanak 2~~
1864 Maidanak 1 2003.0->
1868 Komsomolsk-na-Amure
2008.0 ->
1873 Simeiz 2001.0 ->
1879 Altay
1884 Riga
~~1885 Riga~~
1886 Arkhyz
1887 Baikonur
1888 Svetloe
1889 Zelenchukskya
1890 Badary
1891 Irkutsk
1893 Katzively
~~1953 Santiago~~
7080 McDonald Obs.
7090 Yarragadee
~~7097 Easter I~~
7105 Greenbelt
7110 Monument Peak
7119 Haleakala
7122 Mazatlan

7124 Easter I
7124 Tahiti
~~7125 Greenbelt~~
~~7130 Greenbelt~~
7210 Haleakala
~~7231 Wuhan~~
7236 Wuhan
7237 Changchun
7249 Beijing
~~7295 Richmond~~
7308 Koganei
~~7328 Koganei~~
7335 Kashima 99/04-00/05
~~7337 Miura~~
7339 Tateyama
~~7355 Urumqi~~
~~7356 Lhasa~~
~~7357 Beijing A~~
7358 Tanegashima
~~7359 Daedeok~~
~~7394 Sejong~~
7403 Arequipa
~~7404 Santiago~~
7405 Conc@423
7405 Conc@847

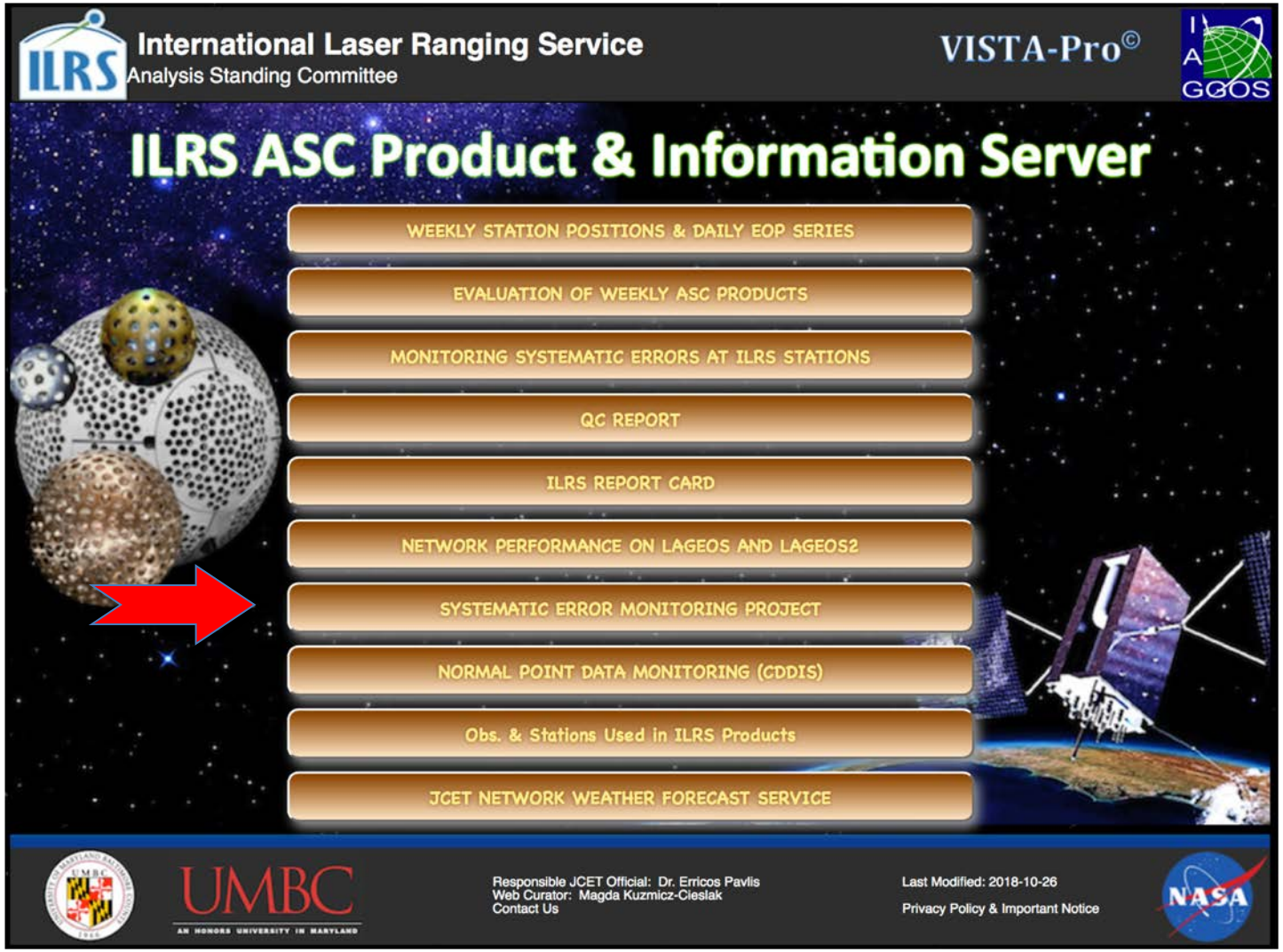
7406 San Juan → 2013.0
7407 Brasilia
~~7410 Algonqui~~
~~7411 La Grand~~
7501 Hartebeesthoek
~~7502 Sutherla~~
~~7525 Yrisokel~~
~~7530 Bar Giyy~~
~~7545 Punta Sa~~
~~7548 Cagliari~~
~~7597 Wettzell~~
7806 Metsahovi 99/09->
7810 Zimm@423
7810 Zimm@532
7810 Zimm@846
7811 Borowiec
7819 Kunming
~~7820 Kunming~~
7821 Shanghai
~~7822 Tahiti~~
~~7823 San Fernando~~
7824 San Fernando
7825 Mt Stromlo
~~7830 Chania~~
~~7831 Helwan~~

7832 Riyadh
7835 Grasse
7836 Potsdam
7837 Shanghai
7838 Simosato
7839 Graz
7840 Herstmonceux
7841 Potsdam
7843 Orroral
7845 Grasse
~~7848 Ajaccio~~
7849 Mt Stromlo
~~7850 Mcdonald~~
~~7882 Cabo San~~
~~7883 Ensenada~~
~~7884 Albuquer~~
~~7918 Greenbelt~~
7939 Matera
7941 Matera
~~8833 Kootwijk~~
8834 Wettzell

Site Participation in the SSEM Project

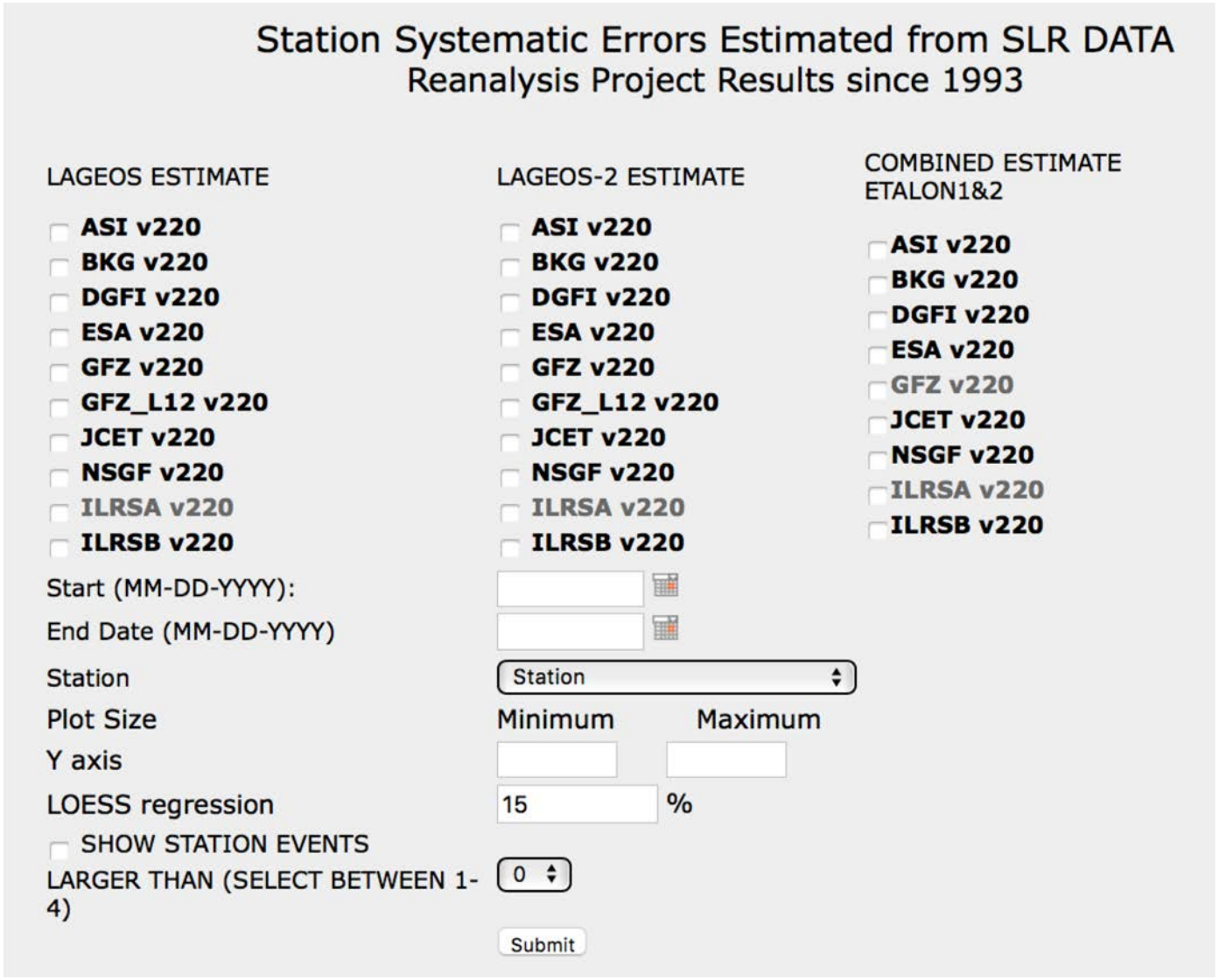


JCET Portal UPDATE - 1

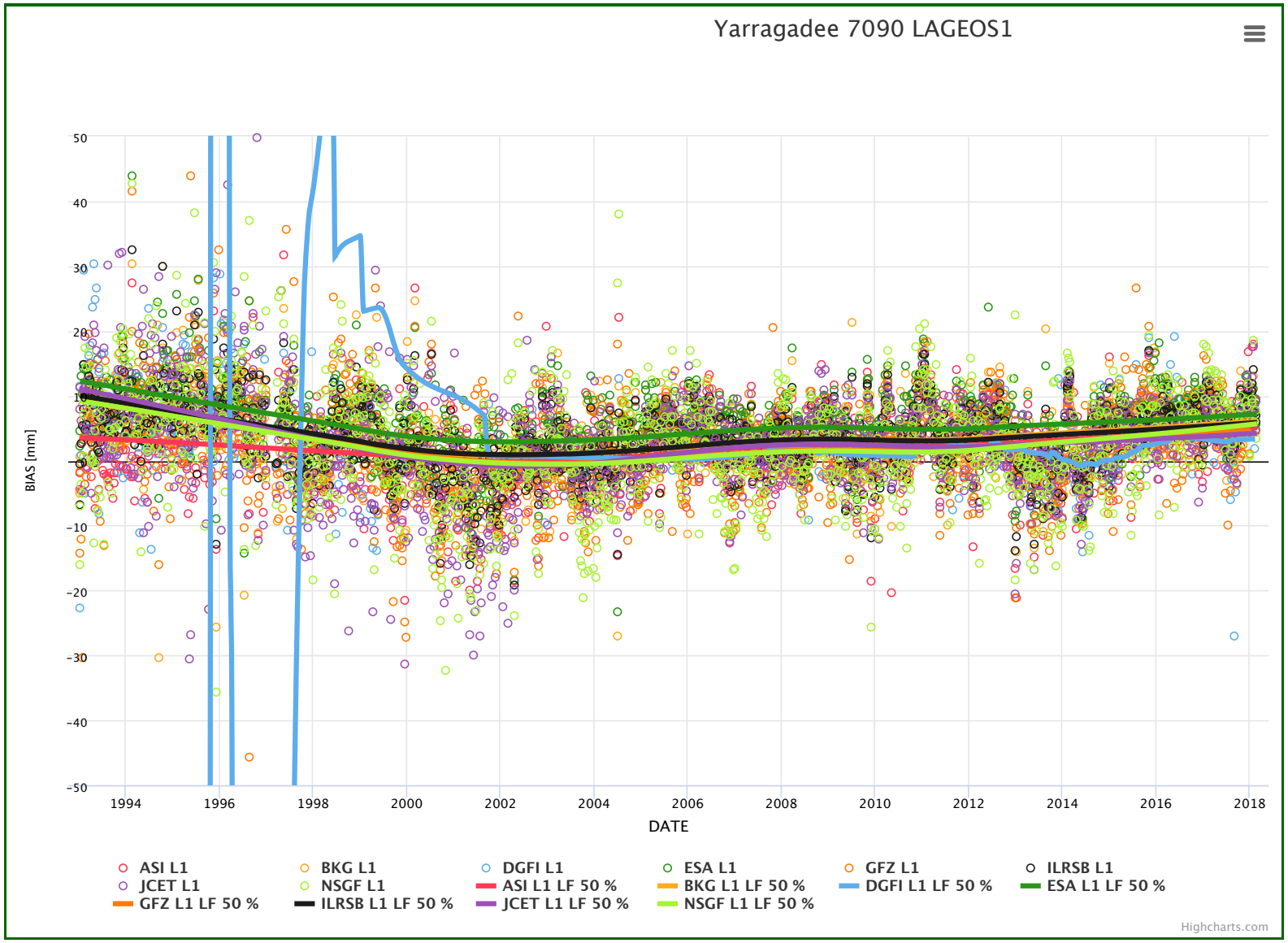


http://geodesy.jcet.umbc.edu/ILRS_AWG_MONITORING/

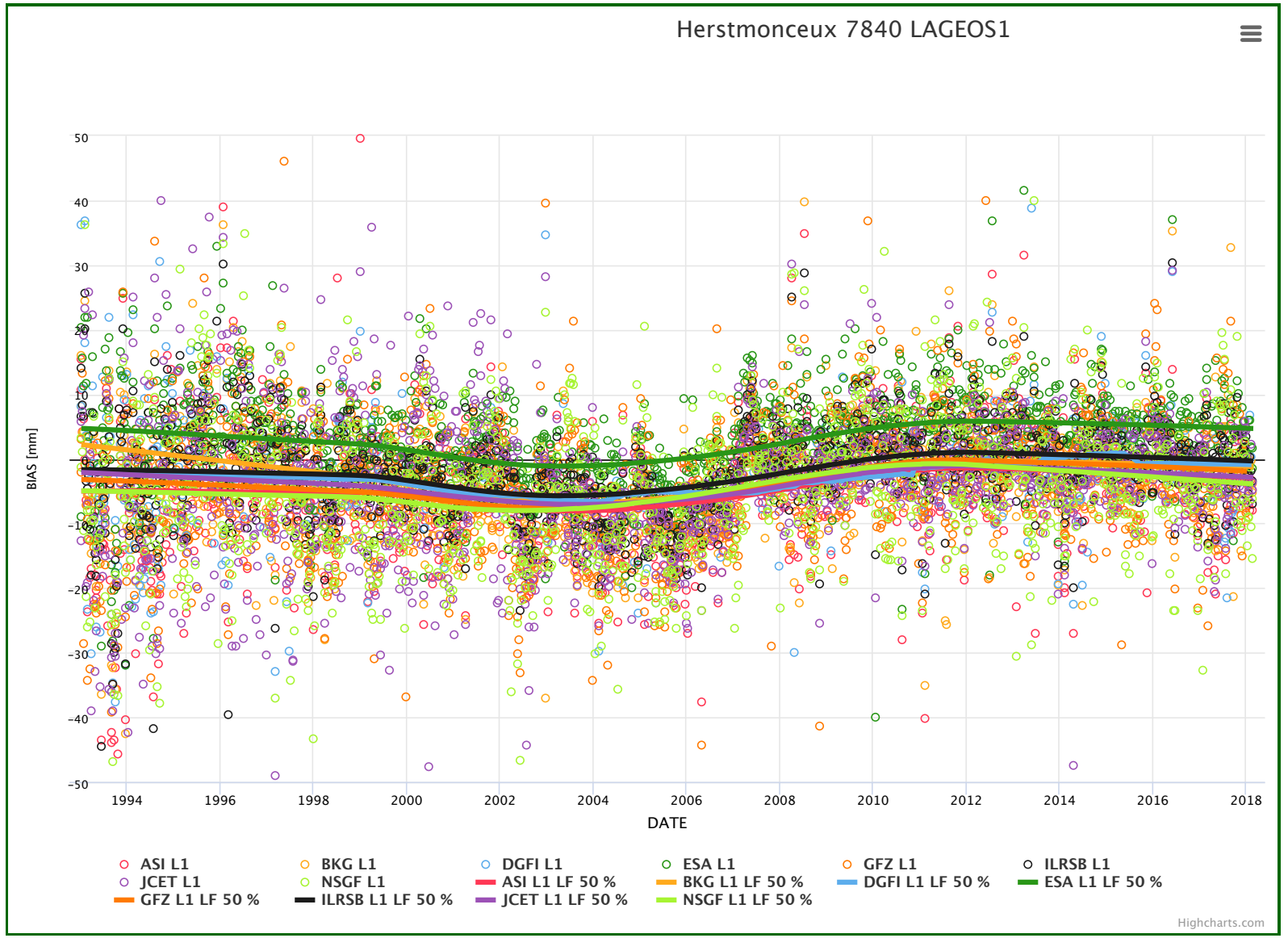
Station Systematic Error Monitoring Project



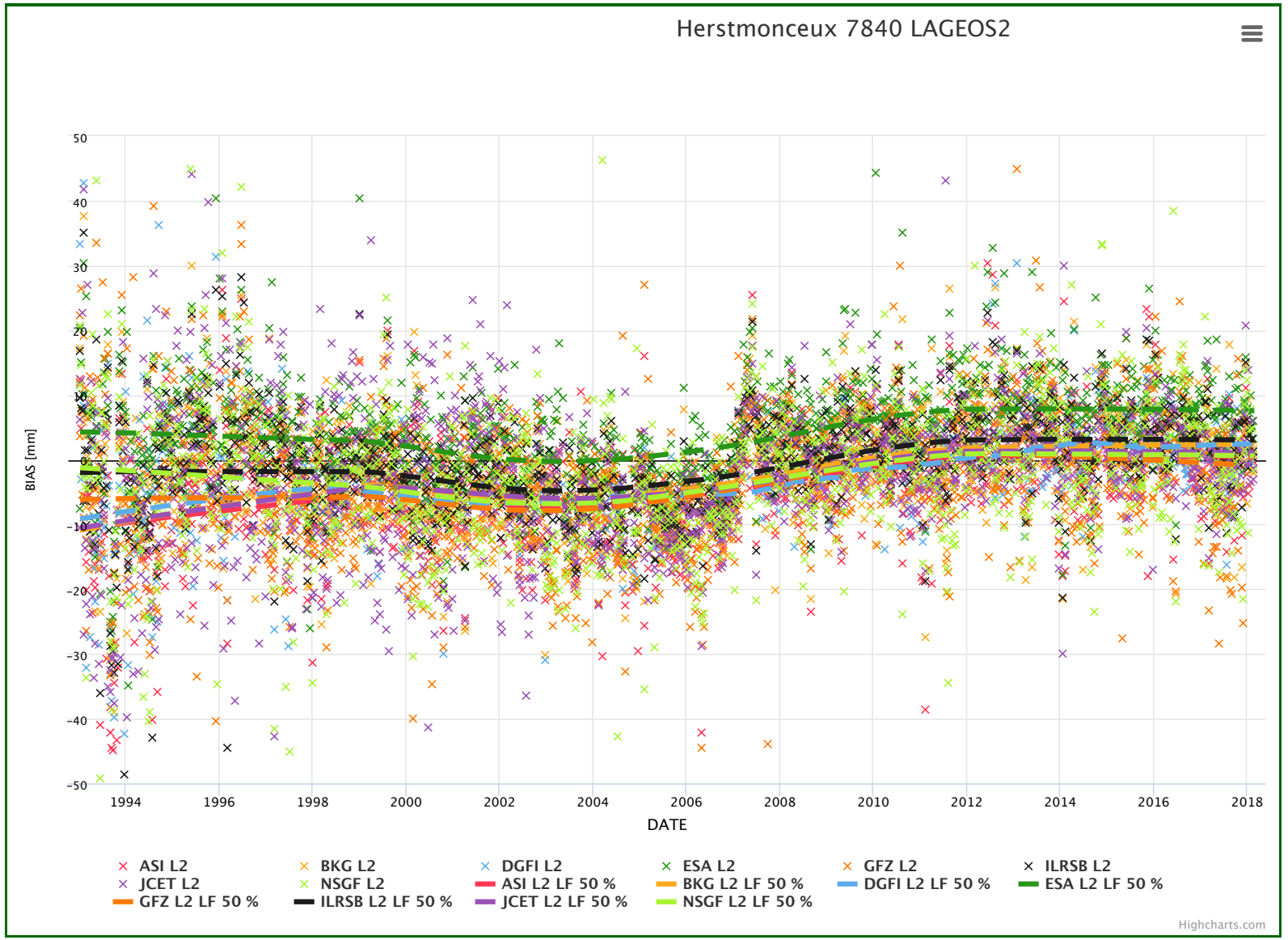
Station Systematic Error Project Results 1



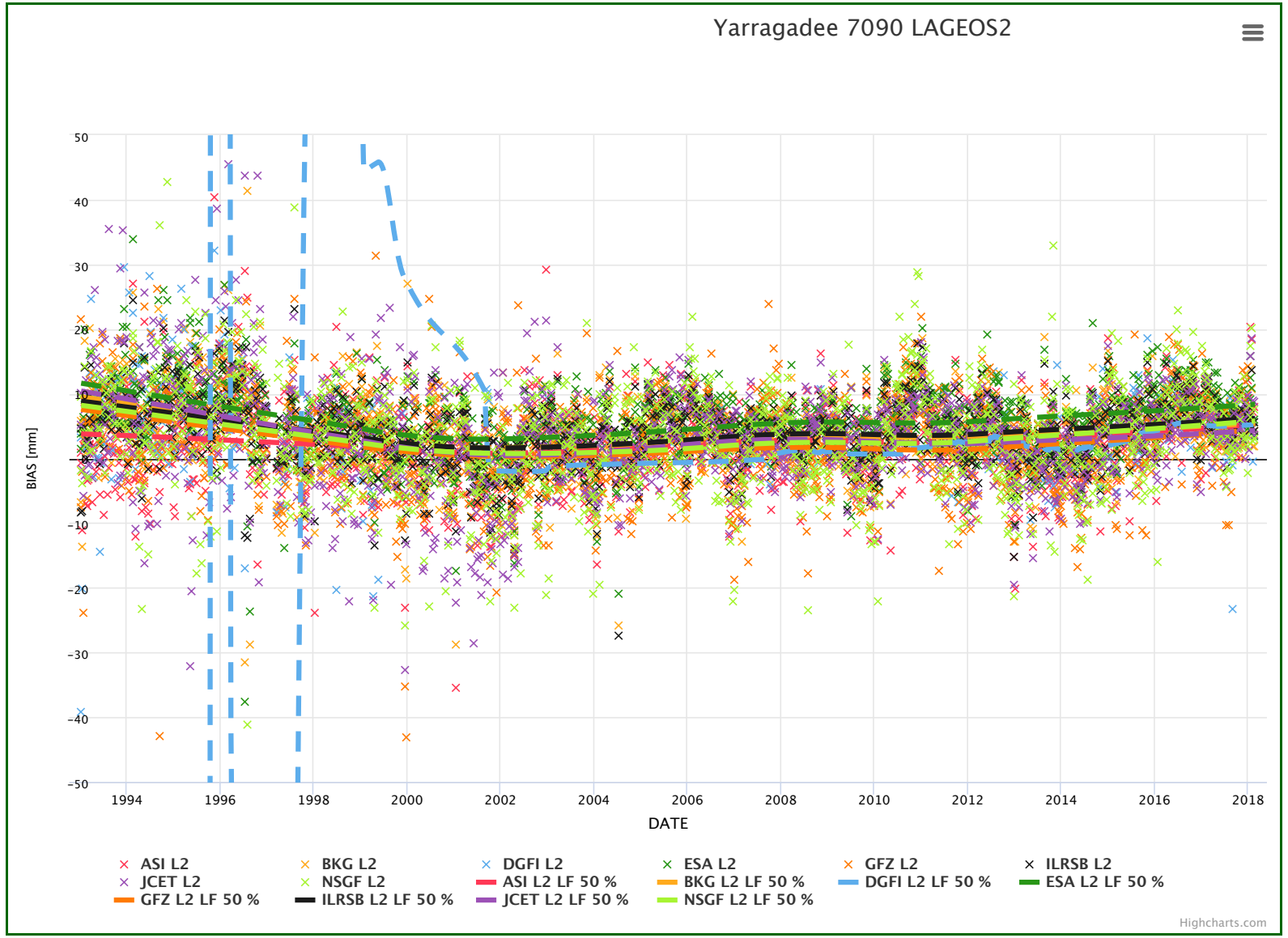
Station Systematic Error Project Results 2



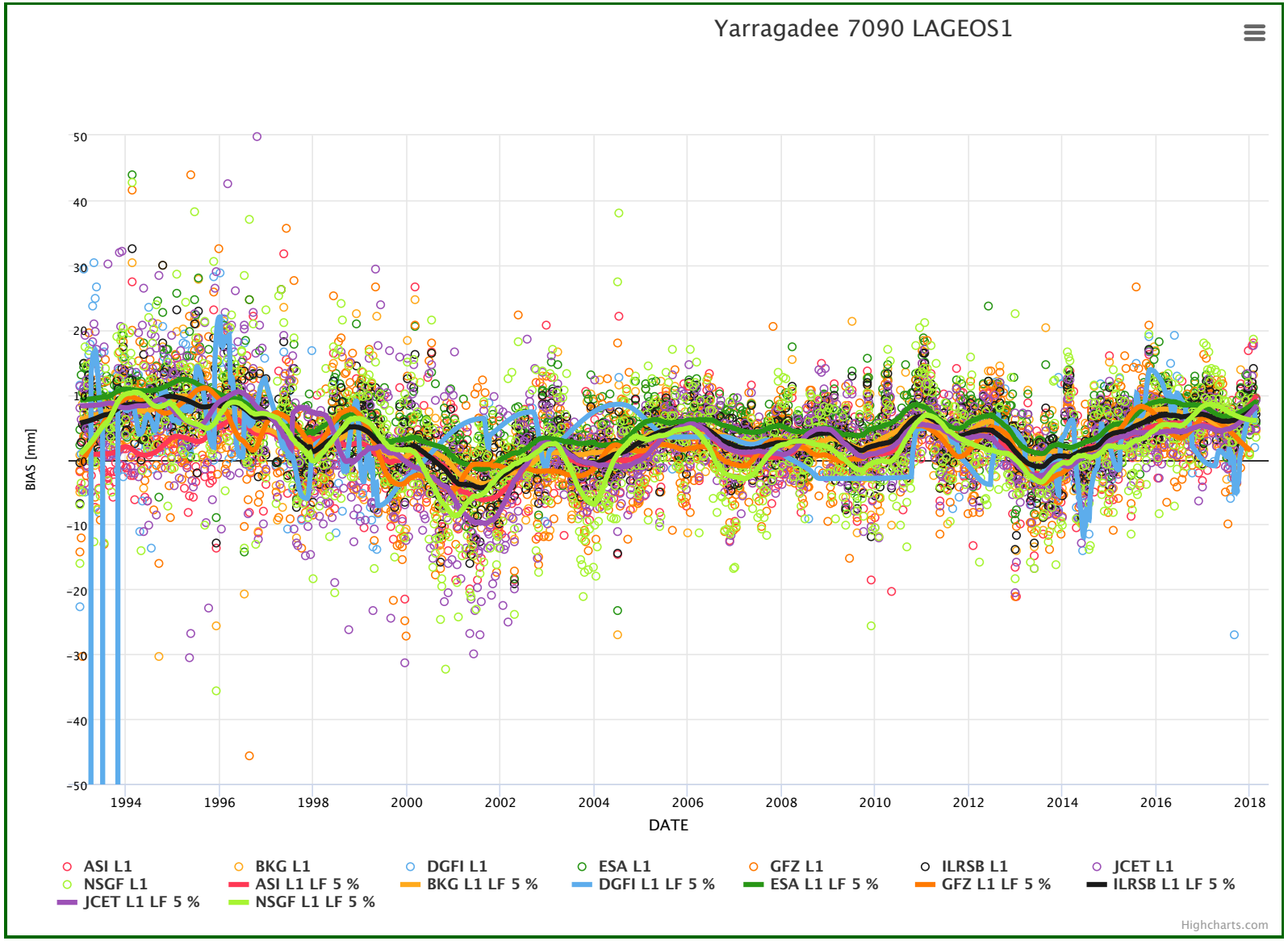
Station Systematic Error Project Results 3



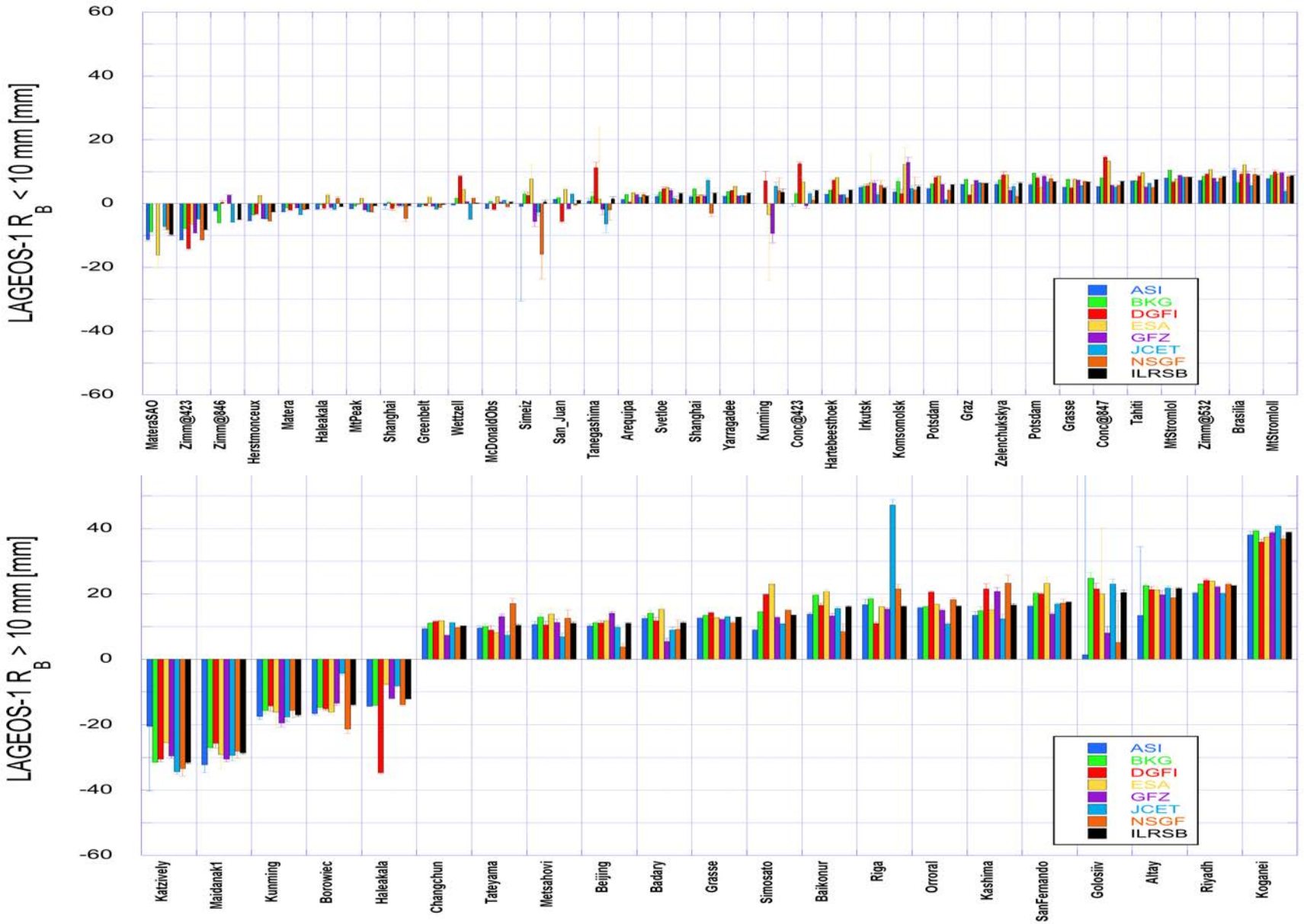
Station Systematic Error Project Results 4



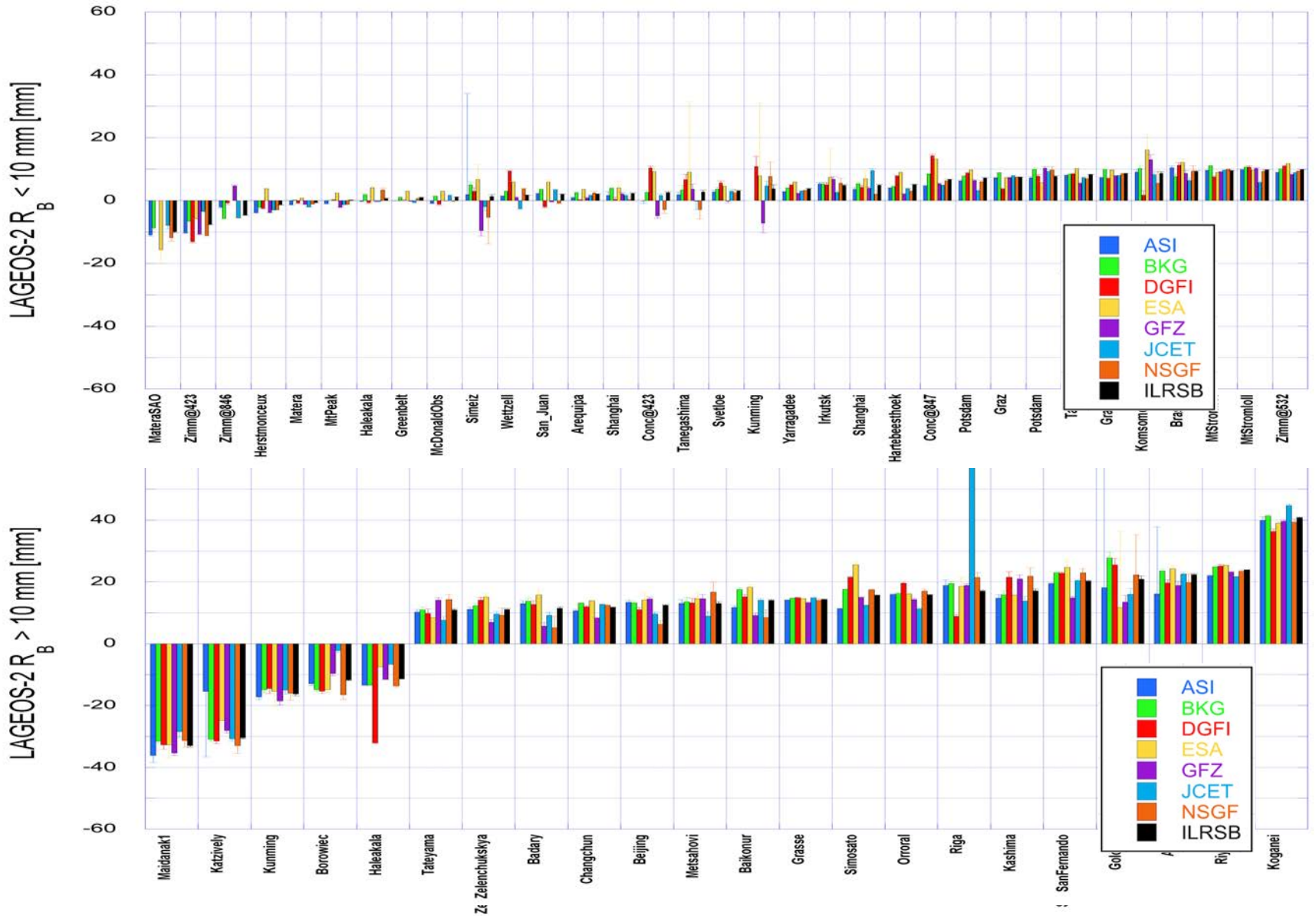
Station Systematic Error Project Results 5



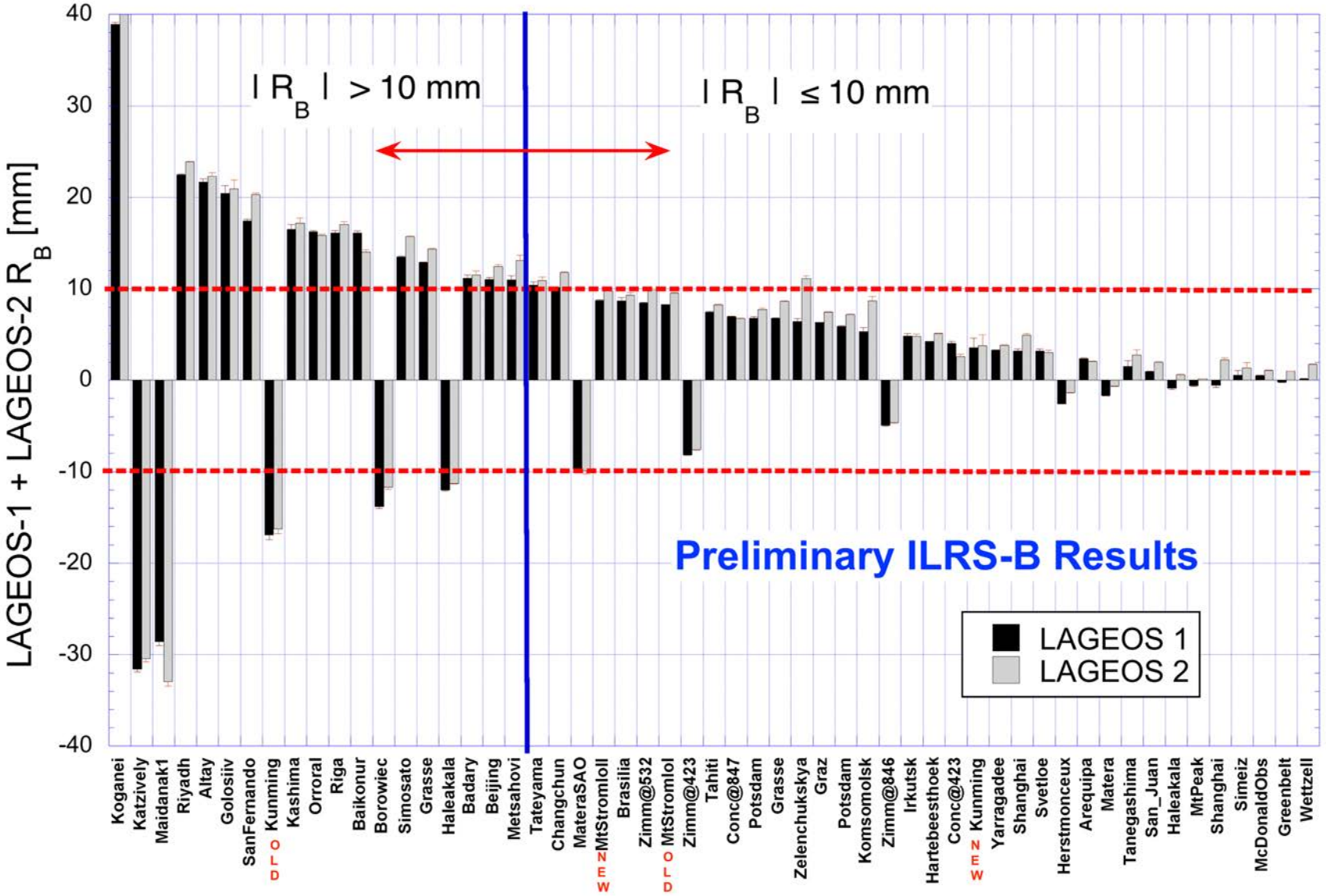
Long-term Systematic Errors LAGEOS



Long-term Systematic Errors LAGEOS-2



Long-term Systematic Errors LAGEOS1/2



Station Systematic Error Monitoring-SSEM Project -2

- We need to evaluate the results from each AC and subsequently review the combined result for each LAGEOS;
- The combined time series will be reviewed for each system at each site and the goal here is to identify the “breaks” due to logged activities at the site (from their HST logs);
- At a next step we will need to discuss* with the stations any additional “events” identified in their time series, to rationalize the adoption of additional corrections;
- The adopted long-term mean biases will be applied a priori;
- We will need to do a “dry run” for 1-2 months, then move to an operational phase by March 1, 2019 or wait after the EGU**???**

* We already have had discussions up to ~2014, so we have most of the answers by now

Where

A Geodetic Software

Ingrid Fausk, Michael Dähnn, Ann-Silje Kirkvik

April 6, 2019

Where Timeline

- 2015: Start
- 2018: First release as an open source project on GitHub
- 2019: Two proposed IVS analysis centers with Where:
  - Kartverket, Norway
  - Instituto Geográfico Nacional, Spain
- 2020: IVS Analysis centers with Where?
- 2022: ILRS Analysis center with Where?

Live Demo of Where

- Running *Where*
- Running *There*, a companion tool for visualizing results
- Status, discussion
- Bugs...

The Technical Stuff

The **Where** software is mainly being written in *Python*

- Cross-platform: Runs on Linux, Mac, Windows
- Solid, flexible and fast libraries like `numpy`, `astropy`, `matplotlib` and `scipy` are available
- We use a **HDF5**-based format for internal data storage
- *Python* has effective interfaces to *C* and *Fortran* code, and we use the **SOFA** and **IERS** software libraries directly
- Orbit integrator using *Cowell* method written in *Python*.

ILRS Analysis Committee meeting
NSGF report

José Rodríguez, Graham Appleby

BGS Space Geodesy Facility, UK

5th April 2019, Vienna

NSGF activities/updates

- CoM corrections delivered to ACs and other selected members of the community closely involved with SLR analysis
- Details and implications of new CoM in Canberra presentations (ASC and main meeting)
- CoM paper already submitted → public release of tables as soon as it's approved
- Briefly: changes are big enough for us to care (CoM big contributor to overall error budget and previously identified biases, especially for bigger targets!)
- Lower CoM values → higher station heights → increase in network scale
- Of course, CoM changes and RB effects are *not* cumulative

NSGF activities/updates

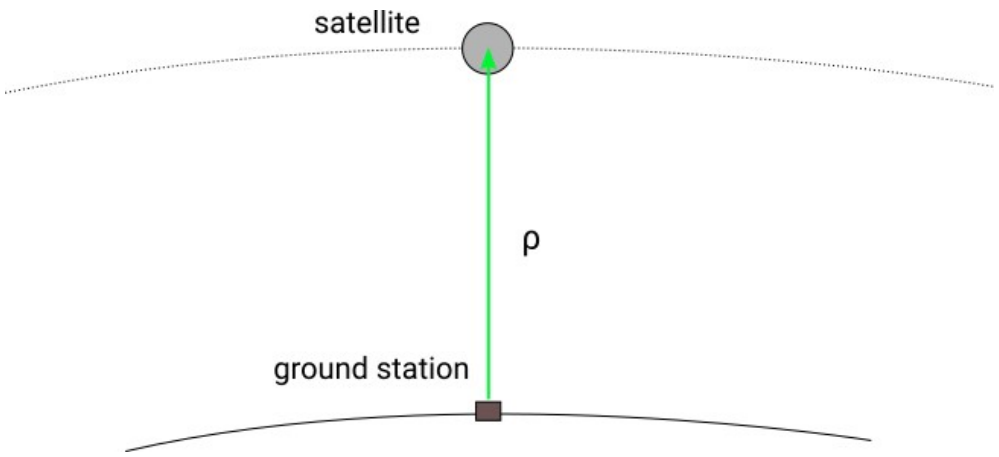
- TB from T2L2 not implemented
- Except for that, ready for reanalysis (once DH file sorted out)
- Will implement shortly more modern atmospheric modelling than what is available in SATAN at the moment (thanks, F.Lemoine!), hoping to improve LARES fits
- Spherical harmonics have been ready for a while, but output is in non-standard format

NSGF activities/updates

- Contribution to IERS TN on TRF comparison
- No surprises here:
  - Similar performance on the basis of LG1/LG2 residuals
  - But: different network scale. s(DTRF14) = s(ILRS-A); s(ITRF14) = s(ILRS-A) + 0.7 ppb
  - On the basis of solutions with RB estimation ITRF14 appears more accurate
  - No need for RB to see this, analysis of residuals offers a lot of information

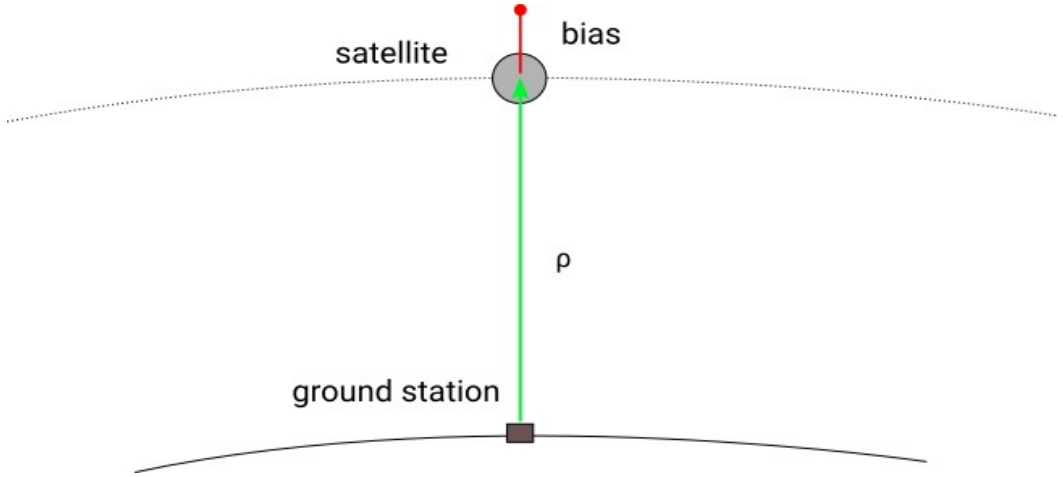
Post-fit residual trends

No range error, perfect measurement. Station height accurately estimated



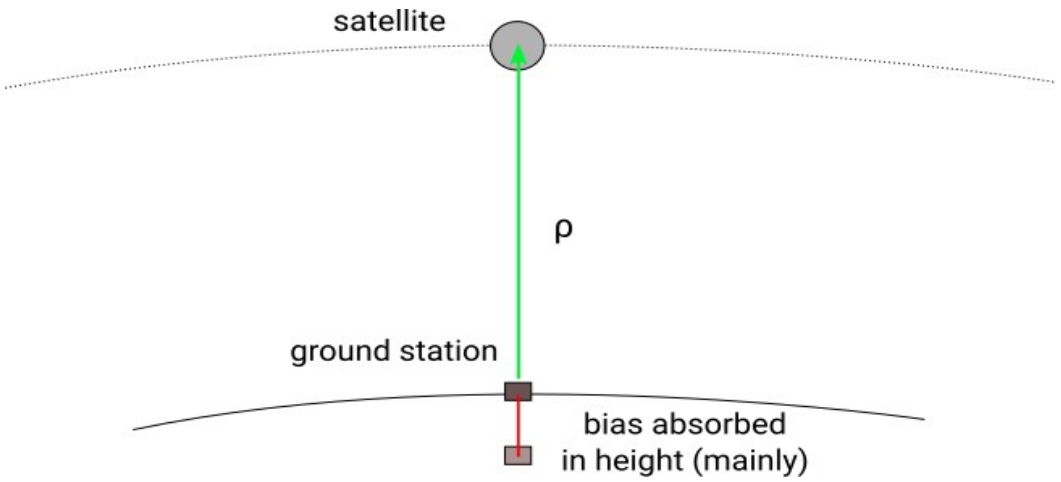
Post-fit residual trends

Positive range error (assumed constant over an orbital arc). Positive residual if station coordinates not estimated (nor biases)



Post-fit residual trends

Positive range error. Station height inaccurately estimated (lower than “true” value).
Bias absorbed in coordinates (biases not estimated)

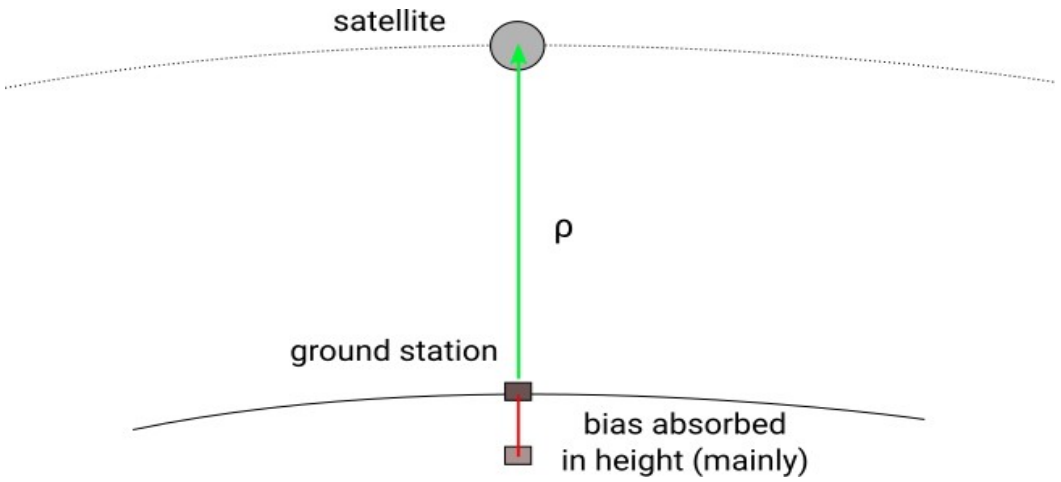


Post-fit residual trends

Positive range error. Station height inaccurately estimated (lower than “true” value). Bias absorbed in coordinates.

BUT: height offset > bias value (because of observation geometry)

High elevation: negative residuals; low elevation: positive residuals



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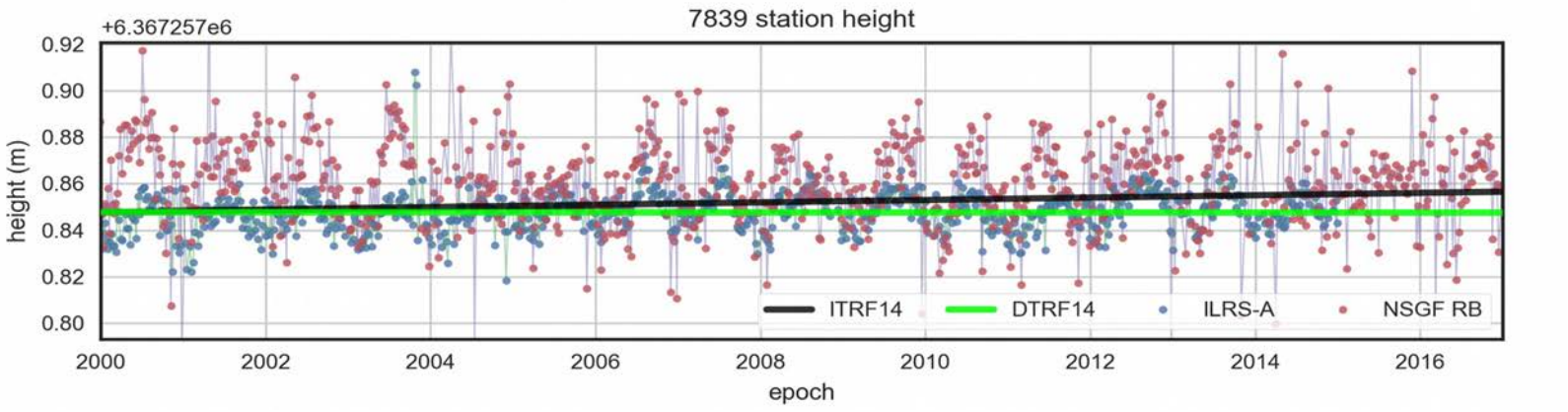

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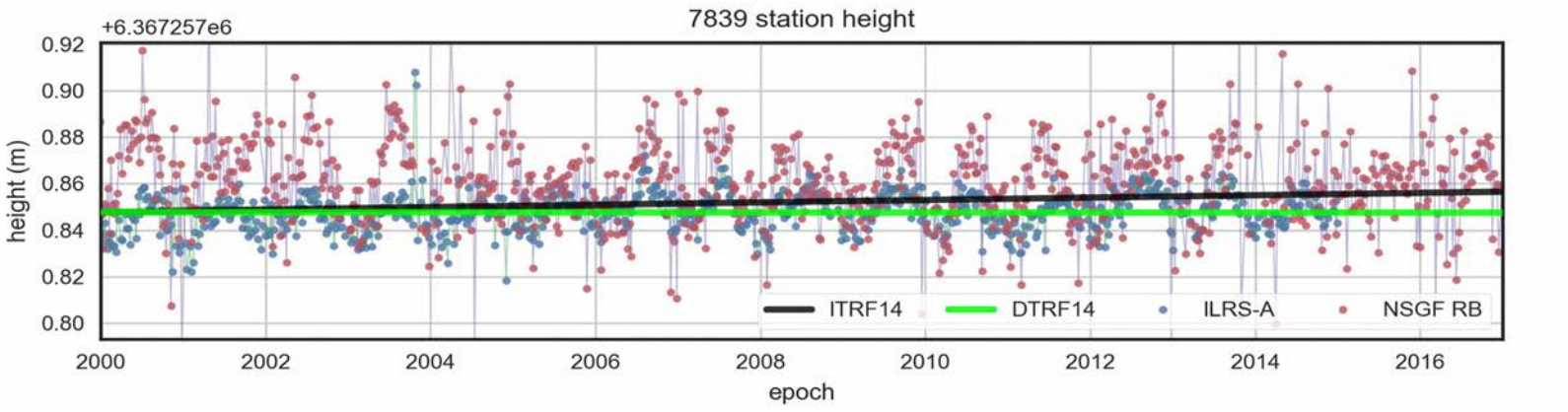
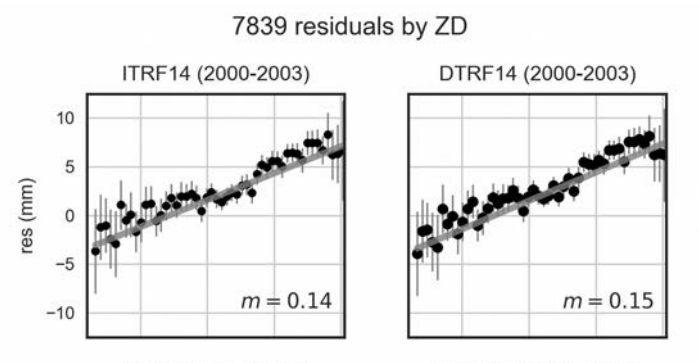
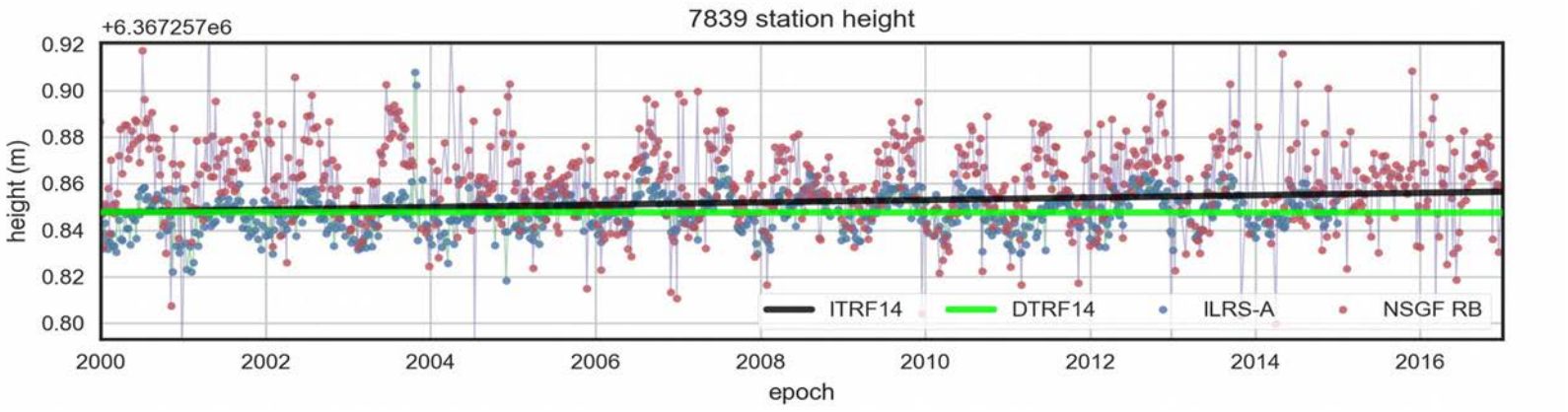
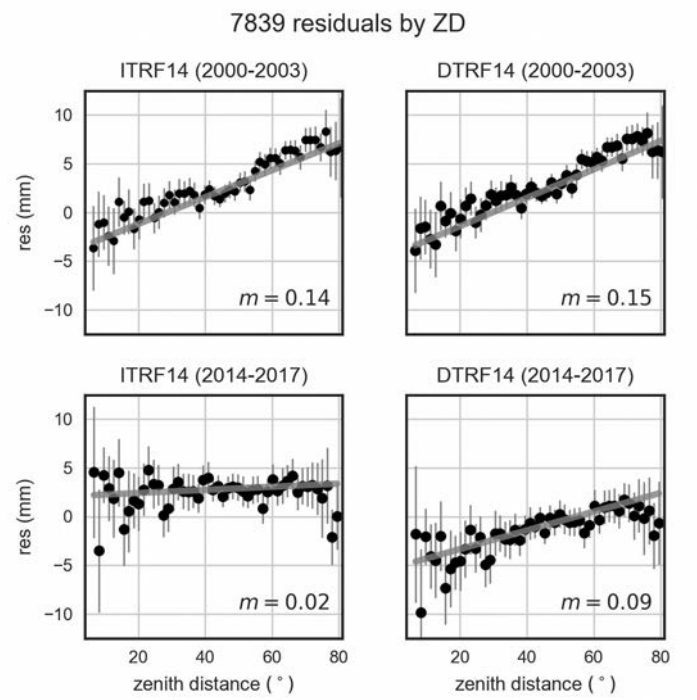




Post-fit residual trends





NSGF activities/updates

- Simply looking at residuals (no RB estimation) can reveal problems in station heights
- But: inaccurate coordinates not the only relevant effect (intensity dependent effects)
- This is possible because we don't have many parameters in SLR that could absorb these effects, so everything responds to geometry in a simple, predictable way
- What will happen with SLR support for other missions?

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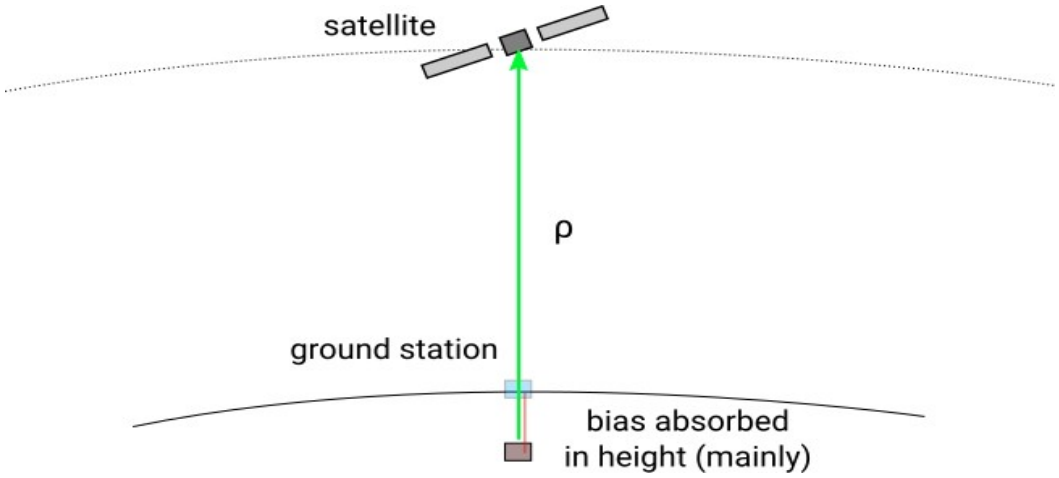

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- This is possible because we don't have many parameters in SLR that could absorb these effects, so everything responds to geometry in a simple, predictable way
- What will happen with SLR support for other missions?
- Transferability of RB will depend on bias structure. But overall we'll be in a better situation