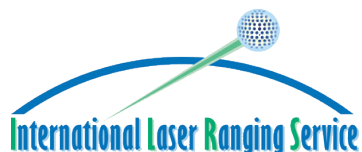# Report of COL-CC DGFI on SLR SINEX submissions

Mathis Bloßfeld

Deutsches Geodätisches Forschungsinstitut (DGFI)
Centre of Geodetic Earth System Research (CGE)
Munich

email: *blossfeld@dgfi.badw.de*

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Submission overview

		DGFI	AIUB	ASI	ESOC	GRGS
Submission date		09.11.2012; resubmission on 22.04.2013	05.06.2012	12.11.2012; CONT11 again on 29.04.2013	Submission of CONT08 on 26.04.2013	16.04.2013
Satellite data included in NEQs		ET1, ET2, LA1, ET2, AJI, STA, STE, LTS, BTS (only CONT11)	LA1, LA2	ET1, ET2, LA1, LA2	ET1, ET2, LA1, LA2 + pre-combined (GPS+SLR+DORIS)	LA1, LA2 ?
Parameters in NEQ	Station coordinates	X, Y, Z @ mid-epoch of arc	X, Y, Z @ mid-epoch of arc	X, Y, Z @ mid-epoch of arc	X, Y, Z @ mid-epoch of arc	X, Y, Z @ mid-epoch of arc
	Range biases	acc. to ILRS, pre-reduced	acc. to ILRS	acc. to ILRS, pre-reduced	for every station	for every station?
	Pole angles	8 off. @ 0h	CONT08: 7 off. @ 0h, 7 rates @ 12h CONT11: 8 off. @ 0h	off. in 3h interval	CONT08: 7 off. @ 0h, 7 rates @ 0h	8 off. @ 0h (off. of celestial pole angles in 0.5 day interval)
	(UT1-UTC)	8 off. @ 0h	CONT08: 7 off. @ 0h CONT11: 8 off. @ 0h	off. in 3h interval	-	7 off. @ 0h
	LOD	-	CONT08: 7 off. @ 12h	-	CONT08: 7 off. @ 12	-
	geocenter	-	X, Y, Z @ mid-epoch of arc	-	-	-

SINEX 2 DOGS conversion - remarks

- ❑ AIUB

  - ▪ CONT08: Offsets and rates @ different epochs → effort to go to pwl parameterization for (UT1-UTC)

- ❑ ASI

  - ▪ During CONT08, a leap second is included in the a priori values

- ❑ ESOC

  - ▪ RBIAS parameter for every STA included

  - ▪ 7 LOD values but no (UT1-UTC) values in SINEX → no change of parameterization possible

- ❑ GRGS

  - ▪ First (UT1-UTC) value is missing in NEQs

  - ▪ Celestial pole angles: first 8 values have a priori values not equal to zero

    → better not to estimate/include in SLR solutions

  - ▪ RBIAS parameter are named exactly the same → no SINEX reading possible!

  - ▪ Wrong STA epochs in grg08237Lw01.n4.snx

NEQ comparison – DoF & statistics

❑ Degrees of freedom for individual NEQs ($R_{x,y,z}$ and m @ Earth surface)

▪ AIUB: geocenter is eliminated (a priori values are equal to zero)

	T_x [cm]	T_y [cm]	T_z [cm]	R_x [m]	R_y [m]	R_z [m]	m [cm]
AIUB	4.0	4.0	10.0	2.5 - 3.3	2.4 - 3.0	2.7 - 3.3	3.0
ASI	3.5 - 5.0	3.5 - 5.0	10.0 - 13.0	2.4 - 2.8	2.2 - 2.5	2.5 - 2.9	3.0
DGFI	0.1	0.1	0.1	2.4 - 2.6	2.3 - 2.6	2.4 - 2.7	0.1
ESOC (SLR)	0.03	0.03	0.4 - 0.6	2.7 - 3.1	2.5 - 2.8	2.5 - 2.7	0.05

❑ lTPl of individual NEQs

▪ AIUB: all lTPls below 4.7

▪ ASI: all lTPls below 1.8

▪ DGFI: all lTPls between 14000 and 21000

▪ ESOC: all lTPls between 10000 and 16000

❑ ESOC NEQs

▪ Until now, the ESOC NEQs are not invertible → further investigation required

NEQ comparison – a priori values (biases)

❑ Current treatment of range biases not optimal for combination

- ▪ AIUB introduces range biases according to ILRS standards

- ▪ ASI / DGFI as AIUB but pre-reduction of range baises → not comparable or combinable after SINEX level

- ▪ ESOC introduces a range bias for every station

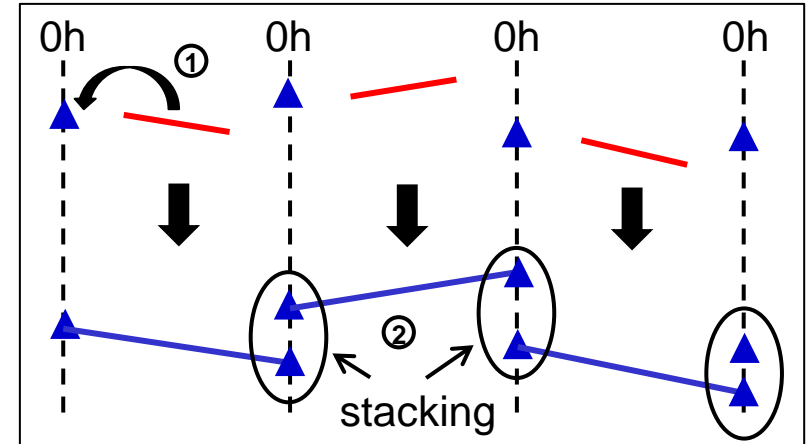❑ Large differences between AIUB and DGFI (exemplarily shown for gpsweek 1653)

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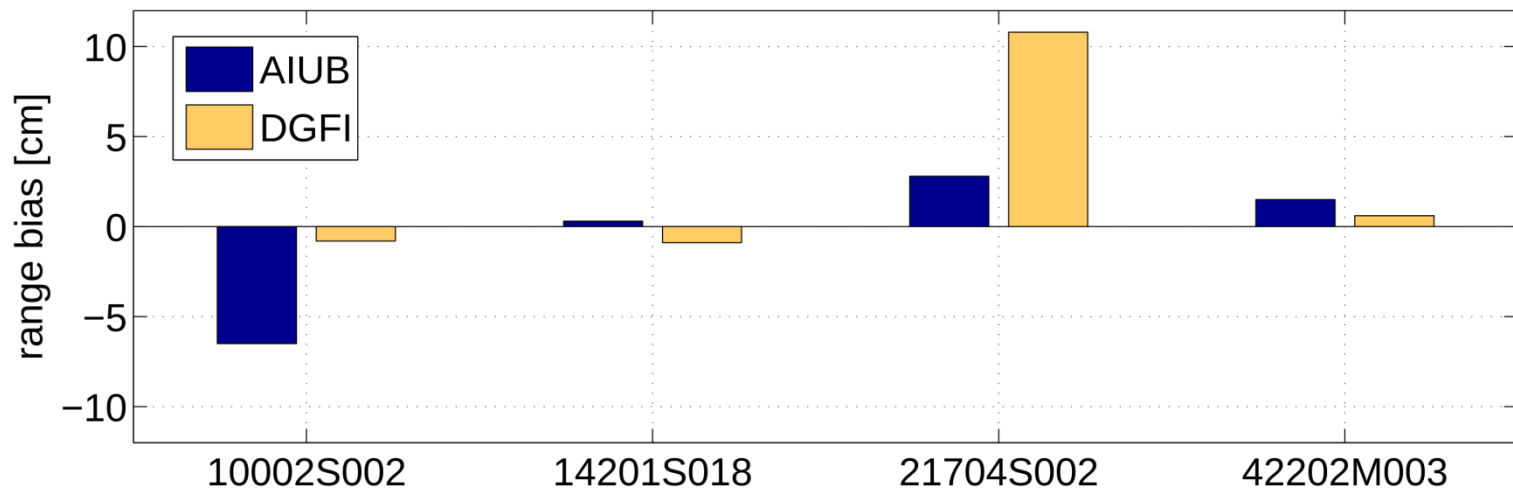
NEQ comparison – a priori values (EOP)

❑ AIUB

▪ Transformation of offset and drift to pwl polygon

① Note: $LOD_{R, 12h} = LOD_{R, 0h}$

② Stacking of (UT1-UTC) values @ day boundaries

❑ ASI

▪ (UT1-UTC) a priori differences between ASI-SINEX and DGFI routine

→ due to large differences, ITPI whould increase significantly during a priori manipulation

→ elimination of ASI EOP

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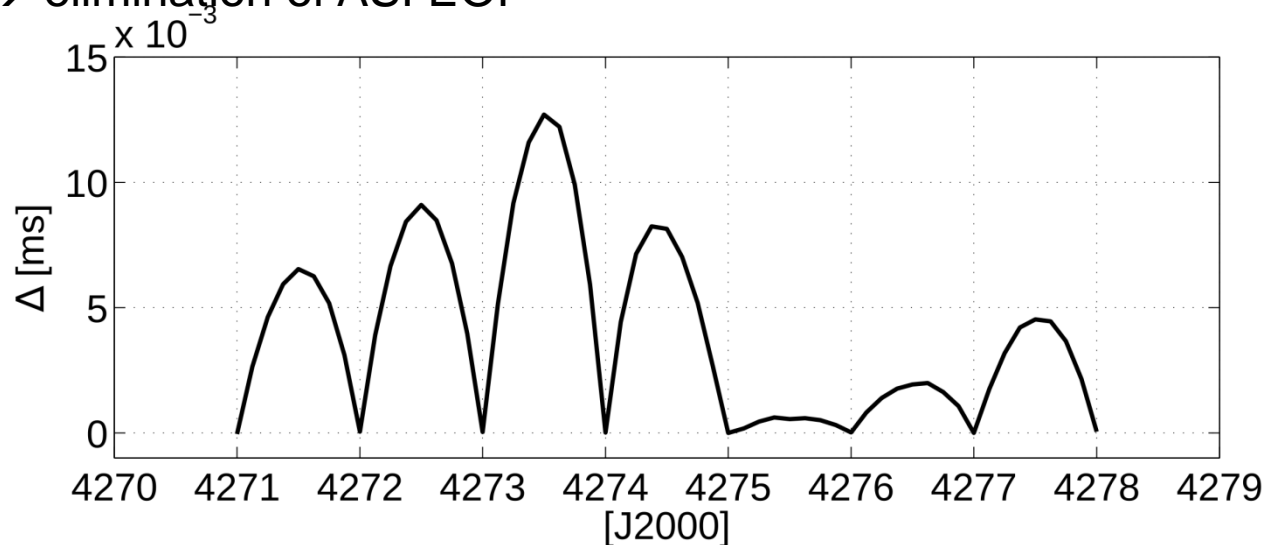
NEQ combination - weighting

❑ The relative weighting is done according to the a posteriori VCs of the AC individual solutions

$$\lambda = \frac{1}{\sigma^2_{post}}$$

▪ Very small a posteriori VCs of AIUB and ASI → high λ in combination

[-]	1492	1493	1494	1653	1654	1655
AIUB	13242	8912.7	4208.8	5602.2	7168.5	6305.5
ASI	9930.5	8196.7	8591.1	7042.3	12900	13676
DGFI	0.99	0.99	0.99	0.99	0.98	0.99

❑ Although weights for AIUB and ASI are huge, they do not dominate the combined solution!

❑ Combination of NEQs

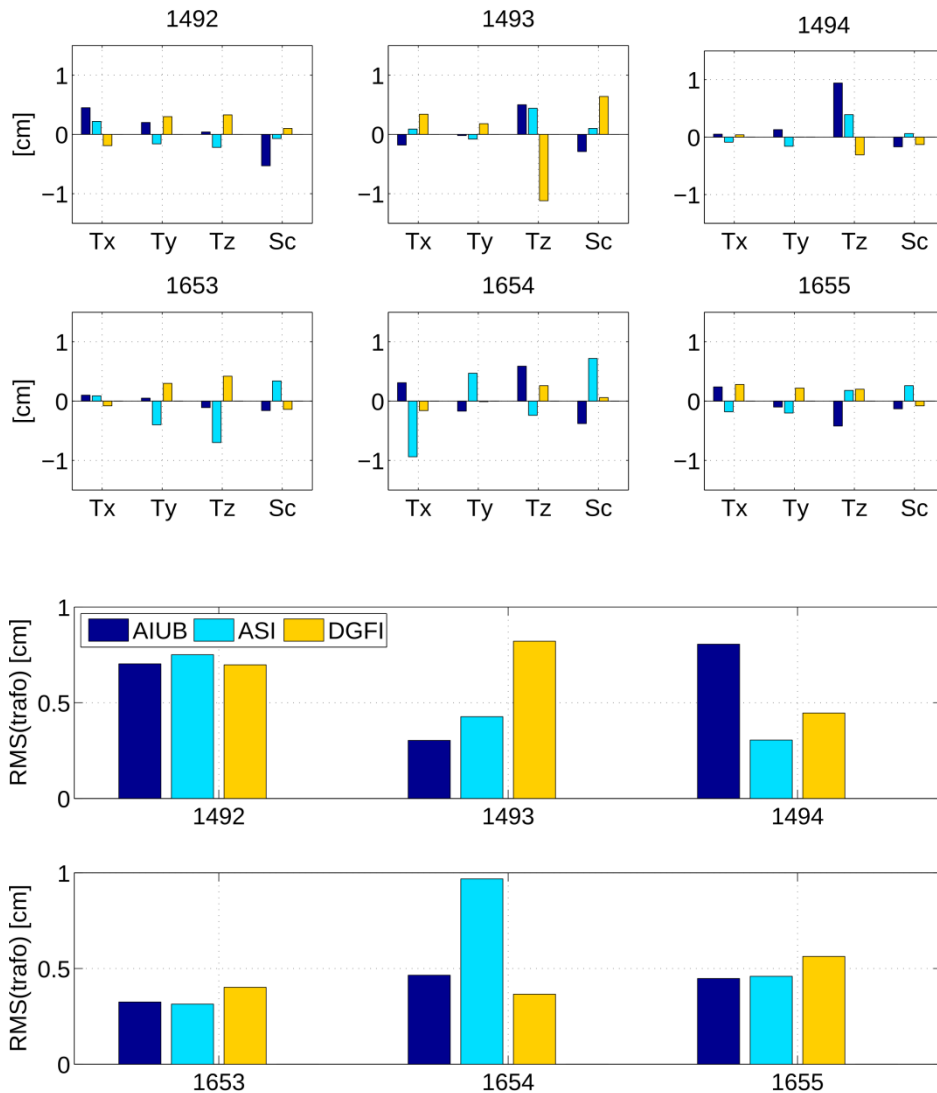▪ Station coordinates: AIUB+ASI+DGFI

▪ EOP: AIUB+DGFI

AC individual and combined solution - validation
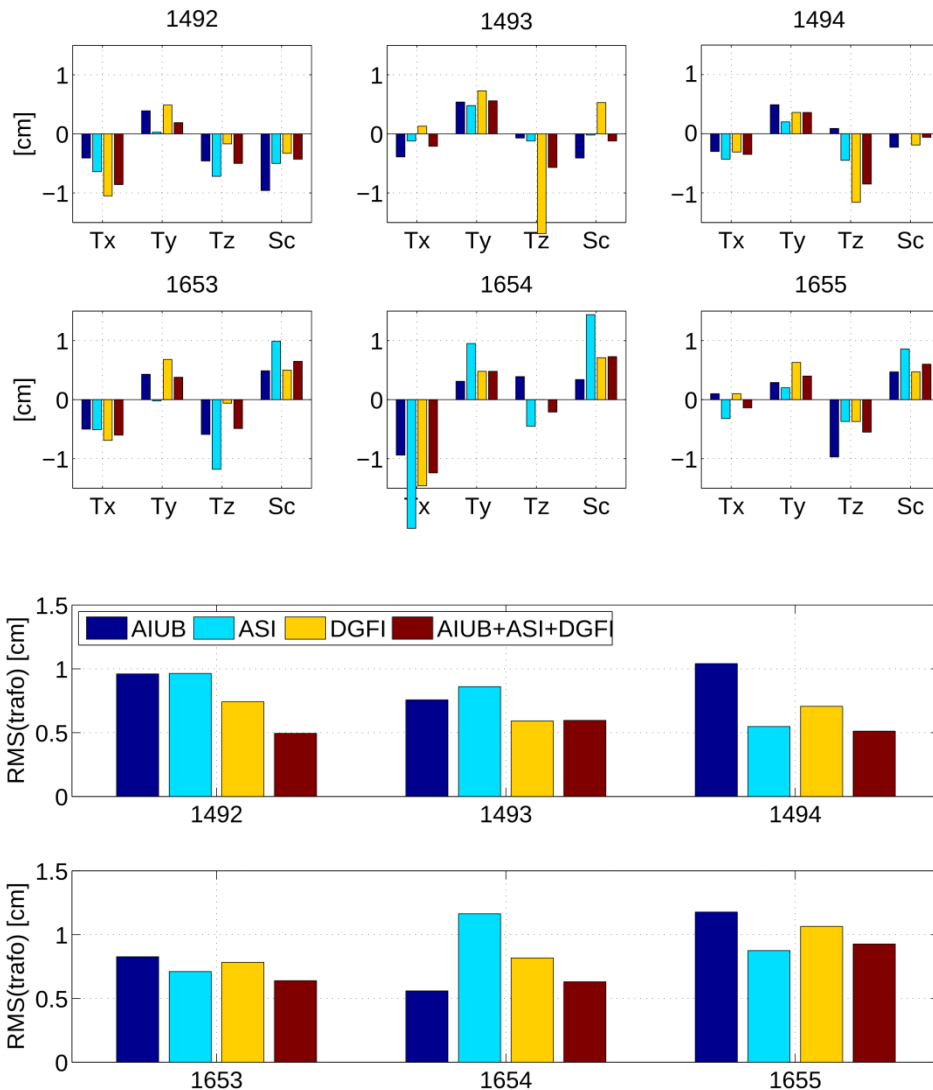
- ❑ External validation of station coordinates

  - ▪ 4-paramter similarity transformation w.r.t. DTRF2008 (translations + scale)

  - ▪ Orientation is fixed with NNR condition to a priori coordinates

  - ▪ All ACs show mainly the same systematics
    → big improvement to last COL meeting!

  - ▪ network deformation w.r.t. DTRF2008 is mainly smaller than 1.0 cm (explainable since solutions are weekly solutions)
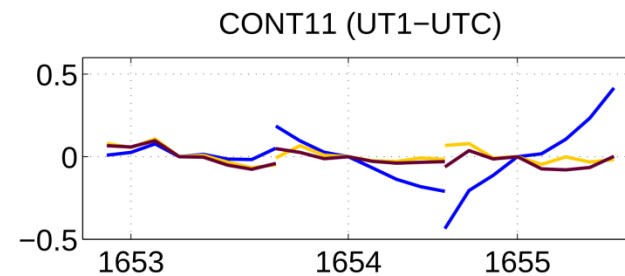
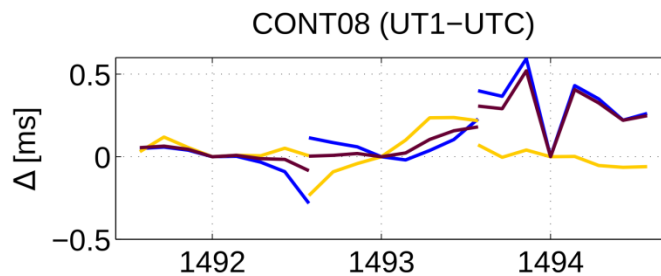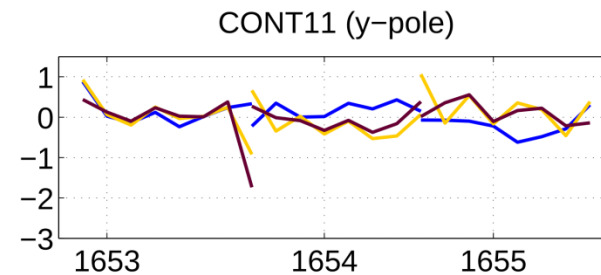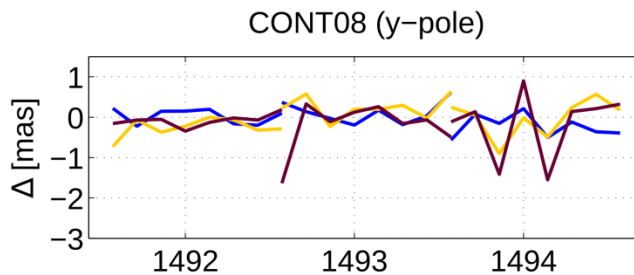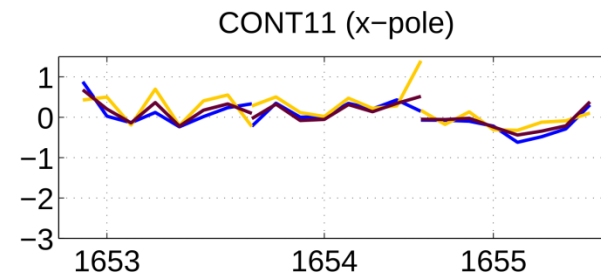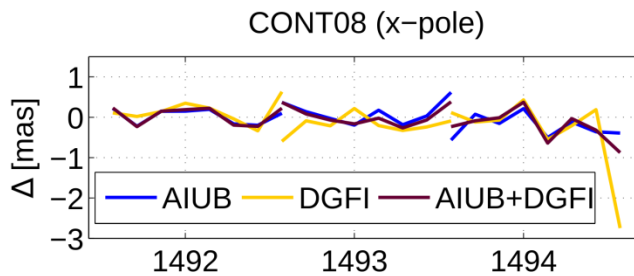# AC individual and combined solution - validation

❑ Internal validation of station coordinates

- ■ 4-paramter similarity transformation w.r.t. weekly combined solution (translations + scale)

- ■ Orientation is fixed with NNR condition to a priori coordinates

- ■ Good agreement of all ACs w.r.t. combined solution

- ■ network deformation w.r.t. combined solution is around 0.5 cm for all ACs

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AC individual and combined solution - validation

❑ External validation of EOP w.r.t. IERS 08 C04

  ▪ Only AIUB and DGFI EOP are combined

  ▪ Pole angle outliers in DGFI solution @ end-epoch of arc 1494 and 1654

  ▪ Offset of (UT1-UTC) polygon in AIUB arc 1494

AC individual and combined solution - validation

❑ External validation of EOP w.r.t. IERS 08 C04

- Combined solution shows smallest STDs

- (UT1-UTC) value @ mid-epoch of the arc is fixed to a priori

- CONT11 period of AIUB show strange STD behavior when (UT1-UTC) is directly parameterized as pwl polygon

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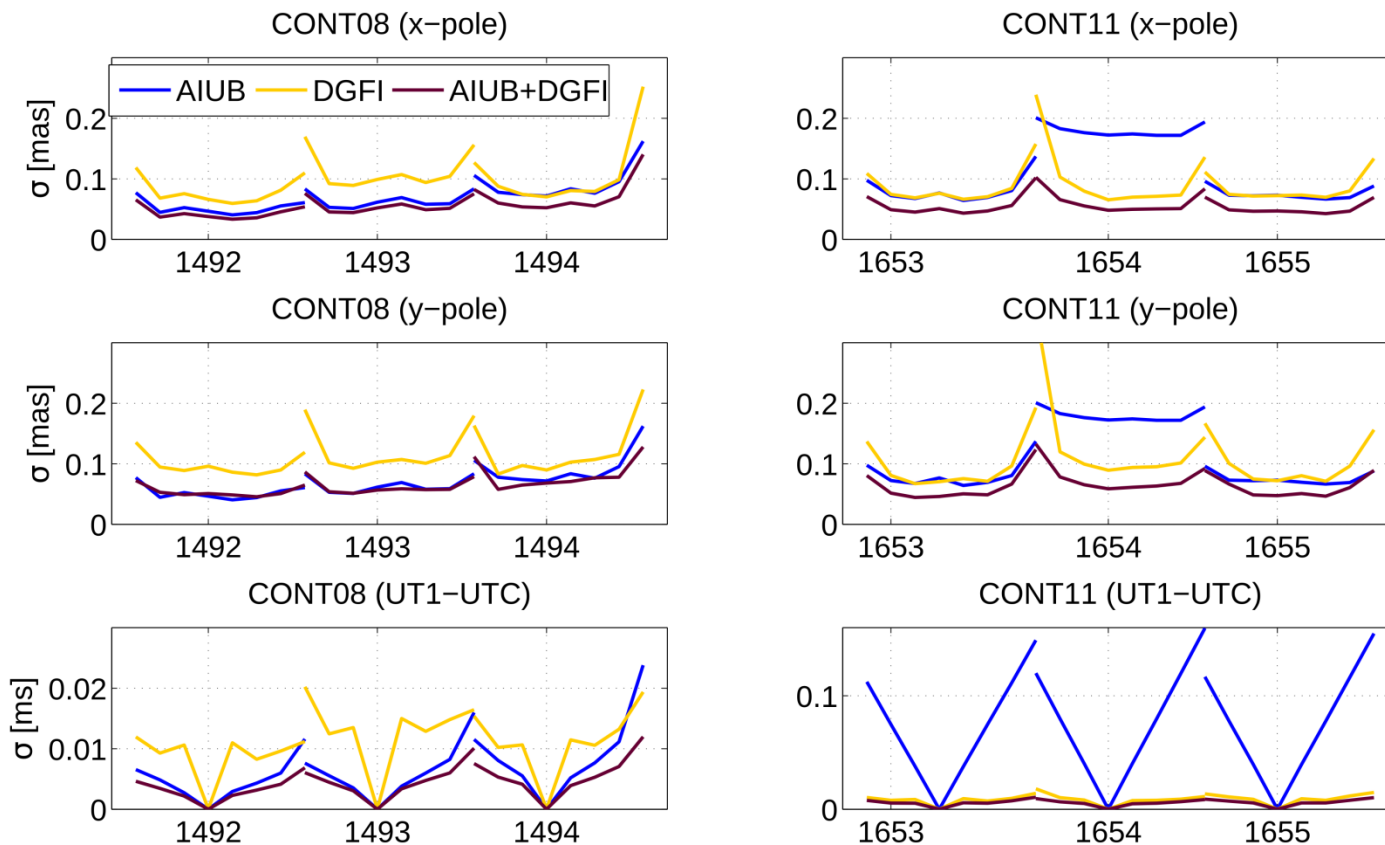
Conclusions & open questions

- ❑ Conclusions

  - ▪ SLR contributions nearly homogeneous and all weeks can be solved

  - ▪ Combination of station coordinates: AIUB+ASI+DGFI

  - ▪ Combination of EOP: AIUB+DGFI

  - ▪ SLR pre-combination analysis is a very good tool to improve the quality of the combined SLR NEQ → good feedback of individual ACs!

- ❑ Open questions

  - ▪ Why are the ITPIs of AIUB and ASI so small?

  - ▪ Should we keep the subdaily EOP parameterization for SLR?

  - ▪ Why are the ESOC NEQs not invertible?

  - ▪ Is there a problem in the AIUB (UT1-UTC) pwl representation?

- ❑ To do

  - ▪ Submission of AC SINEX files to the CCs at least one month before the next COL meeting

  - ▪ Parameters and their parameterization are still not homogeneous enough (e.g. EOP and RBIAS)
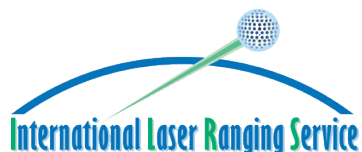
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