Single-satellite Analysis Campaigns
Tests on ALCATEL/STAREC antennas

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- Evaluation wrt ITRF2008 of SINGLE-satellites solutions OVER 1995
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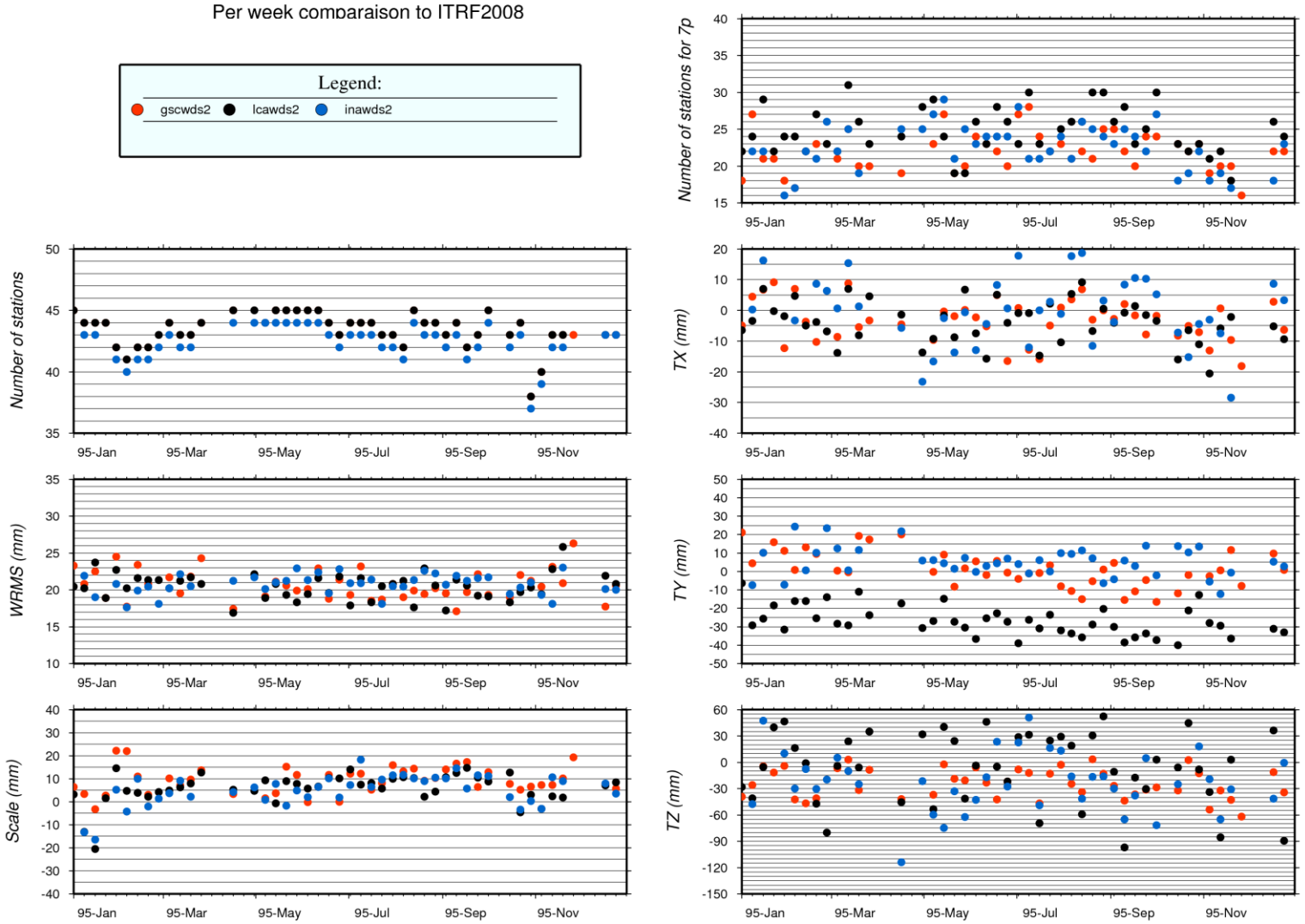
- Evaluation wrt ITRF2008 of SINGLE-satellites solutions OVER 2011-2012 Envisat, Spot-4-5, Cryosat-2, Jason-2, HY-2A

- SIMPLE TEST on ALCATEL and STAREC ANTENNAS

EVALUATION WRT ITRF2008 OF SINGLE-SATELLITES SOLUTIONS OVER 1995

SPOT-2, SPOT-3, TOPEX-POSEIDON

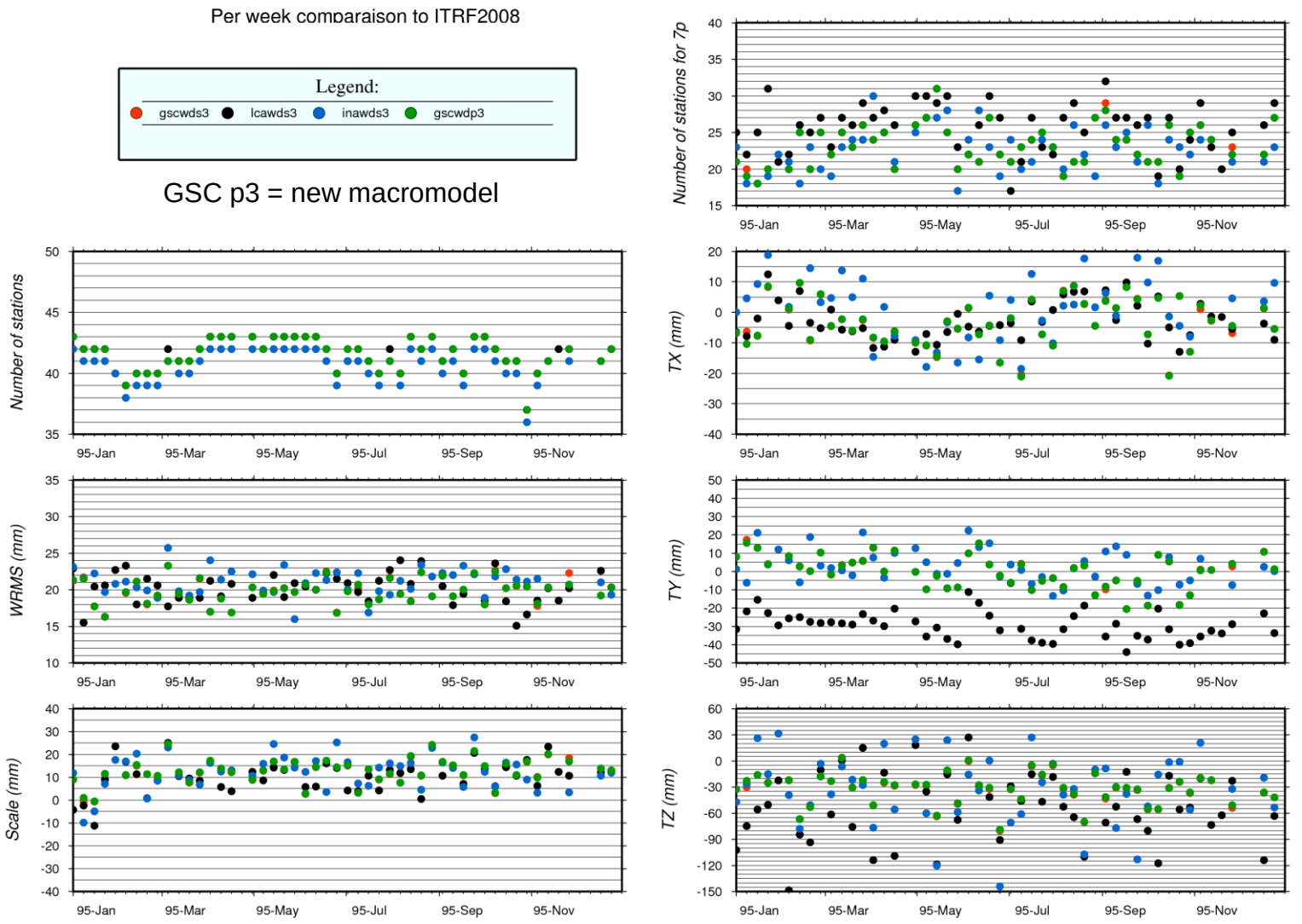
Spot-2 - 1995



GSC, INA

LCA

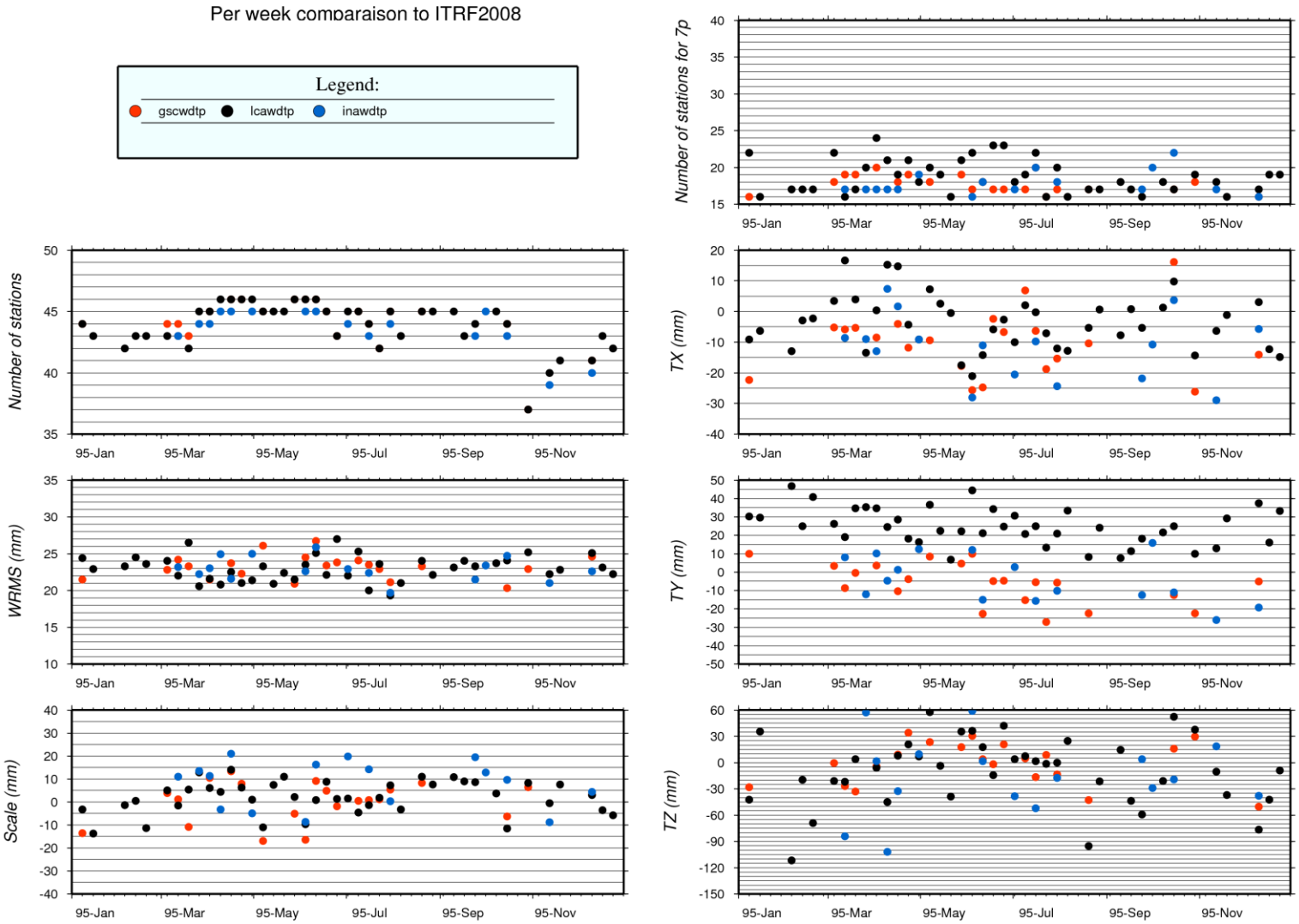
Spot-3 - 1995



GSC, INA

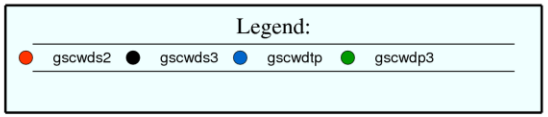
LCA

TOPEX/POSEIDON - 1995

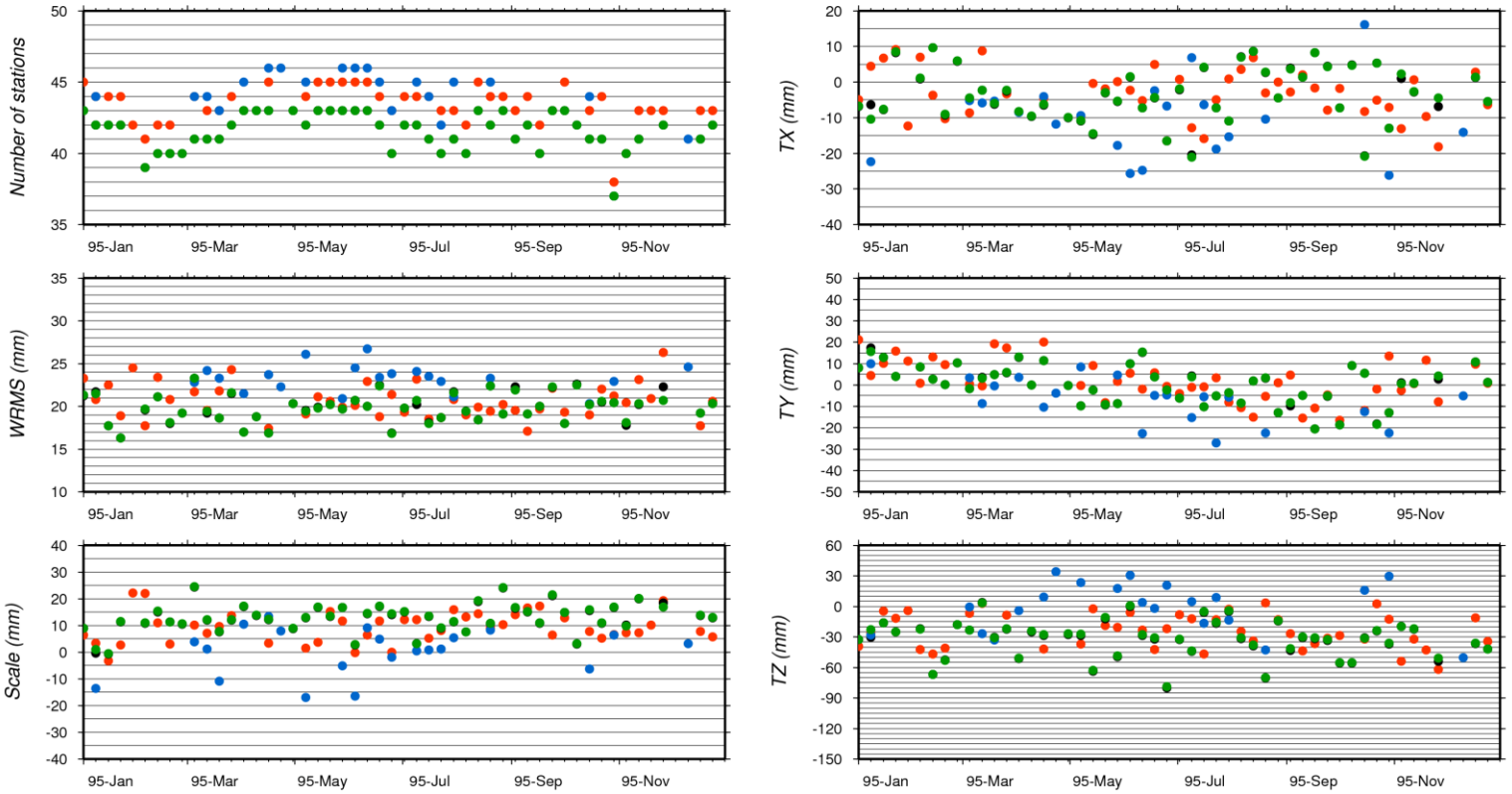


GSC - 1995

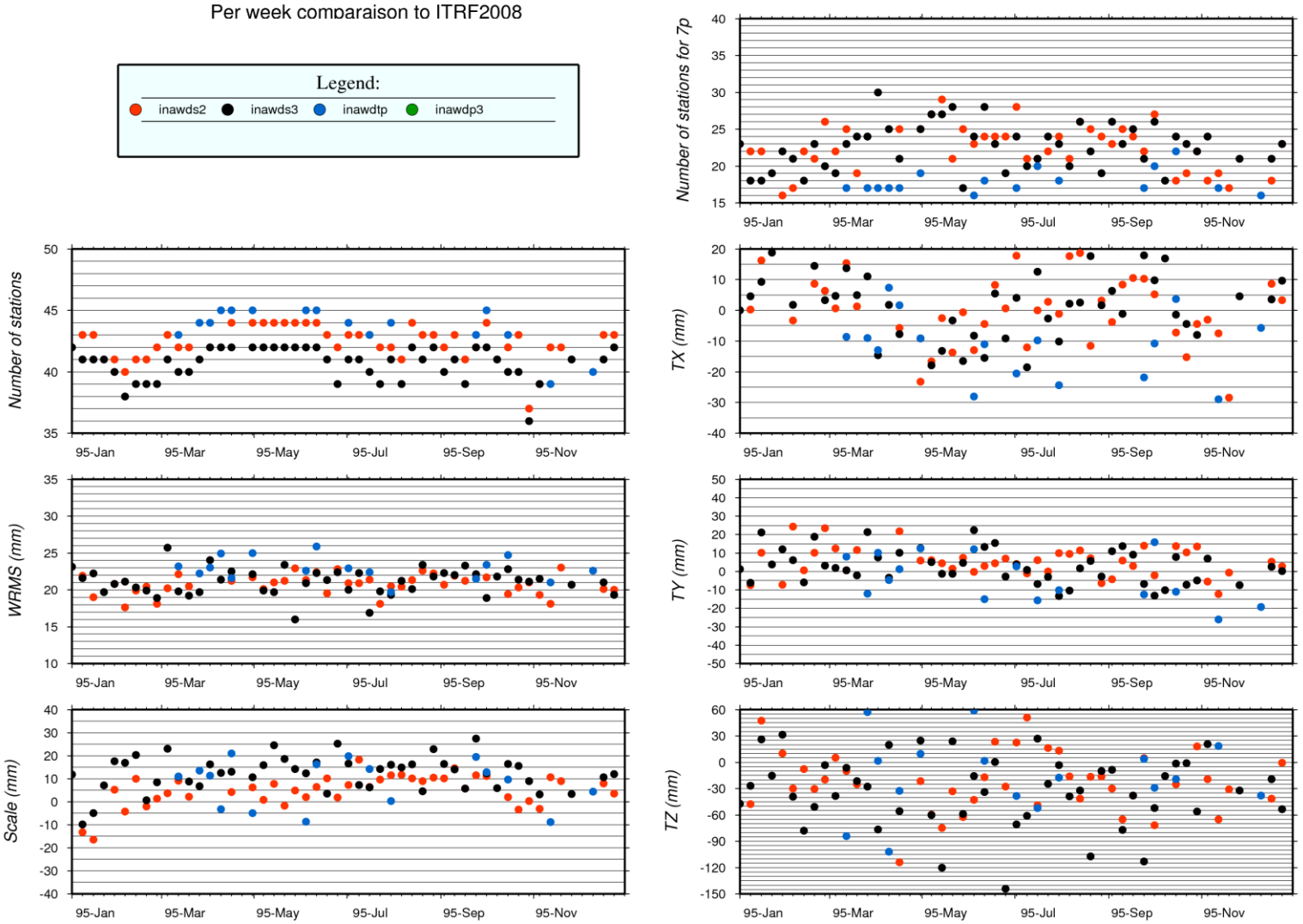
Per week comparaison to ITRF2008



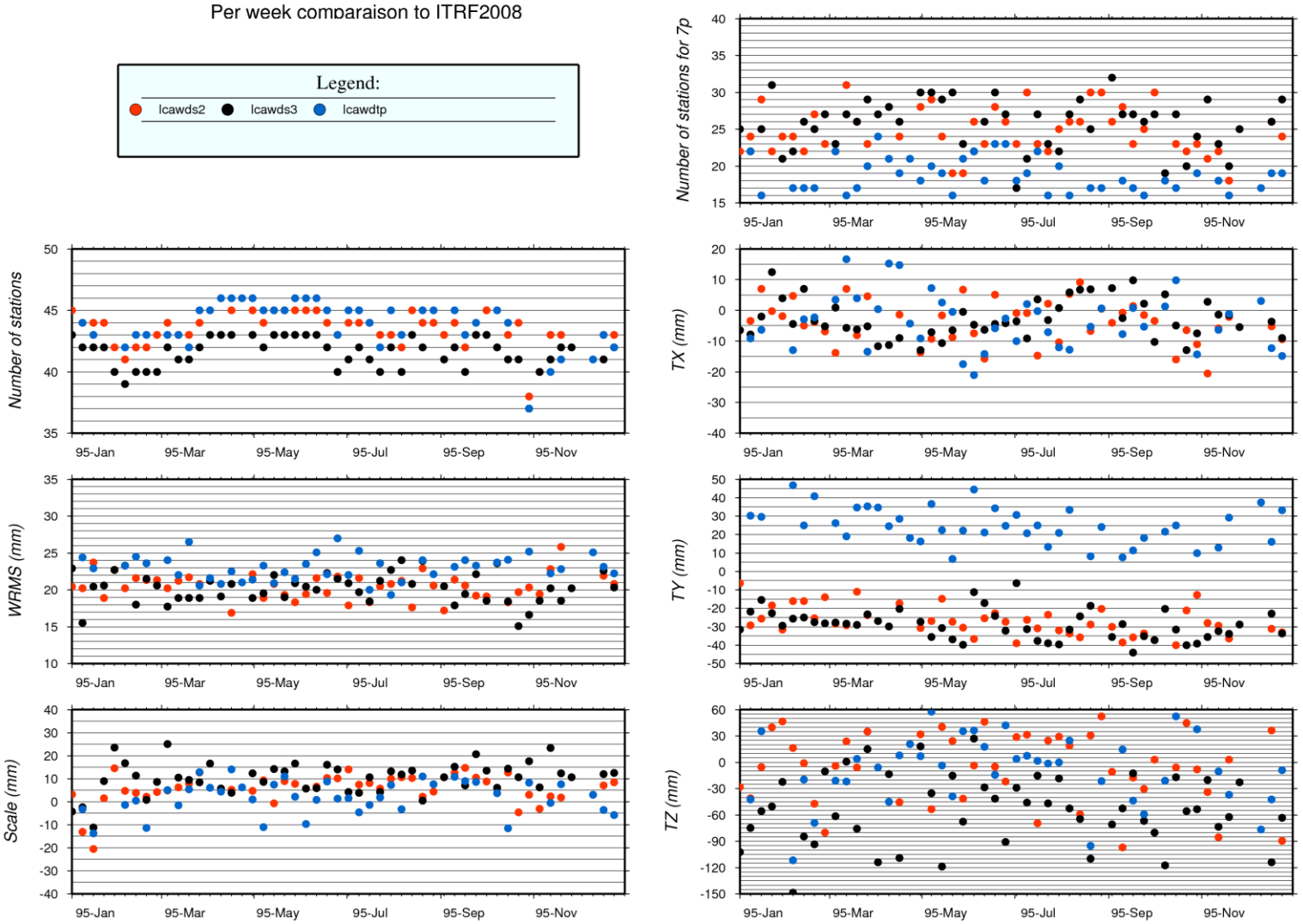
GSC p3 = new macromodel for Spot-3



INA - 1995


Per week comparaison to ITRF2008
Legend:
inawds2
inawds3
inawdtp
inawdp3
Number of stations for 7p
Number of stations
WRMS (mm)
Scale (mm)
TX (mm)
TY (mm)
TZ (mm)
95-Jan
95-Mar
95-May
95-Jul
95-Sep
95-Nov

LCA - 1995


Per week comparaison to ITRF2008
Legend:
lcawds2
lcawds3
lcawdtp
Number of stations for 7p
Number of stations
TX (mm)
WRMS (mm)
TY (mm)
Scale (mm)
TZ (mm)
95-Jan
95-Mar
95-May
95-Jul
95-Sep
95-Nov

1995 – statistics and conclusions

- Mission order by number of stations:
  - TOPEX/POSEIDON
  - Spot-2
  - Spot-3
- 3 missions are similar (excepted on Ty for LCA).
- GSC has more homogeneous Helmert parameters for all the missions
- INA and LCA show Tz with higher variations

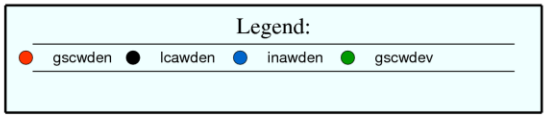
AC	#serie	#weeks	wrms[mm]		scale[mm]		Tx[mm]		Ty[mm]		Tz[mm]	
			mean	std	mean	std	mean	std	mean	std	mean	std
gsc	s2	45	20.584	2.047	9.060	5.787	-3.527	6.812	1.713	9.702	-25.180	17.516
ina	s2	42	20.743	1.339	5.047	6.798	0.881	12.127	5.307	8.056	-20.200	37.744
lca	s2	46	20.448	1.746	5.611	6.608	-4.326	7.286	-27.204	8.164	-7.270	41.007
gsc	s3	48	19.821	1.682	12.521	5.441	-3.217	7.703	0.050	9.040	-32.921	17.881
gsc	p3	48	19.796	1.630	12.689	5.366	-3.167	7.780	0.083	8.951	-32.208	17.833
ina	s3	47	21.083	1.770	12.146	7.443	2.789	11.547	2.849	9.127	-33.287	40.505
lca	s3	49	20.235	2.043	10.084	7.014	-2.710	6.251	-29.169	7.795	-55.465	40.018
gsc	tp	21	23.210	1.611	0.234	8.792	-10.381	10.490	-6.310	11.118	-1.000	24.630
ina	tp	16	22.913	1.621	7.991	10.144	-11.762	10.823	-4.019	13.047	-16.413	43.611
lca	tp	42	22.998	1.704	2.201	7.089	-3.981	9.027	25.198	10.095	-7.360	40.947

EVALUATION WRT ITRF2008 OF SINGLE-SATELLITES SOLUTIONS OVER 2011-2012

ENVISAT, SPOT-4-5, CRYOSAT-2, JASON-2, HY-2A

Envisat - 2011/2012

Per week comparaison to ITRF2008

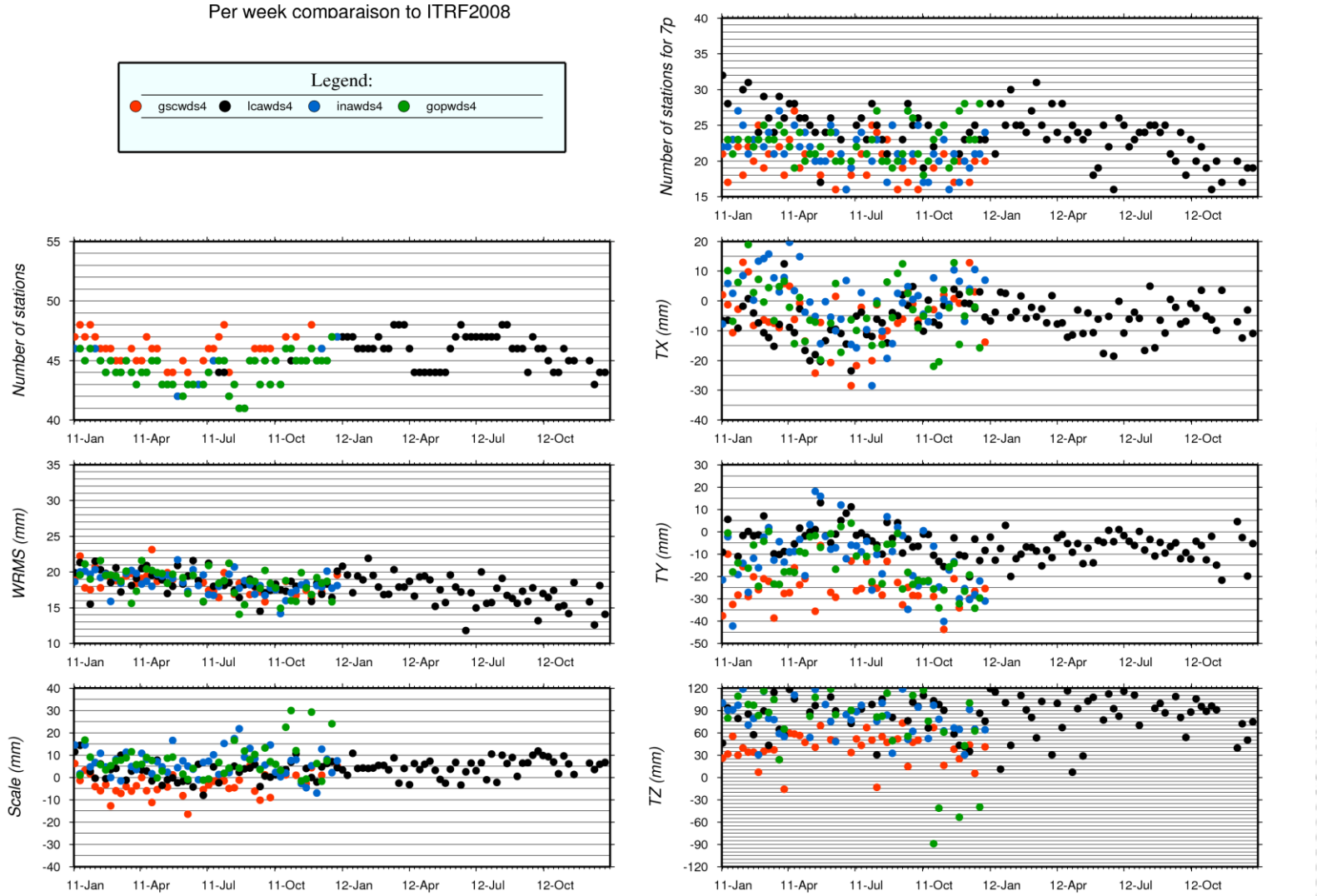


GSC ev = new macromodel – no major difference

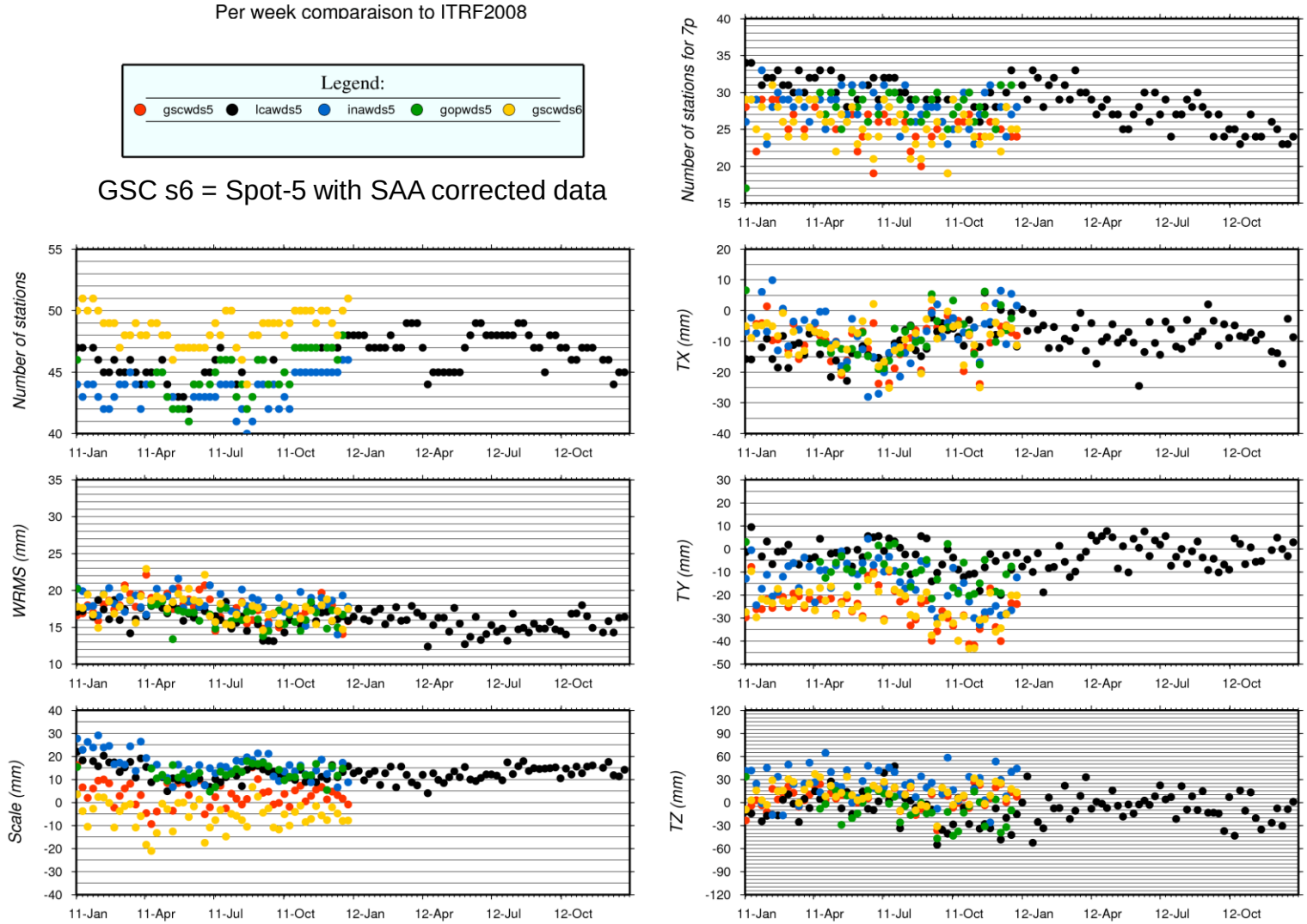
LCA

GSC, INA

Spot-4 - 2011/2012

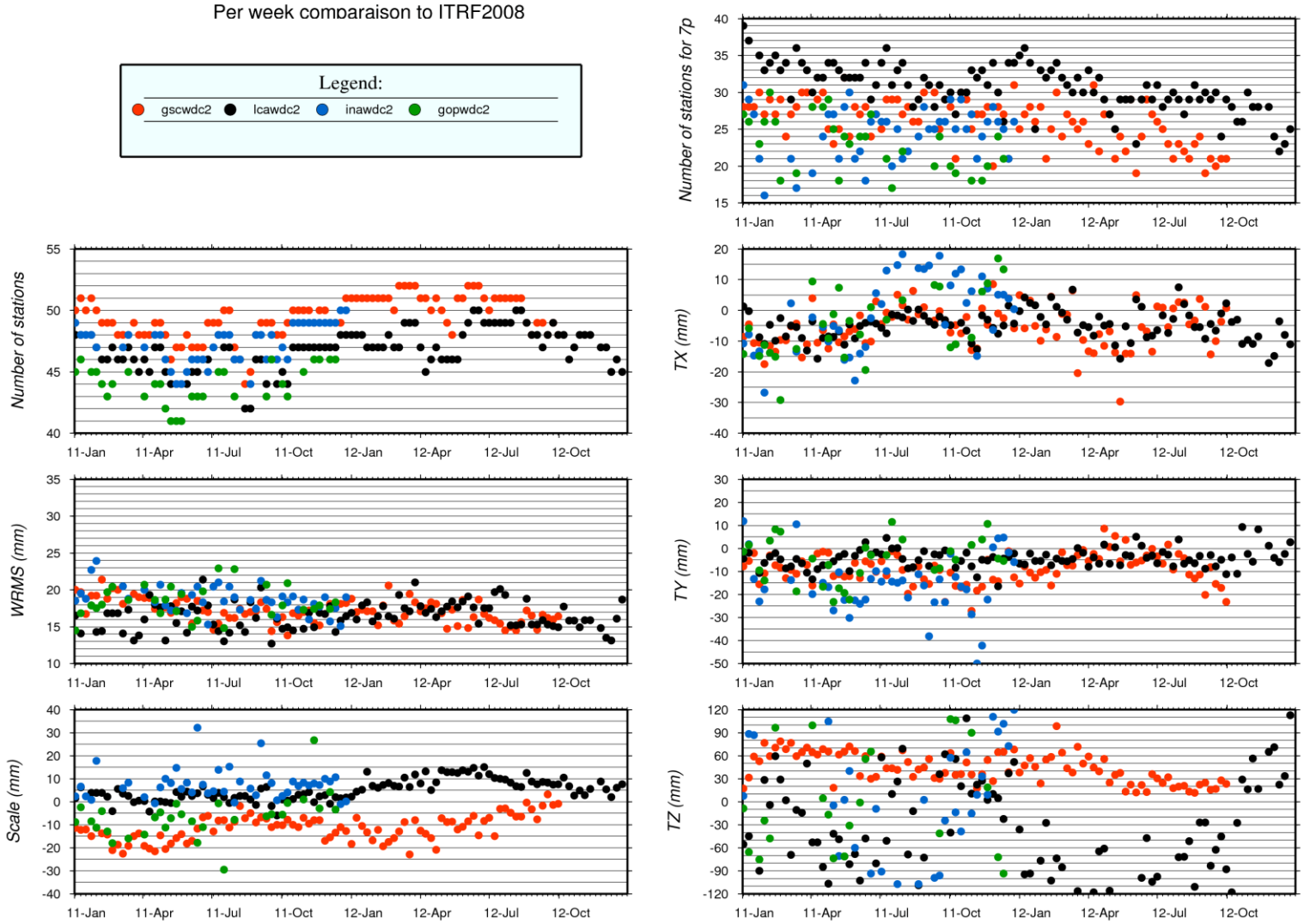


Spot-5 - 2011/2012



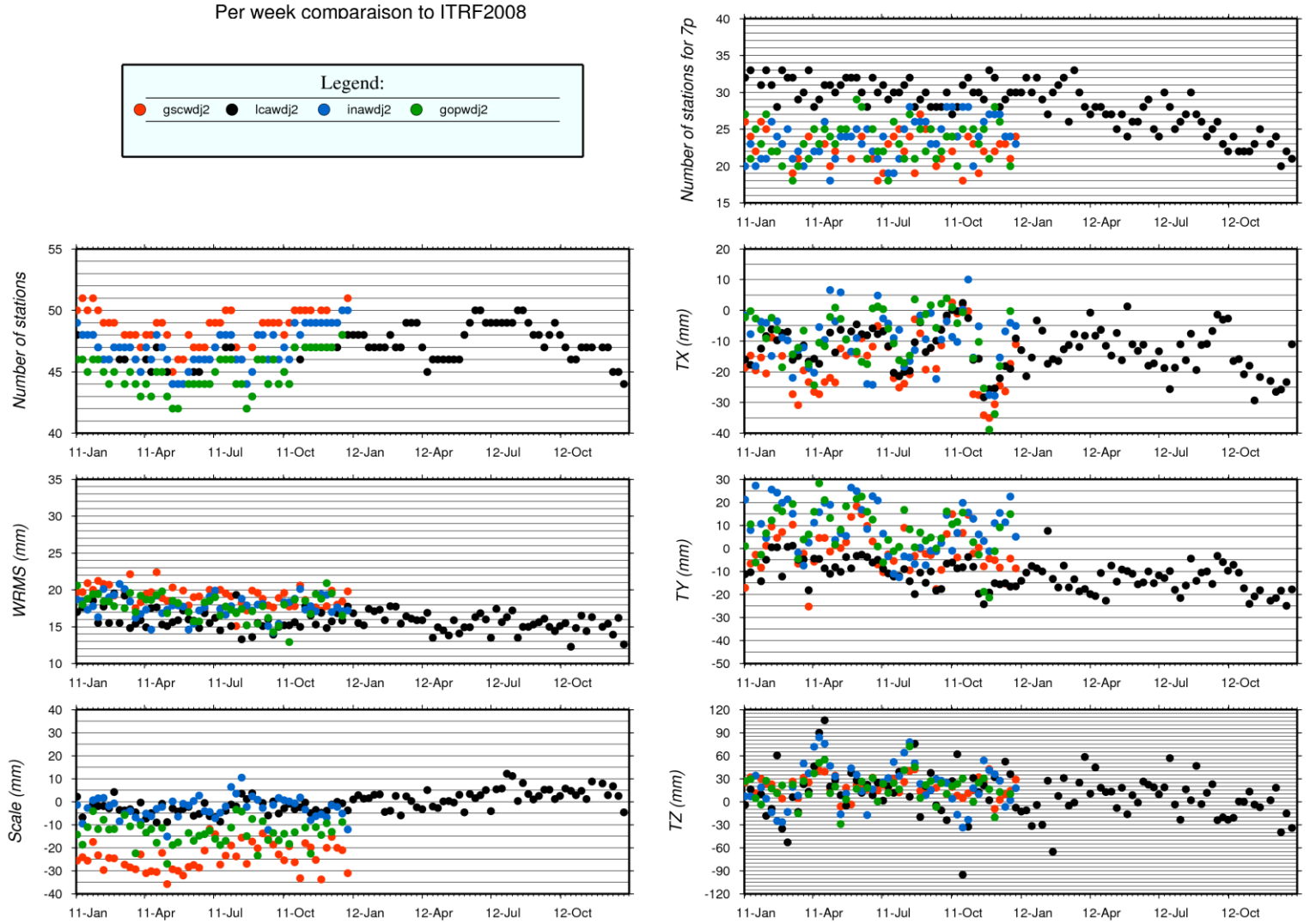
GSC s6 = Spot-5 with SAA corrected data

Cryosat-2 - 2011/2012

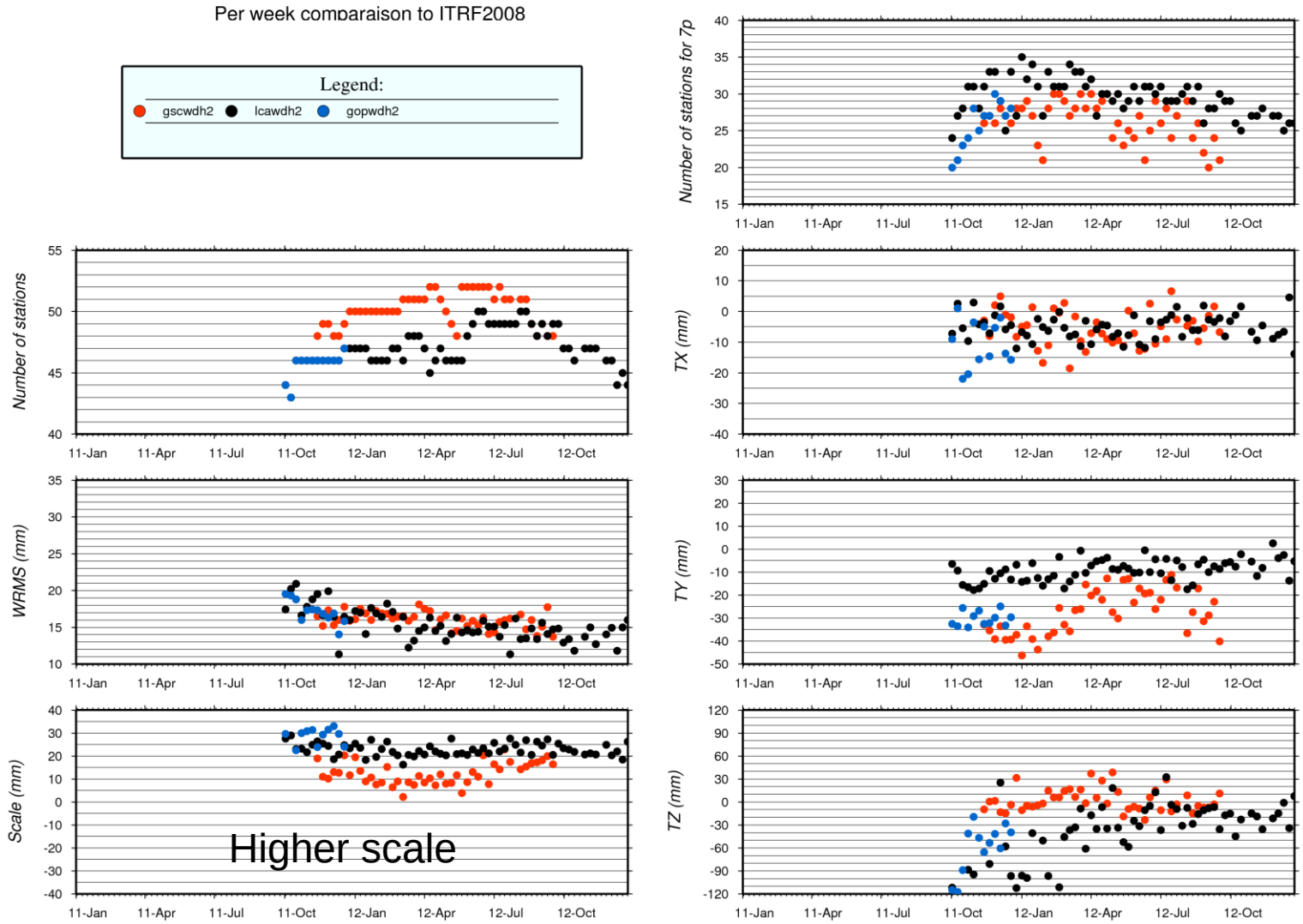


Tz: less dispersion for GSC

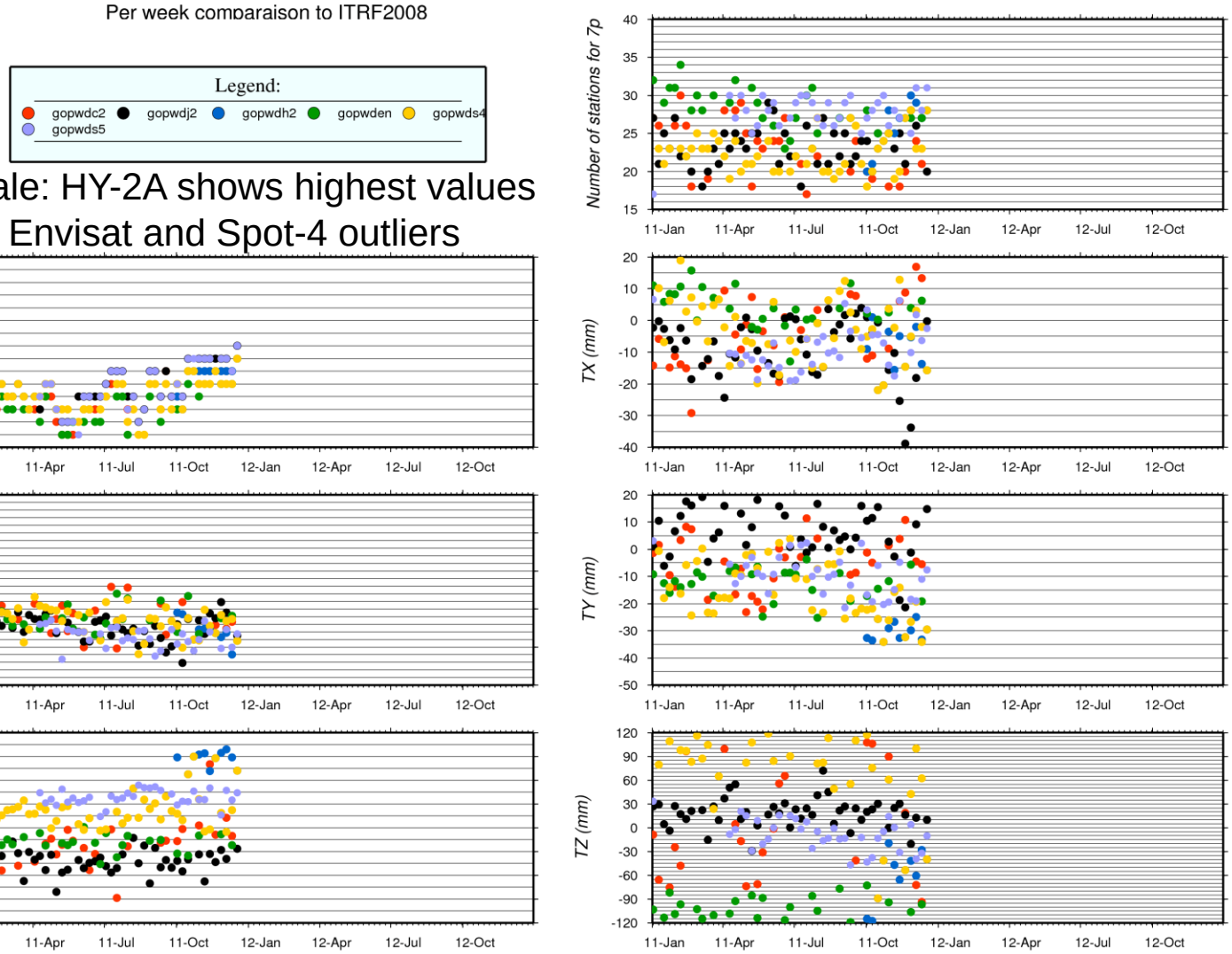
Jason-2 - 2011/2012



HY-2A - 2011/2012



GOP - 2011/2012



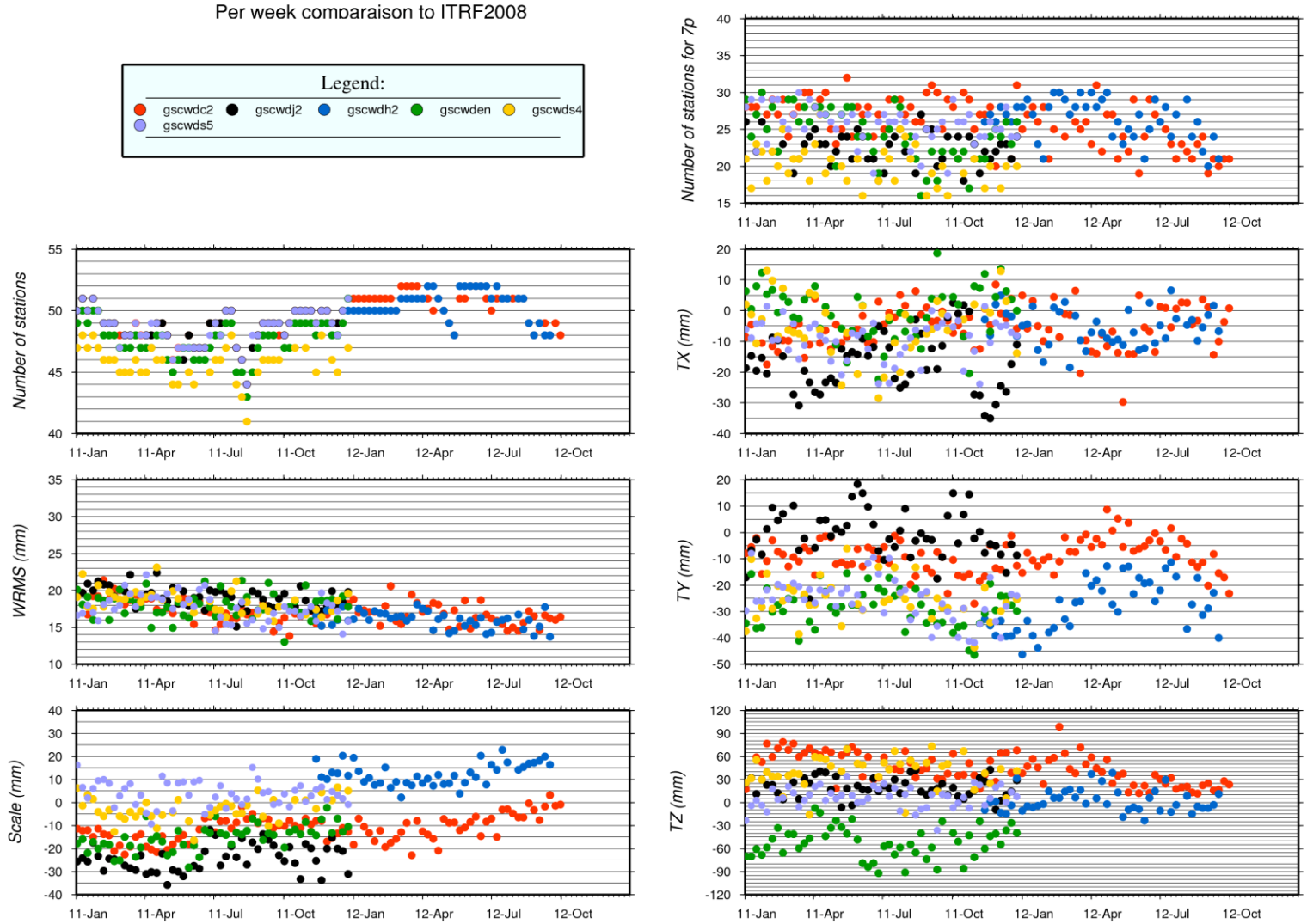
Scale: HY-2A shows highest values

Tz: Envisat and Spot-4 outliers

Scale: HY-2A outlier

Tz: Envisat and Spot-4 outliers

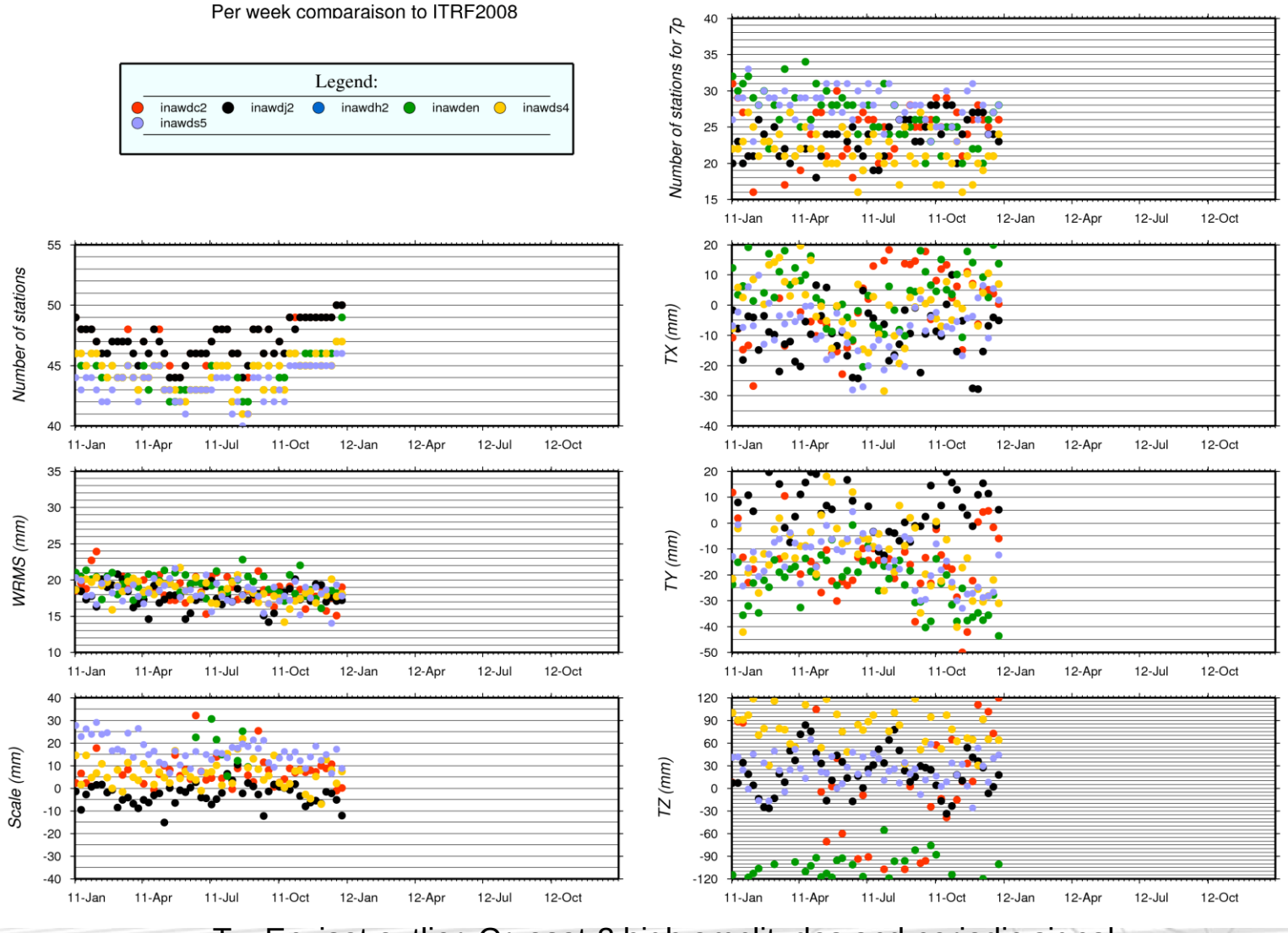
GSC - 2011/2012



Scale: HY-2A highest values but absolute value similar with Envisat

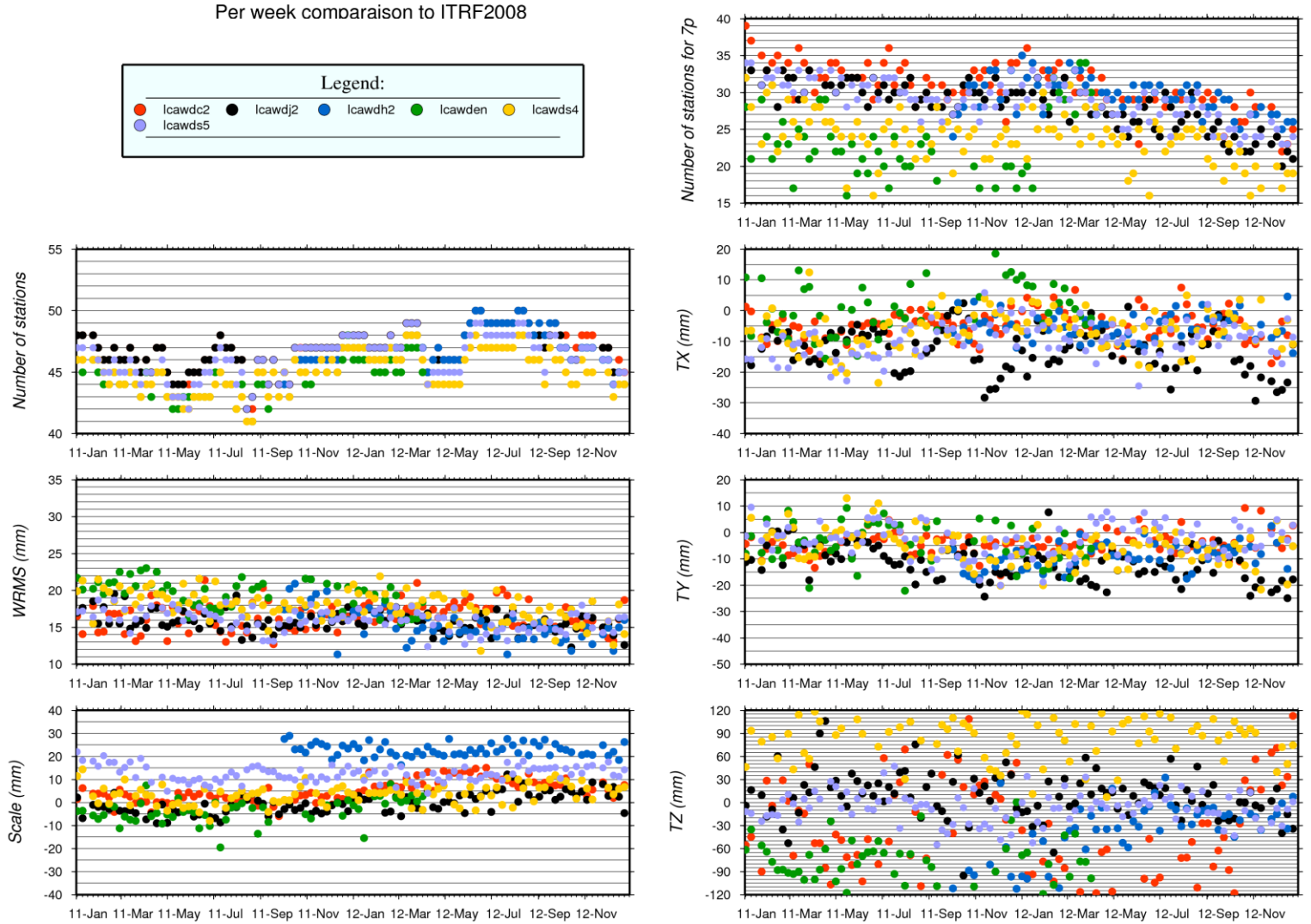
Tz: Envisat apart (not in absolute value)

INA - 2011/2012



Tz: Envisat outlier, Cryosat-2 high amplitudes and periodic signal

LCA - 2011/2012



Scale: HY-2A outlier

Tz: Envisat and Spot-4 outliers, HY-2A high amplitudes

2011 - Statistics

AC	#serie	#weeks	wrms[mm]		scale[mm]		Tx[mm]		Ty[mm]		Tz[mm]	
			mean	std	mean	std	mean	std	mean	std	mean	std
gop	en	28	18.796	1.574	-5.998	3.604	3.996	5.910	-12.664	5.577	-105.421	17.531
gsc	en	51	18.025	1.746	-15.247	5.526	-0.543	8.593	-28.690	7.303	-52.214	20.347
ina	en	52	19.365	1.455	194.493	123.588	4.929	9.899	-23.573	9.580	-120.704	25.165
lca	en	54	19.563	1.923	-3.631	5.238	0.713	7.831	-4.380	7.739	-78.602	29.897
gop	s4	46	18.539	1.840	7.640	7.444	-3.124	9.660	-15.293	10.339	91.926	57.629
gsc	s4	41	18.532	1.547	-2.934	5.173	-4.971	9.540	-25.239	7.757	39.307	20.078
ina	s4	52	18.492	1.409	6.393	5.777	1.165	10.948	-12.690	13.373	90.246	32.118
lca	s4	100	17.868	1.994	3.608	4.277	-6.329	6.364	-5.495	6.546	93.153	34.062
gop	s5	35	16.506	1.425	12.763	3.241	-8.440	7.069	-9.486	7.055	-8.274	19.486
gsc	s5	52	17.615	1.727	3.682	5.255	-9.388	6.504	-25.671	7.835	6.350	13.465
ina	s5	52	18.267	1.477	16.221	5.549	-7.700	8.249	-14.892	9.266	23.771	20.233
lca	s5	101	15.971	1.413	12.542	3.390	-9.537	5.530	-2.890	6.090	-6.876	19.939
gop	c2	30	18.353	2.123	-6.682	9.252	-3.530	12.154	-5.090	9.638	17.210	111.087
gsc	c2	92	17.159	1.585	-11.320	5.568	-5.358	6.752	-8.865	6.425	44.061	19.607
ina	c2	44	18.664	1.798	7.425	6.439	0.702	12.847	-15.516	12.582	1.255	113.531
lca	c2	102	16.475	1.843	5.172	4.543	-4.979	4.827	-4.291	4.176	-48.130	70.657
gop	j2	47	17.764	1.643	-13.594	5.018	-8.821	9.667	7.147	10.161	18.706	18.436
gsc	j2	51	19.069	1.372	-24.085	5.749	-16.814	9.395	-0.992	9.035	19.796	12.516
ina	j2	52	17.700	1.471	-2.866	4.665	-10.256	9.744	9.054	10.743	21.002	28.129
lca	j2	102	15.780	1.363	-0.301	4.358	-12.715	7.063	-11.745	6.342	9.164	30.114
gop	h2	12	17.117	1.565	29.840	5.291	-10.492	7.538	-30.383	3.197	-59.825	31.885
gsc	h2	44	16.011	1.107	12.410	4.805	-5.448	5.825	-28.170	10.259	2.291	14.830
lca	h2	63	15.295	2.105	22.866	2.738	-5.167	4.117	-9.162	4.699	-47.467	48.793

2011 - Conclusions

- HY-2A shows highest scale values
- Excepted for GSC, Envisat and Spot-4 are still Tz outliers
- INA and LCA have strong Tz std values for DG-XX satellites

SIMPLE TEST ON ALCATEL AND STAREC ANTENNAS

ALCATELvsSTAREC: methodology

1. Based on the DORIS site logs, I identified a first set (A) of sites where we moved from acronym XXXA to XXXB so we replaced an Alcatel by a Starec antenna ➔ set A
2. From the previous set A, I only kept sites where antenna was only changed (beacon was unchanged) ➔ set B
3. From set B, I rejected sites when IGN or LCA had less than 2 years of observations before and after the change.
4. I end up with 8 candidates: AREA/AREB – KERA/KERB – LIBA/LIBB – META/METB – OTTA/OTTB – REYA/REYB – RIOA/RIOB and YELA/YELB.
5. For each STCD series and for each site, using the a-prior coordinates indicated in the STCDs headers, I recomputed absolute Cartesian coordinates time series and apply to XXXB the local ties between A and B.
6. I computed linear regression in all the directions (X, Y, Z) independently based on N points, where N corresponds to the minimum of points in series of XXXA and XXXB (so it varies from one site to the other and also from AC and the 2 projections are based on the same number of points)
7. I projected the linear regressions at the median date between last observation of XXXA and first observation of XXXB in the STCDs.
8. I projected the differences in N, E, U.

Moreover, for each pair, I also analyzed (when it happened) when we moved from XXXB to XXYB so when we only changed the beacon (from 1st to 3rd generation) and kept the Starec antenna in order to have for each site other points of comparisons. Note that when we moved from YELB to YEMB we also moved from a beacon with an USO to a beacon without USO.

ALCATELvsSTAREC: results

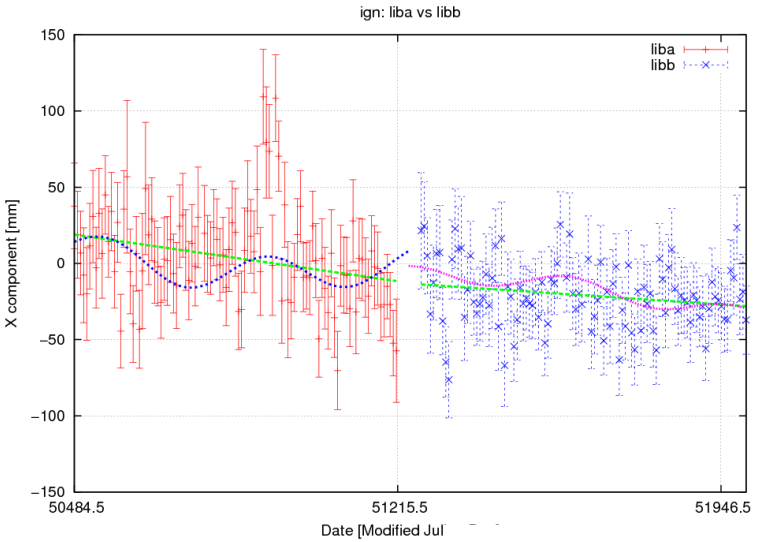
positions differences: (estimated position from XXXB) - (estimated position from XXXA)
mean res = mean residuals of linear interpolation or mean interpolation error ; unit is mm
Similar results wer obtained through harmonic analysis (6m, 1y, 2y…)

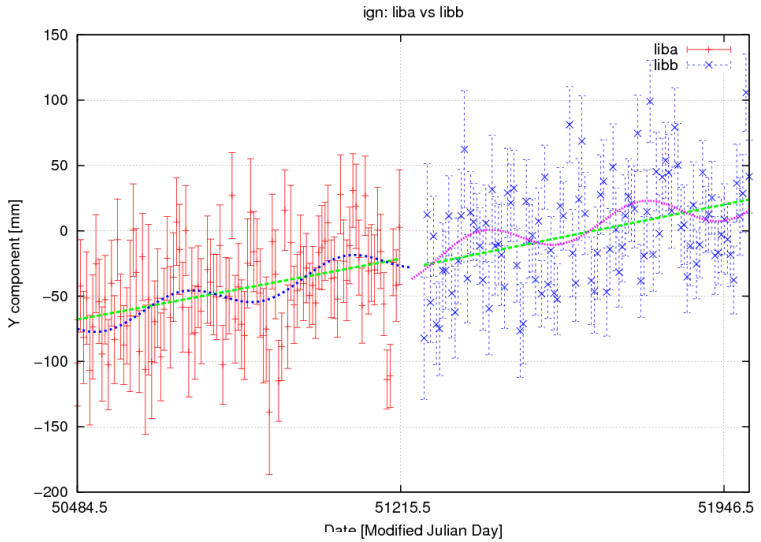
	IGN						LCA					
	N	East	North	Up	3D	mean res	N	East	North	Up	3D	mean res
AREA/AREB	83	-355.5	-535.2	-9.1	642.6	20.1	86	-370.1	-502.8	-17.4	624.6	18.4
AREB/ARFB	83	47.3	93.3	54.6	117.9	18.2	86	15.2	92.9	3.1	94.2	13.3
KERA/KERB	96	-3.1	7.1	21.6	23.0	22.9	97	-4.5	-16.2	25.0	30.2	16.6
KERB/KESB	132	9.9	20.6	10.5	25.1	14.1	131	6.7	22.8	5.5	24.4	11.7
LIBA/LIBB	298	-1.8	-4.4	-24.4	24.8	18.9	301	-9.4	-1.0	-18.5	20.7	15.7
LIBB/LICB	167	-5.9	-0.8	6.0	8.4	10.5	165	-3.9	-4.2	8.8	10.5	9.1
META/METB	400	9.1	-13.8	4.5	17.1	14.5	398	9.3	8.4	7.7	14.7	12.0
OTTA/OTTB	129	-8.5	82.8	-5.8	83.4	19.8	120	-9.7	86.6	-0.5	87.2	17.2
REYA/REYB	265	-9.9	21.1	-1.5	23.4	14.4	263	-14.1	16.2	12.9	25.0	12.0
REYB/REZB	296	-1.2	52.2	0.5	52.4	10.9	297	-2.1	50.0	3.0	50.2	8.9
RIOA/RIOB	107	-12.0	-27.6	-35.1	46.2	20.3	106	-41.1	-16.7	-48.8	66.0	17.0
RIOB/RIPB	189	-24.9	9.2	11.6	29.0	15.4	192	-27.4	9.8	0.3	29.1	13.2
YELA/YELB	288	10.4	-15.5	0.9	18.7	11.2	283	7.5	-6.1	3.1	10.2	9.5
YELB/YEMB	251	-3.2	-3.5	4.4	6.4	7.6	230	0.9	-0.3	-1.1	1.4	6.5

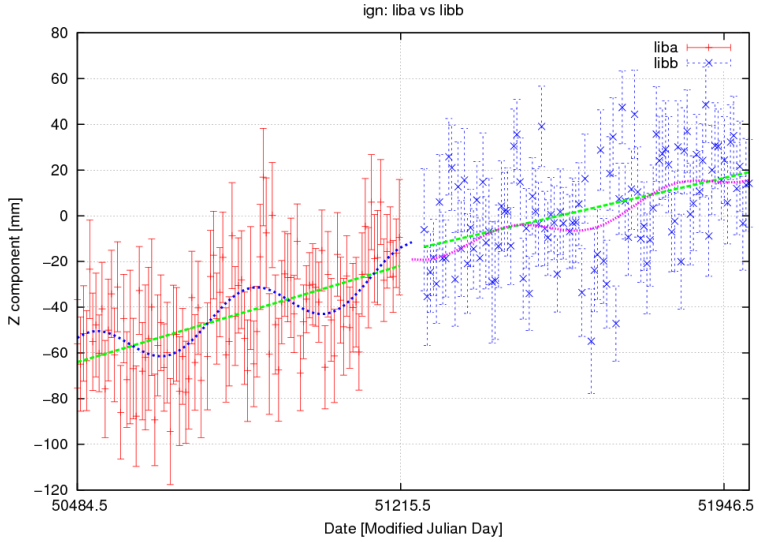
AREA/AREB differences reflect the earthquake

ALCATELvsSTAREC: results

Example: LIBA vs LIBB from IGN STCD







ALCATELvsSTAREC: conclusions

- Very few sites correspond to the selection criteria.
- No evidence of 17mm offset maybe due to the fact that STCDs correspond to stations positions variations after projection in ITRF2008 which may be affected by ALCATEL 2GHz COP offset.
- Change of beacon has impact similar to antenna change.
- Sigmas of positions estimates are at the order of the 10-20mm (which is also the order of week to week rms).