

COMPARISON OF STATION COORDINATES, ESTIMATED BY DORIS AND GLONASS MEASUREMENTS FOR COLLOCATED SITES

S.Kuzin, S.Tatevian

Institute of Astronomy RAS , Moscow, Russia

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Sites for comparison (14 sites)

IGS (GPS+GLONASS) site	DORIS site	Location
BADG	BADB	Badary, Russia
METZ	METB	Kirkkonummi, Finland
NKLG	LICB	Libreville, Gabon
NRMD	NOXB	Noumea, France
PDEL	PDMB	Ponta Delgada, Portugal
REUN	REUB	Le Tampon, France
REYK	REZB	Reykjavik, Iceland
STHL	HEMB	Longwood, United Kingdom
STR1	MSPB	Canberra, Australia
THTI	PAUB	Tahiti, French Polynesia
THU2	THUB	Thule Airbase, Greenland
TLSE	TLSB	Toulouse, France
WUHN	JIUB	Wuhan, P.R. China
YAR3	YASB	Dongara, Australia

General information

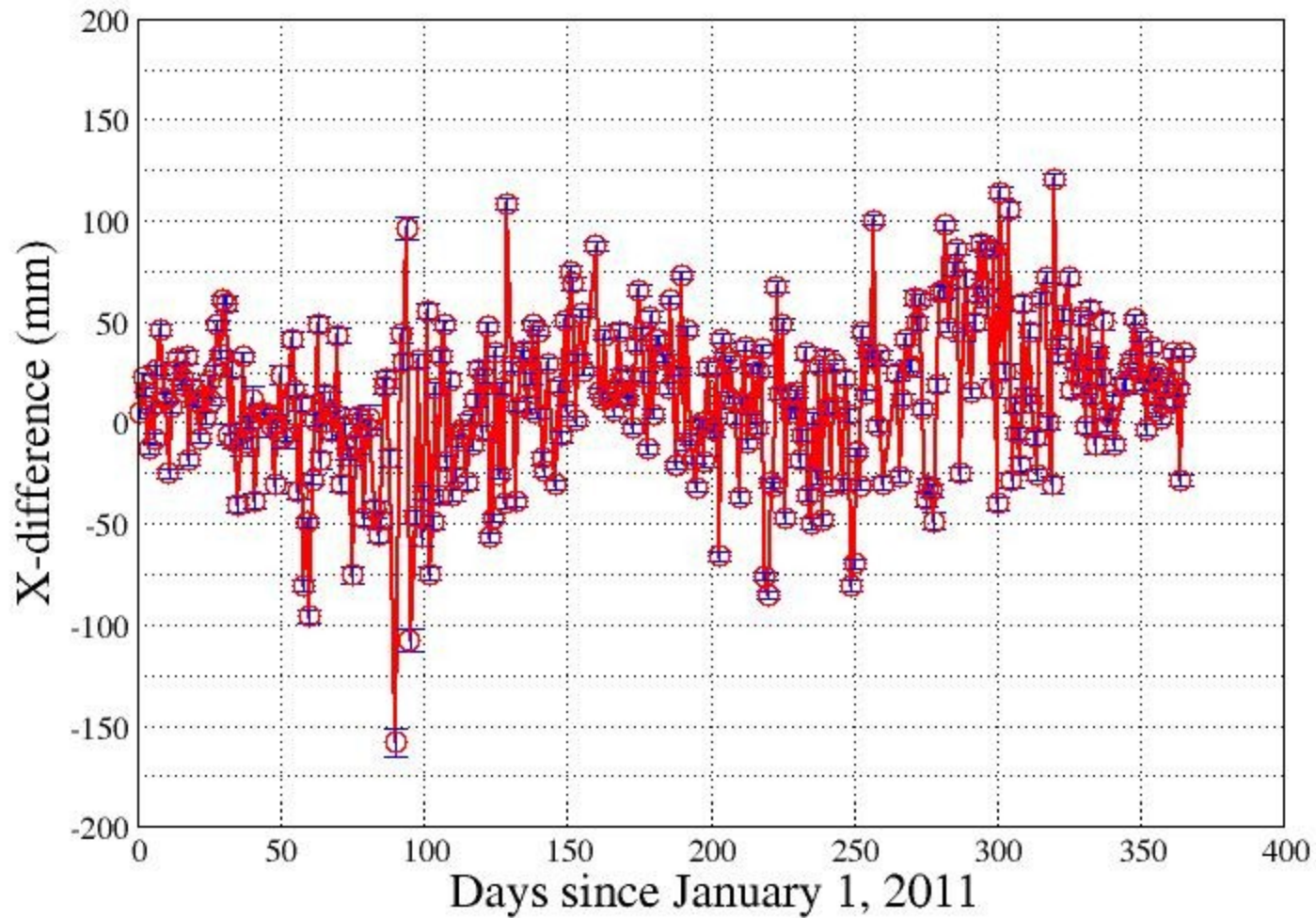
- **One year data (2011) used for DORIS and IGS**
- **Gipsy-Oasis II (JPL, JPL/IGN Doris part, Linux version 6.1.2) used for data processing**

GLO-GPS comparison

- **Gd2p.pl** Gipsy's utility used for daily GPS and GLONASS computations (precise point positioning strategy)
- All models are the same
- GPS used JPL's precise orbits and clocks, GLONASS – IGS (GFZ AC) precise orbits and clocks
- GPS used ambiguity resolution, GLONASS not
- GPS used satellite antenna PCV, GLONASS not
- Different IGS receiver and antenna types used

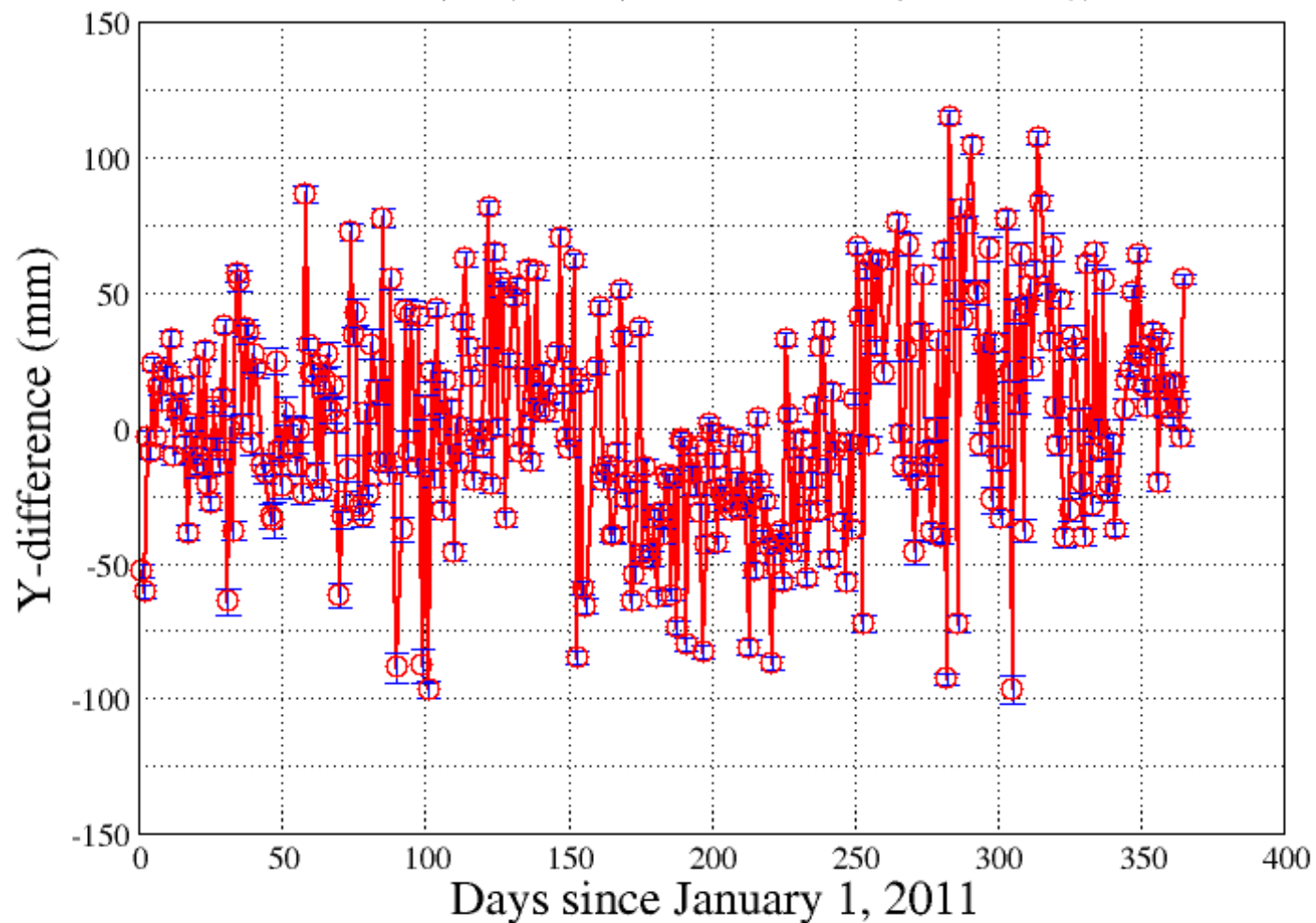
X-component GLO-GPS station coordinate differences

THU2(IGS) site (Thule Denmark (Greenland))



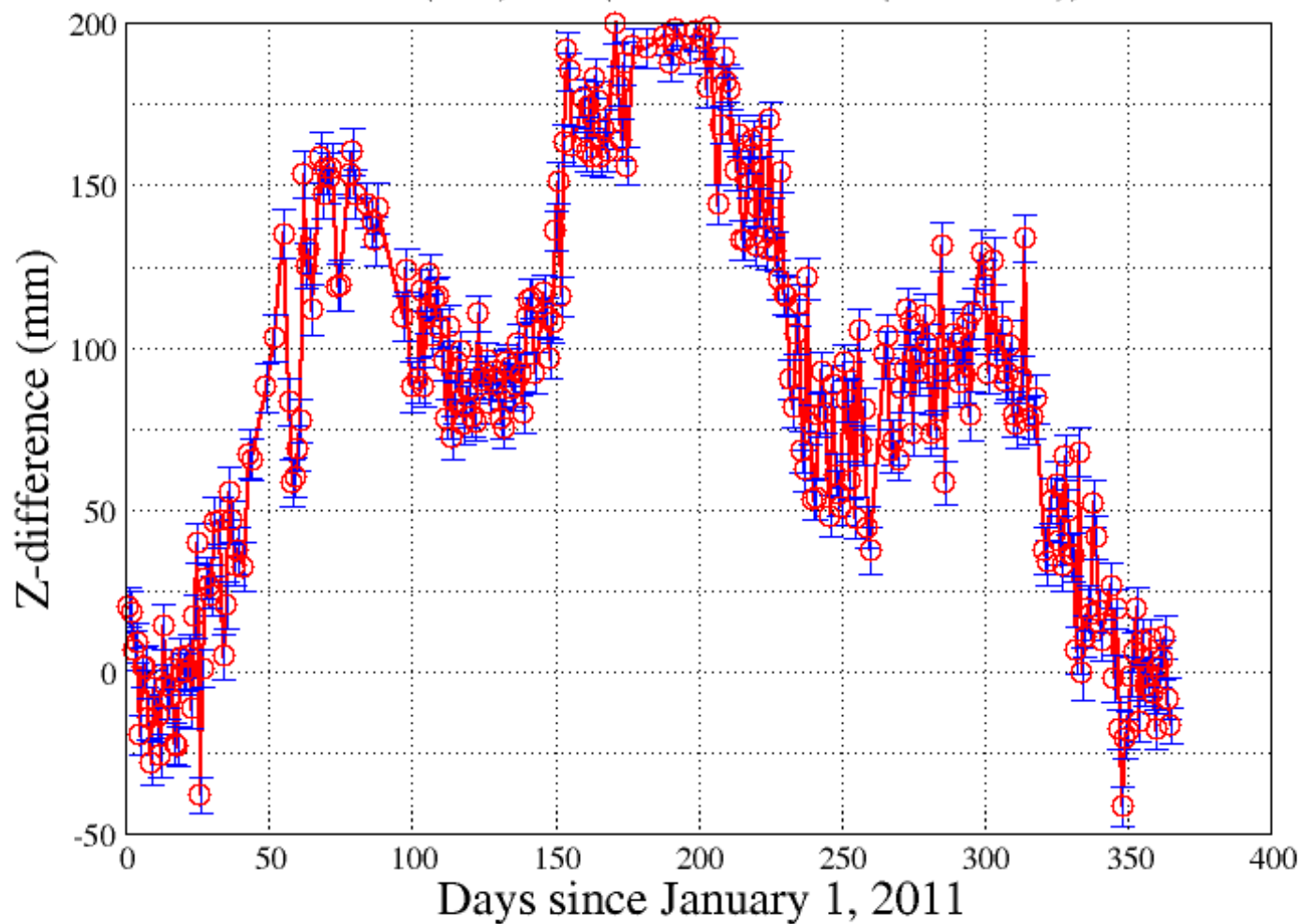
Y-component GLO-GPS station coordinate differences

THU2(IGS) site (Thule Denmark (Greenland))



Z-component GLO-GPS station coordinate differences

THU2(IGS) site (Thule Denmark (Greenland))



GLO-GPS station coordinates differences

Site	Mean coordinate differences (mm)		
	X-component	Y-component	Z-component
BADG	-7.20 ± 1.39	60.32 ± 2.13	51.82 ± 2.48
METZ	73.91 ± 2.93	27.12 ± 2.39	102.84 ± 4.21
NKLG	132.40 ± 3.72	21.40 ± 2.13	2.37 ± 0.91
NRMD	-94.63 ± 3.56	21.47 ± 2.66	-43.50 ± 1.79
PDEL	92.61 ± 2.75	-43.24 ± 1.90	72.19 ± 2.15
REUN	63.98 ± 2.72	86.25 ± 3.35	-43.74 ± 1.73
REYK	63.35 ± 1.74	-16.36 ± 1.40	95.29 ± 3.02
STHL	125.77 ± 3.53	-10.34 ± 1.60	-55.25 ± 1.33
STR1	-76.75 ± 2.75	51.02 ± 2.11	-70.40 ± 2.07
THTI	-106.30 ± 4.25	-66.22 ± 3.31	-84.38 ± 1.82
THU2	11.70 ± 2.58	1.88 ± 2.70	85.52 ± 4.73
TLSE	103.38 ± 2.53	2.34 ± 1.41	94.20 ± 2.20
WUHN	-21.48 ± 2.60	92.36 ± 4.62	57.35 ± 2.82
YAR3	-38.69 ± 1.99	88.69 ± 2.96	-57.53 ± 1.80

GLO(GPS) – DORIS comparison

- **Weekly INA AC Doris and GLO(GPS) daily solutions used for comparison**
- **Main processing models were the same as for Doris and IGS measurements**
- **Doris and IGS solutions are in ITRF2008**
- **Doris sites have beacon models 3.0 (3.1) and Starec antenna types**
- **IGS sites equipped with different receiver and antenna types**

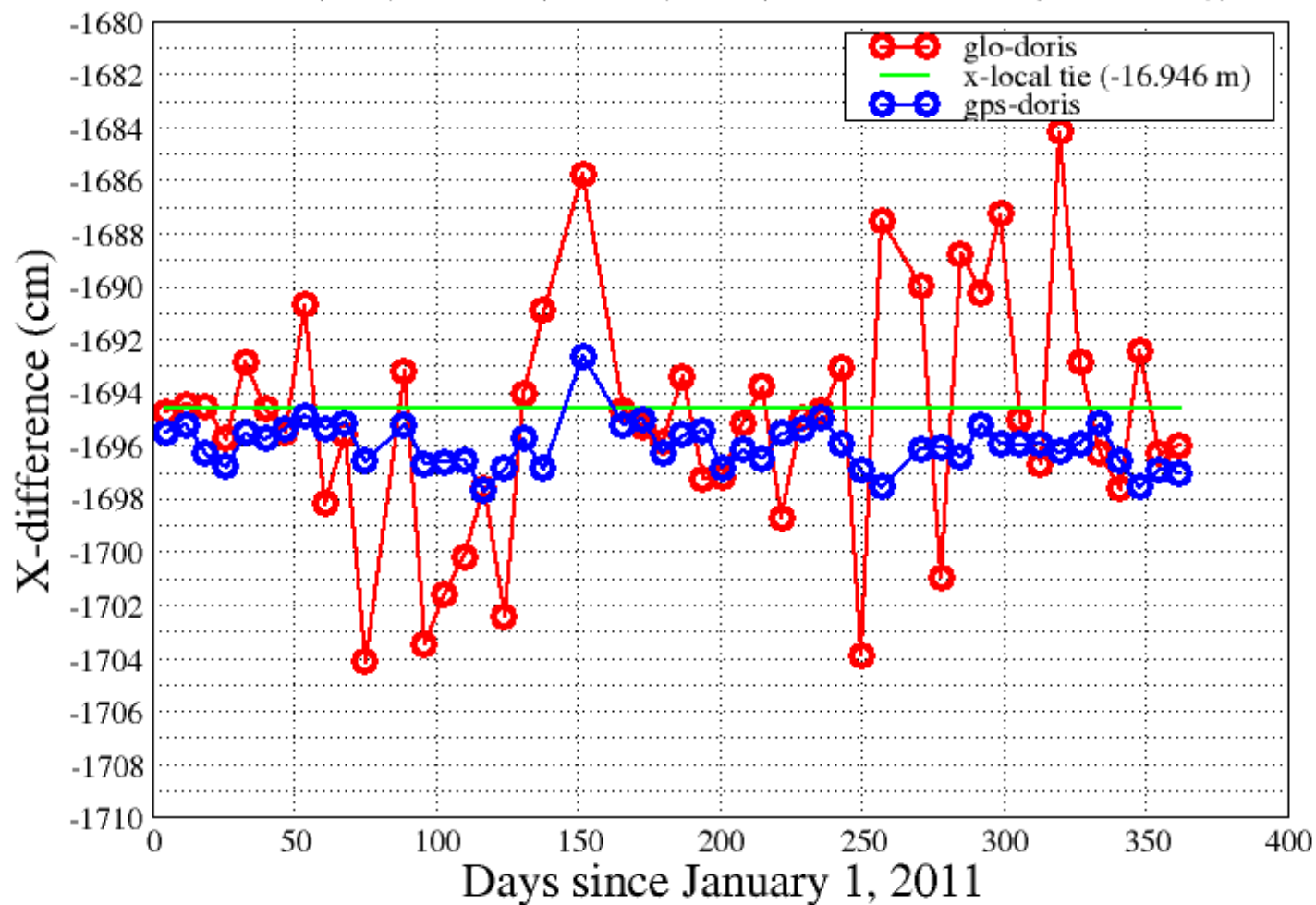
Reference points for JIUFENG station (China) (photo from site log)



reference point

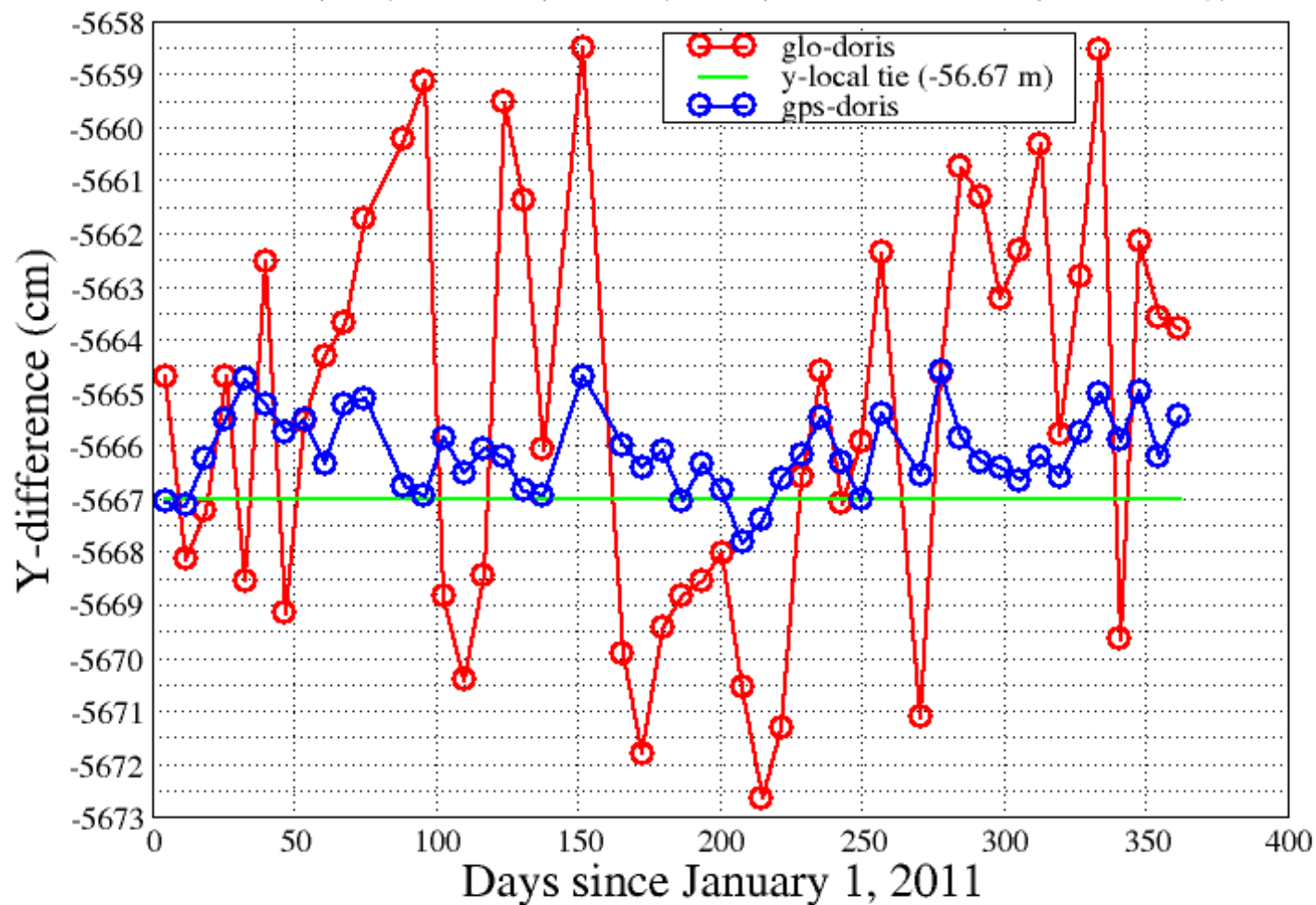
X-component GLO(GPS)-DORIS station coordinate differences

THU2(IGS) - THUB(DORIS) site (Thule Denmark (Greenland))



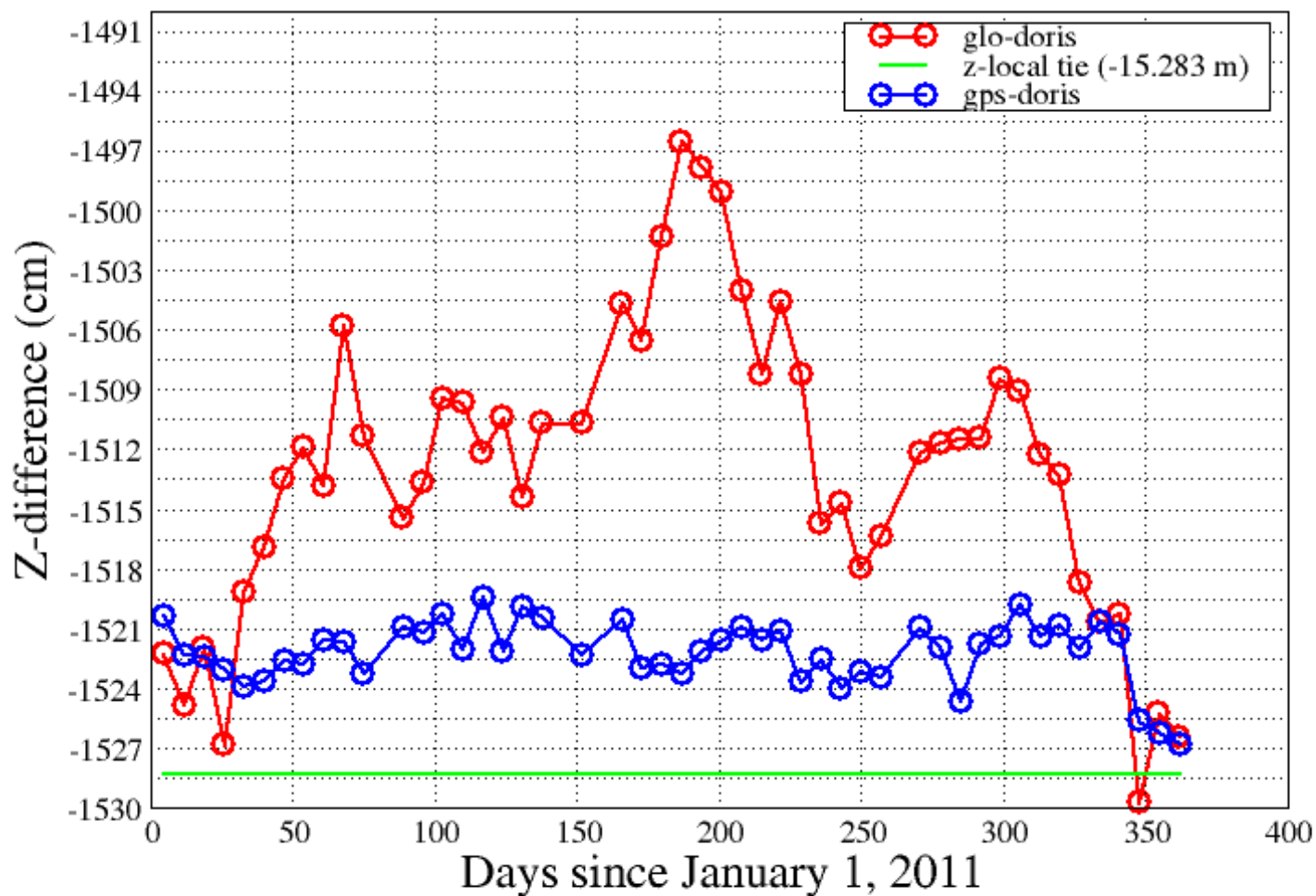
Y-component GLO(GPS)-DORIS station coordinate differences

THU2(IGS) - THUB(DORIS) site (Thule Denmark (Greenland))



Z-component GLO(GPS)-DORIS station coordinate differences

THU2(IGS) - THUB(DORIS) site (Thule Denmark (Greenland))



Comparison with local ties

SITE	<i>Mean coordinates differences (mm)</i>								
	X-component			Y-component			Z-component		
	<i>GLO-DORIS</i> – <i>GPS-DORIS</i>	<i>GLO-DORIS</i> – <i>local ties</i>	<i>GPS-DORIS</i> – <i>local ties</i>	<i>GLO-DORIS</i> – <i>GPS-DORIS</i>	<i>GLO-DORIS</i> – <i>Local ties</i>	<i>GPS-DORIS</i> – <i>Local ties</i>	<i>GLO-DORIS</i> – <i>GPS-DORIS</i>	<i>GLO-DORIS</i> – <i>Local ties</i>	<i>GPS-DORIS</i> – <i>Local ties</i>
BADG- BADB	-7.41 ± 19.39	No	No	61.56 ± 26.02	No	No	48.47 ± 27.90	No	No
METZ- METB	80 ± 14.22	-859 ± 29.13	-939 ± 11.24	30 ± 25.53	266 ± 18.55	236 ± 16.97	110 ± 27.19	554 ± 19.35	444 ± 17.83
NKLG- LICB	125.6 ± 22.68	97.36 ± 36.29	-28.24 ± 16.05	32.75 ± 40.38	67.17 ± 21.77	34.42 ± 20.61	2.3 ± 24.49	36.9 ± 13.39	34.6 ± 13.10
NRMD- NOXB	-100.25 ± 22.65	-124.89 ± 36.50	-24.64 ± 15.82	24.62 ± 37.23	29.71 ± 19.78	5.09 ± 19.45	-69.4 ± 27.09	-67.3 ± 14.99	2.1 ± 14.10

Comparison with local ties (cont.)

SITE	<i>Mean coordinates differences (mm)</i>								
	X-component			Y-component			Z-component		
	<i>GLO-DORIS</i> – <i>GPS-DORIS</i>	<i>GLO-DORIS</i> – <i>local ties</i>	<i>GPS-DORIS</i> – <i>local ties</i>	<i>GLO-DORIS</i> – <i>GPS-DORIS</i>	<i>GLO-DORIS</i> – <i>Local ties</i>	<i>GPS-DORIS</i> – <i>Local ties</i>	<i>GLO-DORIS</i> – <i>GPS-DORIS</i>	<i>GLO-DORIS</i> – <i>Local ties</i>	<i>GPS-DORIS</i> – <i>Local ties</i>
PDEL- PDMB	99.19 ± 19.15	98.61 ± 33.41	-0.58 ± 13.53	-48.66 ± 32.59	-14.42 ± 17.69	34.24 ± 16.91	67.9 ± 25.92	122.89 ± 14.23	54.99 ± 13.70
REUN- REUB	63.2 ± 24.83	85.04 ± 38.14	21.84 ± 17.74	98.98 ± 37.63	137.08 ± 22.31	38.10 ± 21.31	-50.5 ± 25.83	-45 ± 16.18	5.5 ± 15.65
REYK- REZB	65 ± 12.32	69 ± 26.88	4 ± 8.88	0 ± 22.09	-15 ± 13.42	-15 ± 12.67	96 ± 25.17	119 ± 14.87	23 ± 14.31
STHL- HEMB	175.29 ± 31.47	108.64 ± 40.06	-66.65 ± 24.68	-9.67 ± 50.19	-25.11 ± 26.42	-15.44 ± 25.77	-69.3 ± 40.37	-41.7 ± 21.40	27.6 ± 20.96

Comparison with local ties (cont.)

SITE	<i>Mean coordinates differences (mm)</i>								
	X-component			Y-component			Z-component		
	<i>GLO-DORIS</i> – <i>GPS-DORIS</i>	<i>GLO-DORIS</i> – <i>local ties</i>	<i>GPS-DORIS</i> – <i>local ties</i>	<i>GLO-DORIS</i> – <i>GPS-DORIS</i>	<i>GLO-DORIS</i> – <i>Local ties</i>	<i>GPS-DORIS</i> – <i>Local ties</i>	<i>GLO-DORIS</i> – <i>GPS-DORIS</i>	<i>GLO-DORIS</i> – <i>Local ties</i>	<i>GPS-DORIS</i> – <i>Local ties</i>
STR1-HEMB	-72.3 ± 19.81	-89.7 ± 33.98	-17.4 ± 13.981	50.1 ± 33.68	52.6 ± 18.29	2.5 ± 17.40	-71.4 ± 27.34	-57.7 ± 14.98	13.7 ± 14.35
THTI-PAUB	-86.83 ± 21.28	-71.25 ± 34.99	15.58 ± 15.21	-40.77 ± 36.06	-42.79 ± 19.65	-2.02 ± 18.41	-70.15 ± 25.84	-41.74 ± 14.22	28.41 ± 13.62
THU2-THUB	9.9 ± 9.63	-4.1 ± 24.23	-14 ± 6.52	6.8 ± 16.45	15.6 ± 10.43	8.8 ± 8.03	92.1 ± 22.66	153.1 ± 13.21	61 ± 11.45
TLSE-TLSB	92 ± 15.78	101 ± 30.38	9 ± 11.29	12 ± 28.68	46 ± 16.71	34 ± 15.97	90 ± 24.20	127 ± 14.39	37 ± 13.81

Comparison with local ties (cont.)

SITE	<i>Mean coordinates differences (mm)</i>								
	X-component			Y-component			Z-component		
	<i>GLO-DORIS</i> – <i>GPS-DORIS</i>	<i>GLO-DORIS</i> – <i>local ties</i>	<i>GPS-DORIS</i> – <i>local ties</i>	<i>GLO-DORIS</i> – <i>GPS-DORIS</i>	<i>GLO-DORIS</i> – <i>Local ties</i>	<i>GPS-DORIS</i> – <i>Local ties</i>	<i>GLO-DORIS</i> – <i>GPS-DORIS</i>	<i>GLO-DORIS</i> – <i>Local ties</i>	<i>GPS-DORIS</i> – <i>Local ties</i>
WUHN- JIUB	0 ± 21.91	No	No	60 ± 33.50	No	No	50 ± 26.51	No	No
YAR3- YASB	-38 ± 24.15	No	No	91 ± 33.71	No	No	-59.2 ± 26.64	No	No

Summary

- *Mean GLO-GPS station coordinates differences evaluated as 7.20-132.42, 1.75-88.42, 2.37-101.85 mm for X,Y and Z components correspondingly and are station-specific*
- *Mean (GLO-DORIS)-(local ties) differences estimated as 4.10-124.89, 15.00 – 266.00, 36.90- 554.00 mm for X,Y and Z components correspondingly*

- ***Mean (GPS-DORIS)-(local ties) differences estimated as 0.58-939.00, 2.02 – 236.00, 2.10- 444.00 mm for X,Y and Z components correspondingly***
- ***Differences between GPS and DORIS solutions more accurate compare to GLONASS-DORIS ones***
- ***It is possible to estimate local ties with rather high accuracy using space technics for sites without usual terrestrial ties***