The IDS Contribution to the ITRF2020: Realization and Evaluation

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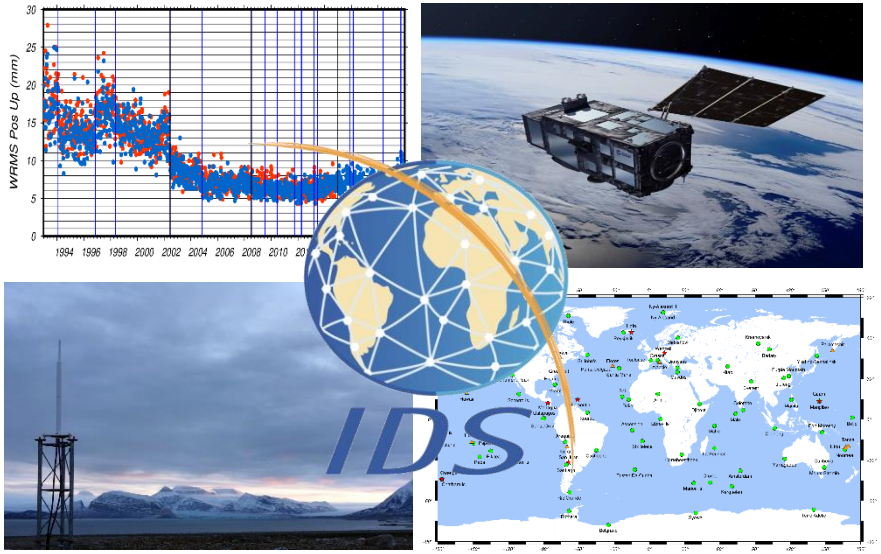
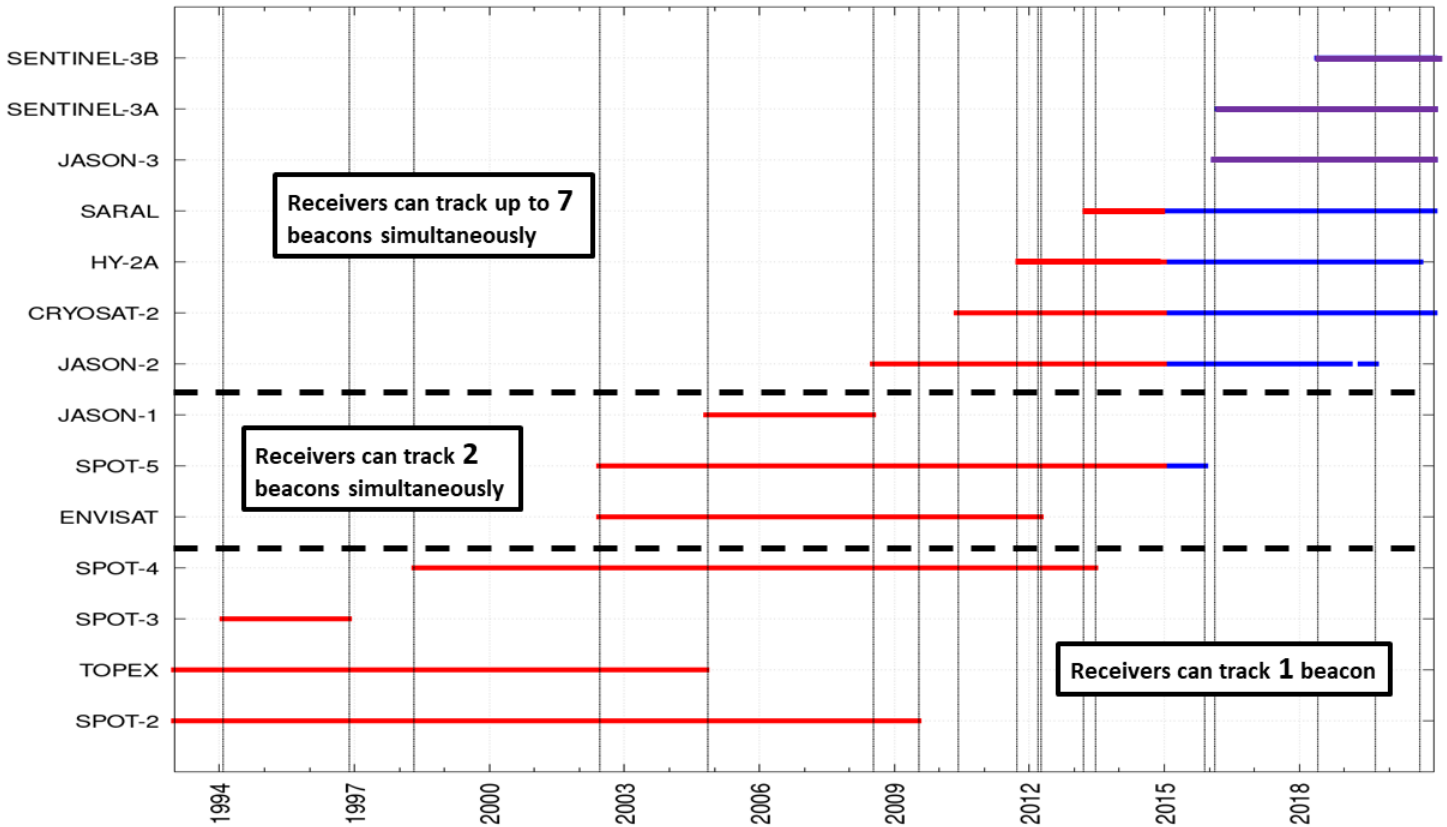


ITRF2020 = ITRF2014 + new missions (Jason-3, Sentinel-3A, Sentinel-3B)



There are a total of 14 DORIS missions since 1993, and only DGXX missions since 2016.

The IDS contribution to ITRF2020 is based on 4 solutions from 4 different software packages.

AC	Software	Series number	Nb of Files	Nb of Sites	Nb of stations	Solution Type	EOPs
ESA	NAPEOS	12 / 13	1447	87	199	NEQ	(Motion+rate+LOD)
GOP	BERNESE	65 / 66	1458	83	195	COV	Motion+rate
GRG	GINS-DYNAMO	42	1461	86	199	COV	Motion
GSC	GEODYN	48	1461	88	200	NEQ	Motion
IDS	**CATREF**	**15**	**1456**	**86**	**200**	**COV**	**Motion**

IERS Standards applied (new mean pole model, Desai & Sibois HF tidal EOP model...)

+ Use of DORIS RINEX data (format associated with DGXX receivers)

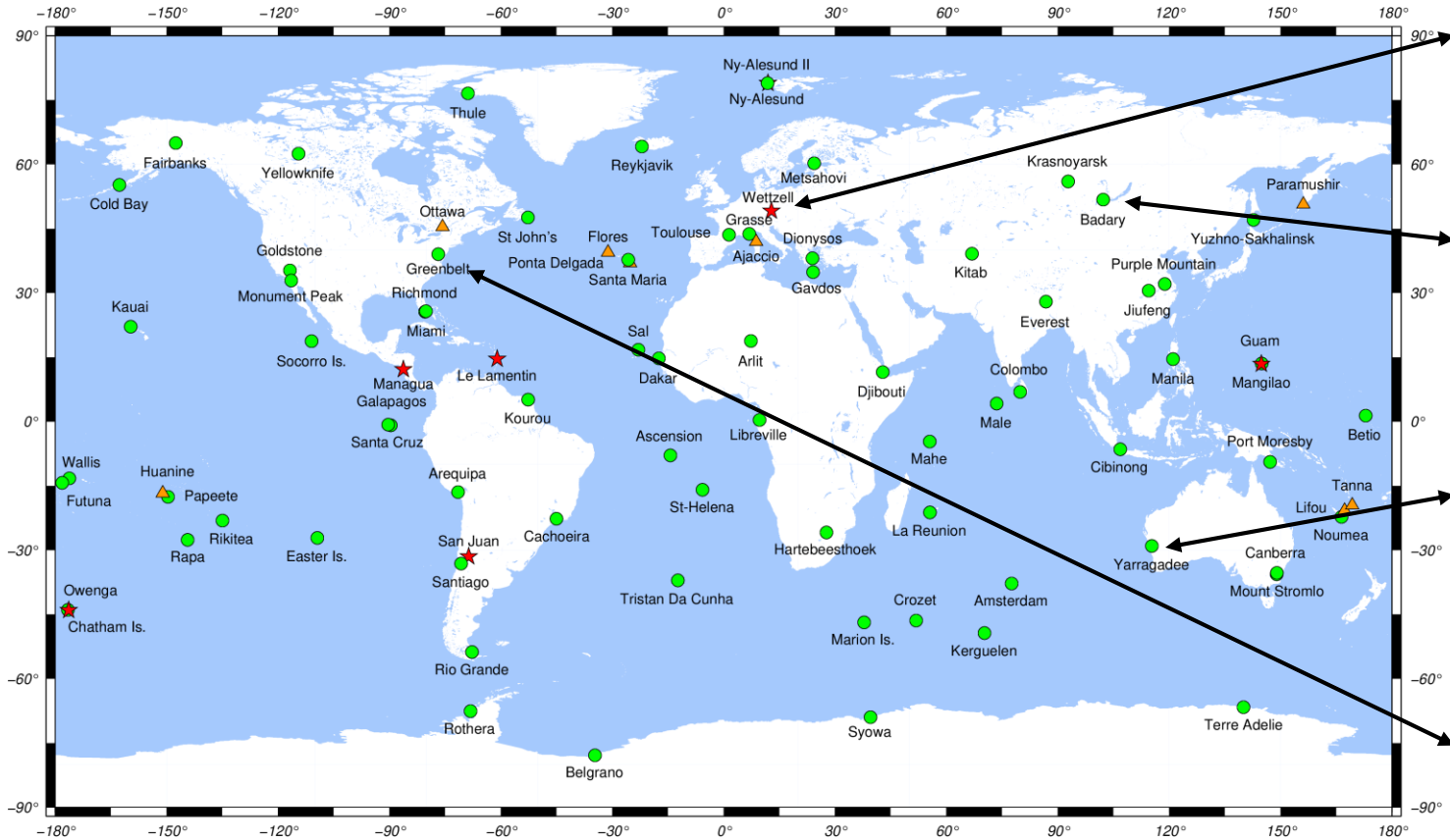
+ New phase center ALCATEL antennae corrections

+ Precise SPOT-5 solar panel angle values

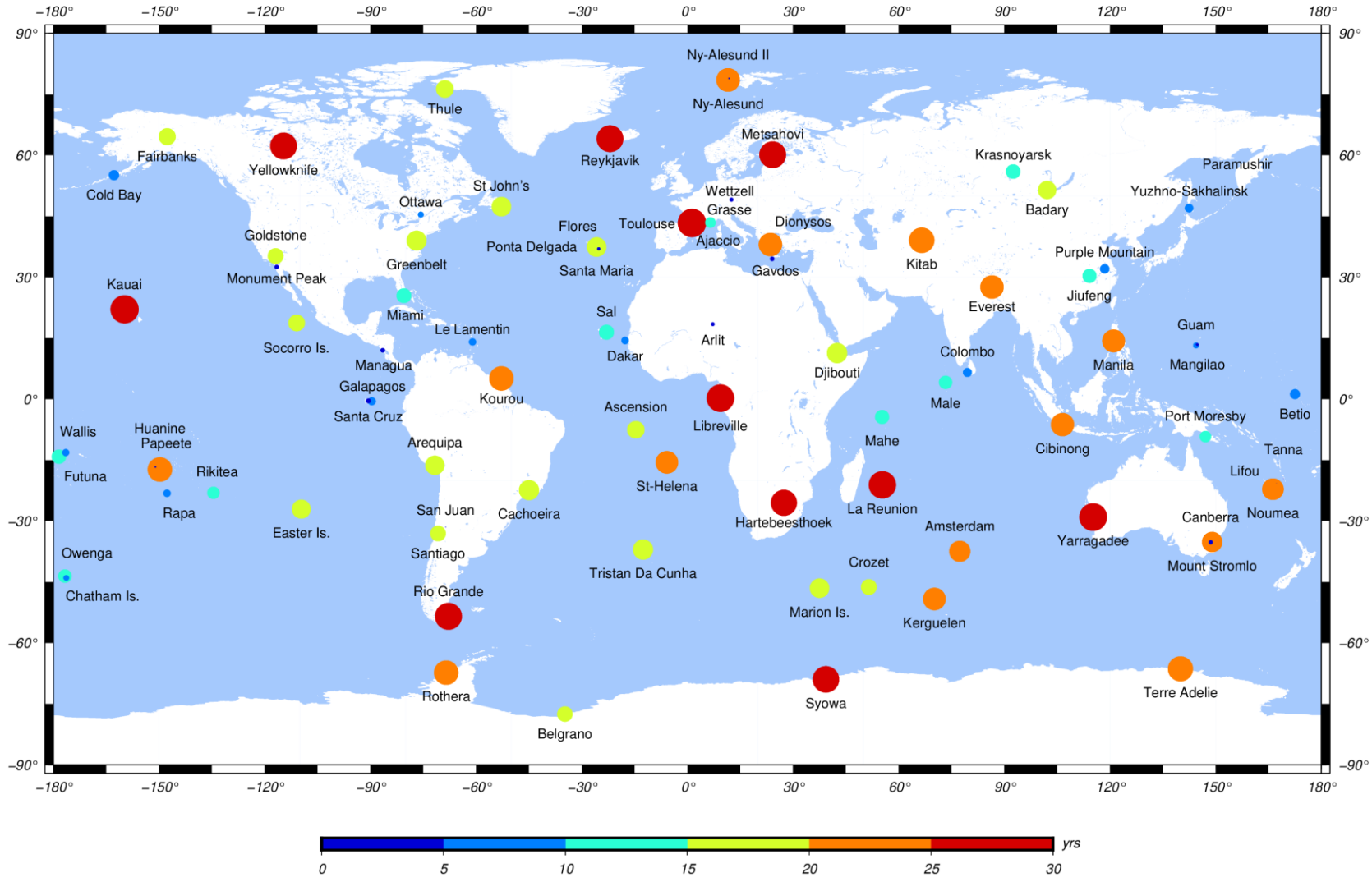
+ South Atlantic Anomaly mitigation strategies for Spot-5, Jason-1/2/3, Sentinel3A/B*

+ …

The IDS ITRF2020 network

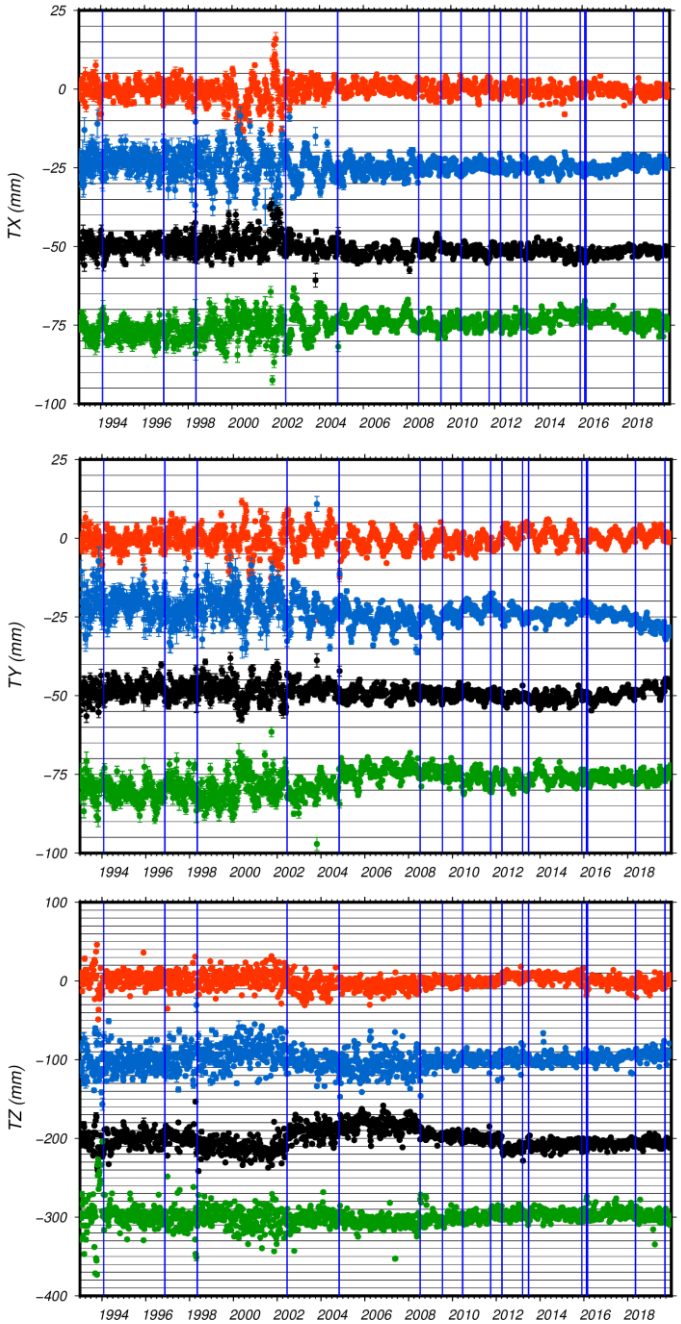


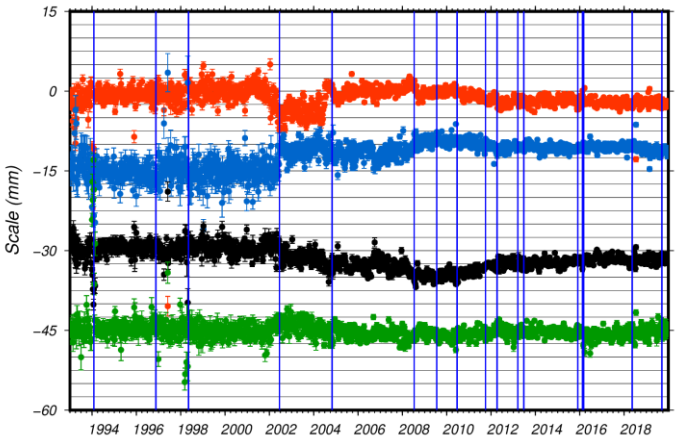
Very homogeneous geographical distribution over time.
Contains 200 stations@86 sites including 4 4 Technique sites.
57 sites co-located with at least one other IERS technique.
Includes old (8) and new (2) sites with less than 2.5yrs of obs.



The IDS ITRF2020 solution includes 26 sites (30%) with more than 20 years of observation thanks to the efforts of the *Host Agencies, IGN and CNES*.

Origin and Scale Residuals (wrt IDS ITRF2020 Solution)

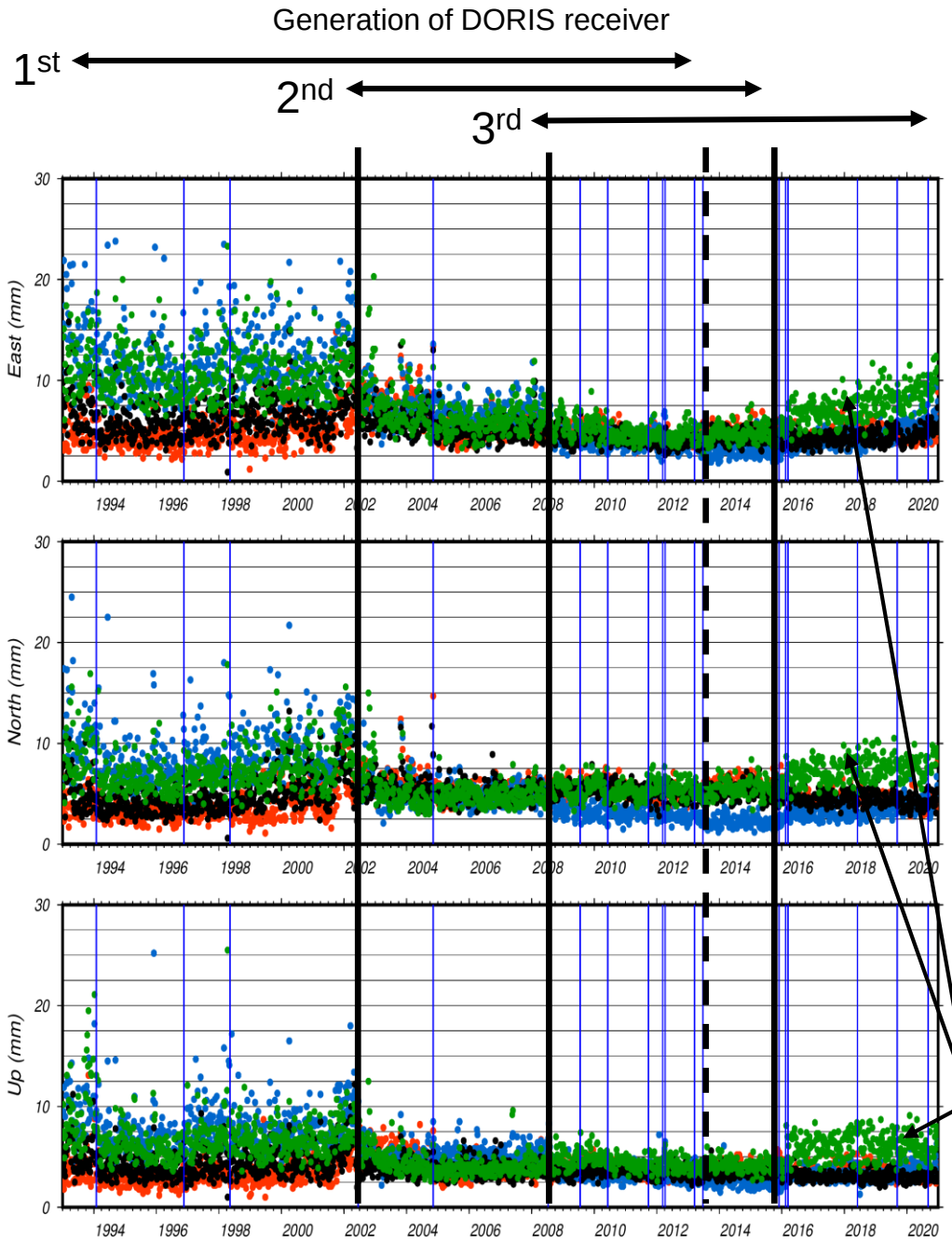




WRMS [mm]	Scale	Tx	Ty	Tz
esa 12/13	3.2	3.6	4.7	11.7
gop 65/66	8.0	3.3	4.5	13.8
grg 42	5.0	3.9	3.5	21.3
gsc 48	2.1	4.4	5.0	13.5

WRMS mostly below 5mm excepted for Tz.

Station Position Residuals (wrt IDS ITRF2020 Solution)



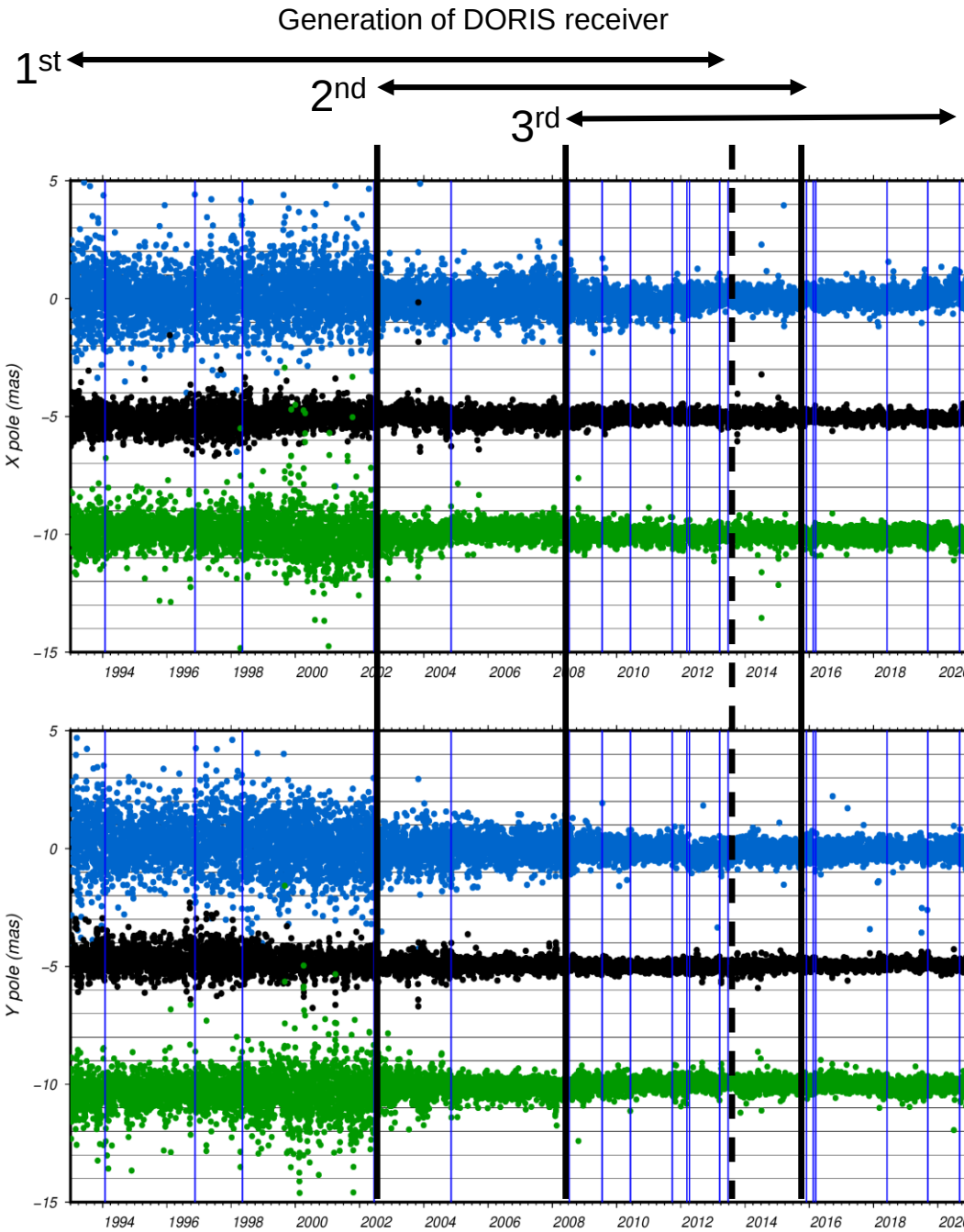
esa 12/13 – gop 65/66 – grg 42 – gsc 48

Strong correlation with the time evolution of the generation of DORIS receivers (i.e. number of stations simultaneously received onboard).

Reflect the AC weighting in the IDS ITRF2020 solution.

GSC does not include Sentinel-3A/B

X- and Y-Pole Residuals (wrt IDS ITRF2020 Solution)

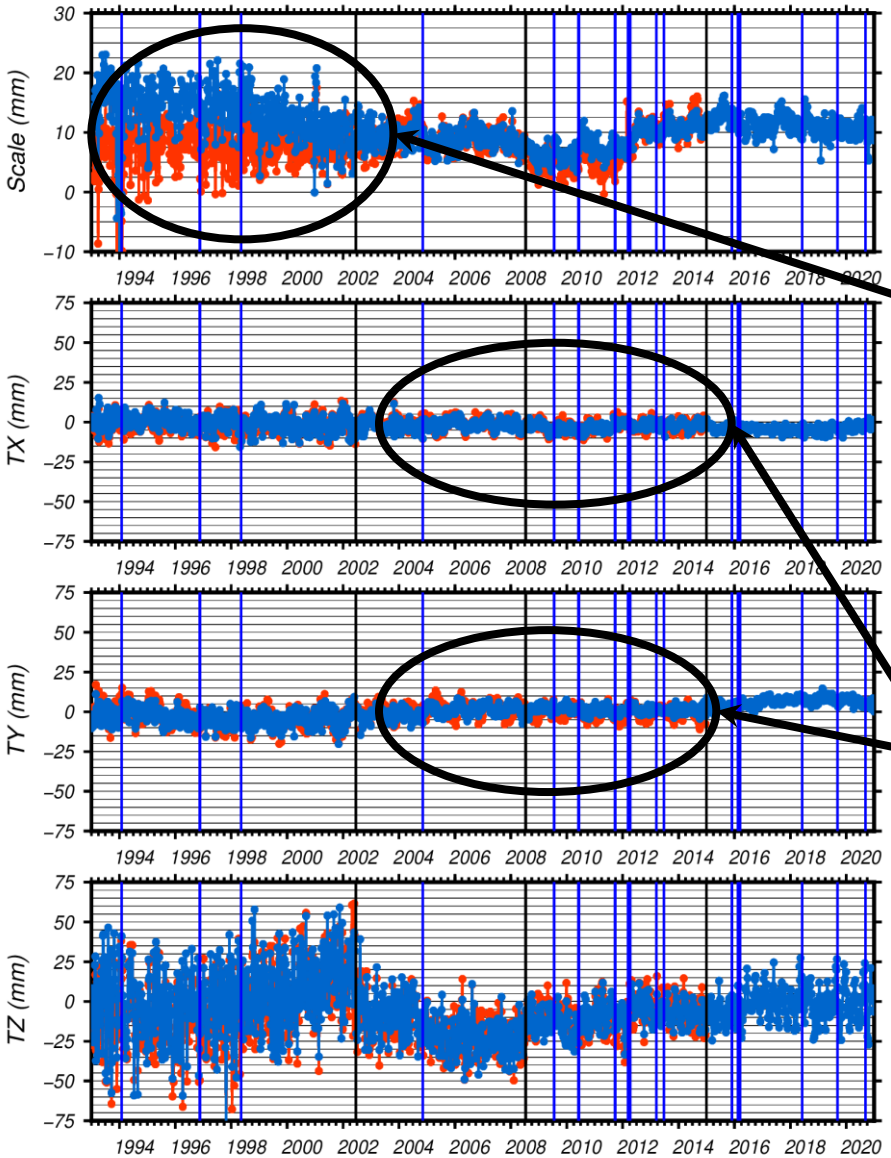


esa 12/13 – gop 65/66 – grg 42 – gsc 48

WRMS [mas]	X-Pole	Y-Pole
esa 12/13	-	-
gop 65/66	0.405	0.400
grg 42	0.219	0.223
gsc 48	0.307	0.323

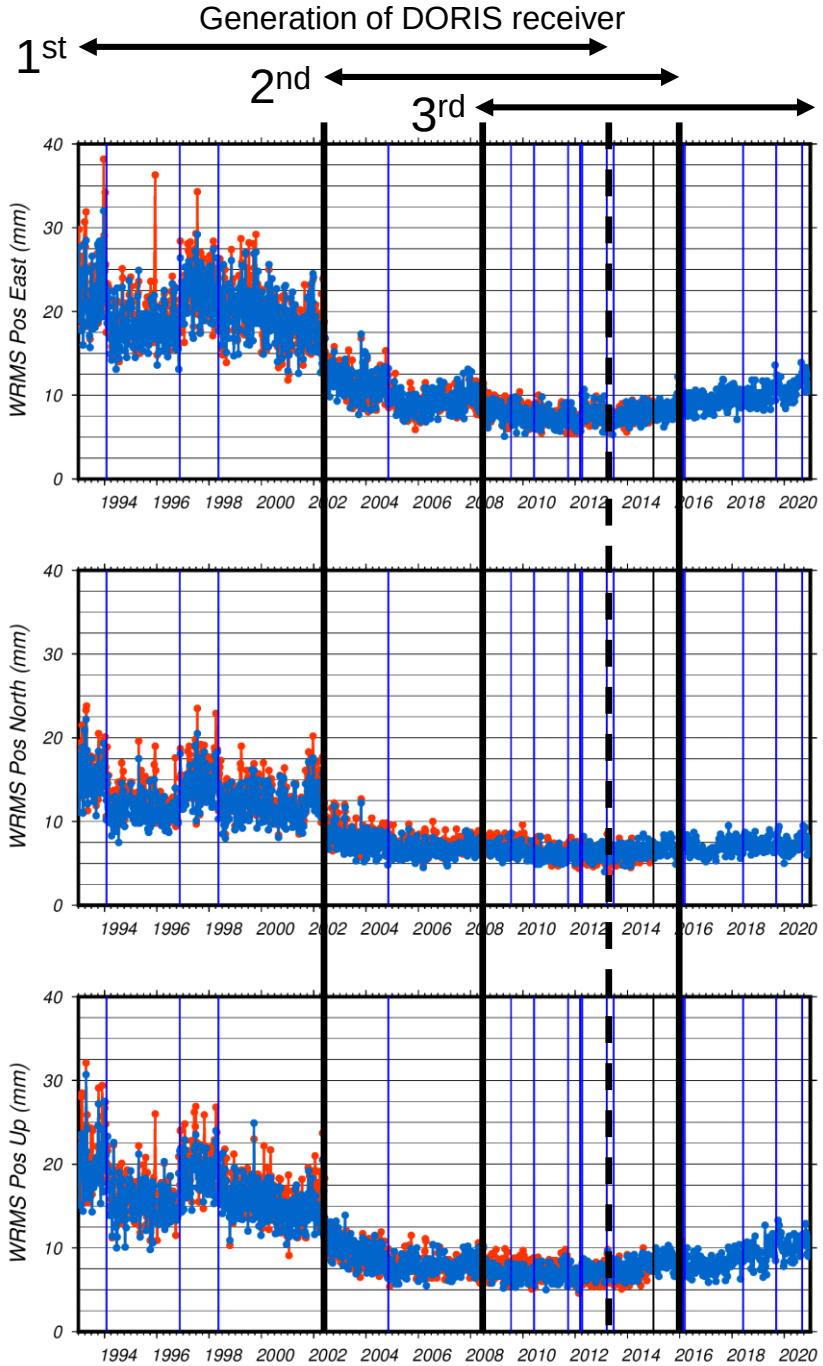
Origin and scale wrt ITRF2014

ids 09 (ITRF2014) – **ids 15** (ITRF2020)
Time period: 1993.0-2021.0



Scale difference until 2002.5 is due to the new ALCATEL antennae PCV.

IDS-ITRF2020 includes a better modelling of non-conservative forces (radiation pressure) on Jason-1/2/3 satellites to diminish 118-day signal.



Station Position WRMS wrt ITRF2014

ids 09 (ITRF2014) – **ids 15** (ITRF2020)
Time period: 1993.0-2021.0

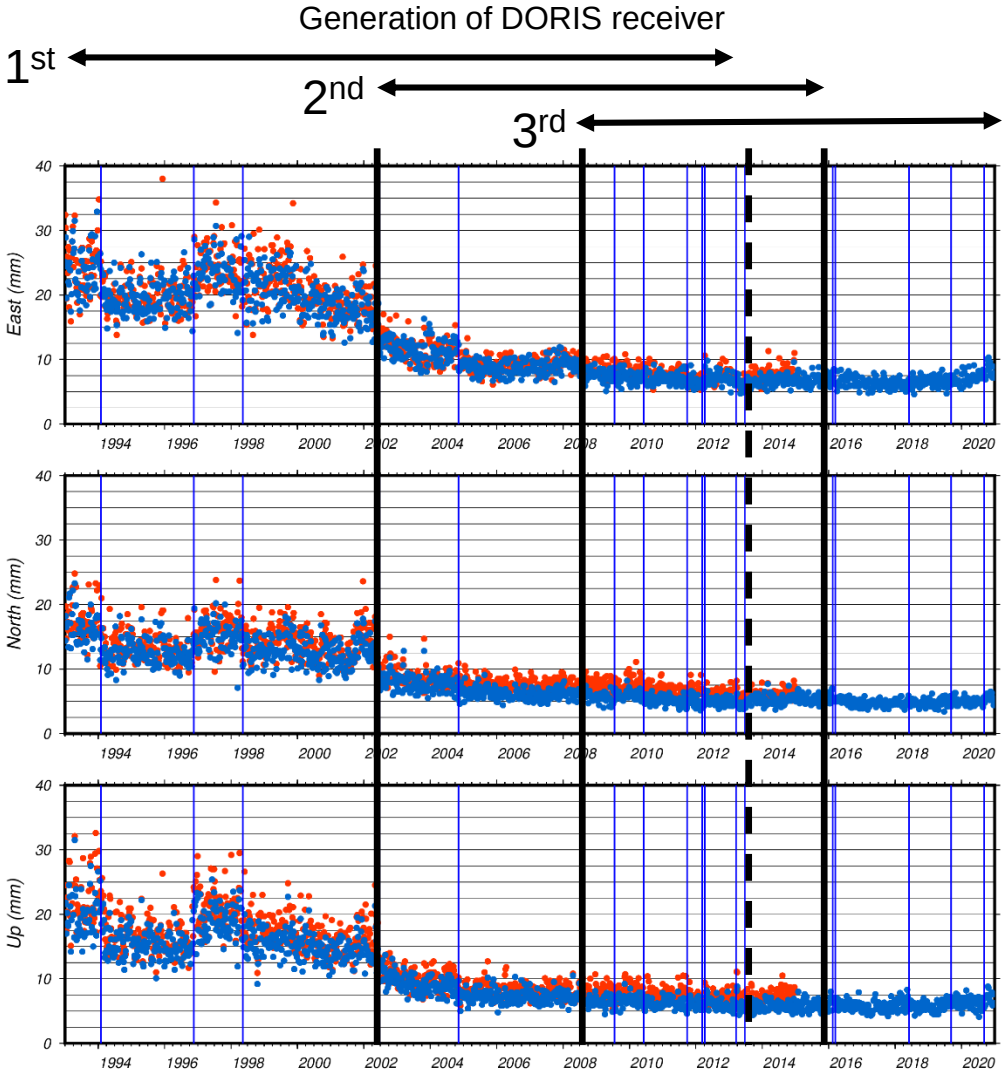
3D WRMS [mm]	1993.0 2002.5	2002.5 2008.5	2008.5 2015.0	2015.0 2021.0
ids 09	16.8 ± 2.8	8.7 ± 1.3	7.1 ± 0.7	
ids 15	15.7 ± 2.5	8.4 ± 1.2	6.9 ± 0.6	8.3 ± 0.9

- **Results improved when more satellites are available and with more and more recent generation of DORIS receivers.**
- **3D WRMS below 10mm after including Jason-1 (late 2004).**
- **3D WRMS around 7-8mm since adding of HY-2A (late 2011).**

IDS-ITRF2020 solution performs better than IDS-ITRF2014.

Station Position WRMS wrt Cumulative Solution

ids 09 (ITRF2014) – **ids 15** (ITRF2020)
Time period: 1993.0-2021.0

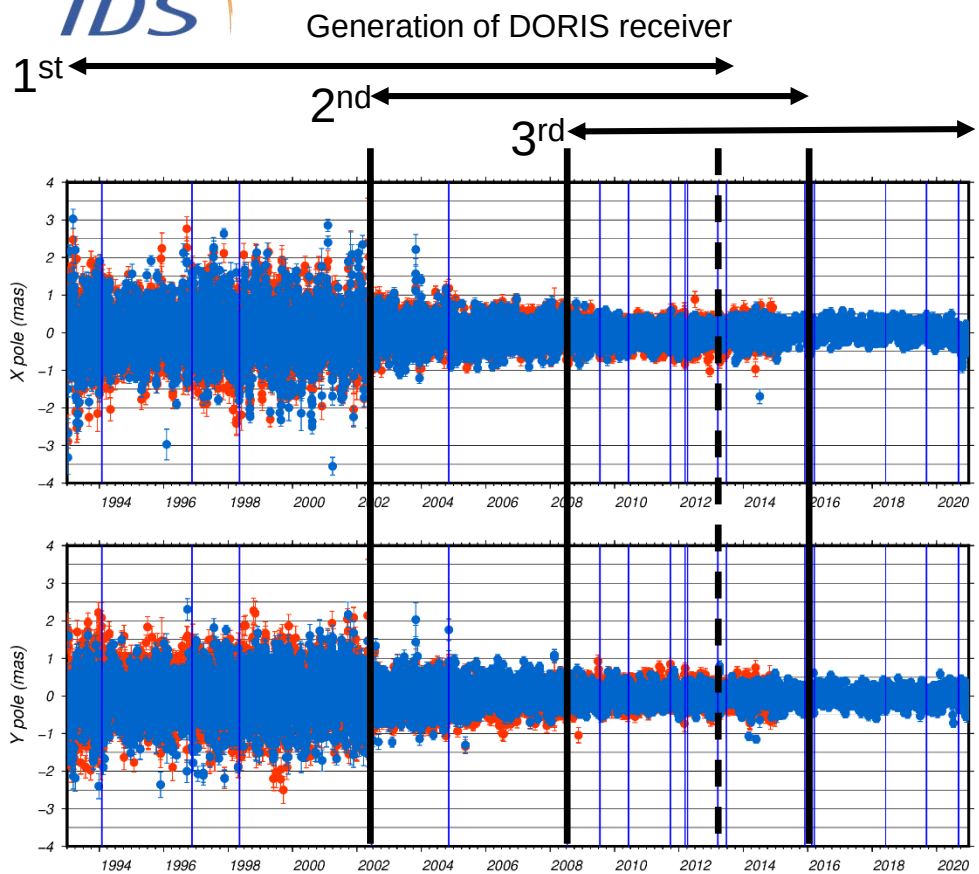


- **Strong correlation with the time evolution of the generation of DORIS receivers (i.e. number of stations simultaneously received onboard).**
- **Slight improvement since late 2015 while only 3rd generation of DORIS receivers are on flight.**

IDS-ITRF2020 solution performs better than IDS-ITRF2014.

3D WRMS [mm]	1993.0 2002.5	2002.5 2008.5	2008.5 2015.0	2015.0 2021.0
ids 09	17.5 ± 2.9	9.0 ± 1.3	7.3 ± 0.8	
ids 15	16.4 ± 2.5	8.1 ± 1.3	6.1 ± 0.6	5.8 ± 0.6

EOPs differences wrt IERS C04 series



ids 09 (ITRF2014) – **ids 15** (ITRF2020)
Time period: 1993.0-2021.0

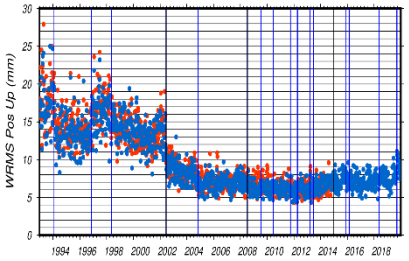
Period of time	Std ΔX [mas]	Std ΔY [mas]
1993.0-2002.5	0.68 / 0.70	0.61 / 0.61
2002.5-2008.5	0.31 / 0.32	0.29 / 0.30
2008.5-2015.0	0.24 / 0.21	0.22 / 0.19
2015.0-2021.0	- / 0.18	- / 0.17

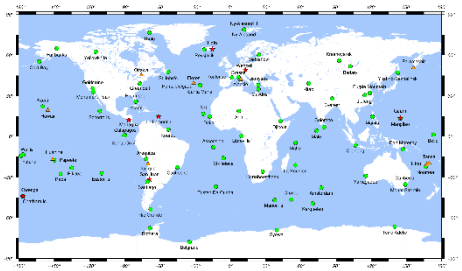
÷ 4

ITRF2020 and ITRF2014 IDS contributions have similar performances in both X and Y.

The IDS contribution to ITRF2020

- **Is based on 4 AC contributions from 1993.0 to 2021.0.**
- **Makes use of 14 DORIS missions.**
- **Includes positions of 200 stations@86 sites with 26 sites with more than 20 years of observation.**
- **Performs better than the IDS contribution to the ITRF2014 in terms of station positioning.**
- **Is available for download from CDDIS and IGN (ids 15).**





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Thanks to the IDS ITRF2020 Contributors