



EGU2015-2492 - IDS Combined Solution improvements between ITRF2008 and ITRF2013

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- **What has changed between ITRF2008 and ITRF2014 ?**
- **Performances of IDS contribution to ITRF2014 compared to IDS contribution to ITRF2008.**
 - DORIS Network.
 - Origin and Scale.
 - Stations position residuals.
 - EOPs.
- **First results of the IDS 09 (ITRF2014) cumulative solution.**
- **IDS News**



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What has changed between ITRF2008 and ITRF2014 ?

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- **In terms of Data**

ITRF2014 = ITRF2008

+ new missions

(Jason-2, Cryosat-2, HY-2A*, Saral*)

+ Jason-1 (SAA corrected data)

between TOPEX and Jason-2 only

+ SPOT5 SAA corrected data from 2006

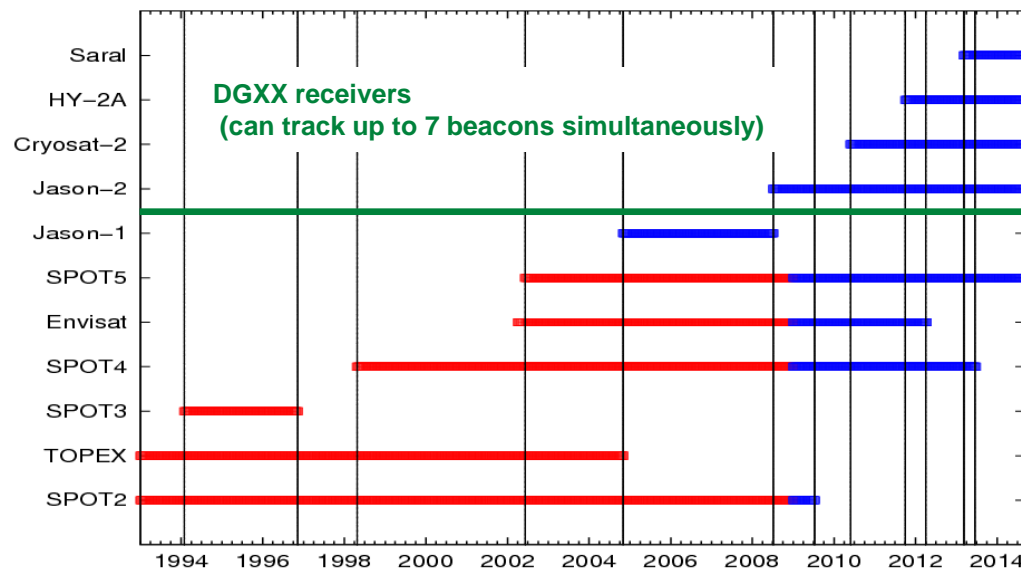
- **In terms of Time Span**

1993.0-2008.0 → 1993.0–2014.67 (due to data latency and to respect IERS submission deadline Feb 27th)

- **In terms of Forces and Models**

ITRF2014

- ✓ Includes Time variable Gravity field.
- ✓ Accounts for beacon frequency offsets (changes wrt nominal frequency).
- ✓ Integrates phase center antennae corrections (PCV: Alcatel/Starec).



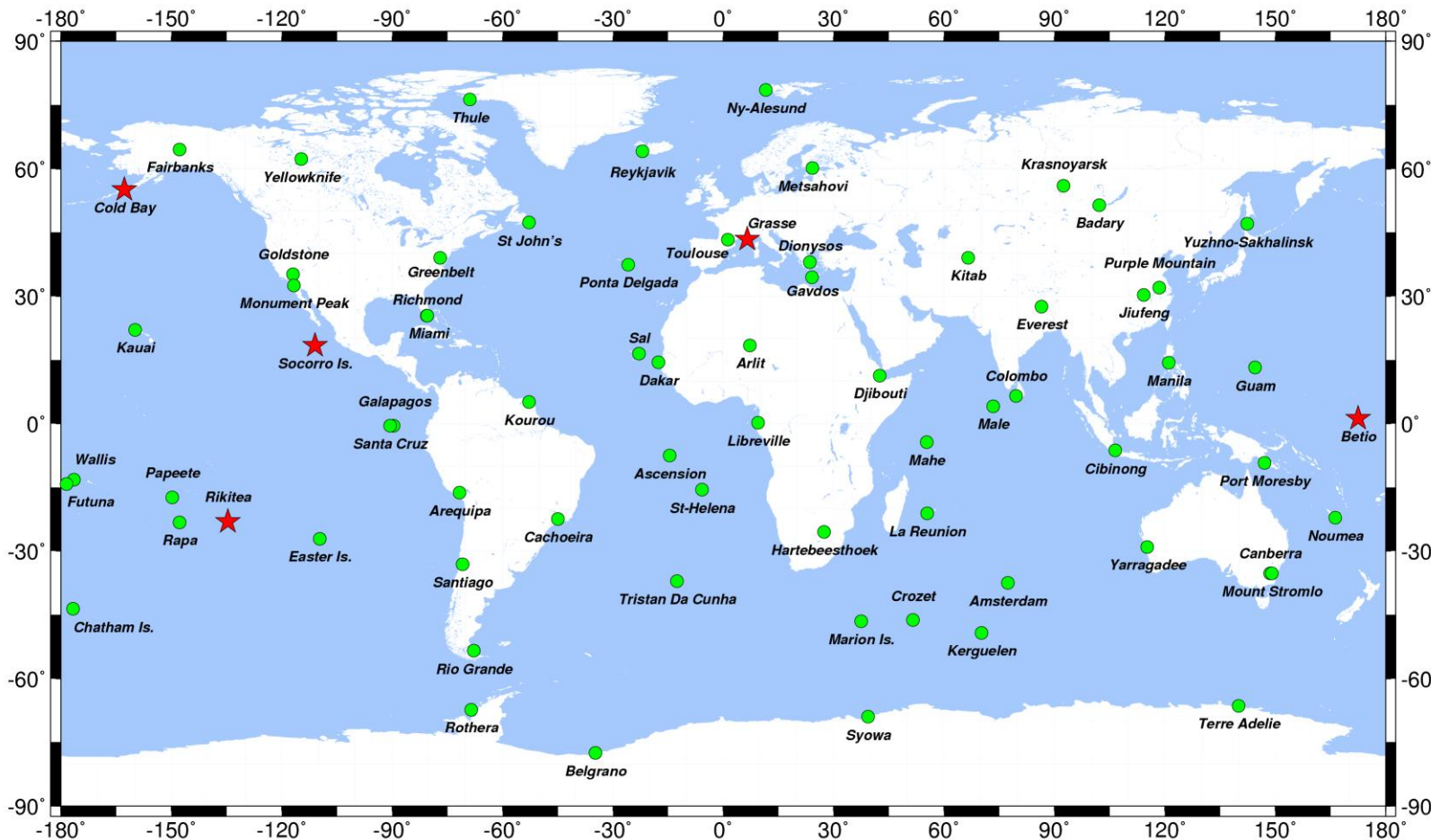
6 ACs from 6 different institutions with 5 different software packages

→ 1 AC less compared to ITRF2008

AC	Software	Series number	Solution Type	Phase laws	Time Span	Nb of SINEXs	EOPs
ESA	NAPEOS	10	NEQ	Yes	1993.0-2014.45	1103 (1082)*	Motion+rate+LOD
GOP	BERNESE	43/45	COV	Yes	1993.0-2014.67	1125 (1119)*	Motion+rate
GSC	GEODYN	26	NEQ	Yes	1993.0-2014.67	1131 (1116)*	Motion
IGN	GIPSY-OASIS II	15	COV	Yes	1993.0-2014.67	1131 (1127)*	Motion+rate+LODR+UT
INA	GIPSY-OASIS II	08	COV	No	1993.0-2014.67	1130 (1123)*	Motion+rate+LODR+UT
GRG (LCA)	GINS-DYNAMO	40	COV	Yes	1993.0-2014.67	1128 (1118)*	Motion
IDS	CATREF	09	COV		1993.0-2014.67	1130	Motion

(xxx) *= number of weeks included in the IDS combined solution

Does not contribute to the combined scale



➔ 156 stations over 71 sites (38 in northern hemisphere).

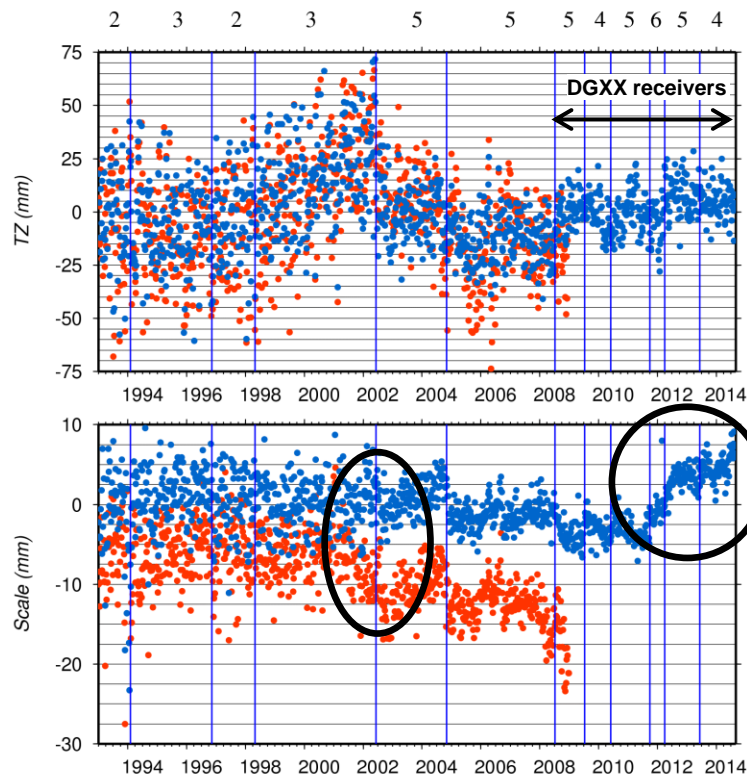
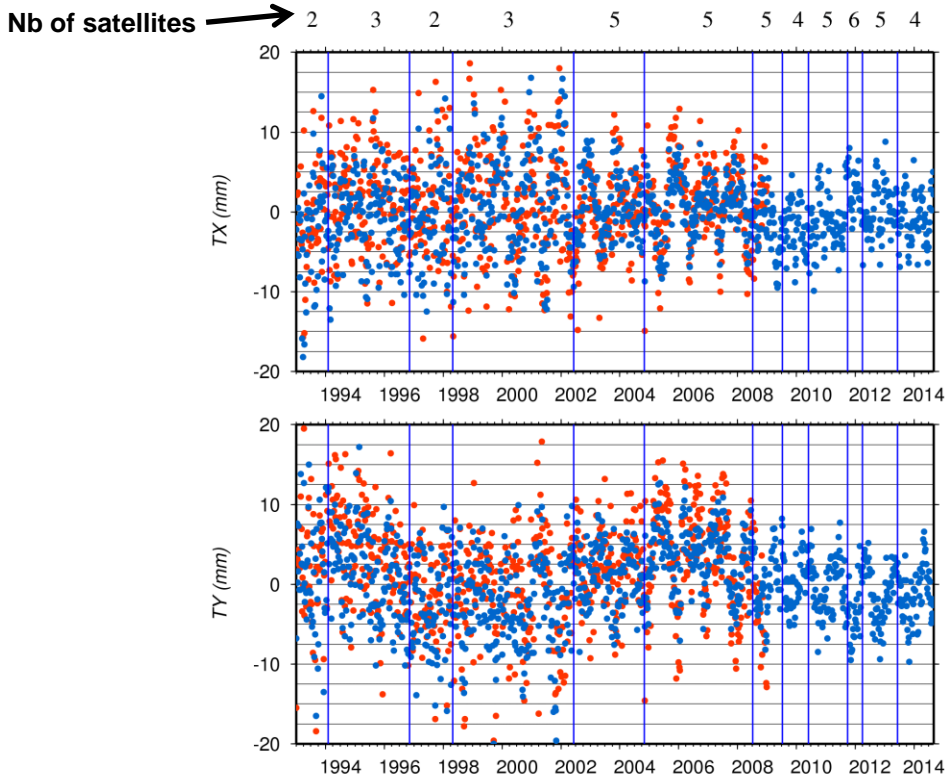
➔ 5 new sites (★) wrt ITRF2008: Betio, Cold-Bay, Grasse, Rikitea and Socorro.



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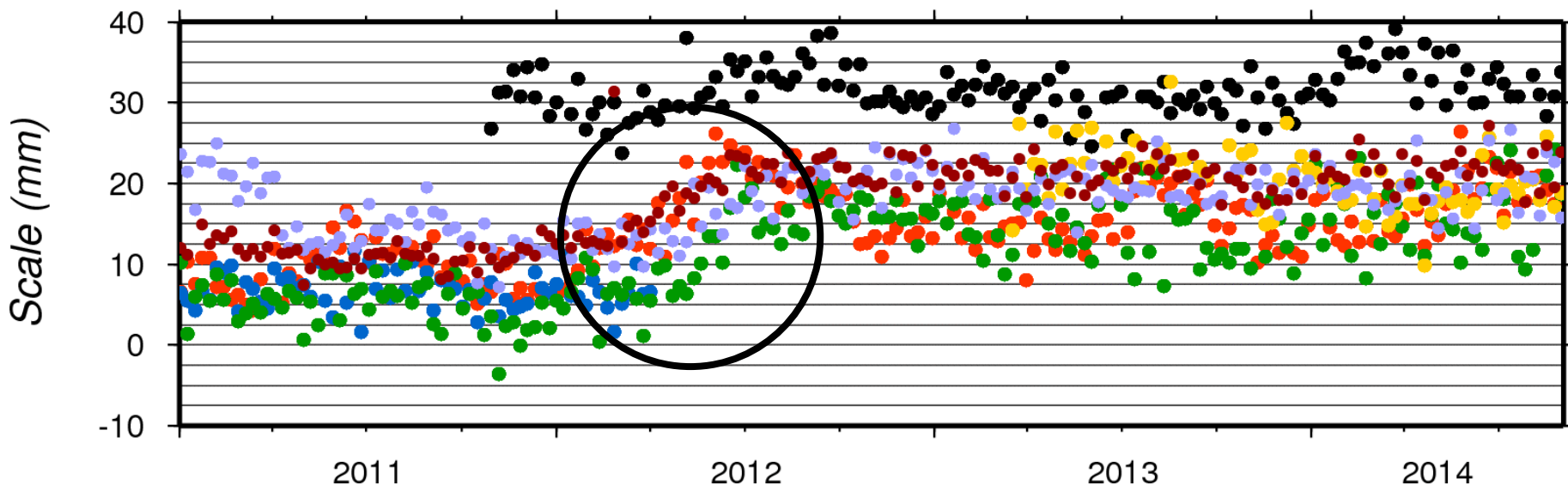
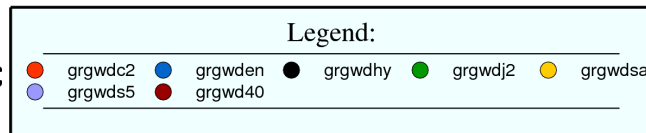
IDS 09 (ITRF2014) vs IDS 03 (ITRF2008) Origin and scale wrt IDSTRF2014

IDS 09 – IDS 03



- Results are improved when more satellites available and with new DGXX receivers.
- Origin: Improvements of Tx, Ty and Tz after 2002 (lower STDs, less annual signal).
- IDS 09 Scale:
 - ✓ Shows an offset wrt IDS 03' due to beacons PCVs.
 - ✓ Has no more scale discontinuity in 2002 thanks to beacon frequency offset estimations.
 - ✓ Presents an increase of around 10mm mid 2012 and is more stable before.

Scale wrt ITRF2008 of single-satellite solutions from CNES/CLS IDS AC



- ❑ Similar scales behavior from GOP, GSC and INA single-satellite solutions.
- ❑ **Cryosat-2** and **Jason-2** present a scale increase mid 2012.
 - ➔ Scale increase of the multi-satellites solution **grg40**.
- ❑ Origin of Cryosat-2 and Jason-2 scale
 - ✓ Does not seem to be the consequence of any network changes.
 - ✓ Part of the increase depends on the origin of the CoM-CoP vector.
 - ✓ Is not yet explained but is still under investigations.

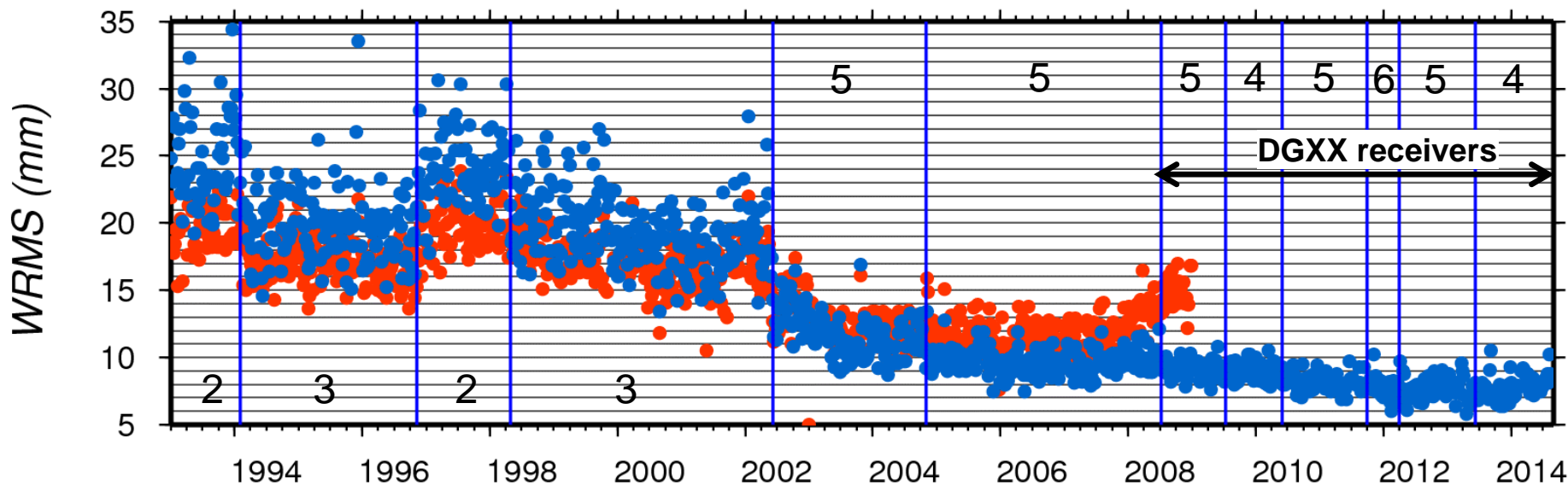


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IDS 09 (ITRF2014) vs IDS 03 (ITRF2008) Station Position Residuals wrt IDSTRF014

IDS 09 – IDS 03

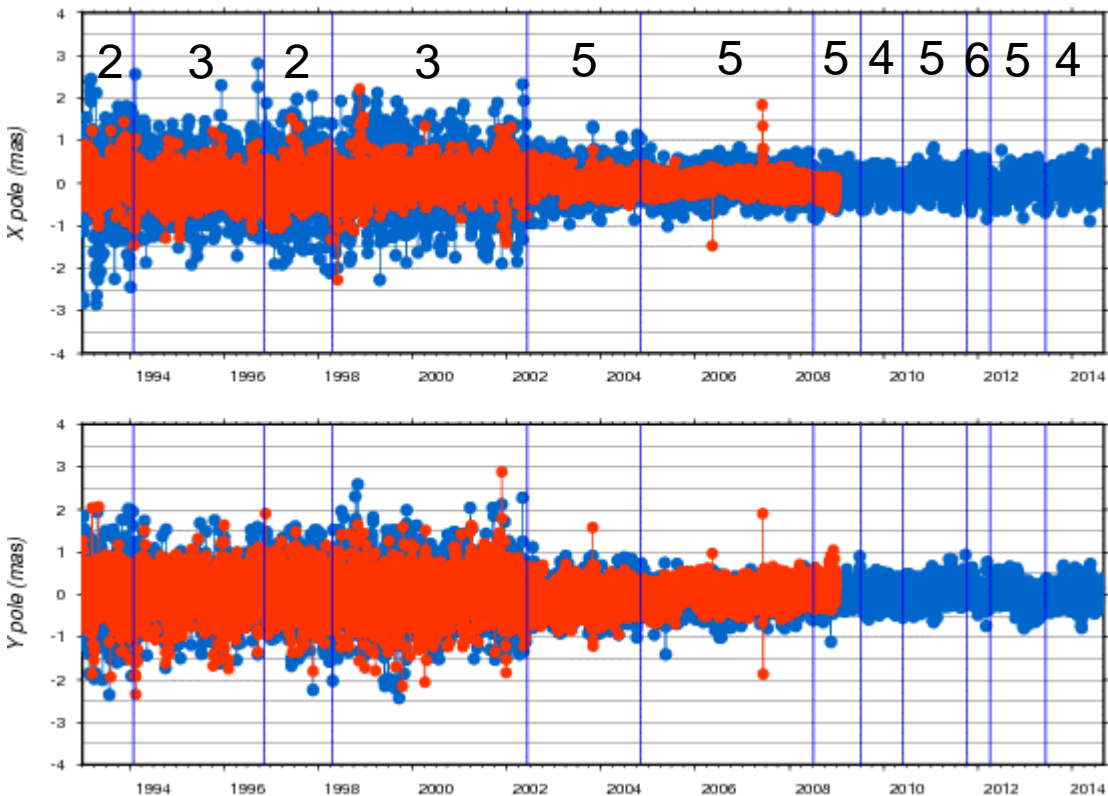
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- Substantial degradation from 1993 to mid-2002.
 - ✓ Mainly in the East direction.
 - ✓ Smaller differences if IDS 09 network is set to IDS 03 mean diff. decreases from 4 to 1.7mm).
- Slightly better performances since mid 2002 thanks to beacon frequency offset estimations.
- North direction gives best performances.
- Results improved when more satellites are available and with new DGXX receivers.
 - ➔ Below 10mm after including Jason-1 (late 2004).
 - ➔ Around 7-8 mm since late 2011 (HY-2A adding).

IDS 09 (ITRF2014) vs IDS 03 (ITRF2008) EOPs differences wrt IERS C04 series

IDS 09 – IDS 03



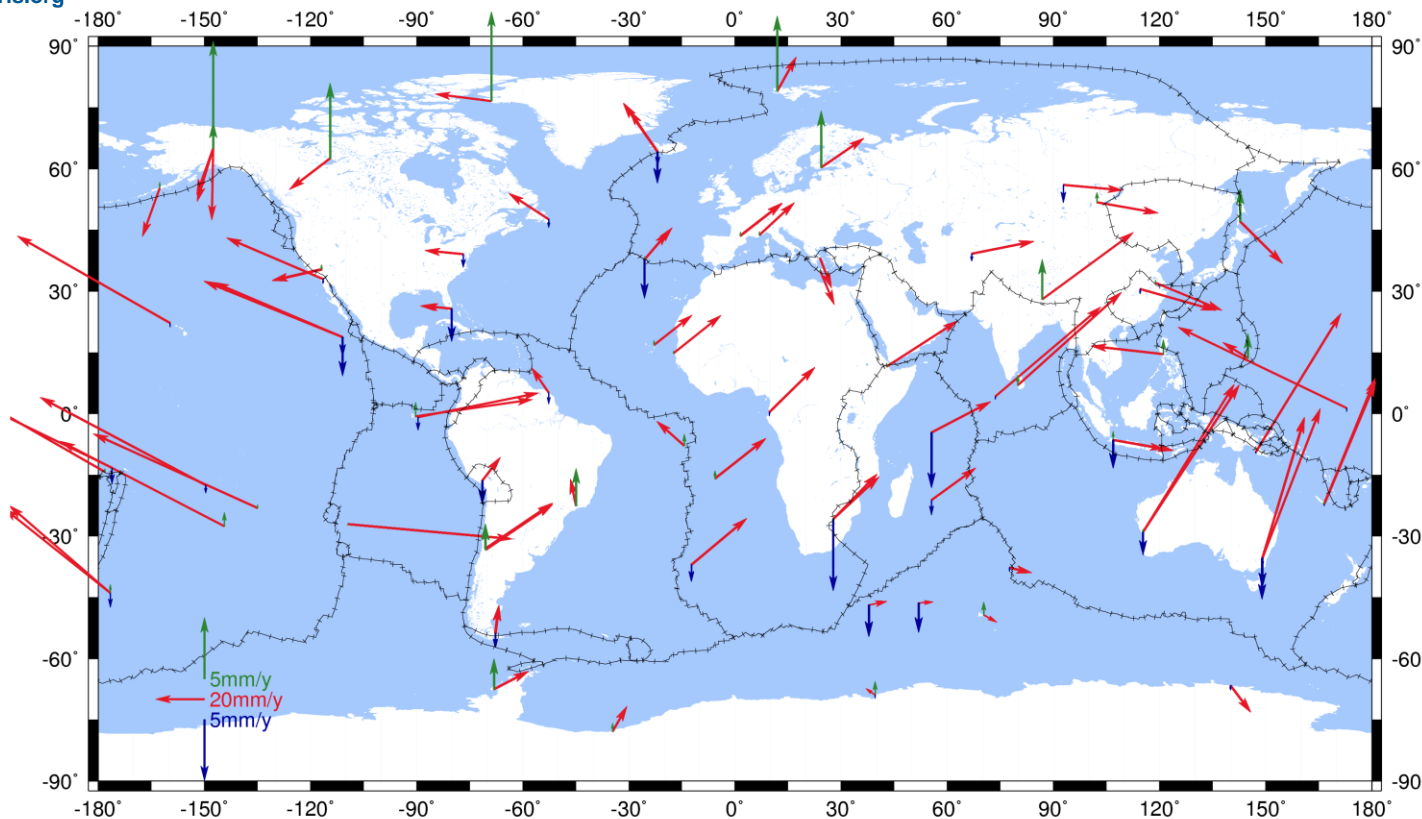
❑ Substantial degradation from 1993 to mid-2002 on X pole mainly (2 ACs less compared to ITRF2008).

❑ X-pole differences present draconitic periods of 118 days (TOPEX, Jason-1/2).

❑ Results are improved when more satellites are available.

Period of time	Std ΔX [mas]	Std ΔY [mas]
1996.00-2002.00	0.68	0.63
2002.50-2008.50	0.31	0.29
2008.67-2014.67	0.24	0.23

Velocities from IDS 09 Cumulative Solution



- From 1130 IDS 09 weekly SINEX files over time span 1993.0 – 2014.67
- Makes use of 96 DORIS-DORIS tie vectors and 132 velocity constraints.
- IDS 09 (resp. IDS 03) counts 63 (resp. 53) position discontinuities
 - ✓ 34 (resp. 14) with seismic origin.
 - ✓ 11 (resp. 07) with beacon change origin.
 - ✓ 18 (resp. 32) with unknown origin.



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Summary of IDS contribution to ITRF2014

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- **For DORIS**

- 6 Analysis Centers.
- 21,67 years of data (1993-2014.67).
- Up to 12 DORIS missions.

- **Results improved**

- **With beacon frequency variations included: removes sporadic jumps in the station height for some stations as well as scale jump early 2002.**
- **With time variable gravity field: reduces periodic signal on translations.**
- **With Jason-1 SAA corrected data.**
- **With new DGXX satellites.**
- **3D positioning is at 7-8 mm from 2010 onward.**

- **New DORIS missions (2015)**

- Jason-3 (July).
- Sentinel-3A (October).

- **IDS beacon network**

- Deployment of new generation of antennae where phase center location is controlled to ± 1 mm.

- **IDS main studies**

- New missions data (format and contents) → use of DORIS RINEX data.
- Scale increase mid 2012.
- SPOT5 scale pattern.

- **Next IDS Analysis Working Group**

- Toulouse, May 28-29th.
- Washington (October, TBC).

- **DORIS Special Issue in Advances in Space Research (submission deadline: May 31st, 2015).**



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