

Abstract

Since the delivery of the ITRF2014, the IDS (International DORIS Service) Combination Center (CC) has completed different studies to improve the quality of the DORIS contribution to the next ITRF realization. These studies can be split into two categories depending on whether they concern the IDS CC itself or the IDS Analysis Centers.

Compared to the DORIS contribution to the ITRF2008, the IDS-combined solution, delivered for the ITRF2014, showed a slight degradation in terms of both station positioning and Earth orientation parameters from 1993.0 to 2002.0. Afterwards, the IDS CC completed a new weekly combined solution using a new preprocessing of the multi-satellite solutions from the six IDS ACs. The presentation will demonstrate that the new parameterization performs as well as the IDS contribution to the ITRF2008 for the time period 1993.0-2002.0 without any degradation for the most recent time period.

Then, the IDS CC will introduce the next generation of DORIS ground beacons which must allow better performances due a longer distance between the beacon and the antenna. Finally, the IDS CC will present some new on-line tools related to the IDS CC products.

IDS Combined Series Performances

Statement: The IDS contribution to the ITRF2014 performs less than the IDS contribution to the ITRF2008 in terms of positioning and EOPs over the time period 1993.0-2002.0 (see Moreaux et al., 2016).

Objectives: Development of a new combination strategy to improve the station position and EOP performances to challenge the ones from the IDS contribution to ITRF2008 from 1993.0 to 2002.0.

IDS Weekly Combined Series:

	IDS 01	IDS 09	IDS 99
Context	IDS contribution to ITRF2008	IDS contribution to ITRF2014	Test series
Time Period	1993.0-2008.0	1993.0-2014.0	1993.0-2014.0
Contributors	7 – esa 03, gau 08, gop 31, gsc 10, ign 08, ina 03, lea 24	6 – esa 10, gop 43/46, gsc 26, ign 15, ina 08, lea 40	5 – gop 43/46, grg 40, gsc 29, ign 15, ina 10
Specificities		<ul style="list-style-type: none"> Use of ground antenna phase laws. INA does not contribute to the scale. GOP and ESA do not contribute to the EOPs. 	<ul style="list-style-type: none"> Use of ground antenna phase laws. All ACs contribute to scale. GOP does not contribute to the EOPs. New preprocessing of AC solutions.

Table 9
Main statistics of WRMS of the station residuals from IDS 03 (ITRF2008) and IDS 09 (ITRF2014) series. Unit is mm.

Series id.	Time span	East		North		Up	
		Mean	Std	Mean	Std	Mean	Std
IDS 03	1993.0-2002.4	19.41	2.73	15.09	2.50	18.08	2.56
IDS 03	2002.4-2008.5	12.97	1.89	10.25	1.94	12.81	1.96
IDS 03	2008.5-2009.0	16.39	2.24	13.26	1.40	14.82	1.85
IDS 09	1993.0-2002.4	25.19	4.78	15.78	3.23	19.95	3.86
IDS 09	2002.4-2008.5	11.97	2.14	8.73	1.51	10.09	1.92
IDS 09	2008.5-2015.0	9.14	1.23	7.18	1.17	8.05	1.19

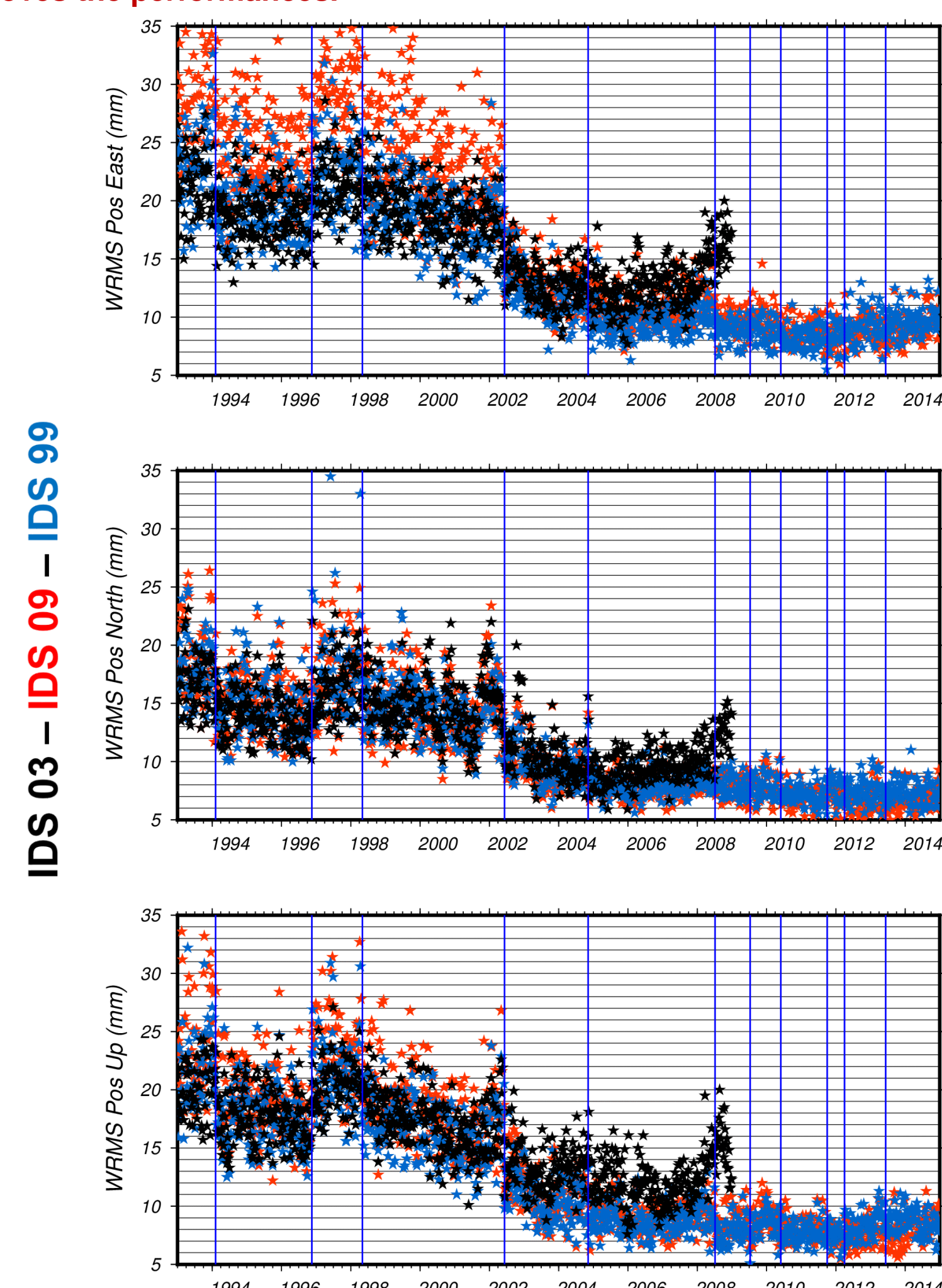
Statistics from Moreaux et al., 2016.
Reference = ITRF2014 / IERC04

Table 7
Main statistics of polar motions from IDS 03 (ITRF2008) and IDS 09 (ITRF2014) series. Unit are mas and mas/yr.

Series id.	Time span	X-pole			Y-pole		
		Trend	Mean	Std	Trend	Mean	Std
IDS 03	1993.0-2002.4	14.87	1.84	346.54	-2.91	-5.05	486.55
IDS 03	2002.4-2008.5	-13.19	1.82	177.38	44.53	0.17	257.77
IDS 03	2008.5-2009.0	-170.76	-1.06	159.65	193.12	1.60	239.32
IDS 09	1993.0-2002.4	10.76	-0.05	685.08	45.95	0.71	624.04
IDS 09	2002.4-2008.5	6.67	0.36	308.55	21.10	-0.26	292.93
IDS 09	2008.5-2015.0	24.44	-0.43	244.74	5.79	-0.02	234.75

- Weighted RMS of station position residuals wrt ITRF2014:
 - New test series IDS 99 performs better than IDS 09 (IDS contribution to ITRF2014) even with one AC less.
 - IDS 99 gives lower WRMS than IDS 03 (IDS contribution to ITRF2008) from 1998.3.
 - Worst performances in the East direction are due to a lack of information in the direction perpendicular to the satellite tracks.

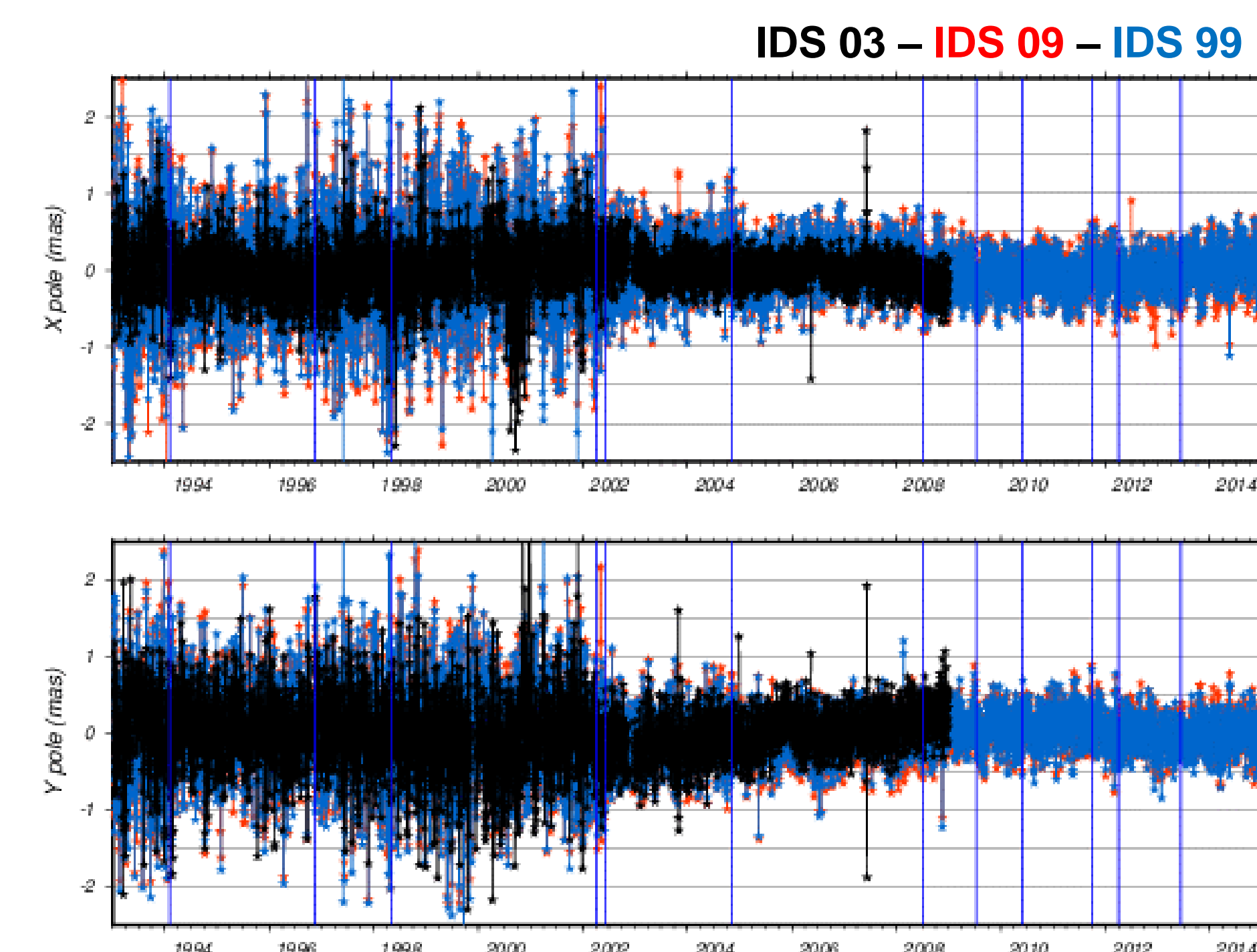
- IDS 99 mostly solves the drawback of the IDS 09 series.
- Including ESA contribution in the forthcoming IDS combined test series may further improve the performances.



Time Period	Nb of Sat.	Series	North	East	Up
1993.0-1994.1	2	IDS 03	16.9 ± 2.4	21.4 ± 2.7	20.1 ± 2.3
		IDS 09	19.0 ± 3.3	29.6 ± 5.0	24.2 ± 4.4
		IDS 99	18.2 ± 2.5	23.2 ± 3.3	21.9 ± 3.3
1994.1-1996.9	3	IDS 03	14.0 ± 2.0	18.8 ± 2.3	17.6 ± 2.3
		IDS 99	14.6 ± 2.5	19.4 ± 2.8	17.5 ± 2.4
1996.9-1998.3	2	IDS 03	16.5 ± 2.5	21.4 ± 2.5	20.6 ± 2.1
		IDS 99	17.7 ± 3.8	22.6 ± 3.5	21.1 ± 3.1
1998.3-2002.4	3	IDS 03	14.8 ± 2.4	18.7 ± 2.5	17.2 ± 2.4
		IDS 99	14.7 ± 2.7	23.1 ± 4.1	18.3 ± 3.0
2002.4-2004.9	5	IDS 03	10.7 ± 2.5	12.9 ± 1.7	13.4 ± 1.9
		IDS 99	9.6 ± 1.5	11.8 ± 1.7	10.7 ± 1.9
2004.9-2008.5	5	IDS 03	9.6 ± 1.4	12.7 ± 1.9	12.0 ± 1.9
		IDS 99	8.0 ± 0.9	10.9 ± 1.5	9.1 ± 1.2

- EOP differences wrt IERS C04 series aligned to ITRF2014:
 - New test series IDS 99 performs as well as the IDS 09.
 - Still a degradation in the X-pole compared to the IDS 03 series.
 - Degradation may be explained by the fact that ESA (which one the best EOP contributors in 2008) and GAU (nota anymore active) are not included in the IDS 09 and 99 series.

Further investigations.

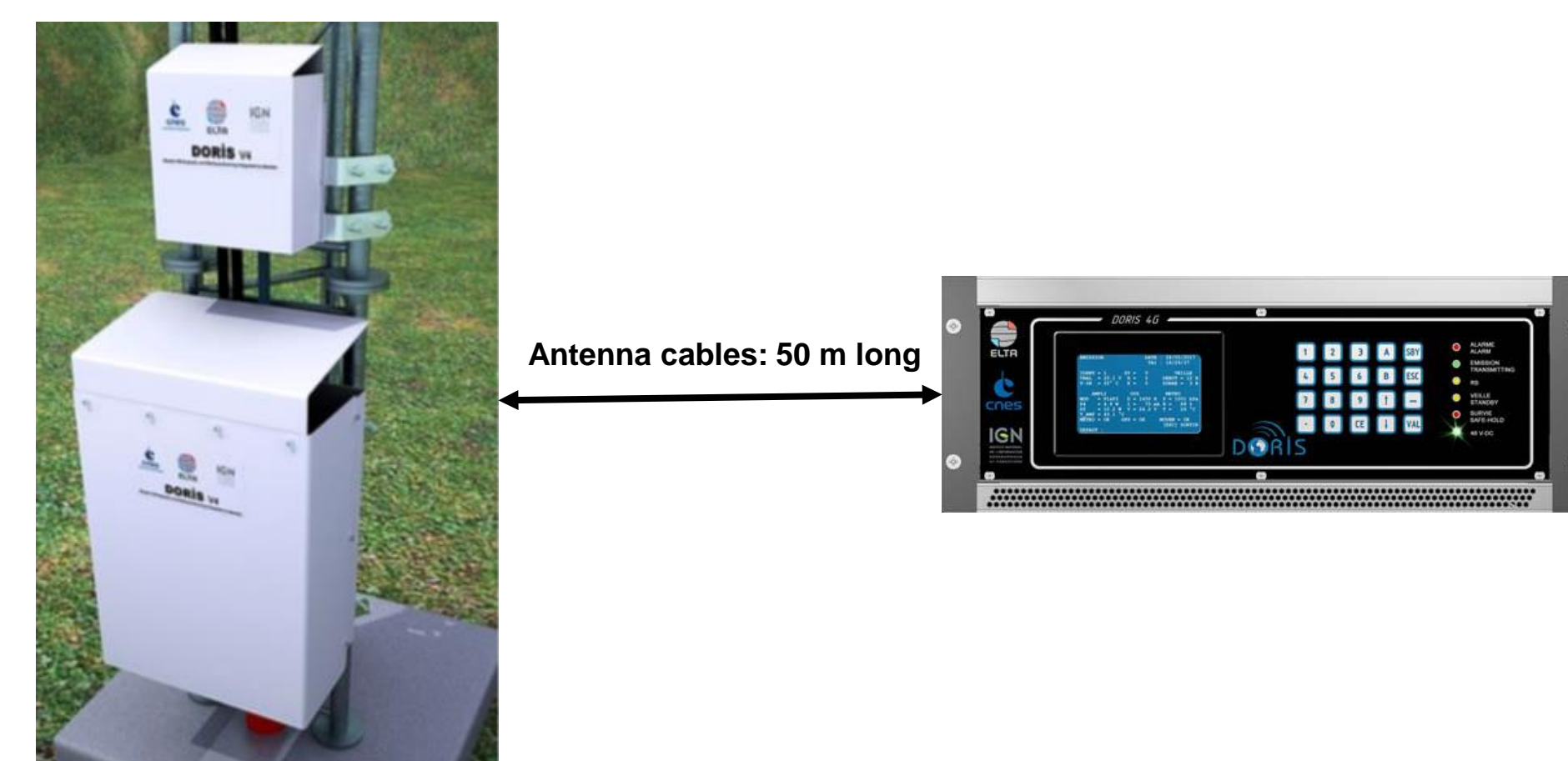


Statistics of the EOP differences wrt IERS C04 (units: mas, mas/yr).

Series	XPO			YPO		
	Trend	Mean	Std	Trend	Mean	Std
IDS 03	-0.006	0.002	0.294	-0.020	-0.004	0.401
IDS 09	0.006	0.000	0.490	0.000	0.000	0.468
IDS 99	0.007	0.000	0.488	0.000	0.000	0.470

4th Generation of DORIS Ground Beacons

- Up-to-date electronic components: to be operational up to 2033.
- Signal amplifier at the foot of the antenna: longer distance between beacon and antenna (up to 50 m vs. 15 m before).
 - finding better environment for the signal transmission.
- Deployment will start in mid-2019.

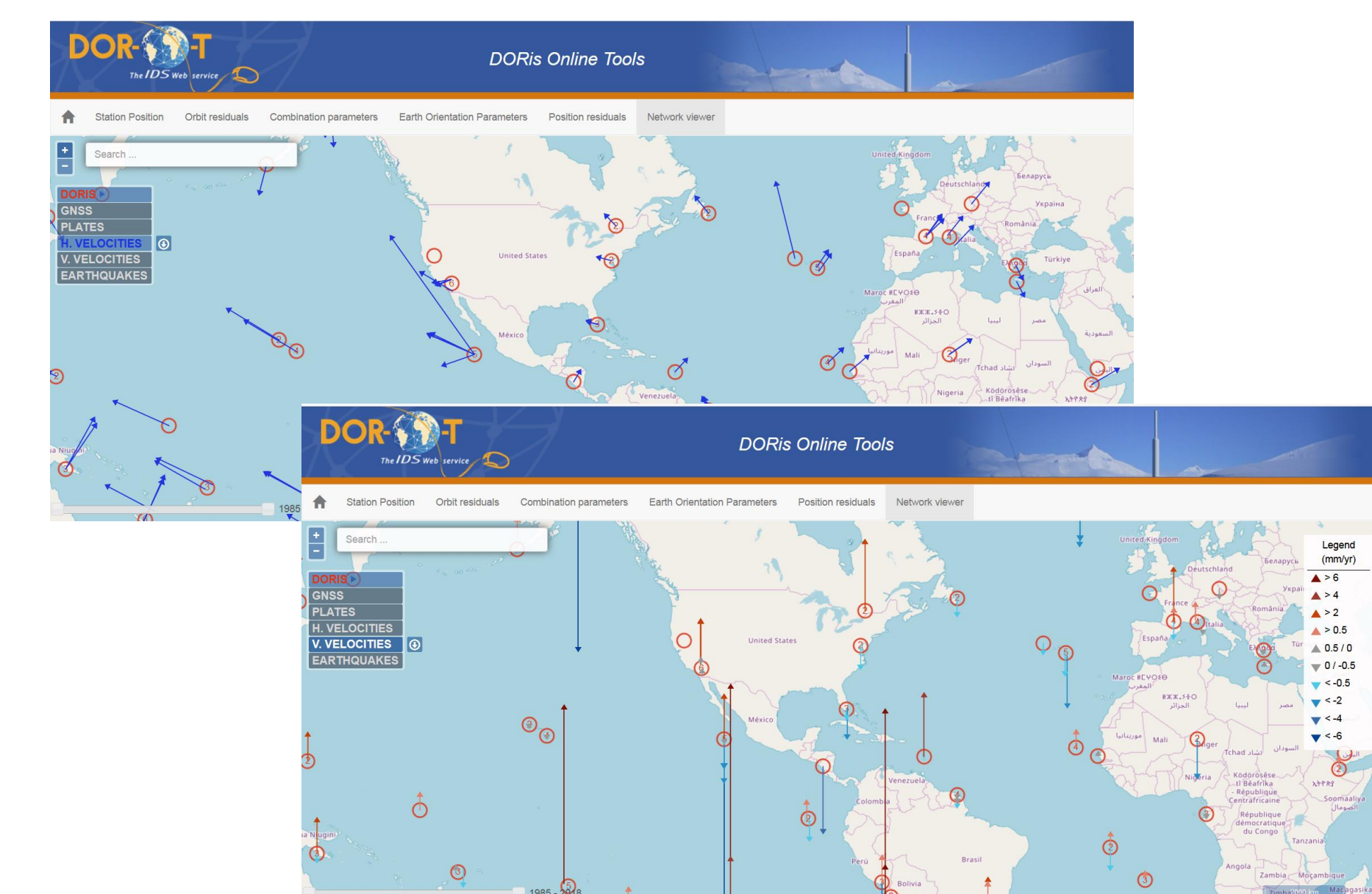


New Web Visualization Tools

The IDS aims at continuously developing new tools to interactively display and work with all the IDS products (orbits, stations positions, EOPs, transformation, parameters, DORIS position and velocity cumulative solutions...).

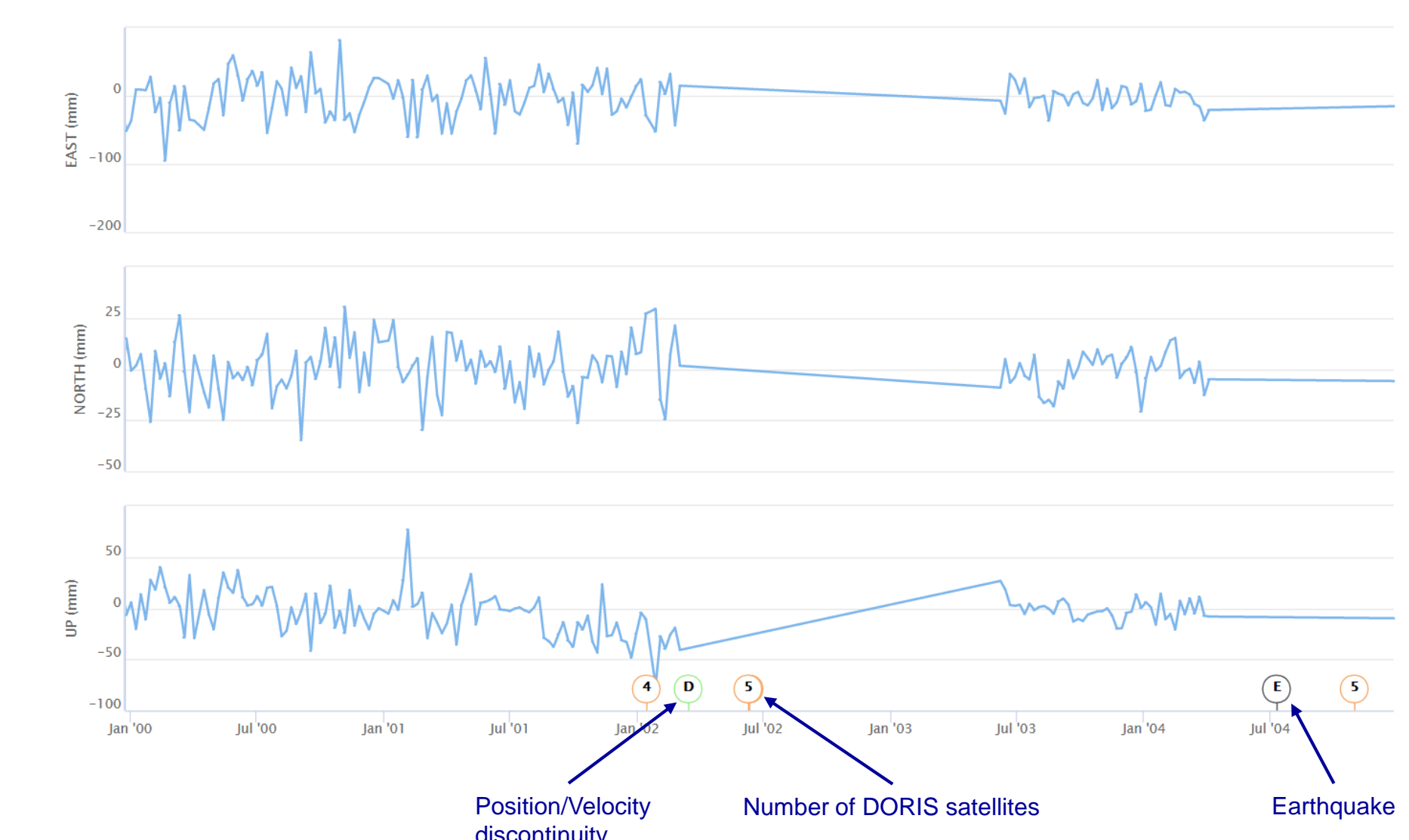
<https://apps.ids-doris.org/apps/>

- Horizontal and Vertical velocities from the DPOD2014 solutions (DORIS extension of ITRF2014 for precise orbit determination – Moreaux et al., 2018).



- Coordinate time series of station position residuals from the IDS position and velocity cumulative solutions.

- Options to superimpose:
- Earthquakes.
 - Position and/or velocity discontinuities.
 - Number of DORIS satellites.



References

- Moreaux, G., Lemoine, F.G., Capdeville, H., et al., 2016. The International DORIS Service contribution to the 2014 realization of the International Terrestrial Reference Frame. *Adv. Space Res.*, 58(12), 2479-2504, doi: 10.1016/j.asr.2015.12.021.
- Moreaux, G., Willis, P., Lemoine, F.G., et al., 2018. DPOD2014: A new DORIS extension of ITRF2014 for precise orbit determination. *Adv. Space Res.*, in press, doi: 10.1016/j.asr.2018.08.043

Contact: gmoreaux@cls.fr