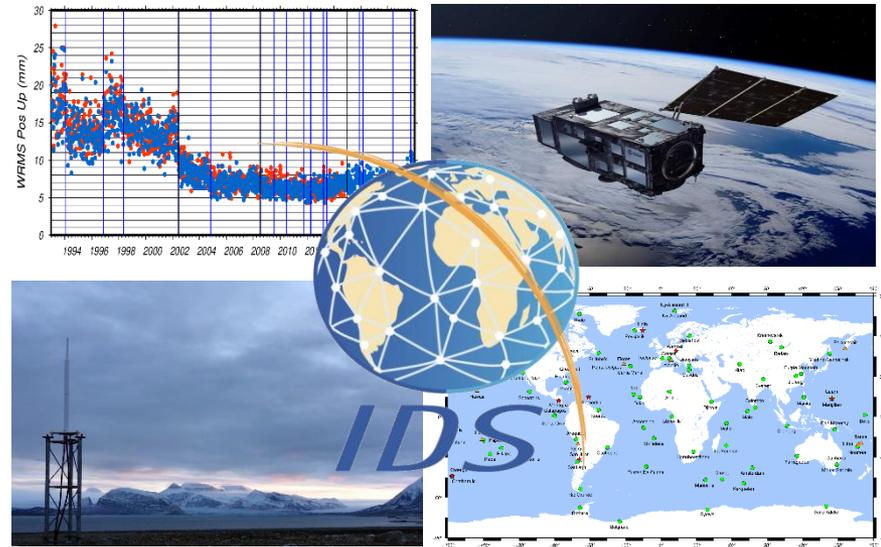


DPOD2020: a DORIS extension of ITRF2020 for Precise Orbit Determination

Guilhem Moreaux (CLS), Frank Lemoine (NASA), Nikita Zelensky (UMD), Alexandre Couhert (CNES) and John Moyard (CNES)



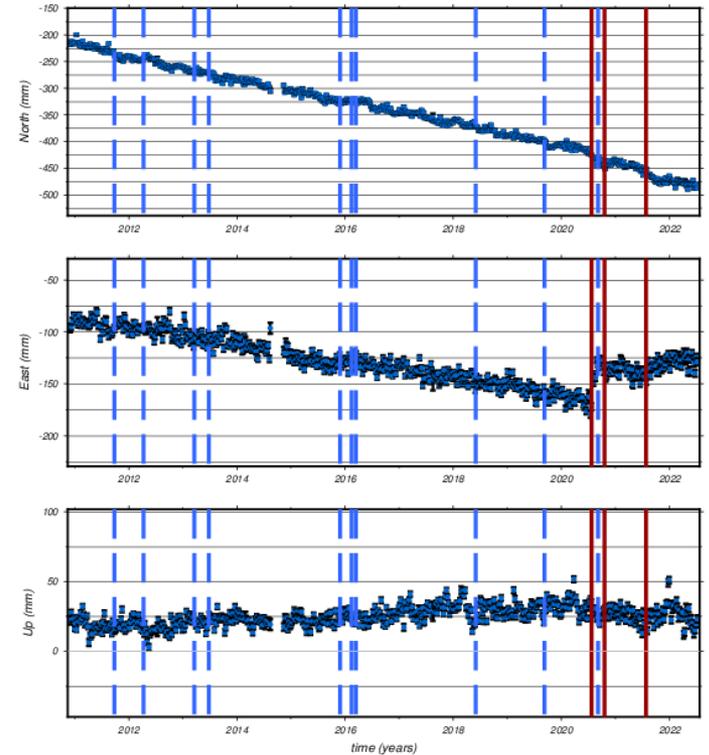


DPOD2020: Motivations

The DPOD solutions were initiated to overcome some intrinsic drawbacks of each ITRF realization:

- ❑ Addition of new stations to the tracking network after the end of the ITRF defined time span (ex: SJVC, SVBC).
- ❑ Stations may be affected by position and/or velocity discontinuities that occur after the release of the ITRF realization (ex: COBB – M8.2 EQ in 2021/07/29).
- ❑ Positions and velocities may be improved by using data over a longer time span.
- ❑ Some problems in data processing might be found after the computation of the ITRF.

ids22wd03 - COBB (Cold Bay)



History of Missions - Legend	
●	2011/09/26 - HY2A (start)
●	2012/04/09 - Envisat (end)
●	2013/03/17 - Siazal (start)
●	2013/06/20 - SPOT4 (end)
●	2015/11/29 - SPOT5 (end)
●	2016/02/14 - Jason3 (start)
●	2016/03/13 - Sentinel3A (start)
●	2018/06/03 - Sentinel3B (start)
●	2019/09/08 - Jason2 (end)
●	2020/09/06 - HY2A (end)

Event History-Discontinuity Legend	
●	2020/07/22 - Earthquake M7.8 SSE Perryville Alaska (263km)
●	2020/10/19 - Earthquake M7.6 SE Seward Point Alaska (208km)
●	2021/07/29 - Earthquake M8.2 SE Perryville Alaska (309km)



DPOD2020: Realization

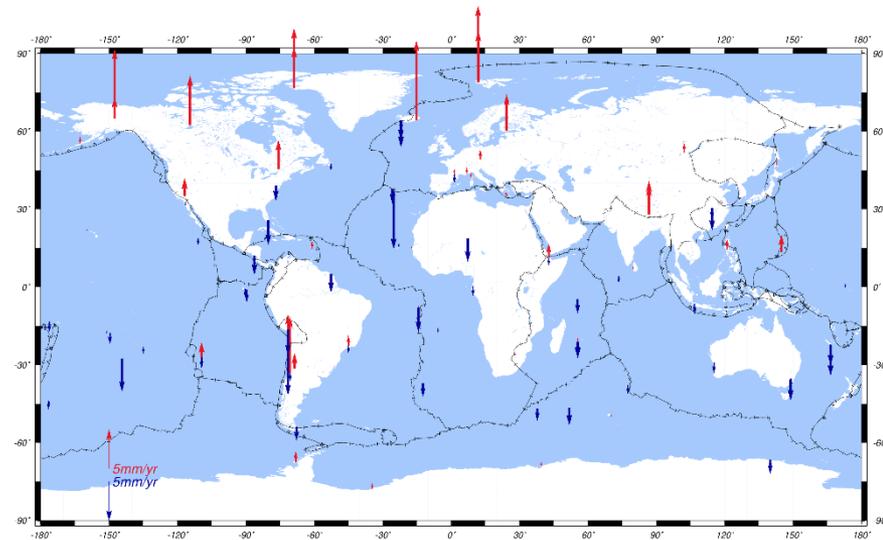
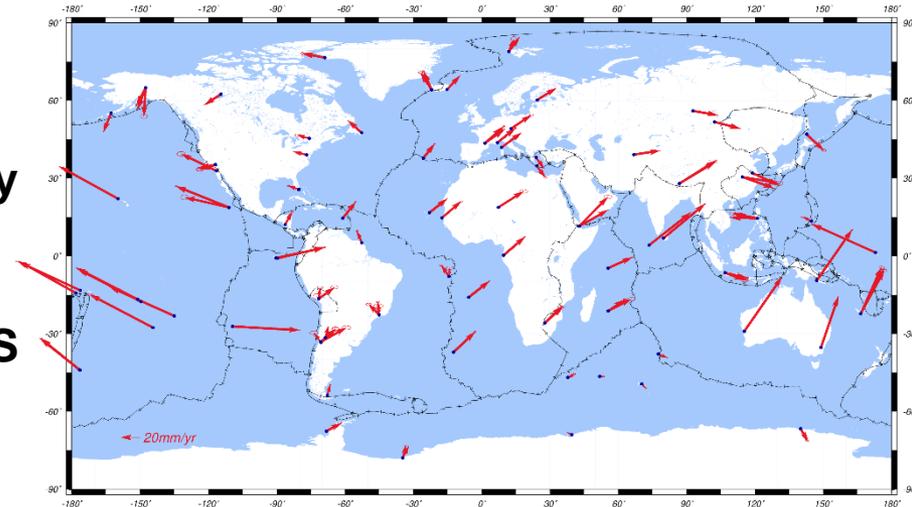
The DPOD2020:

- Is a DORIS cumulative position/velocity solution aligned to ITRF2020.
- Pure linear displacement model.
- To be uploaded on board of DORIS navigation software.

- IDS CC discontinuity file
(105 discontinuities @ 42 sites - 52 with geophysical origin).
- Velocity continuity constraints.
- Stacking using DORIS-to-DORIS ties.

- Velocities of new sites with very short observation time spans are constrained to velocities deduced from GNSS/SLR/VLBI ITRF2020 colocated stations.

- Updated twice a year.

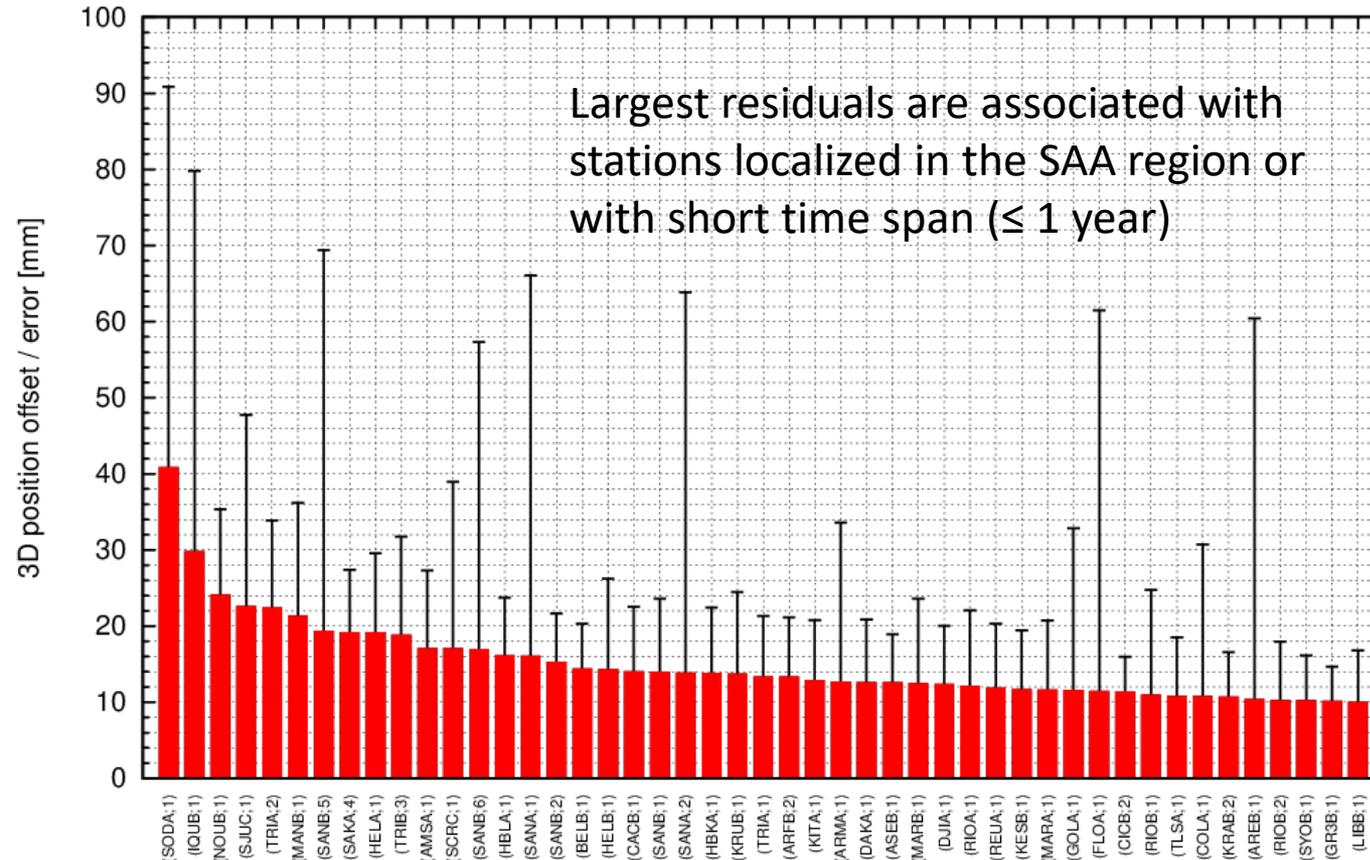


**DPOD2020 v01 includes 211 stations @ 88 sites.
46 of the 88 sites are free of any discontinuity.**

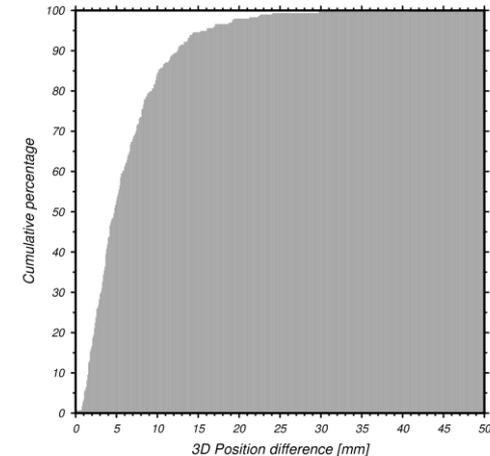


DPOD2020 v01 vs ITRF2020

Coordinate differences estimated at the mean epoch of each time segment of each station



#	294
Max	40.9
Median	4.8
RMS	8.0
Mean	6.2
STD	5.1



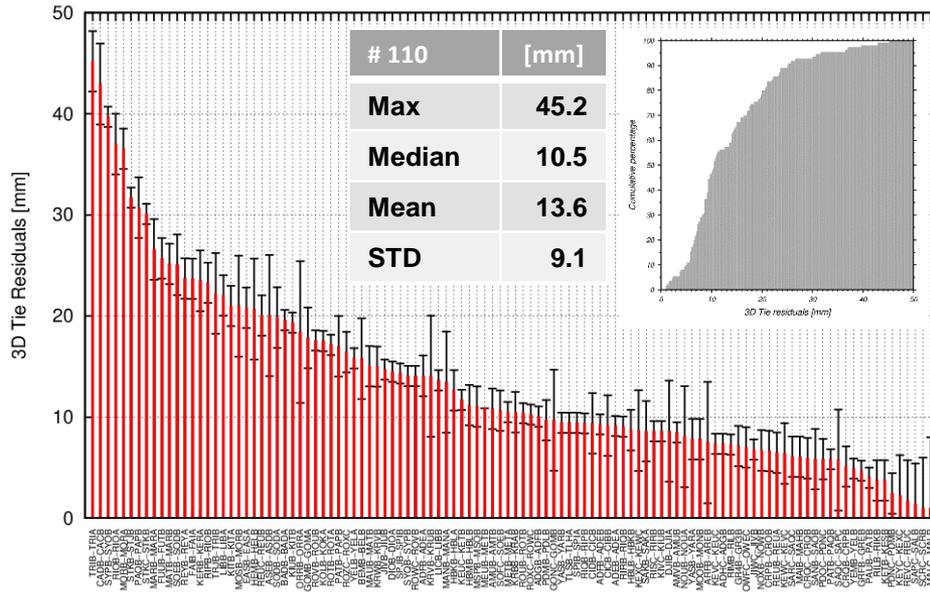
75% of the 3D differences are smaller than the position errors.
80% of the 3D differences are smaller than 10 mm.



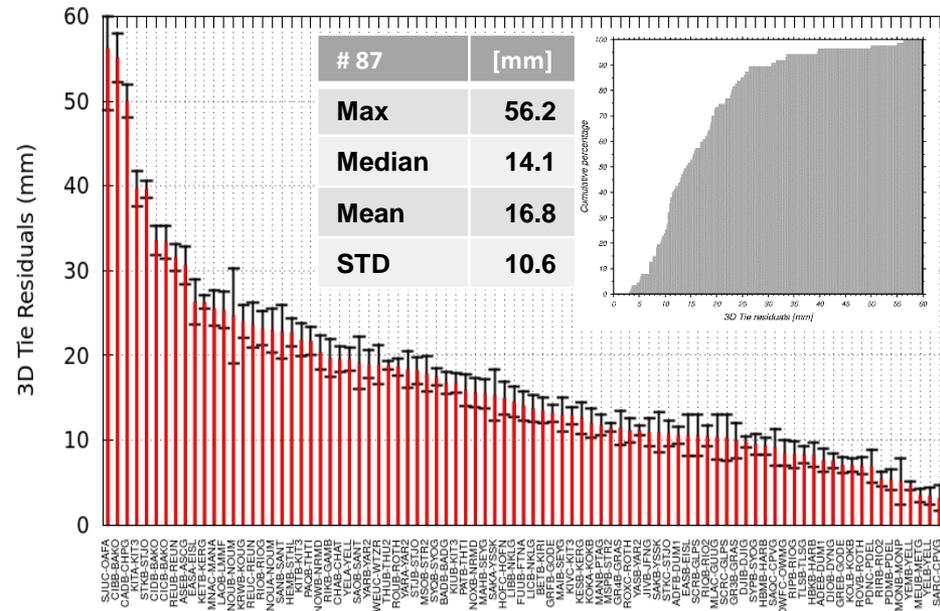
DPOD2020 v01 vs DORIS-to-DORIS/GNSS surveyed ties

Coordinate differences estimated at the date of the surveyed ties
GNSS station positions are estimated from ITRF2020 with PSD corrections.

DORIS-to-DORIS ties



DORIS-to-GNSS ties



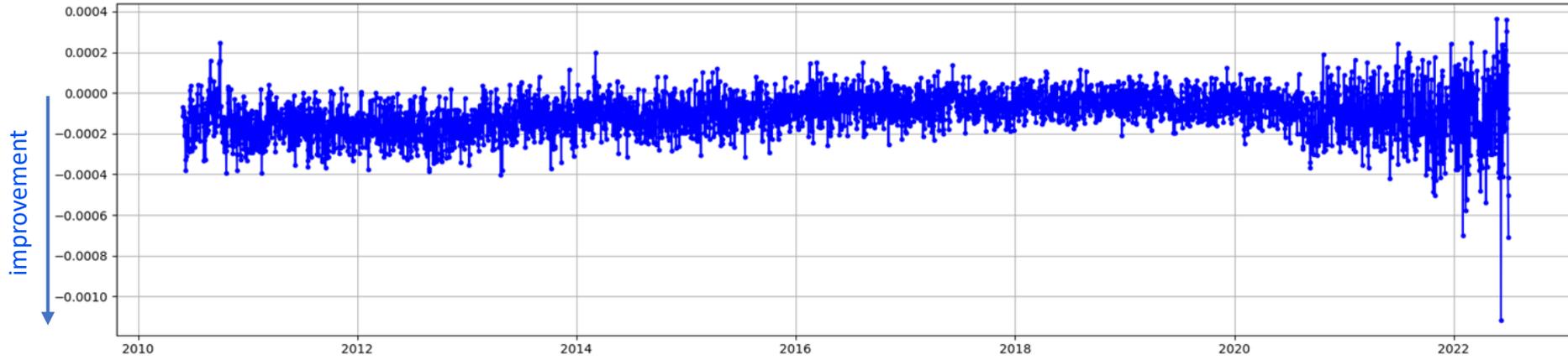
80% of the DORIS-to-DORIS tie residuals are smaller than 20 mm.
80% of the DORIS-to-GNSS tie residuals are smaller than 23 mm.



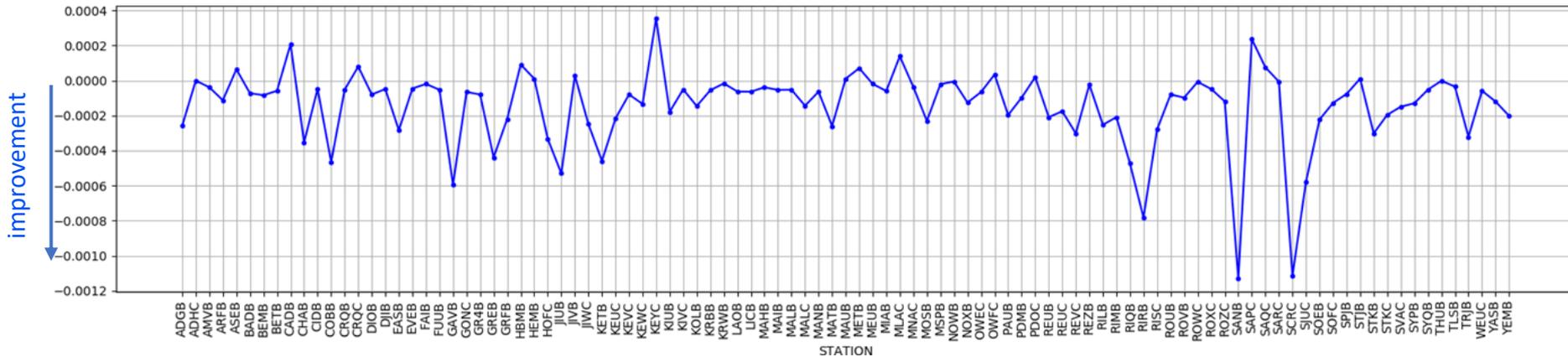
DPOD2020 v01 vs DPOD2014

Validation based on CNES DORIS CRYOSAT-2 Reduced Dynamic orbits
The graphics show the differences of weighted DORIS RMS between both DPOD versions.

DPOD2020 – DPOD2014, weighted RMS by day (cm)



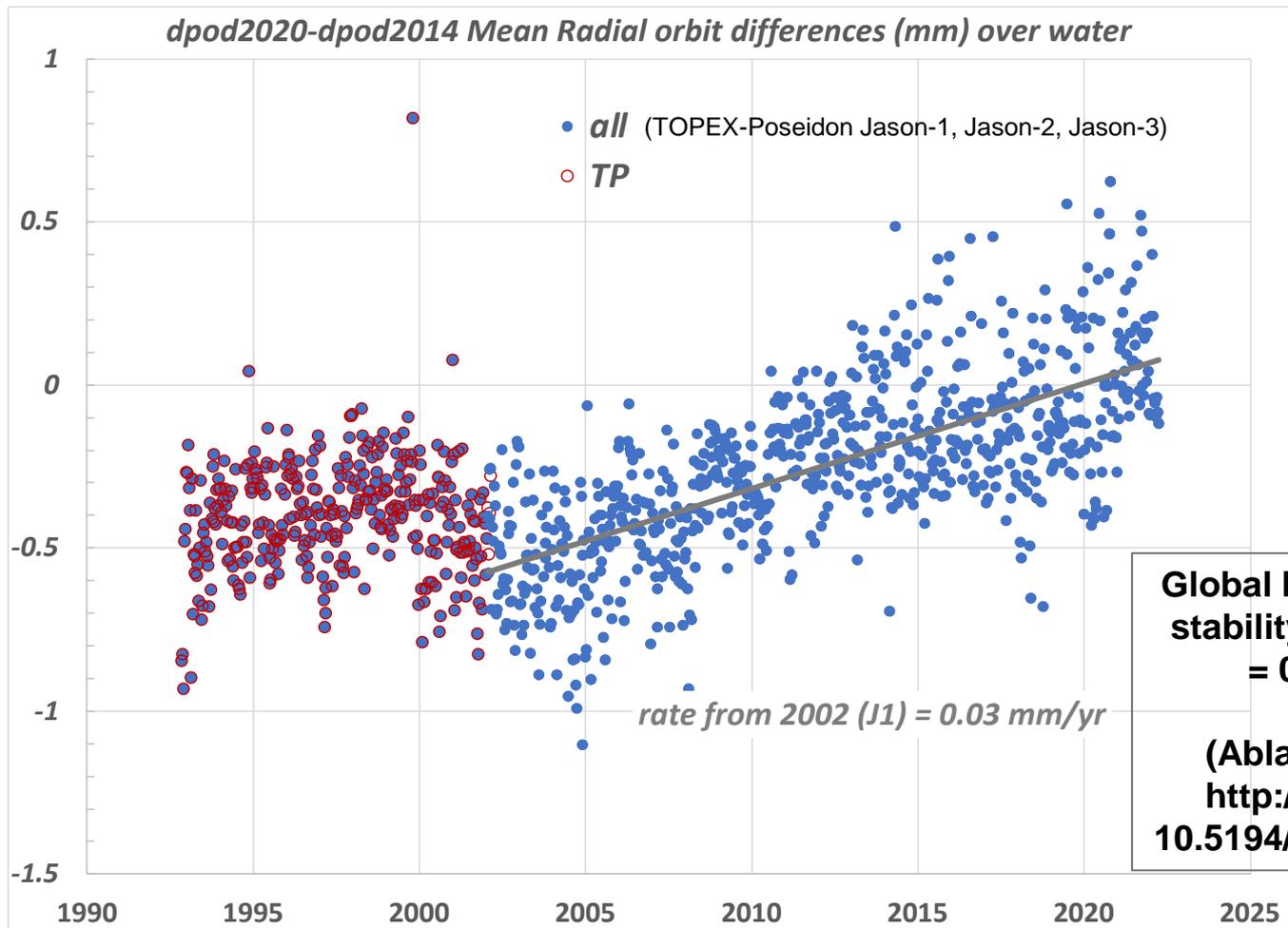
DPOD2020 – DPOD2014, weighted RMS by station (cm)



An improvement with DPOD2020 can be seen for most of the DORIS stations.



DPOD2020 v01 vs DPOD2014



Transition from DPOD2014 to DPOD2020 will have only negligible systematic altimeter satellite radial orbit impact.



DPOD2020 v01 vs DPOD2020 v01P

DPOD2020 v01P stands for DPOD2020 v01 with estimation of periodic signals (annual, semi-annual, two first Jason's draconitics)

Periodic signals over the entire time span of each site

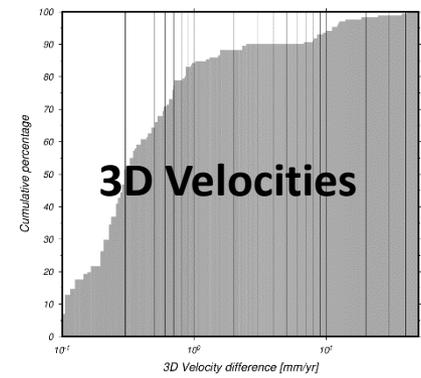
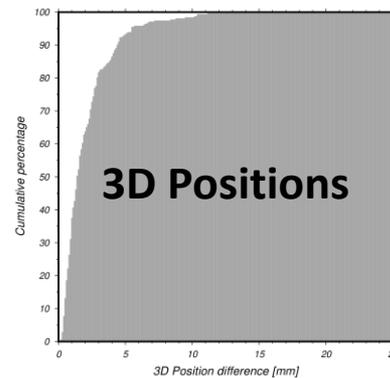
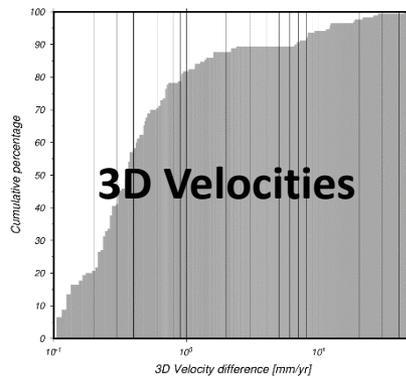
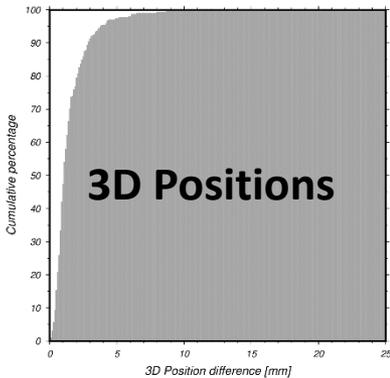
Periodic signals before and after adding Jason-2 (2008.5)

# 312	[mm]
Max	16.3
Median	1.1
RMS	2.1
Mean	1.5
STD	1.5

# 312	[mm/yr]
Max	61.8
Median	0.1
RMS	5.5
Mean	1.3
STD	5.4

# 312	[mm]
Max	17.5
Median	1.4
RMS	2.9
Mean	2.1
STD	2.1

# 312	[mm/yr]
Max	57.5
Median	0.1
RMS	7.4
Mean	1.7
STD	7.2



Largest differences are for sites with strongest periodic signals and short time span. 80% of the position (resp. velocity) differences are smaller than 2.5 mm (resp. 0.8 mm/yr).



DPOD2020: a DORIS extension of ITRF2020 for Precise Orbit Determination

❑ DPOD2020 is a DORIS cumulative position/velocity solution aligned to ITRF2020.

❑ DPOD2020 Version 1.0:

- ✓ Is based on the IDS combined solution from 1993.0 to 2022.0.
- ✓ Satisfied comparisons with ITRF2020 as well as with DORIS-to-DORIS and DORIS-to-GNSS surveyed ties.
- ✓ Shows slight better POD performance compared to DPOD2014 and ITRF2020.
- ✓ Will be released during AGU 2022.

❑ Impact of estimating periodic terms is on the way even if the DPOD2020 will remain purely linear for operational reasons.

