



# IDS REPORT 2022

*IERS Directing Board Meeting*

*April 23, 2023*

DORIS

IDS IERS members:  
Petr Stepanek (GOP)  
Jérôme Saunier (IGN)

Proxy: Laurent Soudarin (CLS)

## New elected members in the Governing Board for 2023-2026

- **Petr Štěpánek** (GO Pecný) was elected as the new **Analysis Coordinator**. He was part of the previous Analysis Coordination team with Hugues Capdeville. He will therefore continue this task for the next 4 years.
- **Laura Sanchez** (DGFI-TUM) succeeds Claudio Abbondanza in one of the positions of **Member-at-large**.

## Call for hosting one IDS station

The Governing Board has made its decision and will make it public as soon as it has been communicated to the last two groups competing in the final selection round.

## IDS 20th anniversary

A special event will be organized in Berlin to celebrate set up of the IDs as an IAG service on July 1st 2003; in preparation

## DORIS special issue (Advances in Space Research)

- Denise Dettmering and Ernst Schrama are ASR guest editors
- 8 papers are accepted in the special issue
- Final wording on the preface, galleys should be there soon.

## The IDS Newsletter #10 has just been released

<https://ids-doris.org/images/documents/newsletters/IDS-Newsletter10.pdf>

## Meetings

- IDS AWG meeting, 14. June 2022, online
- IDS Workshop, 31. Oct – 1. Nov 2022, Lido/Venice, Italy
- IDS AWG meeting, 18. Apr 2023, online

Next: IDS AWG meeting, September-November (TBD) 2023, Paris, France

**Training on DORIS data processing is being organised; target 2024**



**IDS**  
# 10  
April 2023  
Newsletter of the International DORIS Service

### DORIS is on SWOT

A new satellite recently joined the constellation of DORIS satellites. It is SWOT, launched on 16 December 2022. There are now nine active DORIS instruments. Never before have so many DORIS instruments been in operation simultaneously.

SWOT (Surface Water Ocean Topography) is a joint project developed by NASA and Centre National d'Etudes Spatiales (CNES) with contributions from the Canadian Space Agency (CSA) and United Kingdom Space Agency. Thanks to its new technical concept, a wide-swath interferometric altimeter named KaRin for Ka-band Radar Interferometer, the SWOT mission is the first satellite to address both ocean and hydrology objectives. It constitutes a major system design change for space altimetry.

SWOT includes the 1<sup>st</sup> DORIS receiver contributing to IDS and provides the DORIS constellation with a 4<sup>th</sup> orbit plane (78°). The instrument, a type DORIS receiver as on Jason-3, Sentinel-3a and Sentinel-3B, includes the DORIS navigation software (DORIS Immediate On-Board Determination) which processes the DORIS measurement to produce an estimation of the satellite orbit in real-time with a precision of a few centimeters.

On SWOT, the estimated orbit is used to drive the open loop tracking mechanism of the nadir altimeter Poseidon-3C supplied by CNES, and for the first time, DORIS also provides a 30-second prediction of the satellite position to KaRin, thus enabling better altimeter data acquisition in areas like coastal zones, inland waters and ice.

DORIS was switched on on 11 January 2023 and very quickly the analysis of DORIS's calculations showed excellent performance for orbit determination and time tagging. Once again, the instrument has proven its autonomy and reliability.

SWOT (© CNES / MIRA PRODUCTIONS)

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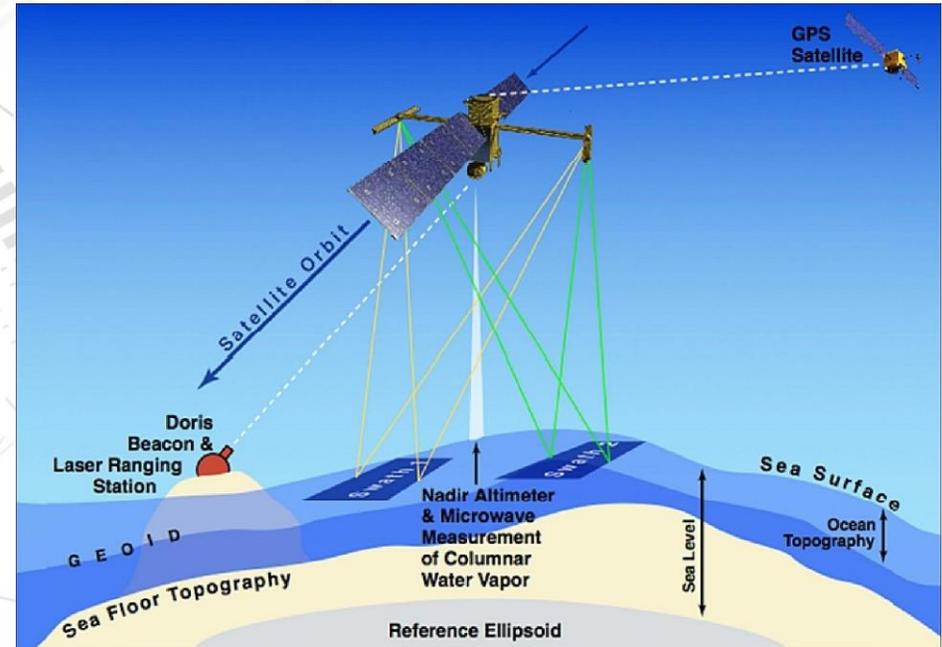
# SWOT



- ❑ New DORIS receiver equipped satellite
- ❑ Surface Water and Ocean Topography
- ❑ NASA/CNES mission + other contributions
- ❑ Altitude 860 km, inclination 77 deg, mass 2000 kg
- ❑ Launched December 2022
- ❑ First CNES POD results under discussion



SWOT (© CNES / Mira productions)





# The DORIS constellation 2023

## Past missions

Spot-2	Spot-4	Spot-5
Topex	Jason-1	Jason-2
Spot-3	Envisat	HY-2A

## Current missions

Cryosat-2	Sentinel-3A	Sentinel-6MF
Saral	Sentinel-3B	HY-2D
Jason-3	HY-2C	SWOT



**3 generations of DORIS instruments**



Number of tracked beacons: 1      2      7

**5 altitudes**

- 1336 kms
- 971 kms
- 891 kms
- ~800 kms
- ~700 kms

**4 orbit planes**



Studio Grafic CNES, 2022-145 - © Adobe Stock

# Active DORIS Satellites



□ 9 active satellites – historical maximum

Name	Cospar	Launch
SWOT	2217301	2022-12-16
HY-2D	2104301	2021-05-19
SENTINEL-6A	2008601	2020-11-21
HY-2C	2006601	2020-09-21
SENTINEL-3B	1803901	2018-04-25
SENTINEL-3A	1601101	2016-02-16
JASON-3	1600201	2016-01-17
SARAL	1300901	2013-02-25
CRYOSAT-2	1001301	2010-04-08



## ❑ Past Events

- April 2022: Shutdown of the Russian DORIS stations (Badary, Krasnoyarsk) following Russo-Ukrainian War: alternative sites under consideration
- June 2022: San Juan (Argentina) restarted after 2-yr outage due to Covid-19 lockdown
- Sep. 2022: Futuna (South Pacific) restarted after 2-yr outage
- Nov. 2022: Nouméa (New Caledonia) and Owenga (New Zealand) restarted

## ❑ Network reliability

- **Good rate of stations in operation: 90%** (6 stations down)
- More than half of the network stations equipped with the 4<sup>th</sup> generation beacon (deployment started from mid 2019)
- Gradual replacement of the Starec B antenna with Starec C: 26/59 stations equipped

## ❑ Planned Network Maintenance (2023)

- Station equipment replacement at Marion Island (South Indian Ocean)
- Antenna replacement at Rothera (Antarctic)
- Station equipment replacement at Santa-Cruz (Galapagos, Ecuador)
- Continuation of the 4<sup>th</sup> generation beacon deployment

## □ Recent Events

- April 13<sup>th</sup>, 2023: Commissioning of a new DORIS station at Hanga Roa (Easter Island)



## □ Short Term (2023)

- Station renovation at Everest (Nepal)
- New station installation in Gavdos Island (Crete, Greece): ESA calibration site
- Station renovation at Cachoeira Paulista (Brazil)
- New station installation in Katherine (NT, Australia): co-location with VLBI and GNSS
- Station renovation at Rikitea (French Polynesia)
- Station relocation at Syowa (Antarctic): co-location with VLBI and GNSS

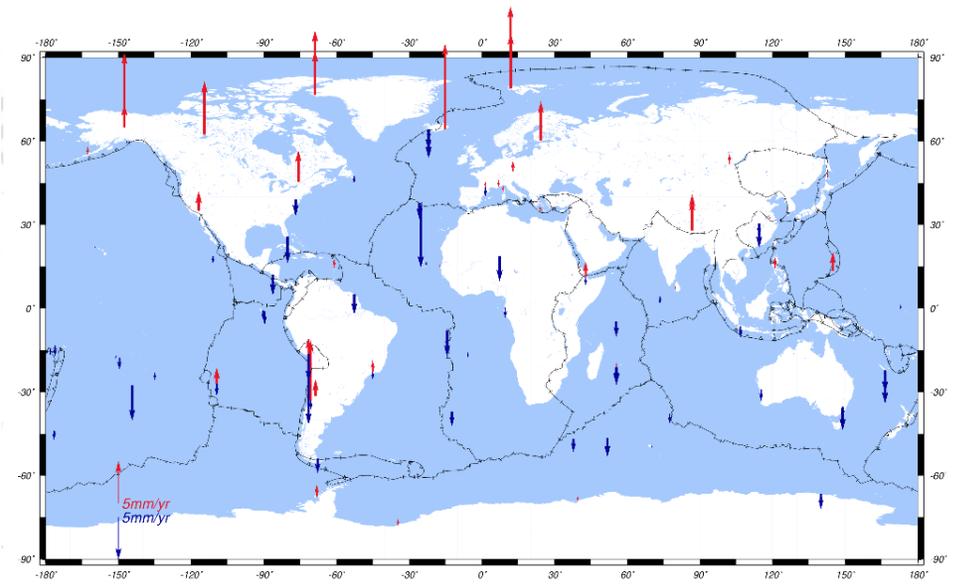
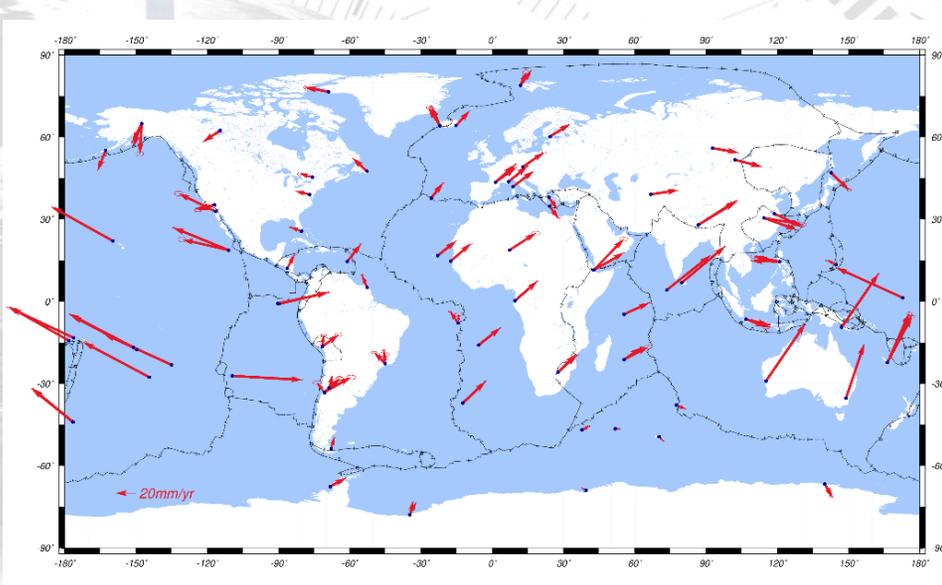
## □ Long Term

- New station in Ulaanbaatar (Mongolia)
- New station in Changchun (China): co-location with SLR and GNSS

# DPOD2020



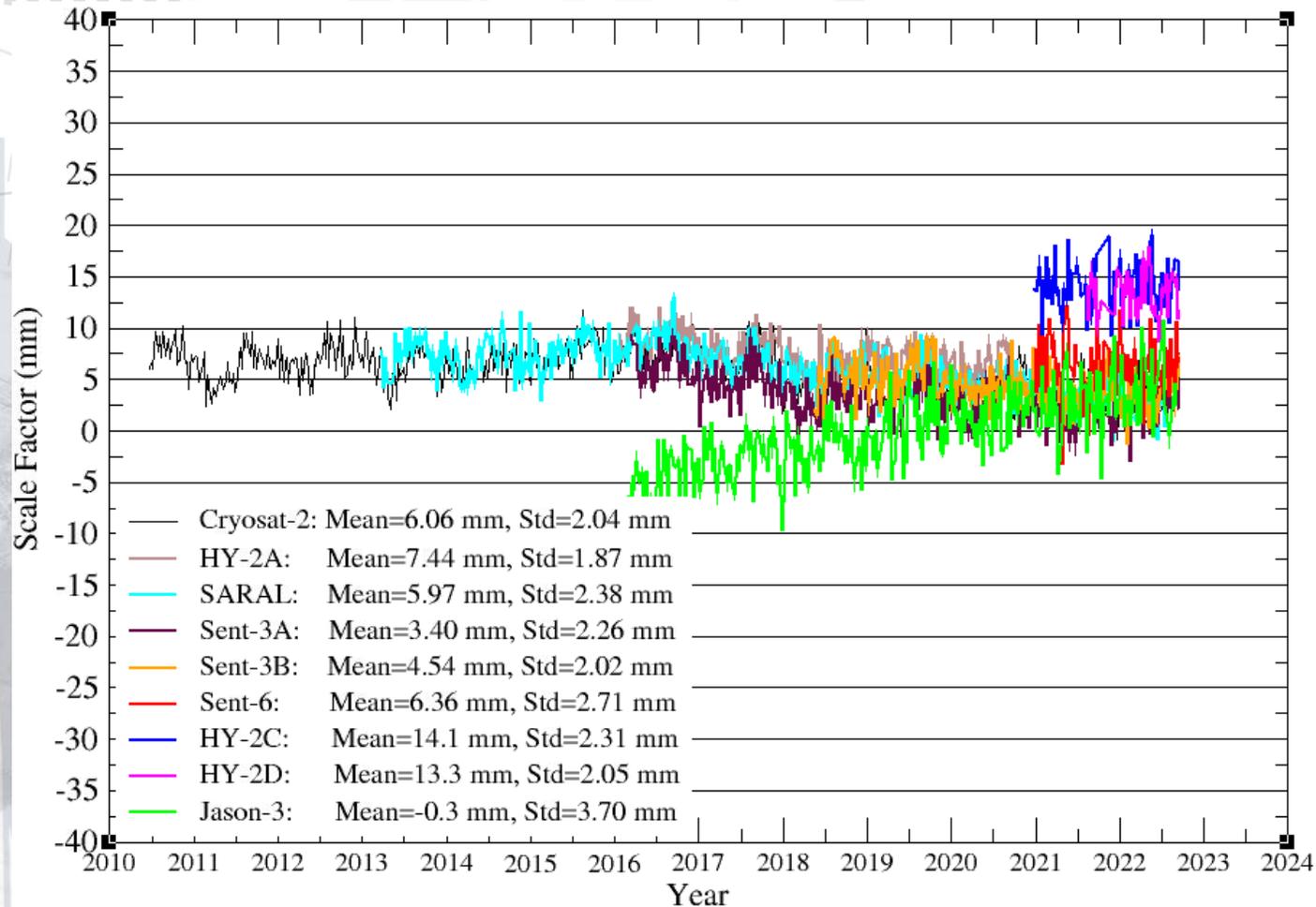
- ❑ DORIS cumulative position/velocity solution aligned to ITRF2020.
- ❑ Pure linear displacement model.
- ❑ IDS CC discontinuity file
- ❑ IDS CC velocity continuity constraints.
- ❑ Stacking using DORIS-to-DORIS ties.
- ❑ Updated twice a year
- ❑ Release of DPOD 2020 (v01)



# Single Satellite scale



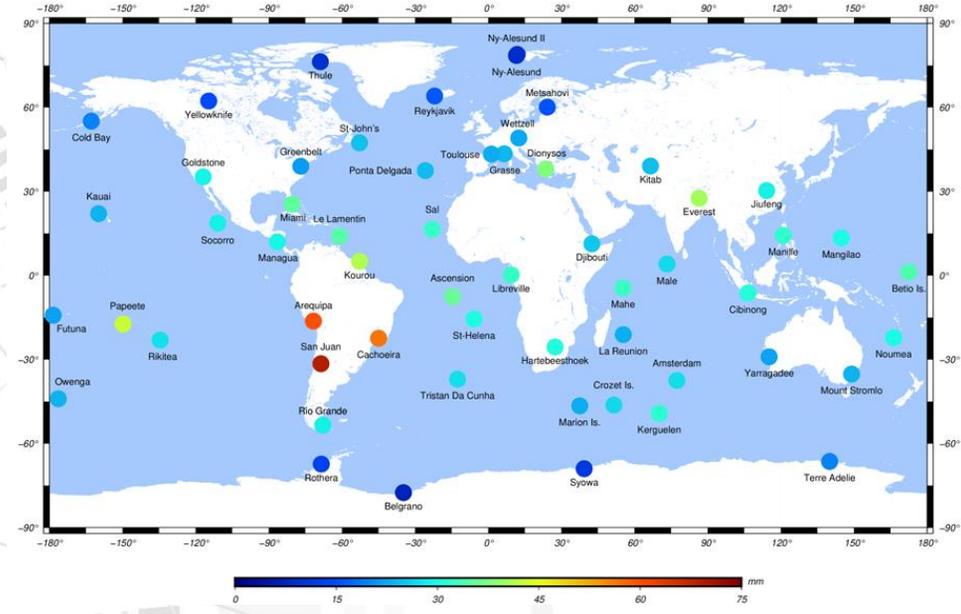
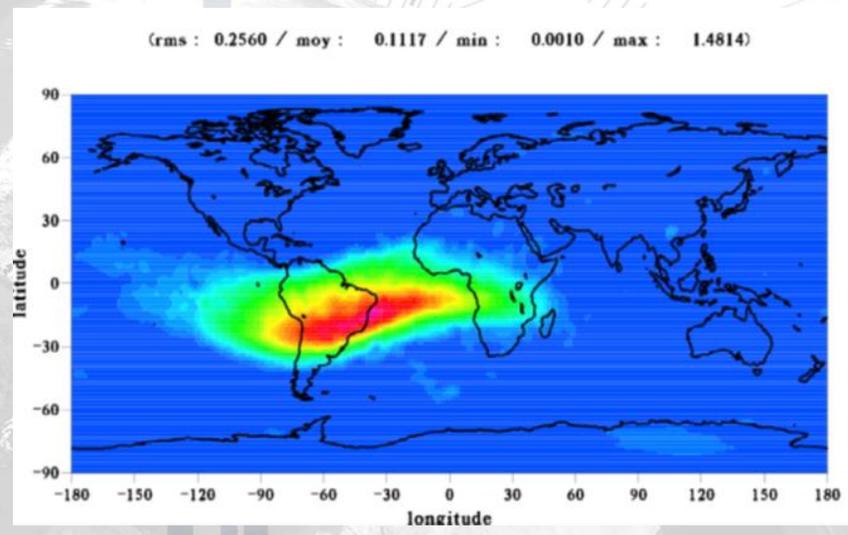
- **Scale bias for Hy-2C, Hy-2D**
  - **Similar problem occurred for Hy-2A in the past due to wrong center of mass vector. To be investigated.**



# South Atlantic Anomaly mitigation strategies



- ❑ Development of data corrective model
- ❑ Downweighting or elimination of data
- ❑ Using station name
- ❑ Estimate frequency bias and drift per satellite pass (instead of bias only)
- ❑ Usage of external (non-DORIS) data

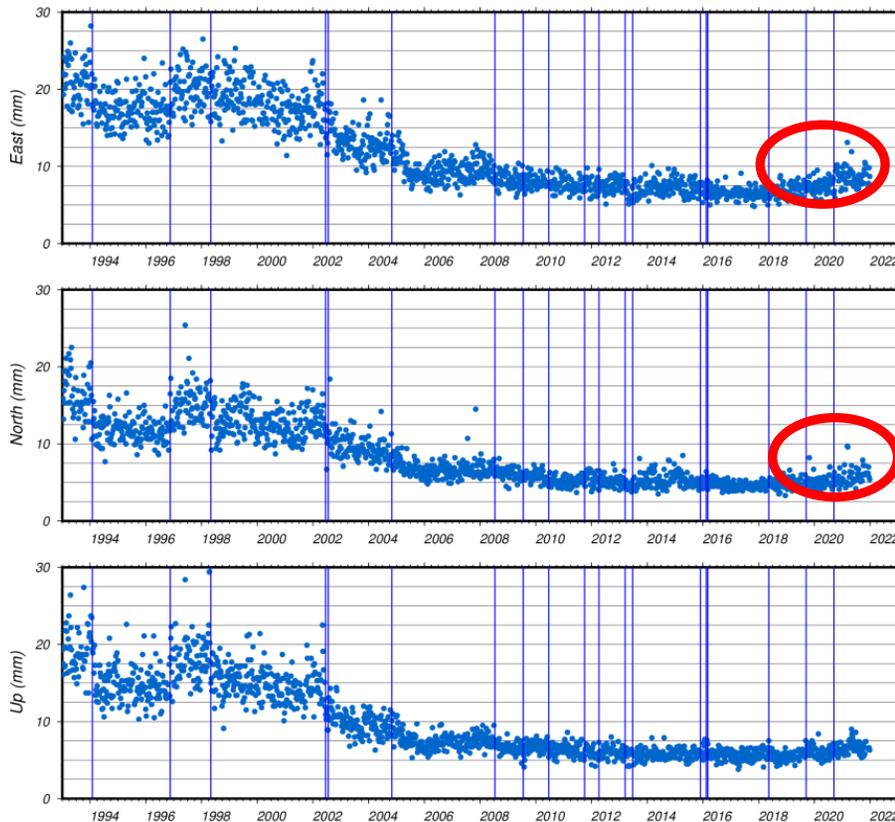


# Cumulative station position residuals

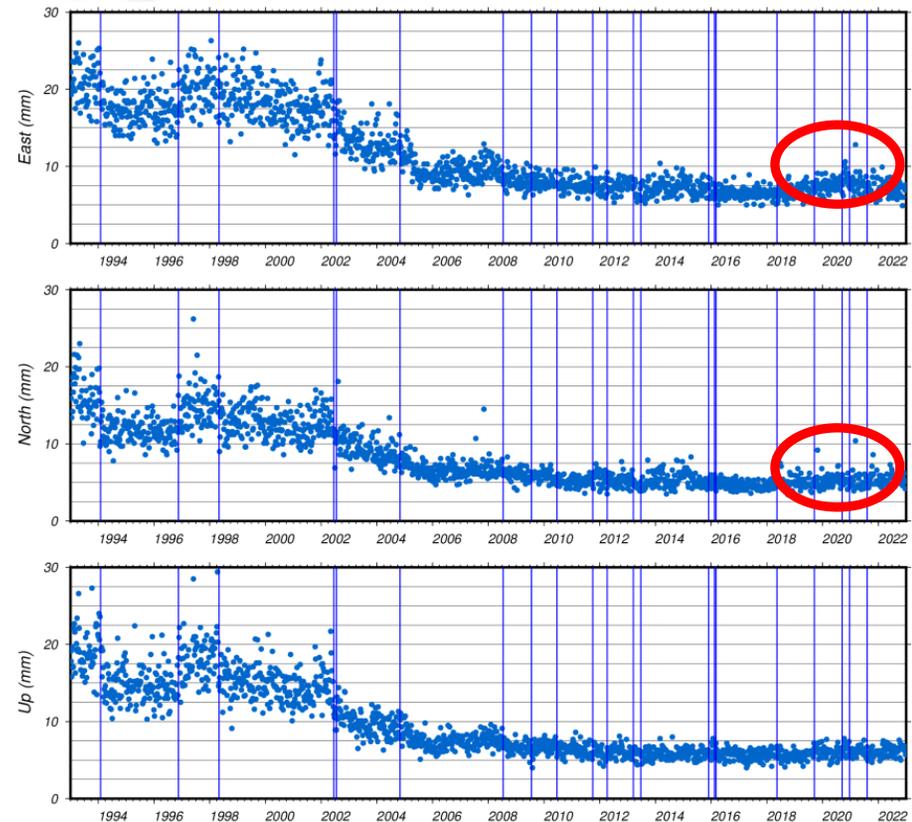


- ❑ After 2019 – Improvement using advanced South Atlantic Anomaly mitigation strategy

## GRG 43 (1993.0-2022.0)



## GRG 52 (1993.0-2023.0)



# Switch to ITRF2020



It is decided to switch to ITRF2020 for data from beginning of 2023, .i.e., delivery of SINEX files realised in June.





<http://ids-doris.org>