DORIS Network Status and Outlook

IDS Analysis Working Group, Athens, November 6th, 2025

Jérôme Saunier, IGN

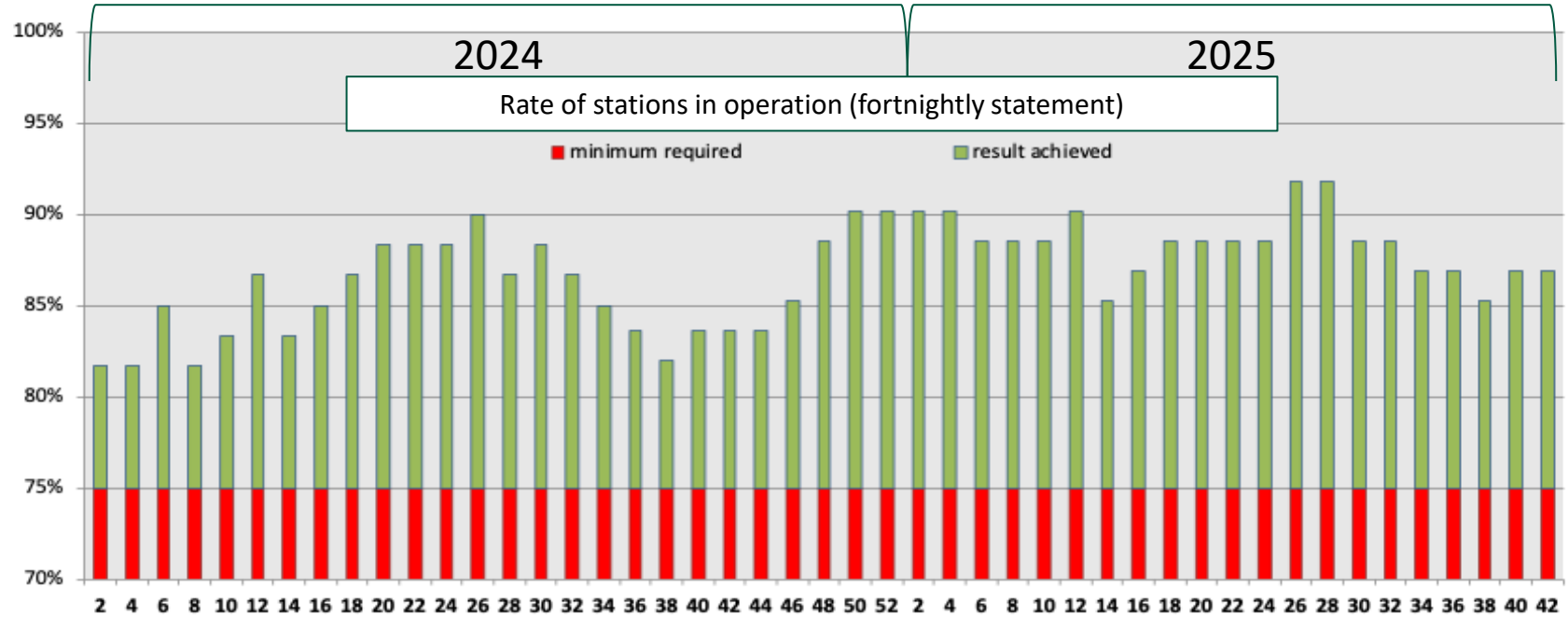
Distribution of the stations

Remaining coverage gaps over Pacific

85% Low-Earth Orbit coverage (800km) 97% coverage at 1300km altitude

Network Availability 2024-2025

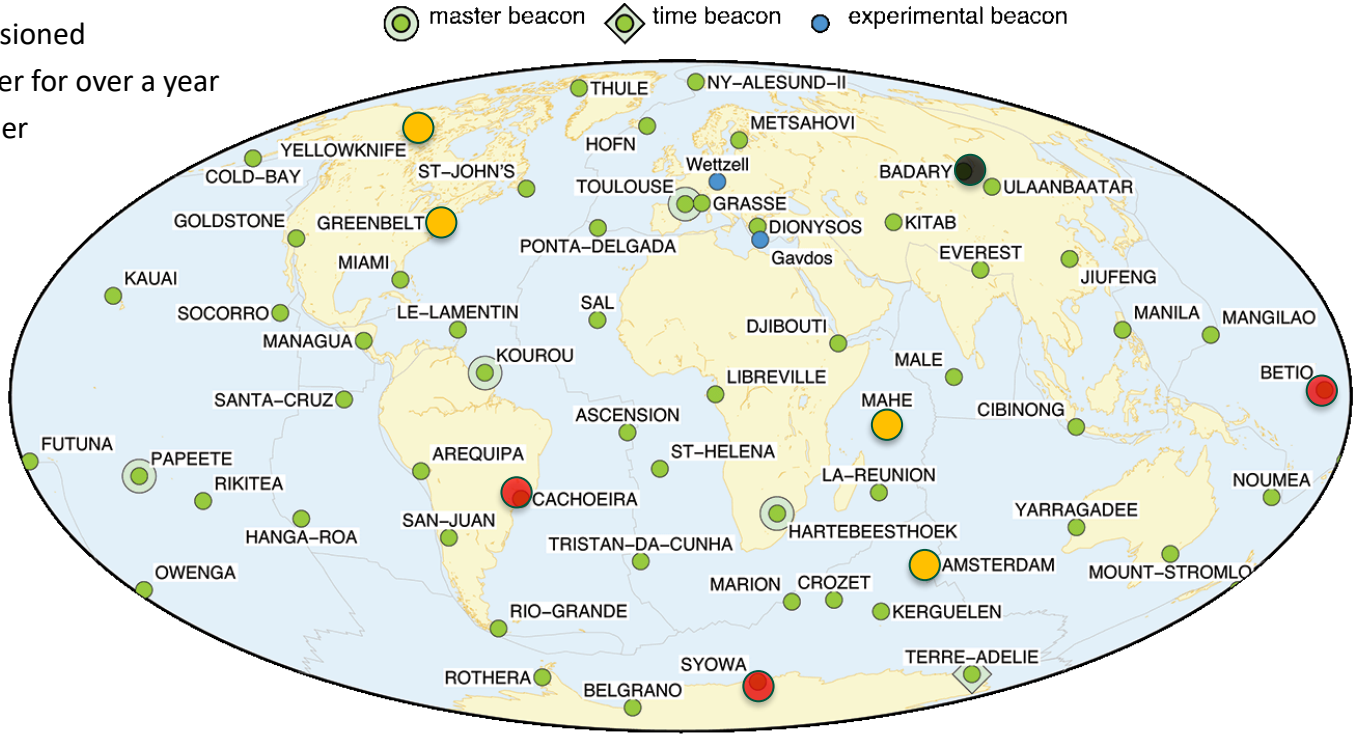
87% average rate of stations in operation over the last two years



Network Operational Status

61 stations of which: 7 beacons are out of order and 1 decommissioned

- Decommissioned
- Out of Order for over a year
- Out of Order



Network Events 2023

2023	Station		Event
Jan.	CIDB	*Cibinong*	*Beacon replacement: 3G > 4G*
April	*KOLB*	*Kauai*	*Beacon replacement: 3G > 4G*
	HROC	**Hanga Roa**	**DORIS station installation (new site)**
	MAVC	*Marion*	*Antenna and Beacon replacement: 3G > 4G*
June	**SCSC**	**Santa Cruz**	**Antenna and Beacon replacement: 3G > 4G**
July		**Ulaanbaatar**	**Site reconnaissance for a new DORIS station**
September	**GAVC**	**Gavdos**	**DORIS station installation**
	CADB	*Cachoeira*	*Beacon replacement 3G*
October	*YEMB*	*Yellowknife*	*Beacon replacement: 3G > 4G*
Dec.	*DJIB*	*Djibouti*	*Beacon replacement: 3G > 4G*
		Kanpur	**Site reconnaissance for a new DORIS station**
	RIMC	**Rikitea**	**Major renovation: antenna move + equipment upgrade**

Network Events 2024

Several antenna replacements following a manufacturing defect in a batch of antennas

2024	Station		Event
Jan.	**ROBC**	*Rothera*	*Antenna replacement*
Feb.	***CRRC***	*Crozet*	*Antenna replacement*
	ARFB	*Arequipa*	*Beacon replacement: 3G > 3G*
Apr.	***TLSB***	*Toulouse*	*New time and frequency reference (TMG)*
	HOGC	*Höfn*	*Antenna replacement*
July	**MAMC**	Malé	Antenna replacement
Sep.	**ULAC**	**Ulaanbaatar**	**DORIS station installation (new site)**
Oct.	*ARFB*	*Arequipa*	*Beacon replacement: 3G > 4G*
	EVEC	**Everest**	**Major renovation: antenna move + equipment upgrade**
Nov.	PAUB	Papeete	*Beacon replacement: 3G > 4G + New time and frequency reference (TMG)*
Dec.	**OWGC**	Owenga	Antenna replacement + site survey

Network Events 2025

Continued deployment of B4G beacons but stock shortage of Starec-C antennas*

2025	Station		Event
Jan.	*ADHC*	*Terre Adélie*	*Beacon replacement: 3G > 4G*
	JIWC	*Jiufeng*	*Beacon replacement: 3G > 4G*
Feb.	*BEMB*	*Belgrano*	*Beacon replacement: 3G > 4G*
Apr.	**LAPB**	**Le Lamentin**	**Major renovation: antenna move + beacon 4G installation**
May	***KEZC***	*Kerguelen*	*Antenna replacement*
	LICB	*Libreville*	*Beacon replacement: 3G > 3G*
June		**Kazakhstan**	**Site reconnaissance for a new DORIS station**
Sep.	RISC	Rio Grande	*Beacon replacement: 3G > 4G*

* : The ground antenna supplier no longer wishes to continue production. Design and prototyping underway with a new supplier. This may impact future installation projects. ☹

Latest generation equipment deployment

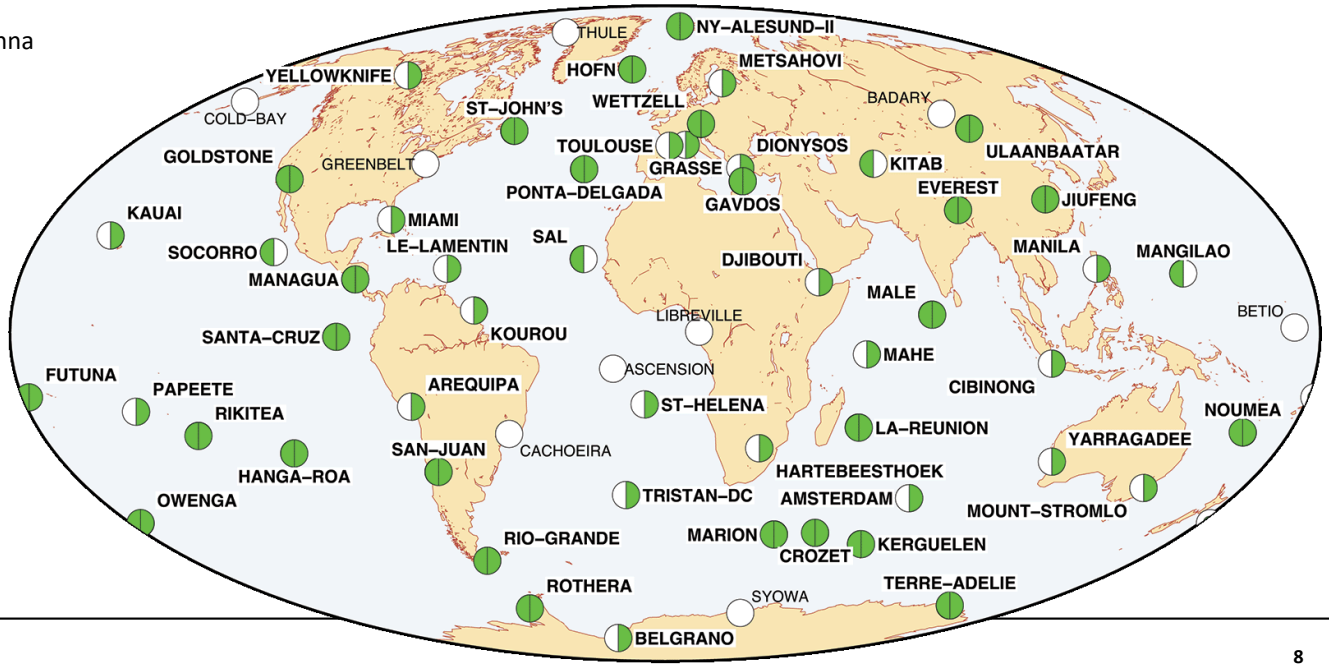
Gradual improvement in network robustness and performance

46 beacons B4G deployed in 6 years

Half of the network equipped with Starec-C antenna

Starec-C antenna

B4G beacon



New DORIS site in Mongolia

Objective: to fill the coverage gap following the shutdown of Russian stations in 2022

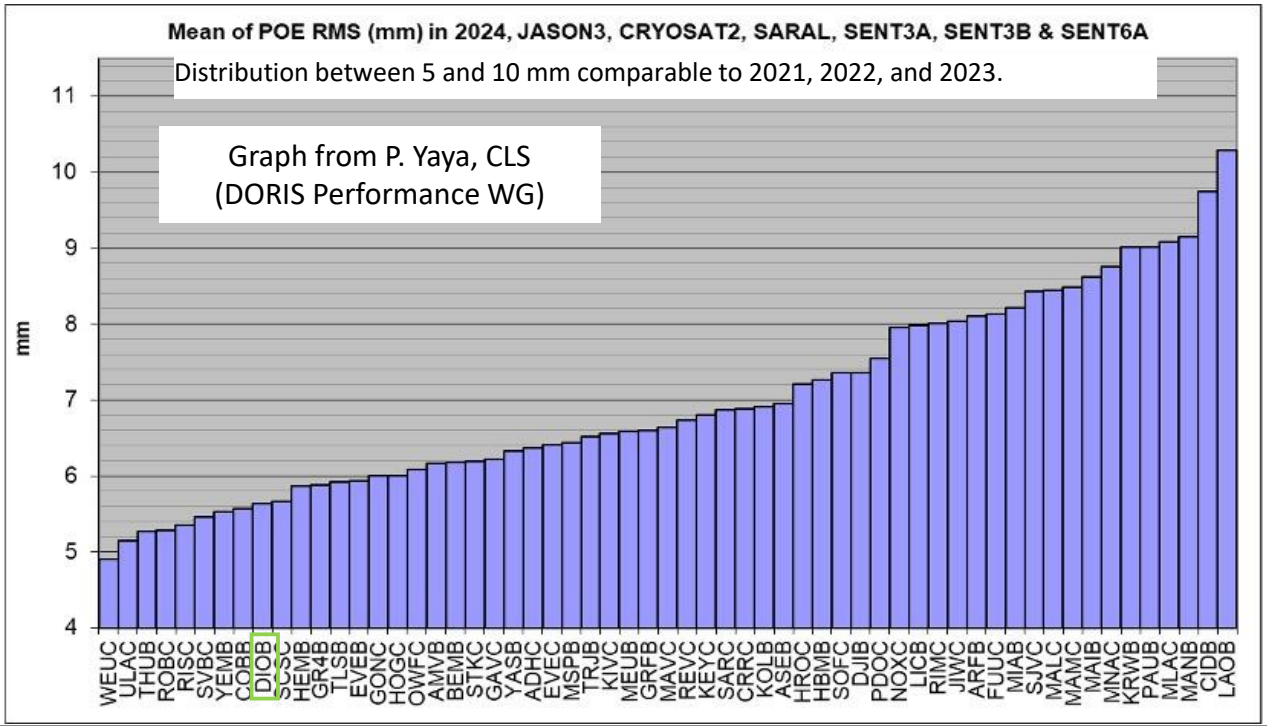
Excellent collaboration with the Institute of Astronomy and Geophysics (IAG-MAS)

Project completed in record time (2 years)

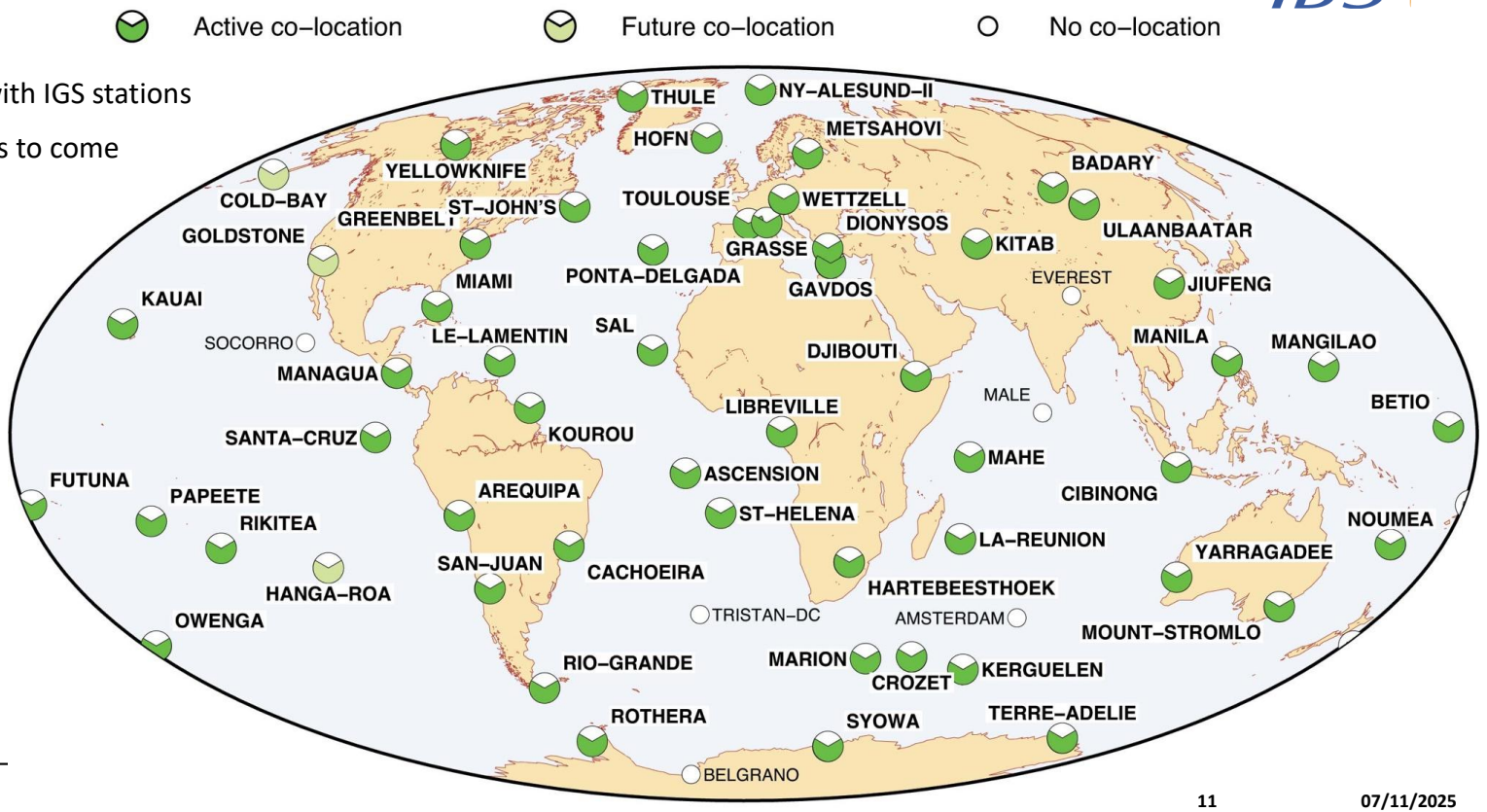
Commissioned on September 5, 2024

Station ranked 2nd in the network (POE orbit adjustment RMS)

Performance review of DORIS stations



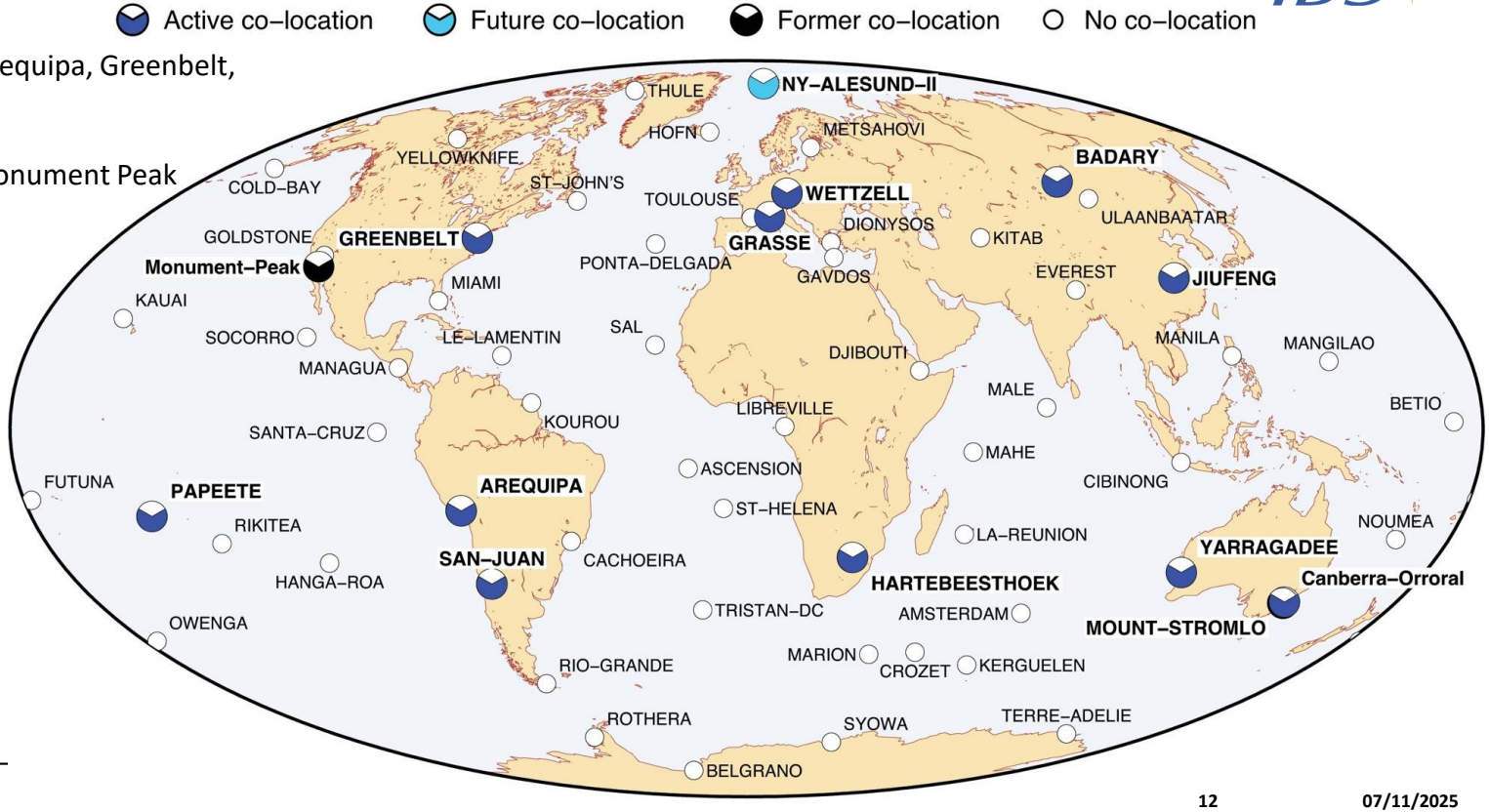
Co-location with GNSS



52 active co-locations with IGS stations

3 additional co-locations to come

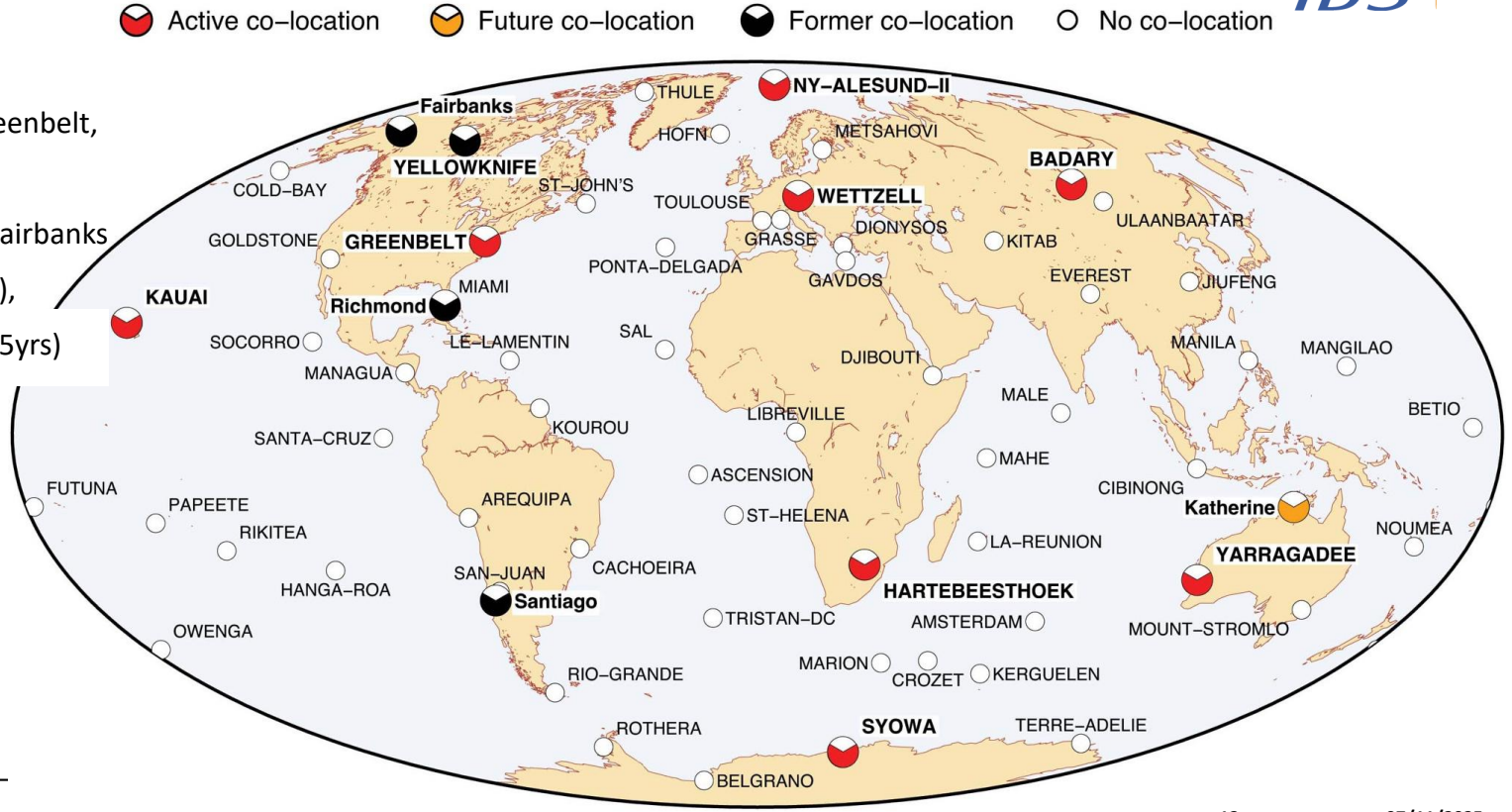
Co-location with SLR



11 active co-locations: Arequipa, Greenbelt, HBK, Yarragadee (>30yrs)

2 former co-locations: Monument Peak (12yrs), Canberra (2yrs)

Co-location with VLBI



8 active co-locations:

HBK, Kauai (>30yrs), Greenbelt, Syowa (>25yrs)

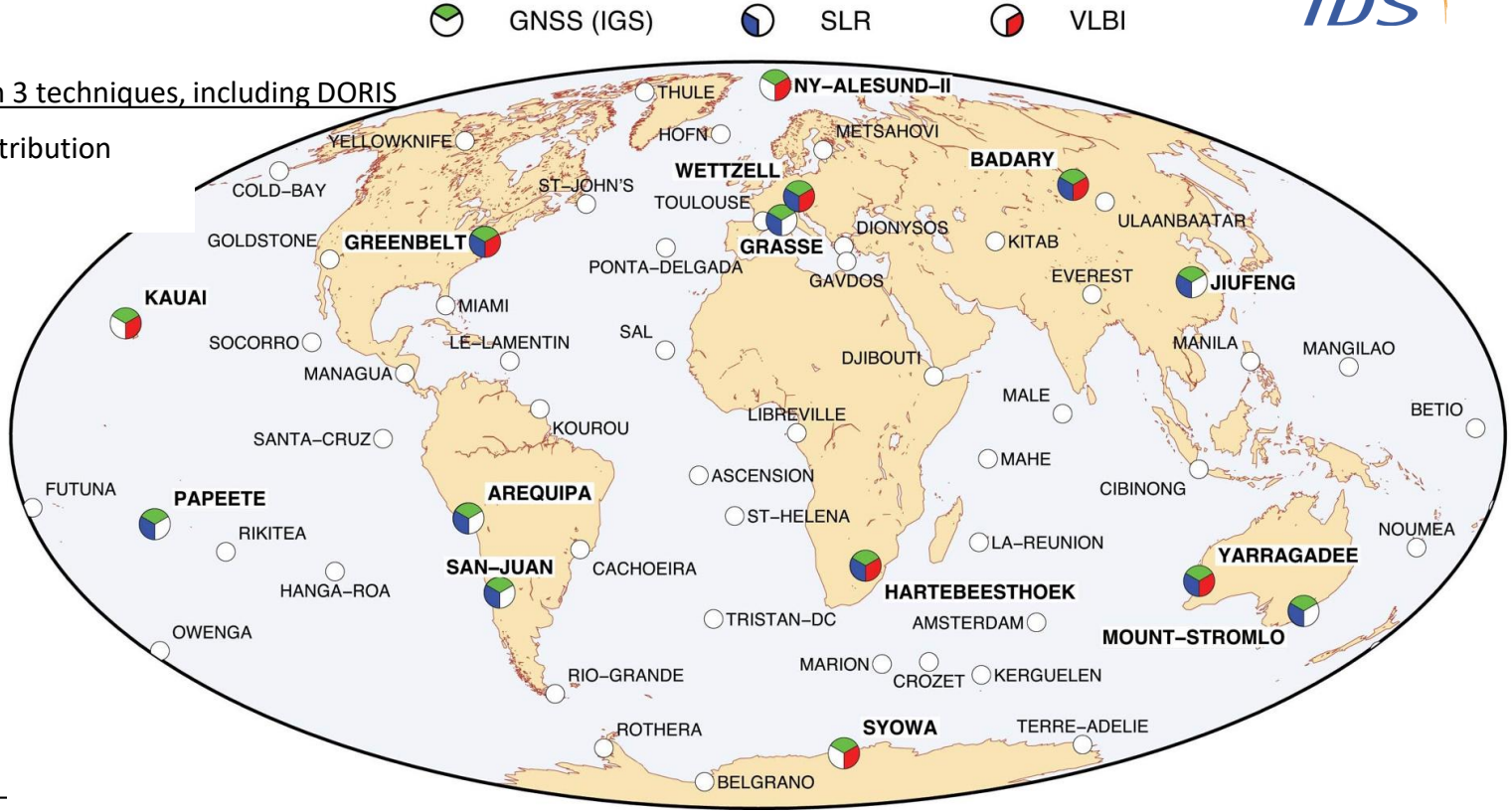
4 former co-locations: Fairbanks (10yrs), Richmond (6yrs), Santiago, Yellowknife (15yrs)

Co-location with 2 or 3 other IERS techniques

5 ITRF core sites

9 co-located sites with 3 techniques, including DORIS

Good North-South distribution



Local Tie Surveys

Local ties used in ITRF combination

- Reports and SINEX files are archived here: https://itrf.ign.fr/en/local-ties
- Most of the local tie surveys at DORIS co-located sites are carried out by IGN

DORIS tie vectors

- Wherever possible using conventional method: from terrestrial measurements of angles, distances and height diff.
- Full list of all available DORIS tie vectors at co-located sites:

  ftp://ftp.ids-doris.org/pub/ids/stations/DORIS_ext_ties.txt (last update in March 2025)
- All available (since 1992) tie vectors between successive antenna locations on the same site:

  ftp://ftp.ids-doris.org/pub/ids/stations/DORIS_int_ties.txt (last update in July 2024)

Ongoing developments

Gradual replacement of the equipment with new generation

- 4th generation beacon deployment
- Starec-C antenna deployment

Site renovation

- Better meet the system requirements to improve station performance

Network densification

- Make the network more robust by adding stations in critical areas
- Enhance the network contribution to various applications

Connection to external clocks

- Connection to atomic clocks where possible: Greenbelt, Kauai, St-John's on the list!
- Connection between DORIS beacons and GNSS receivers: primarily with stations in the REGINA network

Upcoming Network Changes

Short term (within a year)

- Nov. 2025: Sejong, South Korea: reconnaissance with a view to install a DORIS station
- Dec. 2025: Kanpur, India: **station installation** + site survey (co-location with IGS station IITK) 62
- Jan. 2026: Cachoeira, Brazil: major renovation (antenna move + equipment upgrade)
- Feb. 2026: Sal, Cape Verde: major renovation (antenna move + equipment upgrade) 63
- May 2026: Katherine, Australia: **station installation** + site survey (co-location with GNSS and VLBI)

Longer term

- Kazakhstan: **station installation** + site survey (co-location with GNSS) 64
- Syowa, Antarctic: major renovation (antenna move + equipment upgrade)
- Betio, Kiribati: replacement with a new site in Micronesia (search in progress)
- Geodetic and geophysical observatory of Polynesia: **station installation** 65

DENSIFICATION

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DORIS

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