

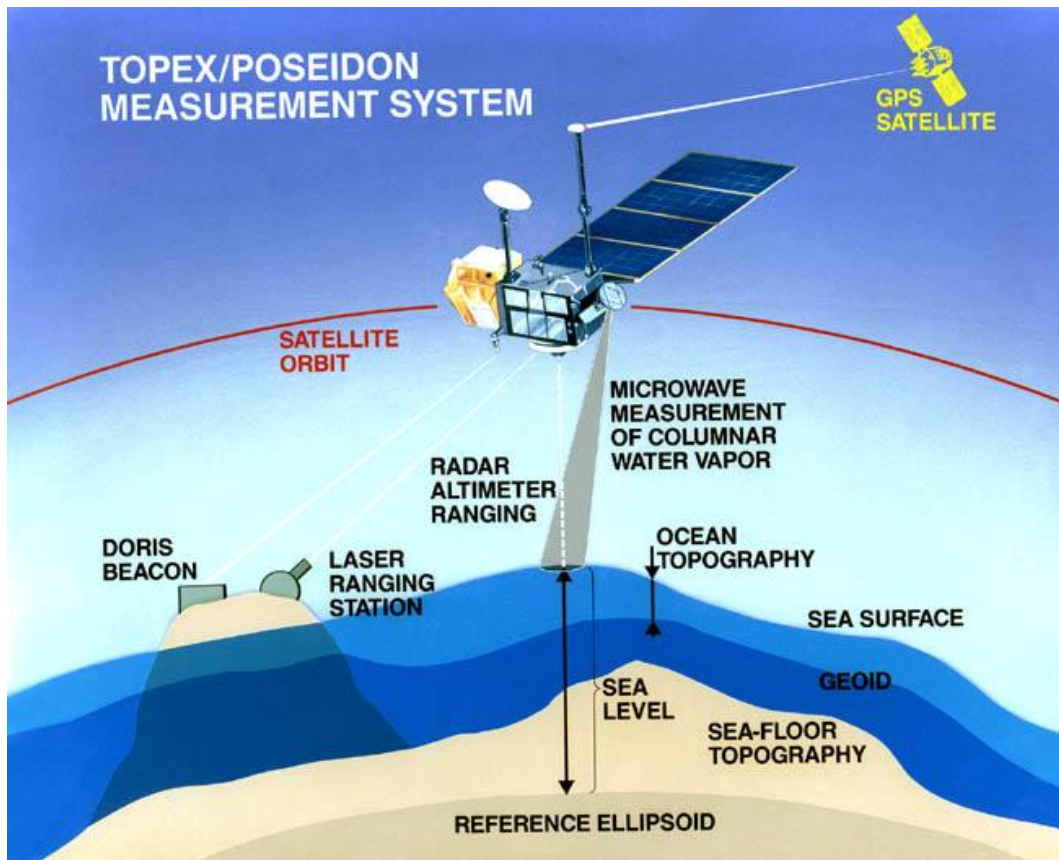
The international DORIS Service (IDS) Current Status and Perspectives

Pascal Willis (IGN/IPGP), Frank Lemoine (NASA),
Guilhem Moreaux (CLS), Laurent Soudarin (CLS),
Pascale Ferrage (CNES)

OUTLINE

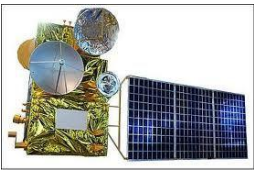
- DORIS system
 - Infrastructure (satellites and ground network)
 - Recent developments (DGXX receivers)
- International DORIS Service
 - Scientific goals (IAG, IERS, GGOS)
 - Current organization
 - Available scientific products
 - Preparation of ITRF2013

Historical considerations

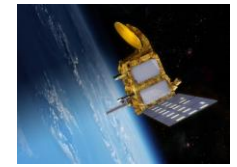


- Developed by CNES (French Space Agency)
 - for T/P for Precise Orbit Determination (1992)
 - First demonstration with SPOT-2 (1990)
 - **Uplink system**
 - 2 GHz, 400 MHz
- Other applications :
 - Geodesy / Geophysics (station coordinates and velocities, Earth Orientation, Geocenter Motion)
 - Atmospheric Sciences (Zenith Total Delays)

See also [Willis et al., Adv. Space Res., 2010](#)

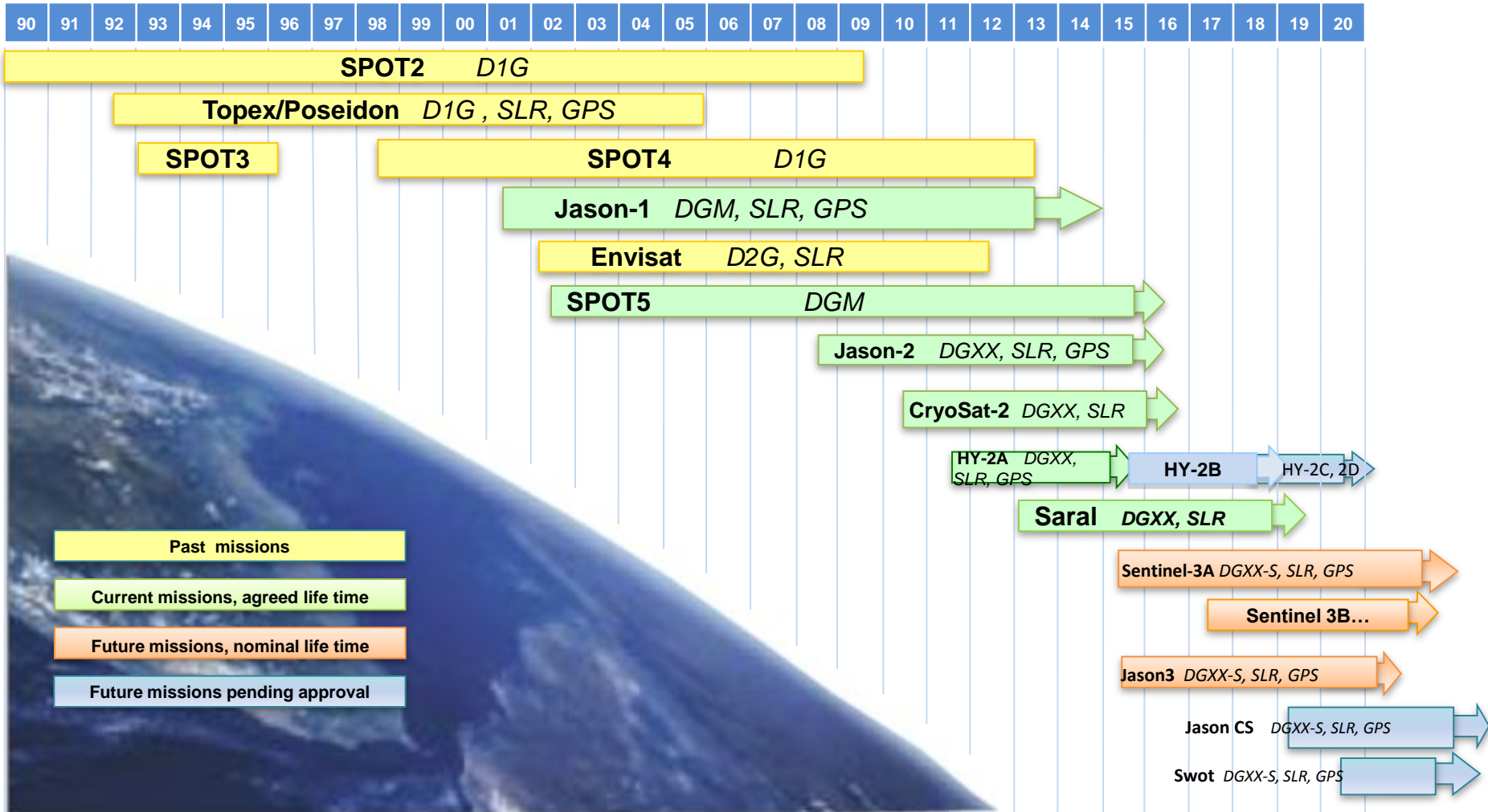


HY-2A (China)

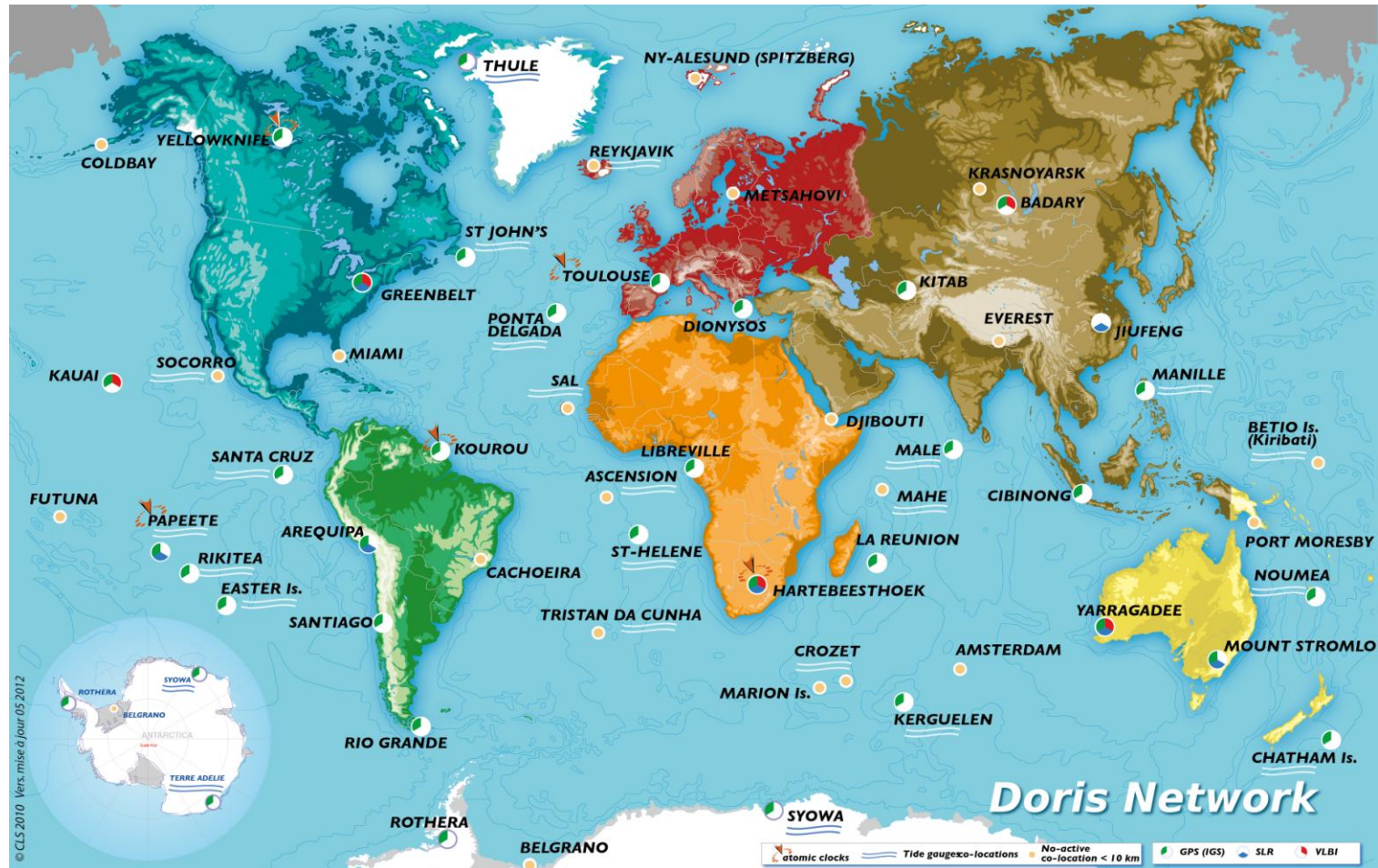


Saral (India)

DORIS satellites



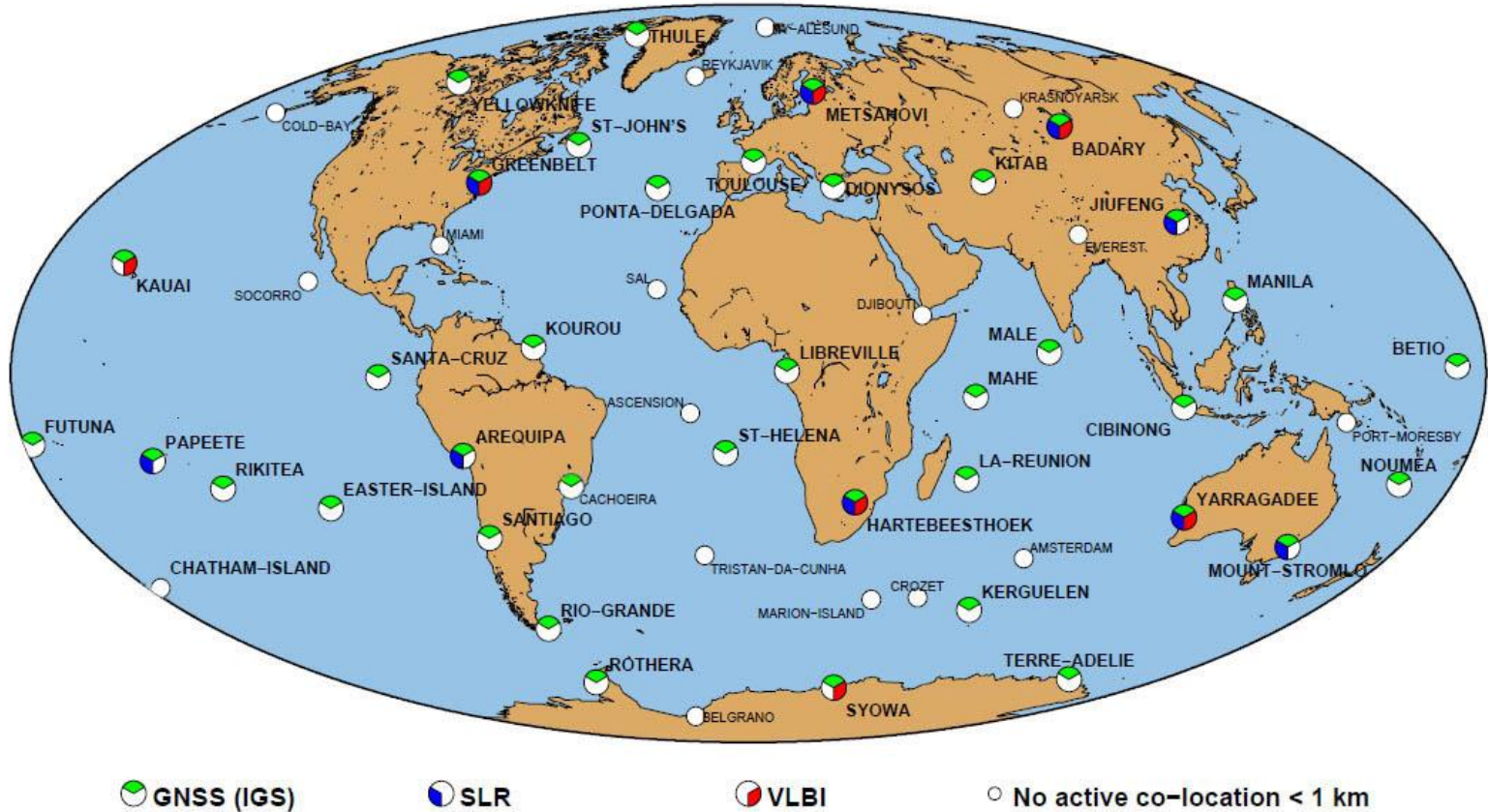
DORIS tracking network (2013)



NB: Also explore network through **GoogleEarth** :
<http://ids-doris.org/network/googleearth.html>

DORIS co-locations

DORIS stations co-located with other IERS techniques (VLBI, SLR or GNSS)



Exploring DORIS Network through GoogleEarth

Network on Google Earth - International DORIS Service

http://ids-doris.org/network/googleearth.html

RSS HY-2A satellite

IPGP Finances Voyages Sports Loisirs Articles Informations (1 007) DORIS Apple (17) OIB

Meetings
Reports & Mails
Contacts & links
Gallery

DORIS SYSTEM

- Official web site
- Tracking Network
 - Site Logs
 - Station management
 - Station coordinate time series
 - Maps
 - Network on Google Earth
- System monitoring
- Plot tools

ANALYSIS COORDINATION

- [Presentation](#)
- [Combination](#)
- [Documents](#)
- [Doris related events](#)
- [Discussion](#)
- [Software](#)

DORIS network on Google Earth:
[Download the file \(June 2009\).](#)

Depending on the resolution of the image, we sometimes adjusted the position of the antenna of the station according to our knowledge of the site. Some positions could still be improved with your help. Comments, maps and pictures are welcome at any time to help us to improve the virtual tour and should be e-mailed to the [Central Bureau](#).

The screenshot displays three satellite images from Google Earth. The top-left image is a globe showing the DORIS network locations. The top-right image is a terrain view of a station site. The bottom image is a close-up of a station with an antenna.

Example of DORIS stations



Yarragadee (Australia)



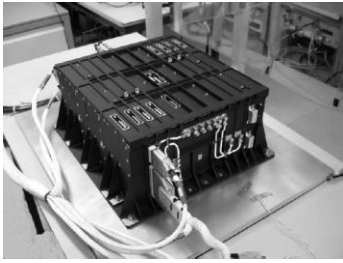
Jiufeng (China)



Cibinong (Indonesia)



Betio (Kiribati)



Recent developments (DG-XX receivers)

- New Capabilities:
 - Digital receiver
 - Phase measurement (vs. Doppler)
 - 7 channel-receiver
 - RINEX type format

See [Auriol and Tourain, Adv. Space Res., 2010](#)

IDS Scientific Goals

- Provide scientific products derived from DORIS data
- IAG Service since 2003 (IAG Pilot Project created in 1999)
- Submit DORIS solutions to IERS (since 1994)
- Participate in GGOS

- Annual reports available upon request
 - Contact : ids.central.bureau@ids-doris.org

IDS Web site (<http://ids-doris.org>)

International DORIS Service

[Home](#) | [Site map](#) | [FAQ](#) | [Glossary](#)

IDS

- Organization
- Data & Products
 - Documents
- Meetings
- Reports & Mails
- Contacts & links
 - Contacts
 - Links
 - Directory
- Gallery

DORIS SYSTEM

- Official web site
- Tracking Network
- System monitoring
- Plot tools

ANALYSIS COORDINATION

- Presentation
- Combination

International DORIS Service

DORIS (Doppler Orbitography and Radiopositioning Integrated by Satellite) is a Doppler satellite tracking system developed for precise orbit determination and precise ground location. It is onboard the Cryosat-2, Jason-1, Jason-2 and HY-2A altimetric satellites and the remote sensing satellites SPOT-4 and SPOT-5. It also flew with SPOT-2, SPOT-3, TOPEX/POSEIDON and ENVISAT.

IDS is an international service which provides a support, through **DORIS** data and products, to geodetic, geophysical, and other research and operational activities. New proposals for Analysis Centers and temporary or permanent DORIS stations are welcome. See the [call for participation](#).

This site is composed of three parts:

"IDS" describes the organization of the service and includes documents, access to the data and products, event announcements, contacts and links.

"DORIS" allows to access general description of the system, and gives information about the system events and the tracking network.

"Analysis Coordination" provides information and discussion areas about the analysis strategies and models used in the IDS products. It includes also the information about the Combination Center activities. It is

Highlights

- [DORIS session at AGU Fall Meeting 2013. Deadline for abstract submission: 6 August](#)
- [SPOT-4 deorbited on June 24th 2013; end of DORIS data dissemination](#)
- Important information for the [next AWG meeting in Washington](#) October 15-16, 2013
- Presentations of the [AWG meeting in Toulouse](#) April 4-5, 2013
- [SARAL in orbit with DORIS onboard!](#)
- New tools for [plotting times series](#)
- [Take 2 minutes to fill in the IDS survey form](#)

IDS organization

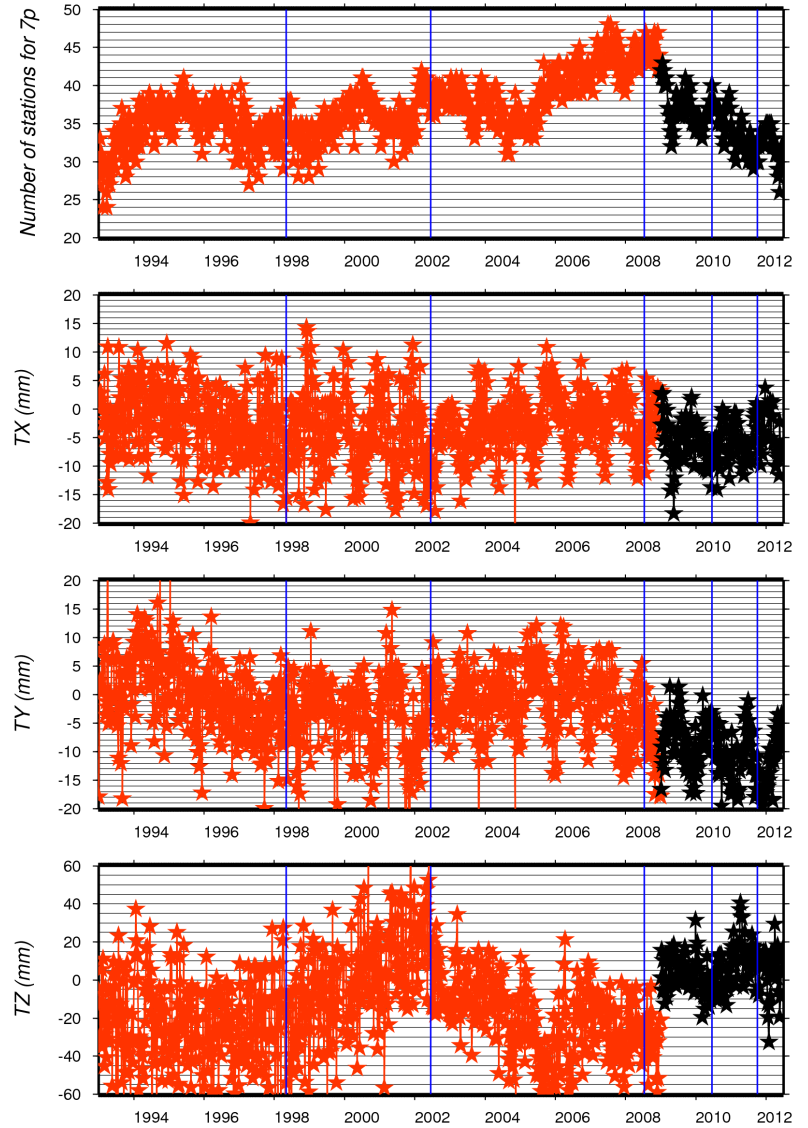
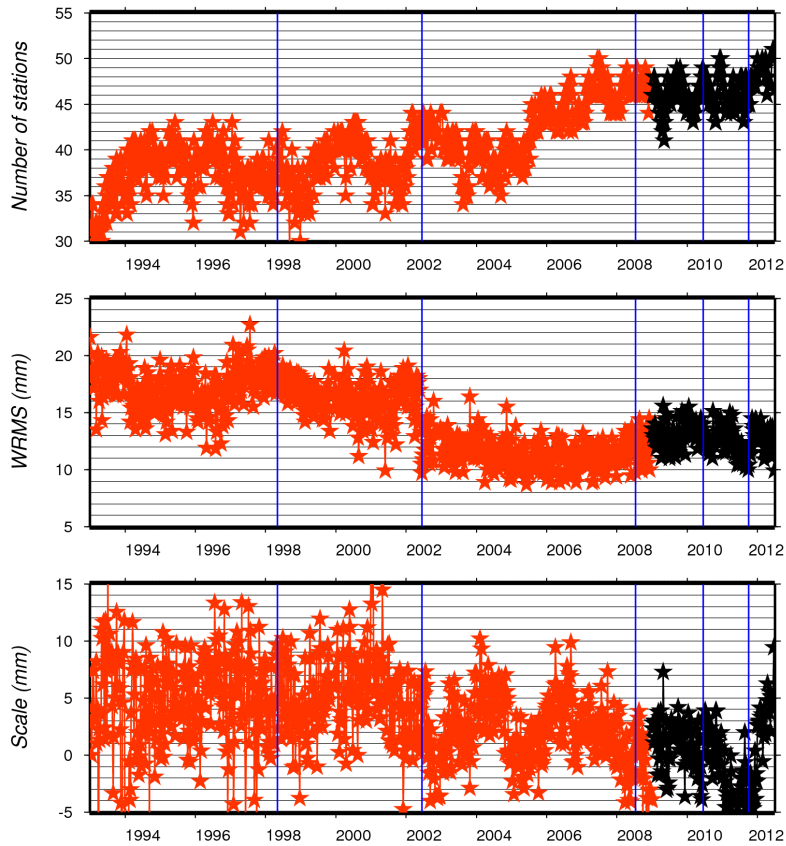
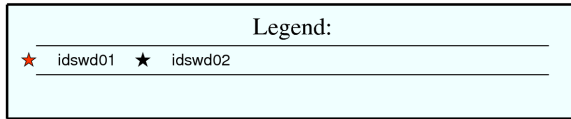
(similar to all IAG Services)

- Central Bureau at CNES+CLS+IGN (France)
- 2 data centers : CDDIS (USA) and IGN (France)
- 7 Analysis Centers : ESA (Germany), GFZ (Germany), GOP (Czech Rep.), IGN (France), INASAN (Russia), LCA (France), NASA (USA)
 - (using 5 different software packages)
- 1 Combination Center (CLS, France)
- Governing Board

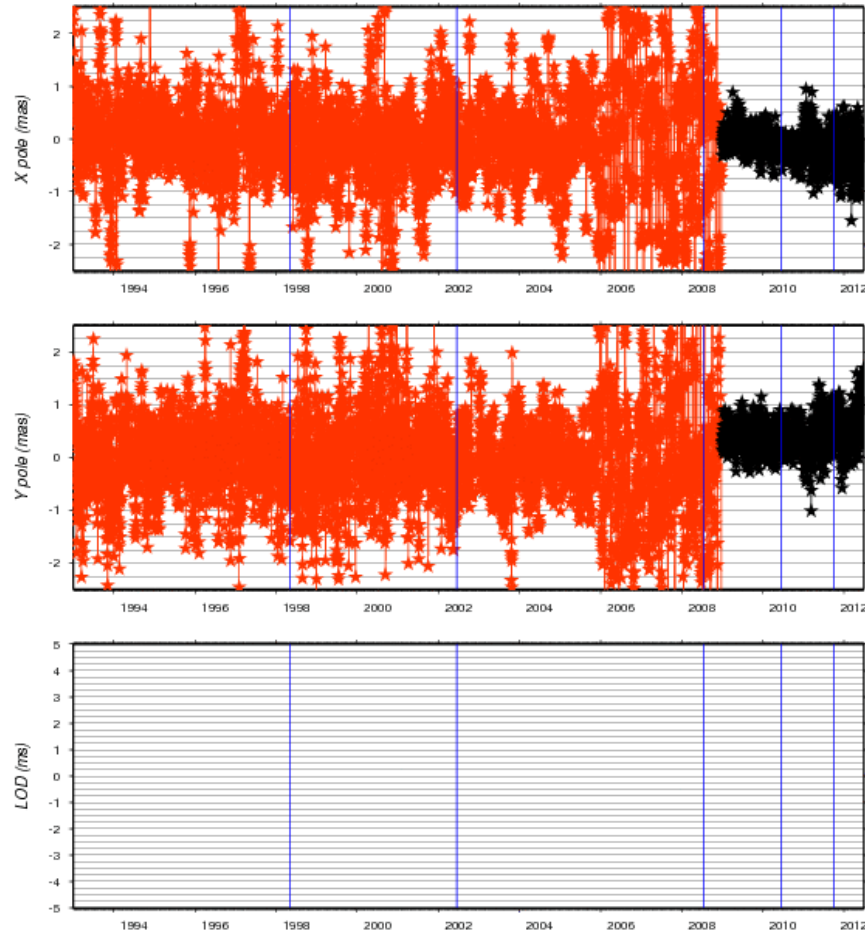
IDS Products

- Station coordinates (weekly time series)
 - Precision better than 10 mm (@ 1 week)
- Station velocities
 - Precision better than 0.5 mm/yr (20 years)
- Earth Orientation Parameters (Polar Motion)
 - Precision better than 0.5 mm/yr
- Geocenter Motion

Per week comparison to ITRF2008



Earth Orientation Parameters wrt IERS C04
 ★ idswd01 ★ idswd02



Red = ids01

Black = ids02

Same data

New reprocessing

AC	serie	# days	X pole (mas)		Y pole (mas)		LOD (ms)	
			mean	std	mean	std	mean	std
ids	01	5746	-0.026	1.146	0.009	1.121	-----	-----
ids	02	1274	-0.127	0.304	0.412	0.310	-----	-----

Plot Tools

(A new Web tool for scientific users)

<http://ids-doris.org/plottool/stcd/stcdtool.php>

The screenshot shows a web browser window titled "STCD Tool" with the URL <http://ids-doris.org/plottool/stcd/stcdtool.php>. The browser's search bar contains "HY-2A satellite". The page header includes the "International" logo and a navigation menu with items like "IPGP", "Finances", "Voyages", "Sports", "Loisirs", "Articles", "Informations (1 007)", "DORIS", "Apple (17)", and "OIB".

A modal dialog box titled "Choose the stations to plot" is open. It contains the following instructions:

You can choose here the data to plot.

1. select the station from the list or on a map
2. choose the data to plot from the available series proposed in the table
3. if wanted, complete your selection with additional data.
4. click on "Plot new graphs" when ready.

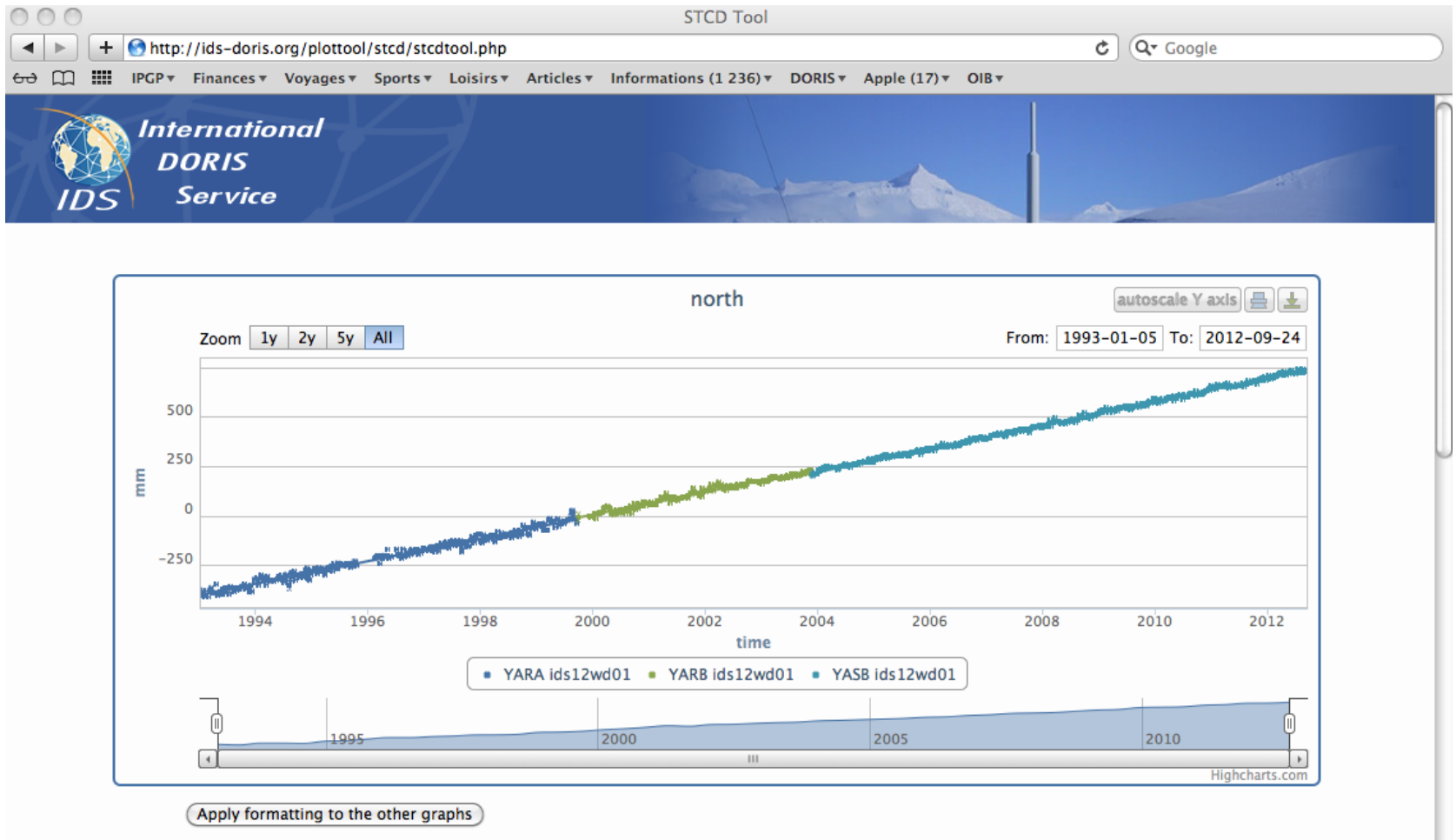
Below the instructions, there is a dropdown menu showing "ADEA", a help icon, and three buttons: "Add station", "Choose by station's name", and "Choose in a map".

A "Legend" section is also present, with the following items:

- : give information about the station.
- : delete the station of the table.
- : download the selected STCD.

At the bottom of the dialog, there is a navigation bar with buttons for "Select Stations", "Graphs appearance", "Statistics", "Modify data", "Create a PDF report", and "Help".

Plot Tools (ex: Yarragadee, North)



NB: improvement after 2002 is due to new satellites (ENVISAT, SPOT-5)

Preparation of ITRF2013 (1/2)

- Goal
 - Reprocess all available DORIS data (1993-2013)
 - Provide IERS with a time series of weekly SINEX files
- Schedule:
 - 4-5 April 2013 : AWG Meeting, Toulouse, France
 - July 2013 : start of reprocessing (7 individual solutions)
 - September 2013: Combine available DORIS solutions
 - October 15-16, 2013 : AWG meeting, Greenbelt, USA
 - January 2014 : Preliminary delivery to IERS
 - April 2014 : Final delivery to IERS

Preparation of ITRF2013 (2/2)

- Major improvements
 - (More data)
 - Improved Gravity Fields (EIGEN-6, GOC3)
 - Including drifts and seasonal corrections
 - South Atlantic Anomaly corrections for SPOT5 and Jason-1
 - Antenna elevation dependency (ANTEX-file)
 - Solar Radiation Pressure
 - Atmospheric Drag

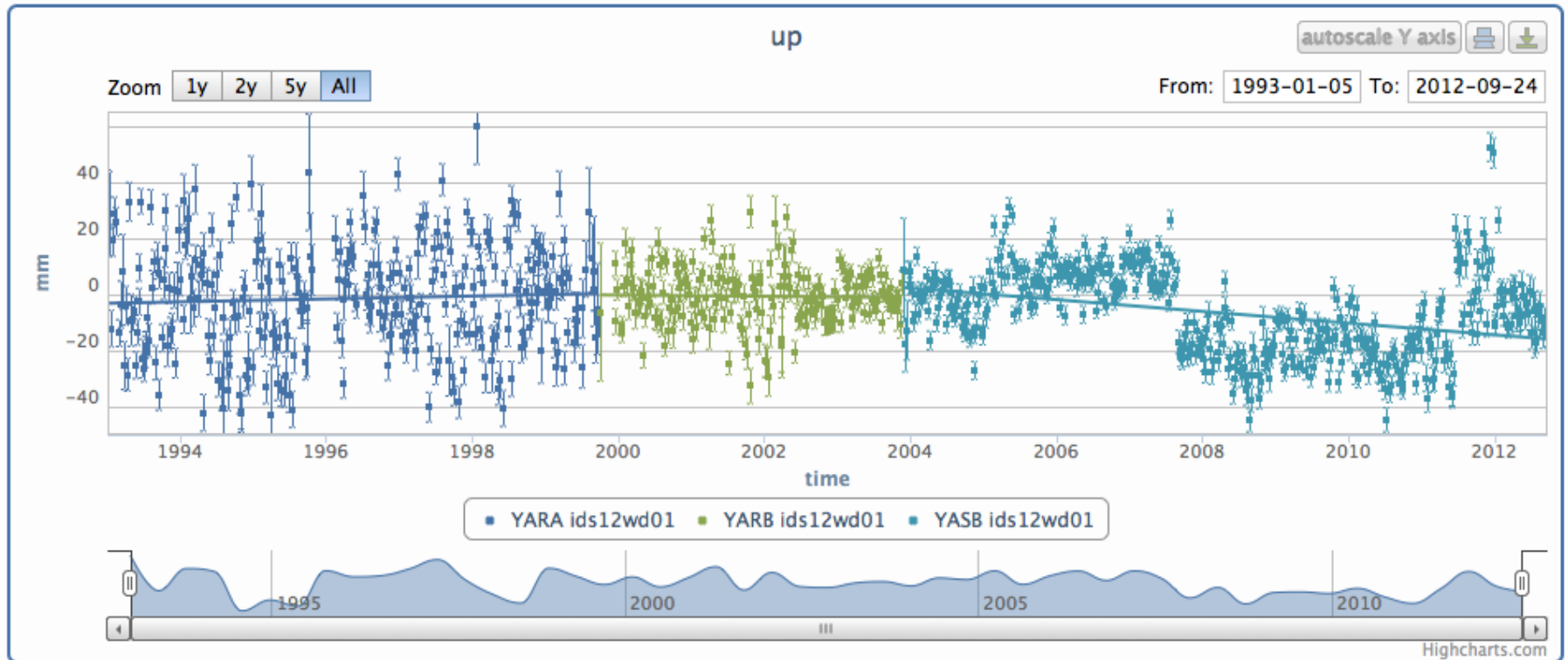
CONCLUSIONS

- DORIS system working since 1990 (7 satellites)
- New satellites planned until 2020+
- Internal DORIS Service (IDS) since 2003
 - 7 Analysis Centers, 2 data centers
 - Current preparation of ITRF2013
- Products available at IDS Web site (<http://ids-doris.org>)
 - Coordinate time series (SINEX + plot tools)
 - Results are improved when more satellites are available (since 2002.5)
 - Station information (site logs, local ties,...)
 - Earth Orientation Parameters
 - Geocenter Time Series
 - Etc.
- Contact: pascal.willis@ign.fr

BACK-UP SLIDES

Plot Tools

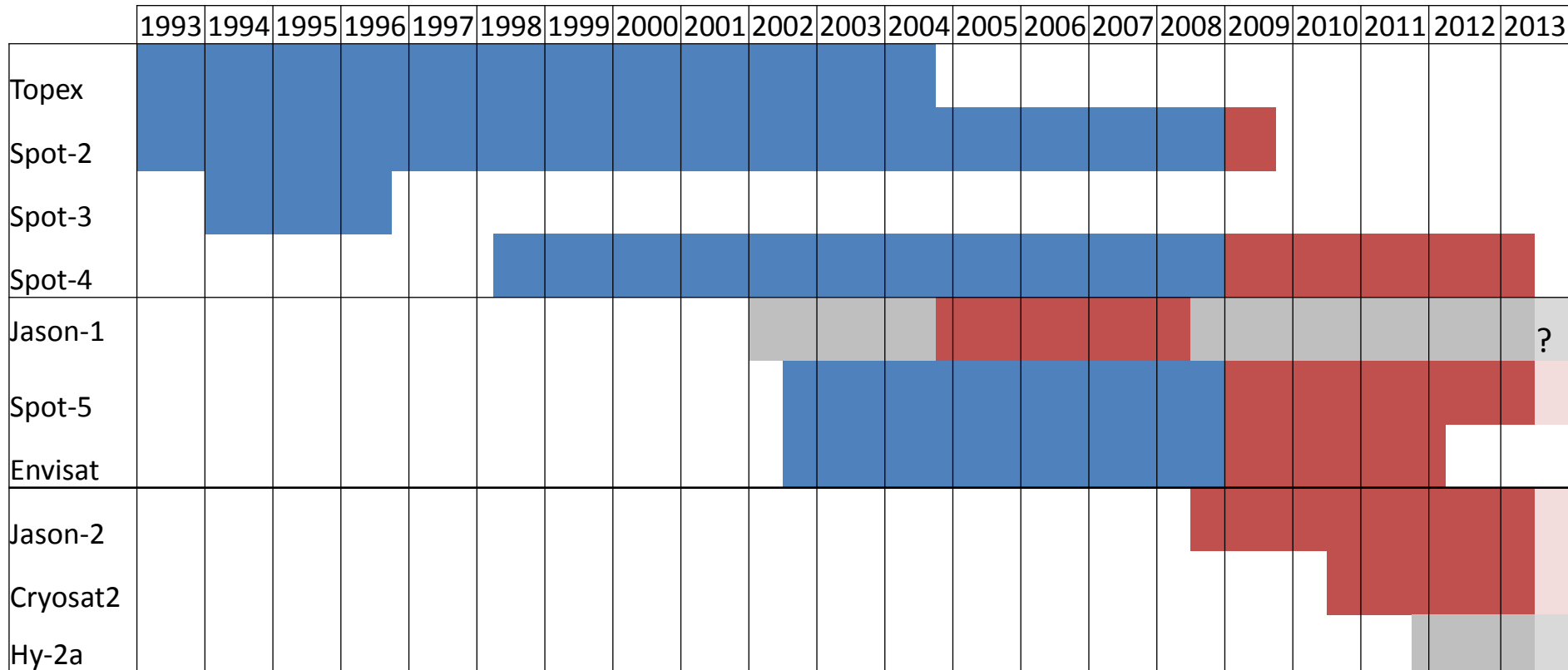
(ex: Yarragadee, North)



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Data for ITRF2013

ITRF 2013 →
ITRF2008 →



- latest version of DORIS 1B files (redeliveries for ENV in 2012, JA2 and CS2 in 2011, SP4 1998 in 2010)
- no data of 1992; HY-2A not included
- Jason-1 (back-up chain) 2004/11 (end TOP) → 2008/07 (start JA2)