# The international DORIS Service (IDS) Current Status and Perspectives

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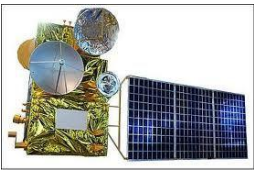
OUTLINE

- 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

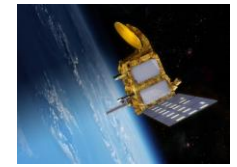# Historical considerations

TOPEX/POSEIDON MEASUREMENT SYSTEM
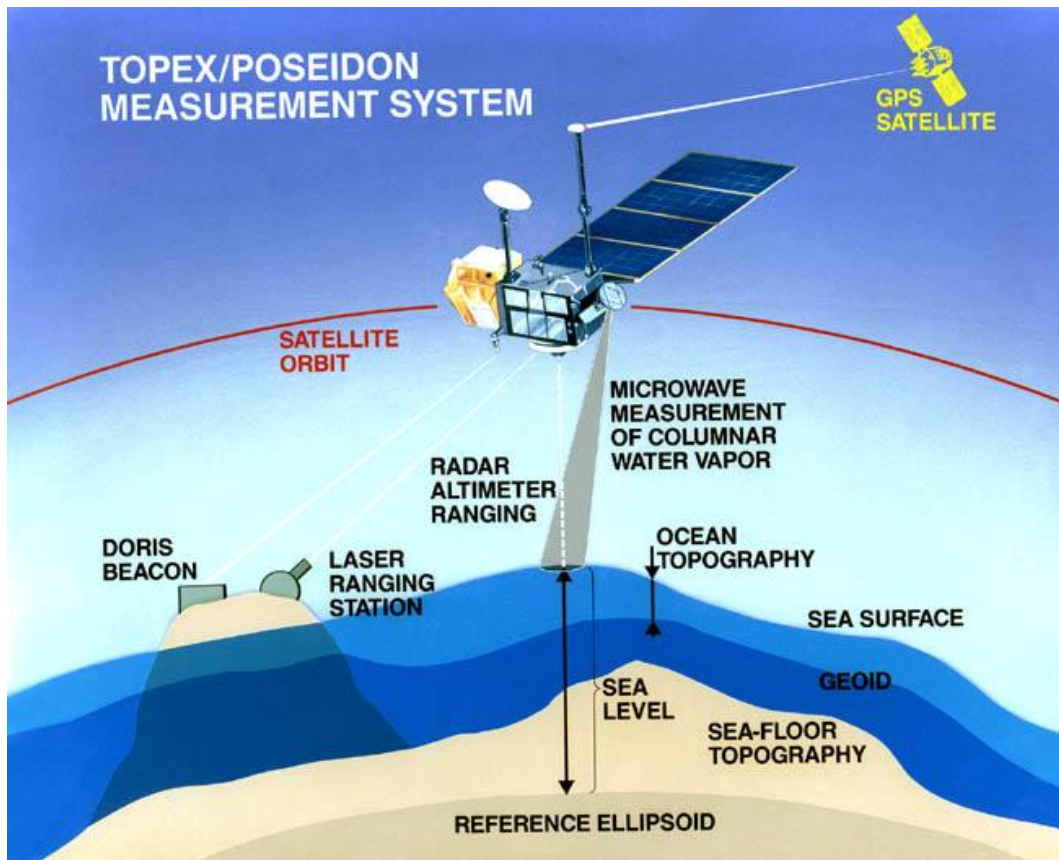
- Developed by CNES (French Space Agency)
  - for T/P for Precise Orbit Determination (1992)
  - First demonstration with SPOT-2 (1990)
  - Uplink system
  - 2 GHz, 400 MHz
- Other applications :
  - Geodesy / Geophysics (station coordinates and velocities, Earth Orientation, Geocenter Motion)
  - Atmospheric Sciences (Zenith Total Delays)
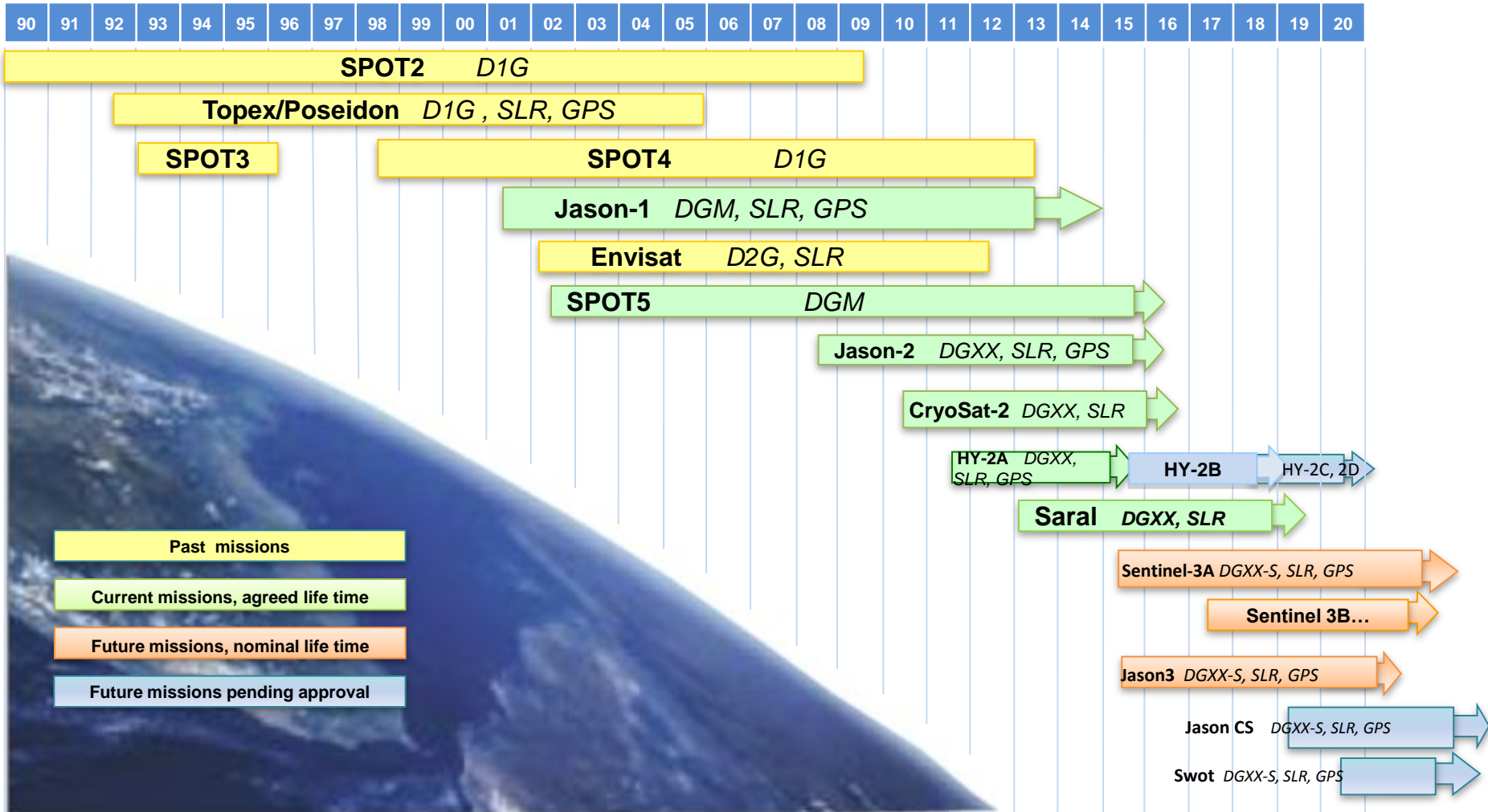
See also Willis et al., Adv. Space Res., 2010

DORIS satellites
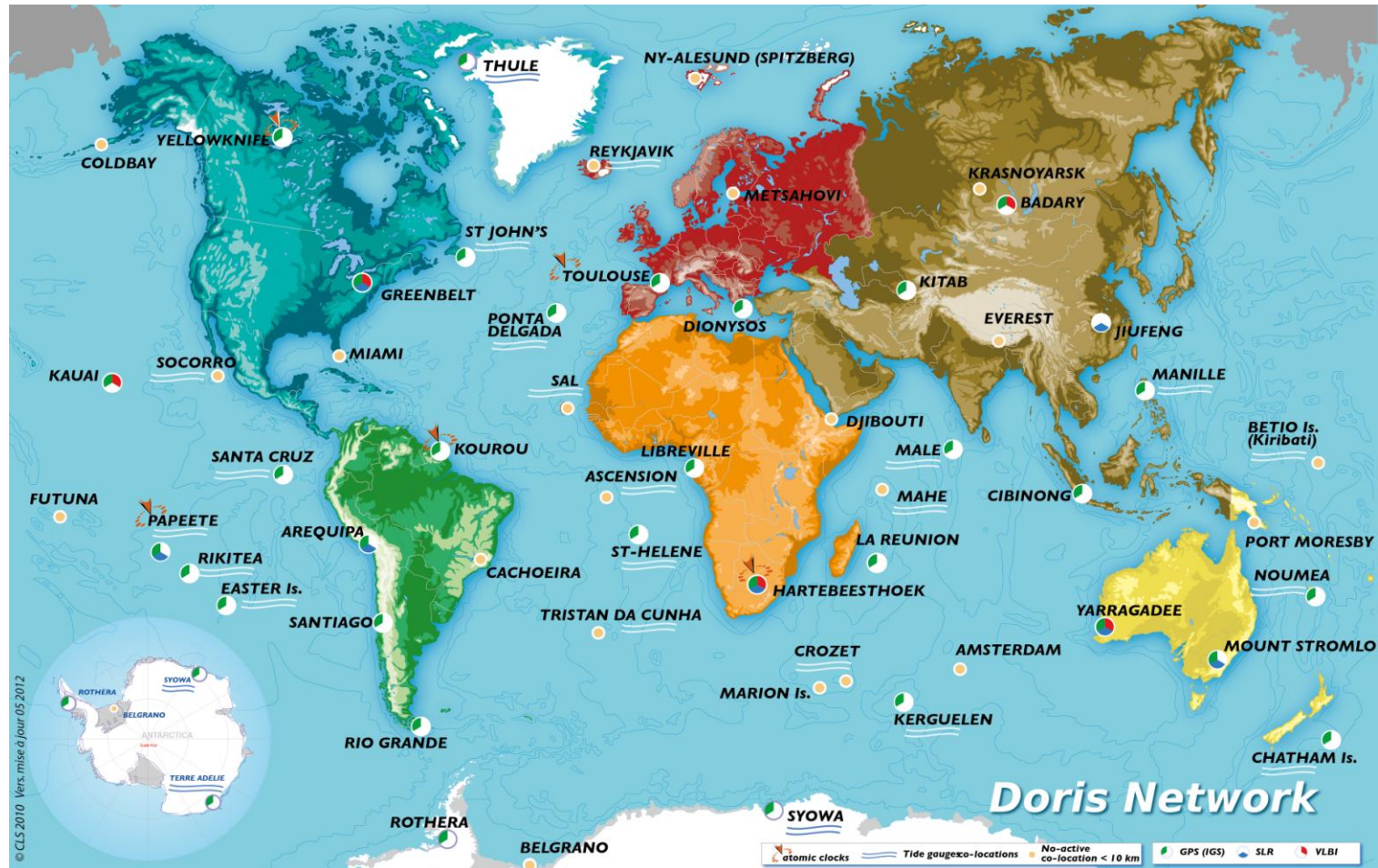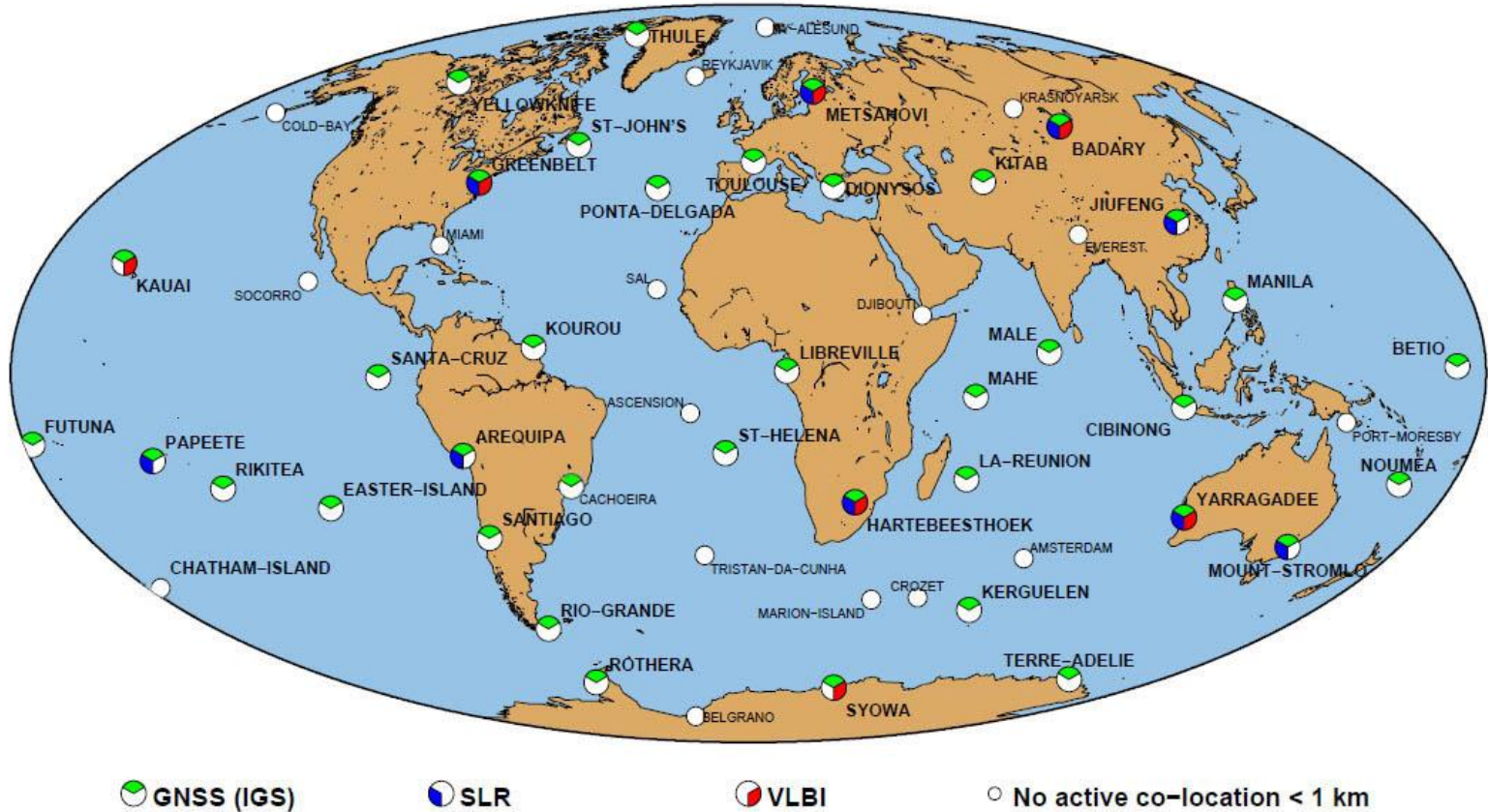
HY-2A (China)

Saral (India)

| 90 | 91 | 92 | 93 | 94 | 95 | 96 | 97 | 98 | 99 | 00 | 01 | 02 | 03 | 04 | 05 | 06 | 07 | 08 | 09 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 |

SPOT2 *D1G*

Topex/Poseidon *D1G , SLR, GPS*

SPOT3

SPOT4 *D1G*

Jason-1 *DGM, SLR, GPS*

Envisat *D2G, SLR*

SPOT5 *DGM*

Jason-2 *DGXX, SLR, GPS*

CryoSat-2 *DGXX, SLR*

HY-2A *DGXX, SLR, GPS*   **HY-2B**   HY-2C, 2D

Saral *DGXX, SLR*

Sentinel-3A *DGXX-S, SLR, GPS*

Sentinel 3B...

Jason3 *DGXX-S, SLR, GPS*

Jason CS *DGXX-S, SLR, GPS*

Swot *DGXX-S, SLR, GPS*

Past missions

Current missions, agreed life time

Future missions, nominal life time

Future missions pending approval

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

Example of DORIS stations

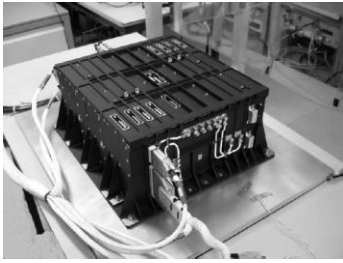Yarragadee (Australia)

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)

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 comparaison to ITRF2008

Legend:
★ idswd01   ★ idswd02
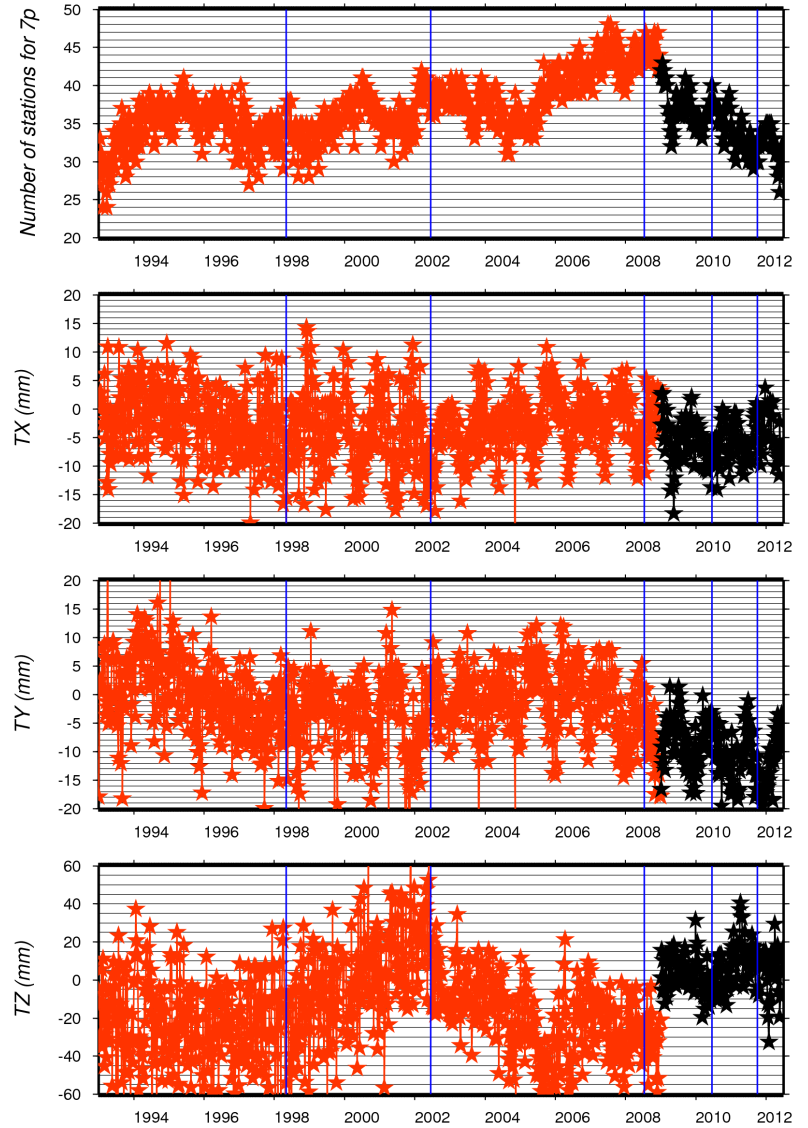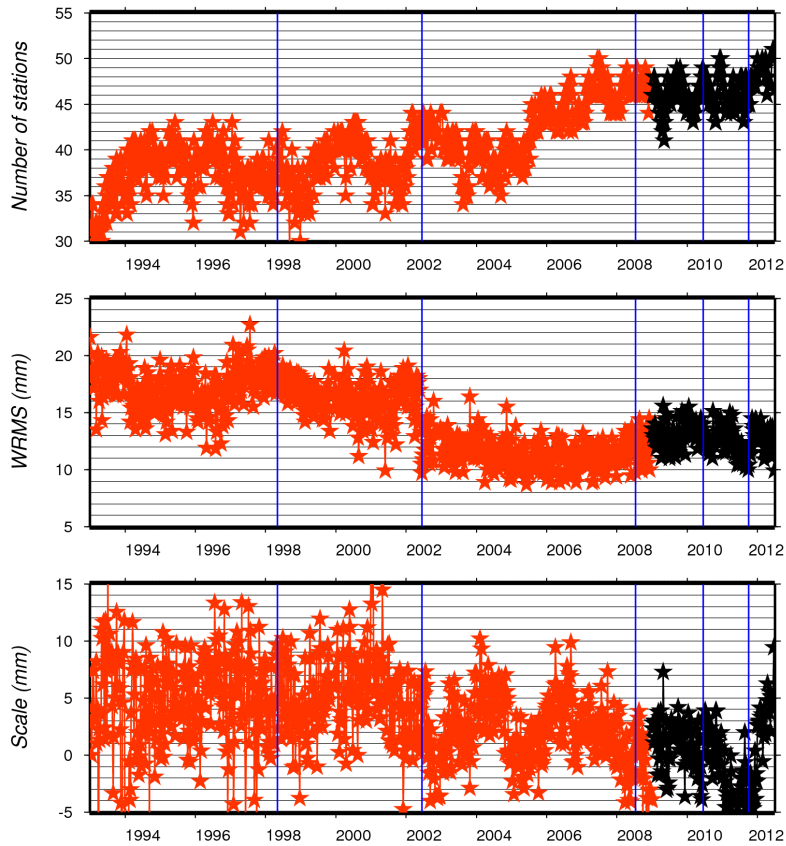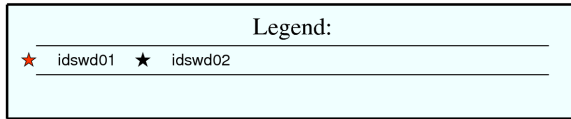
Earth Orientation Parameters wrt IERS C04
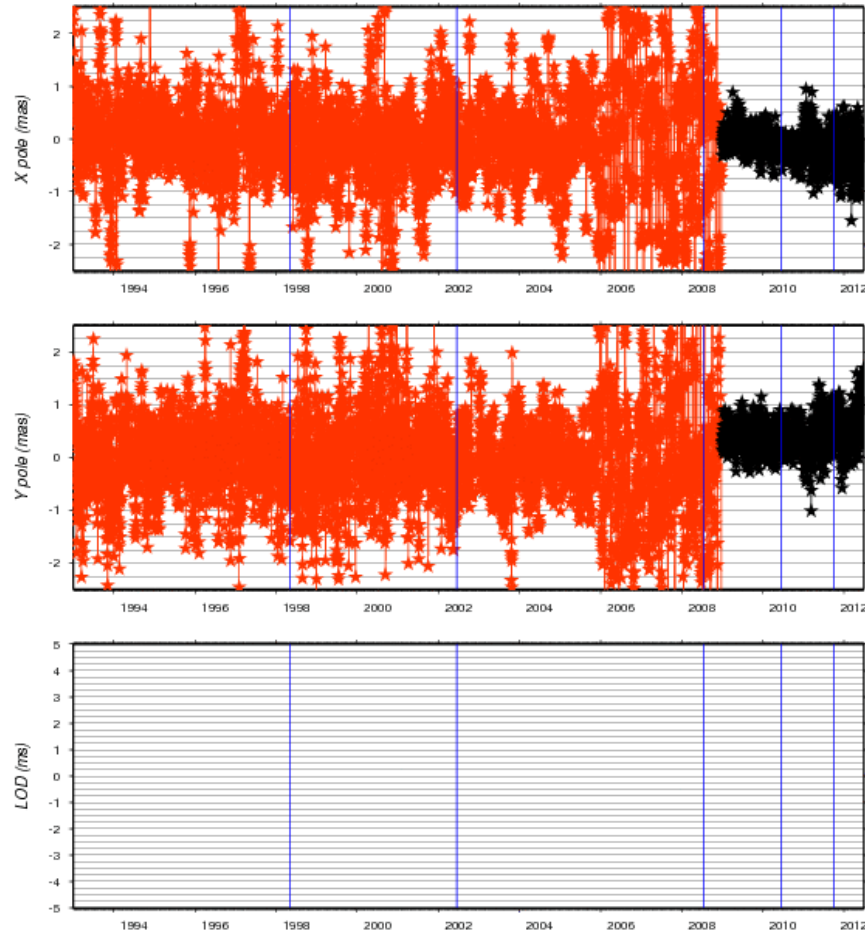
Red = ids01

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	5748	-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

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)
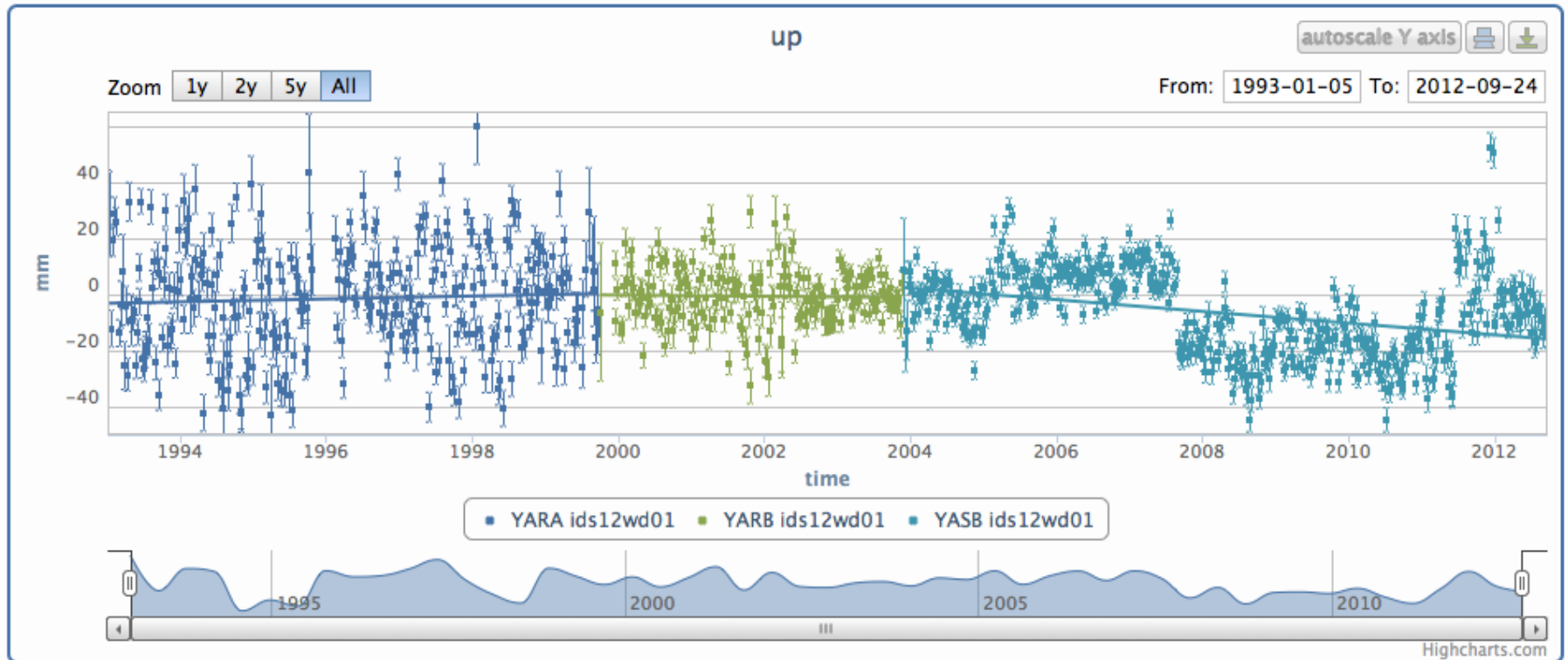
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Data for ITRF2013

ITRF 2013 →

ITRF2008 →

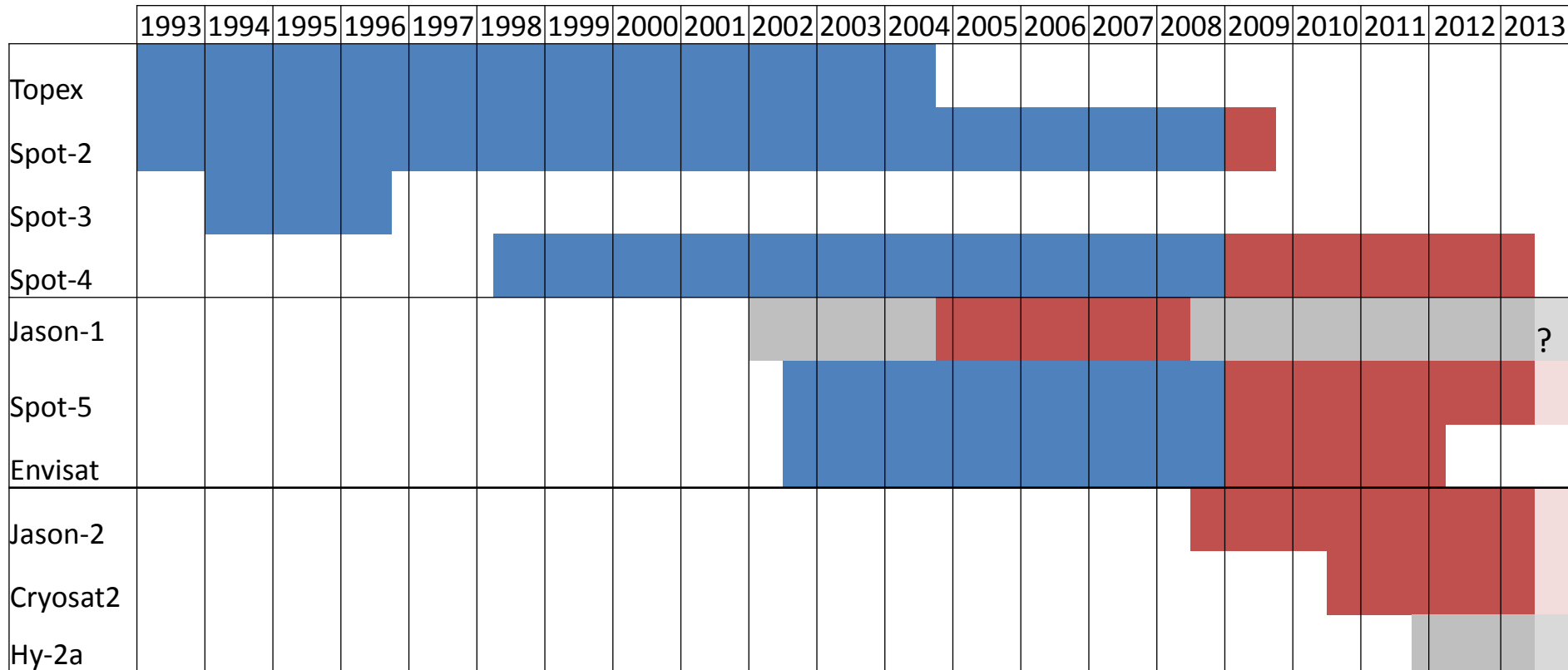|	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
Topex																					
Spot-2																					
Spot-3																					
Spot-4																					
Jason-1																					?
Spot-5																					
Envisat																					
Jason-2																					
Cryosat2																					
Hy-2a																					

• 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)