NETWORK 2008 REVIEW: EVOLUTION, MAINTENANCE AND COLOCATIONS

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Network evolutions since the last IDS workshop

Since March 2006:

- **3 existing stations were completely renovated (complete equipment upgrade and new antenna support): Dionysos, Toulouse & Papeete**
- **2 stations were added to the network:**
  - **Rikitea (replacing Rapa)**
  - **Betio (partly replacing Guam)**
- **2 antennas were repaired following damage: Djibouti and Marion**
- **10 antenna supports were modified (antenna raising) in order to remove the N-type bent connectors**

Current status:

- **49 stations (out of 58 in the current network) were either installed, or renovated after 2000.**

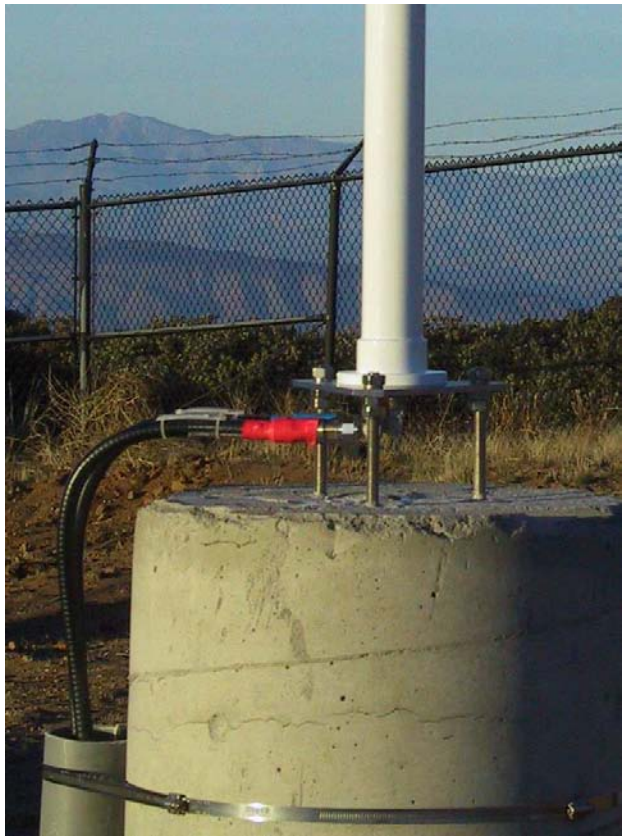
The next step: a new quality leap for the network

- The network renovation action, decided at the end of 1999, is now almost complete
- It aimed at improving the long term stability of the antenna reference point
- In order to also improve the data quality and quantity, new specifications were recently defined by CNES and IGN for the environment of the DORIS stations
- All new stations, and all existing ones when modified, will have to comply with these more stringent requirements
- Exemptions can be granted on an individual basis
- A few stations have already been improved with this aim
- Results are visible on the received power budget

The main requirements

- **For the beacon (and other indoor equipment):**
  - **Reliable and stable power supply**
  - **Clean environment**
  - **Limited temperature changes**
- **For the antenna support and connection:**
  - **Short and long-term stability**
  - **Direct connection of the cables (no bent connectors)**
  - **Minimal mechanical constraints on the connectors**
  - **Increased minimum curvature radius of the cables**
- **For the antenna environment:**
  - **Clear sky view above 5° (formerly 10°), measured from the antenna base**
  - **No metal object (likely to cause multipath) in a 5 m radius around the antenna, except the antenna support itself**
- **For the host agency:**
  - **Should be made aware of these requirements, and of the need to keep on meeting them in the long term**

Antenna support upgrade

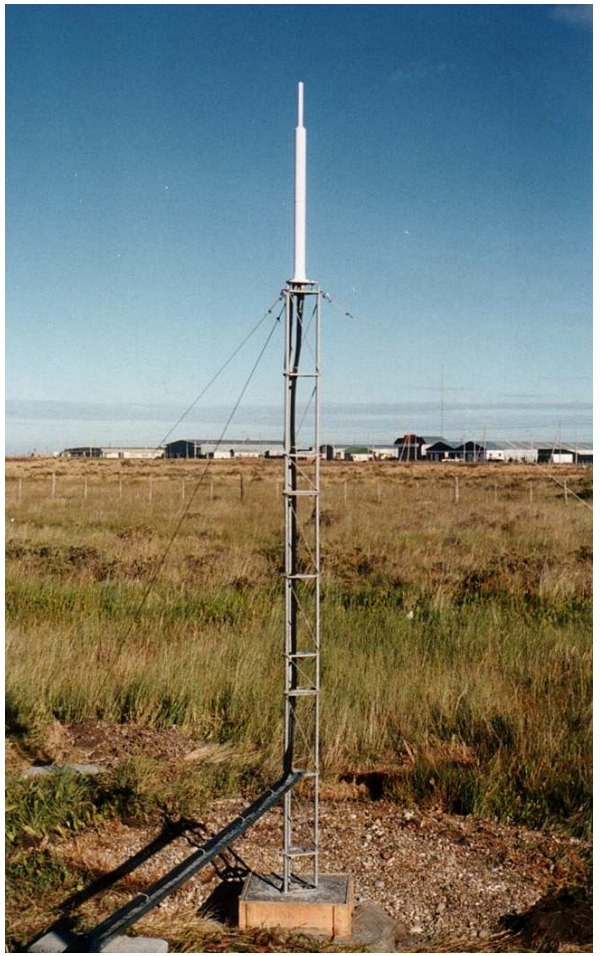


Former support

New support

Antenna support evolution example: Rio Grande (1)

Initial installation (1987):
Alcatel antenna, very loose guying



First upgrade (1995): Starec antenna,
3 m tower, good quality guying,
mm-level centring and verticality

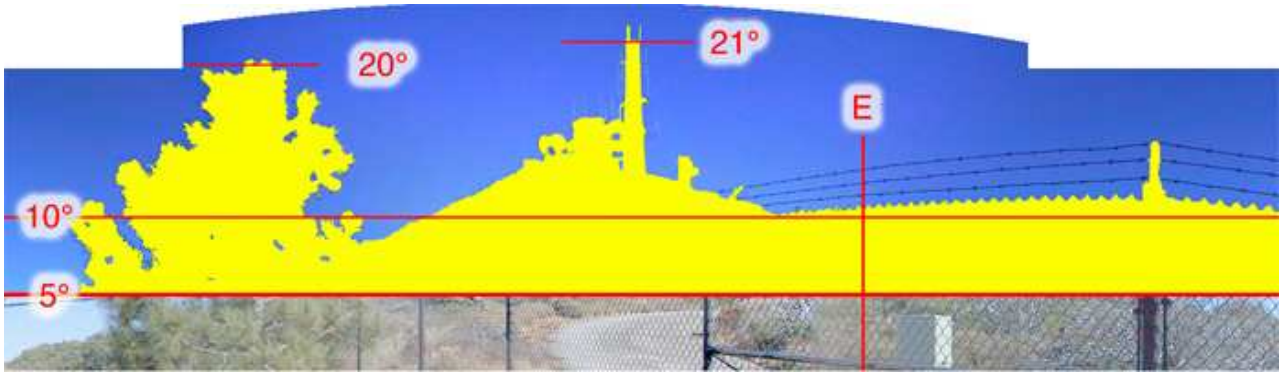
Antenna support evolution example: Rio Grande (2)

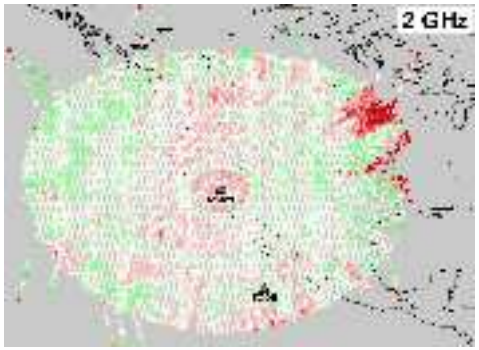
Renovation (2001): deeply anchored concrete pillar, A4 stainless steel plate. But N-type bent connector + strong constraint (due to wind) on the cables.

2008: new antenna support. Cables strongly fastened to the support, direct connection of the cables.

Antenna environment improvement
Example 1: Monument Peak

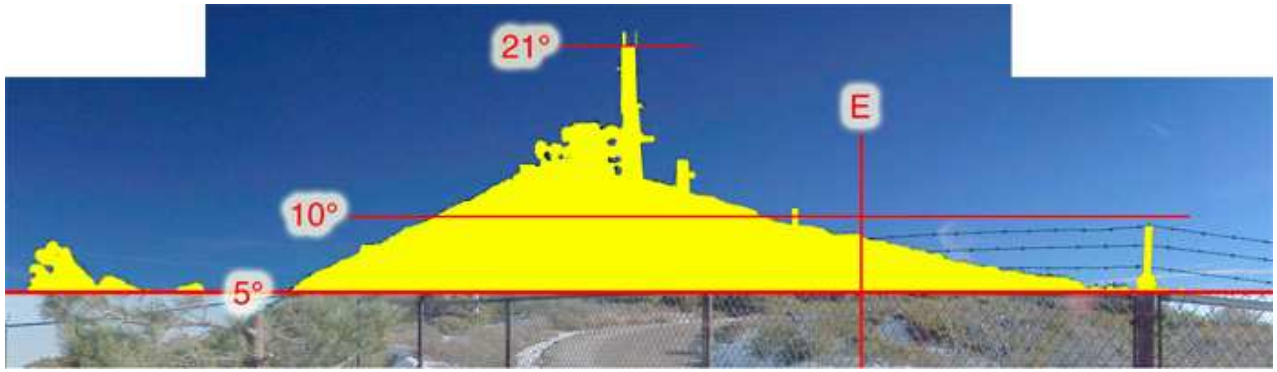
2007 (before the change)

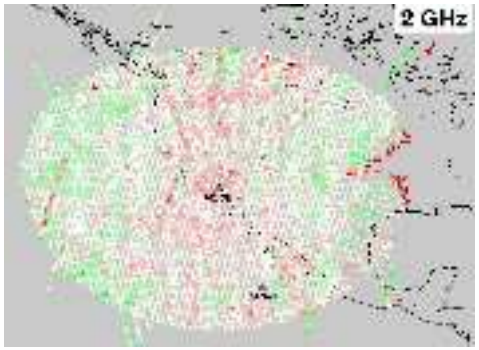




Power attenuation*

2008 (after the change)

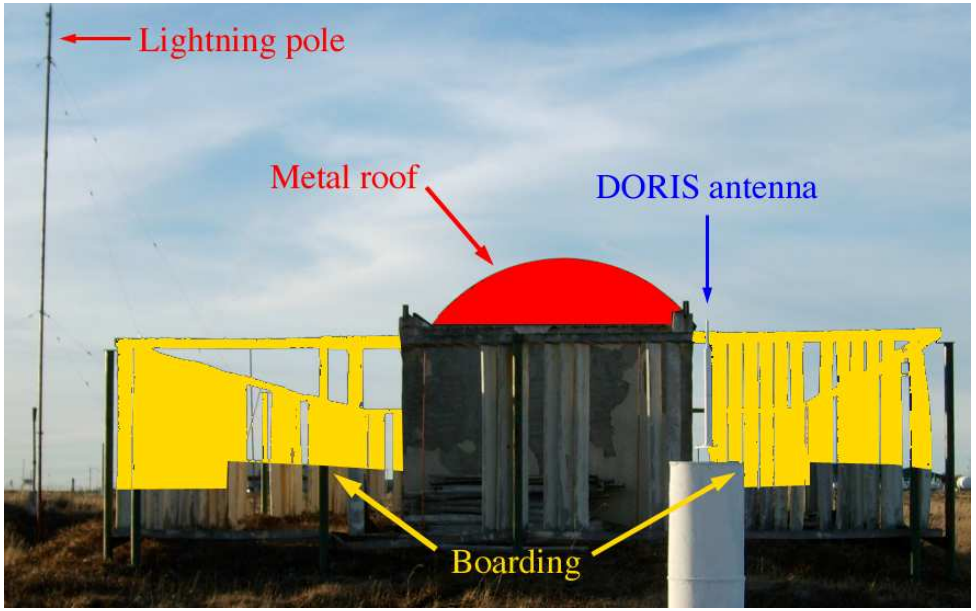




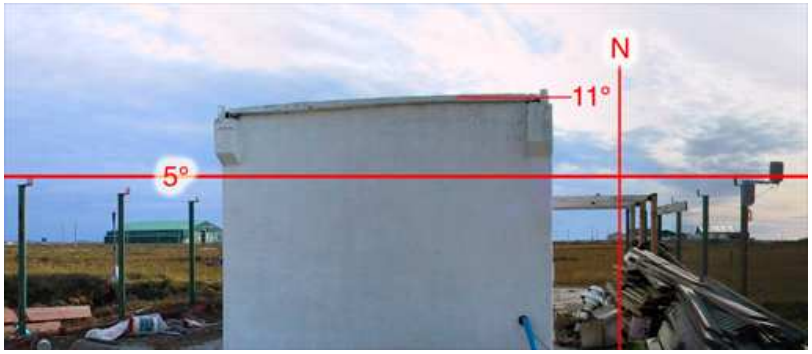
*courtesy of P.Yaya

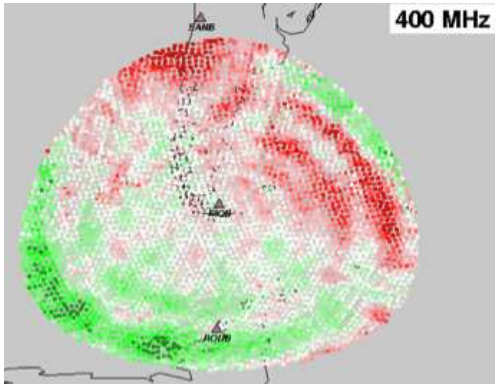
Antenna environment improvement
Example 2: Rio Grande

2007 (before the change)



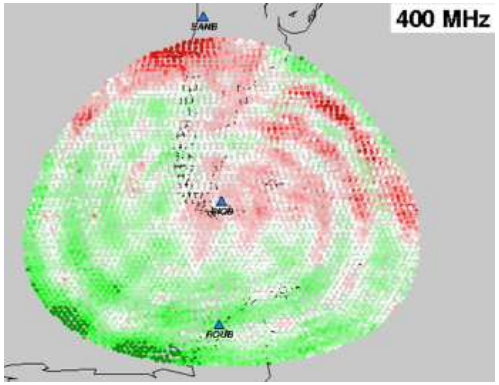
2008 (after the change)





Power attenuation*

*courtesy of P.Yaya



Distribution of the DORIS equipment

Starec antenna

\+

(3rd generation beacon) → 54 stations

\+

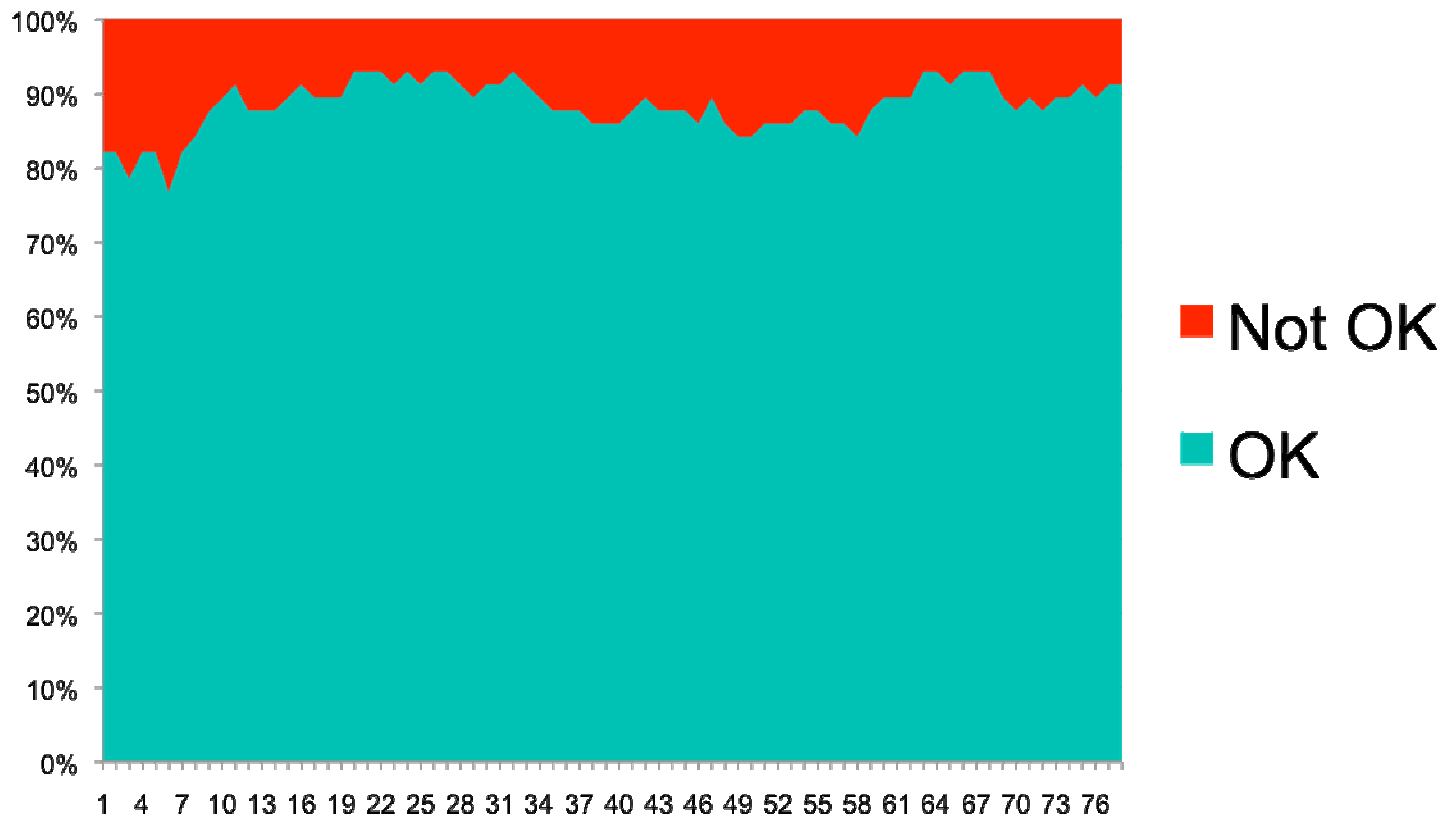
(2nd generation beacon) → 3 stations

\+

(1st generation beacon) → 1 station

No more Alcatel antennas:

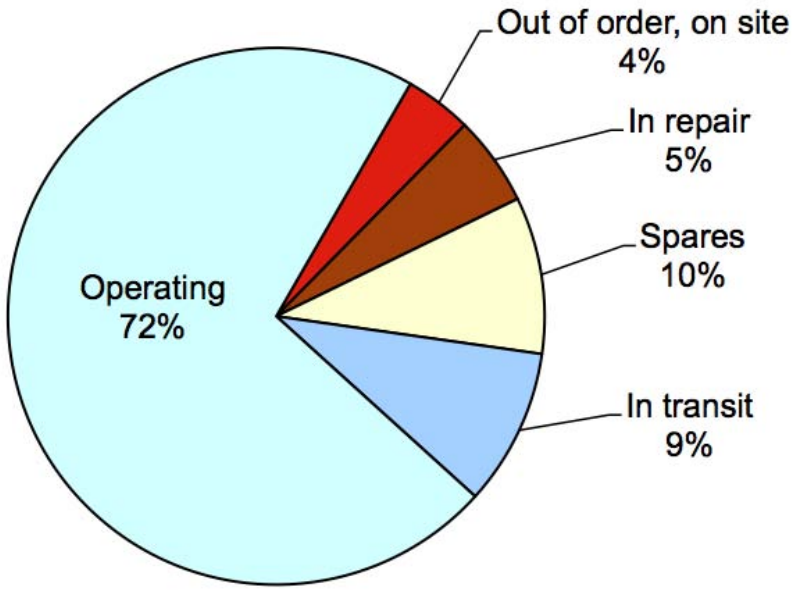
Operation rate since 2007-01-01



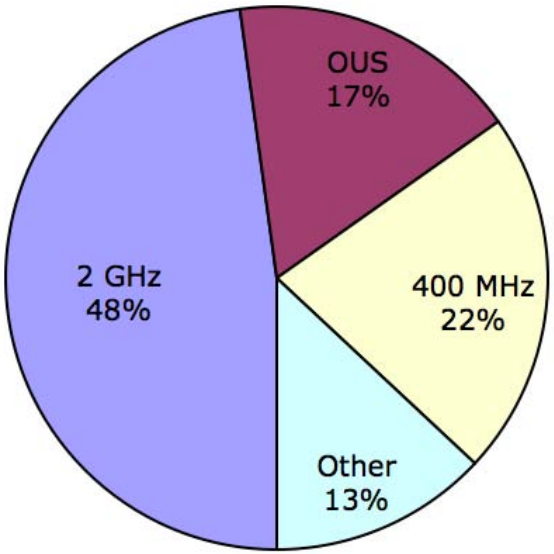
Average value: 88%

3rd generation beacons: current status & failures

Status of the 74 delivered beacons



46 beacon failures since delivery



The antenna failures

- **The Alcatel antennas:**
  - **used for the initial network deployment, from 1986 to 1992**
  - **Still in operation at a few stations, until mid-2007**
  - **Accumulated operating time: 5907 month.antennas = 492 year.antenna**
  - **No failure at all**
- **The Starec antennas:**
  - **Deployed as of 1992**
  - **Accumulated operating time: almost 500 year.antenna (same sample as above)**
  - **Several failures on the 400 MHz channel over the last 3 years**
  - **About 10 antennas have been replaced, 3 more on their way**
- **A major issue:**
  - **Replacing an antenna requires to carry out a geodetic control**
  - **Long data loss (up to a few months)**
- **A corrective action is necessary:**
  - **Problem seems to be due to corrosion and mechanical damage to the internal 400 MHz connector**
  - **Issue taken into account in the evolution of the antenna design, but in the meantime?**

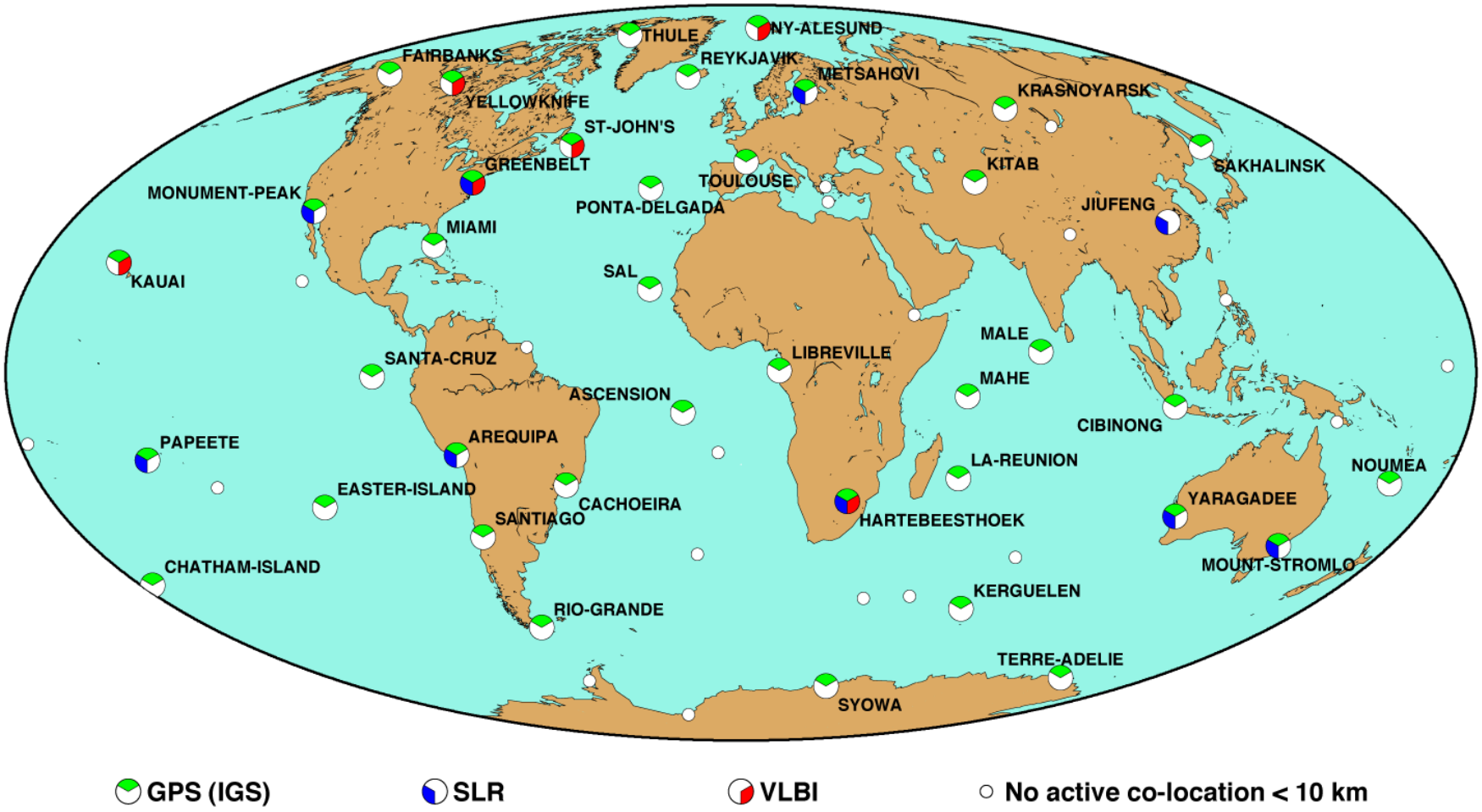
Future evolution of the DORIS equipment

The following evolutions are being considered:

- **Longer antenna cables (requiring an external amplifier):**
  - **More freedom for the choice of the antenna setup and support**
  - **Easier to meet the sky view + stability requirements**
- **Modified antennas:**
  - **Improved 400 MHz connector (failure cause)**
  - **Geometry control**
- **Modified beacon software: better battery runtime in case of power outages**
- **Simplified weather data acquisition: pressure sensor only**

→ version 3.1, available as of 2010

Co-locations (<10 km) with other active IERS techniques



Summary of currently active co-locations

DORIS + GPS: 38 sites

+ SLR: 9 sites

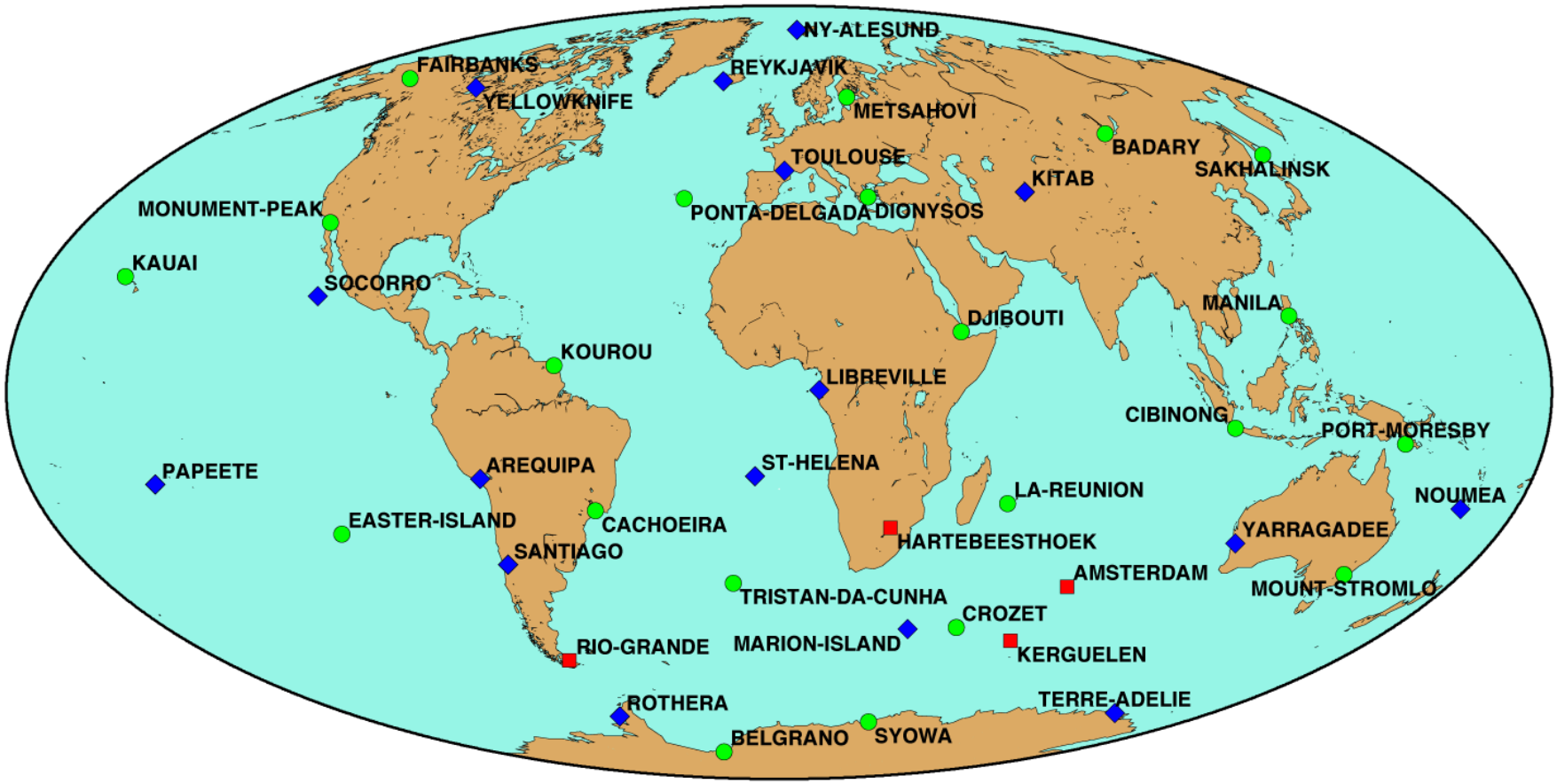
+ VLBI: 6 sites

+ GPS + SLR: 8 sites

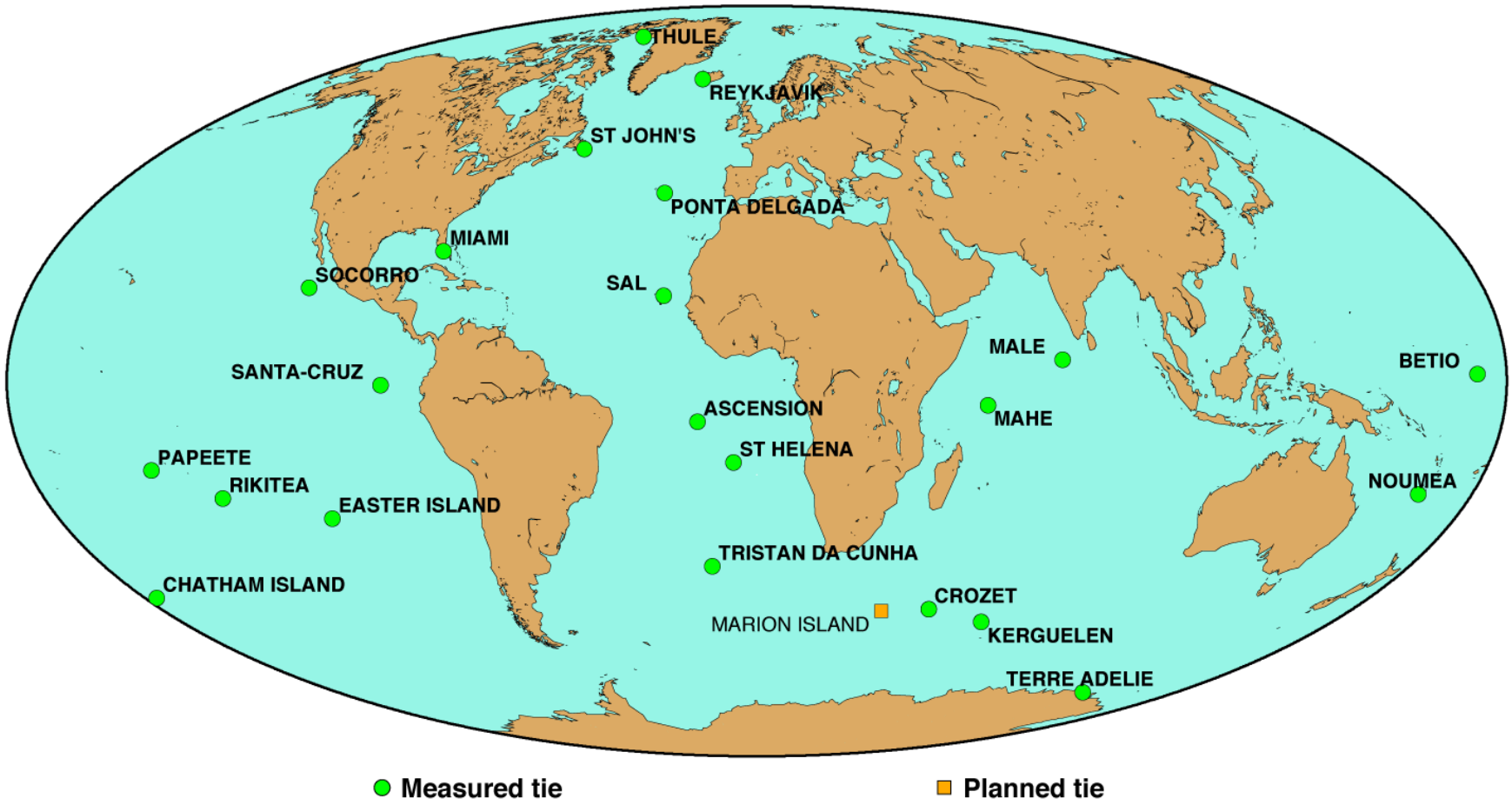
+ GPS + VLBI: 6 sites

+ GPS + SLR + VLBI: 2 sites

DORIS-DORIS co-locations



Tide gauges co-locations (<10 km)



Planned future evolutions

- **Remaining renovations:**
  - **Krasnoyarsk: delayed several years (administrative delays), hopefully next spring**
  - **Socorro: pending a new agreement with the host agency**
  - **Kourou**
- **Continuation of the antenna environment improvement, on the occasion of maintenance trips**
- **New stations in project:**
  - **Tamanrasset, Algeria (replacement for Arlit): GPS, planned SLR**
  - **Riyad, Saudi Arabia: SLR + GPS co-location (agreement ready)**
  - **Other project: Fairbanks antenna move, or site replacement?**

Planned new stations: IGN / IDS proposals

Planned new stations: Pacific Ocean coverage

Note: Fairbanks (which might be replaced by one of these projects) is not shown for better legibility