IDS Report

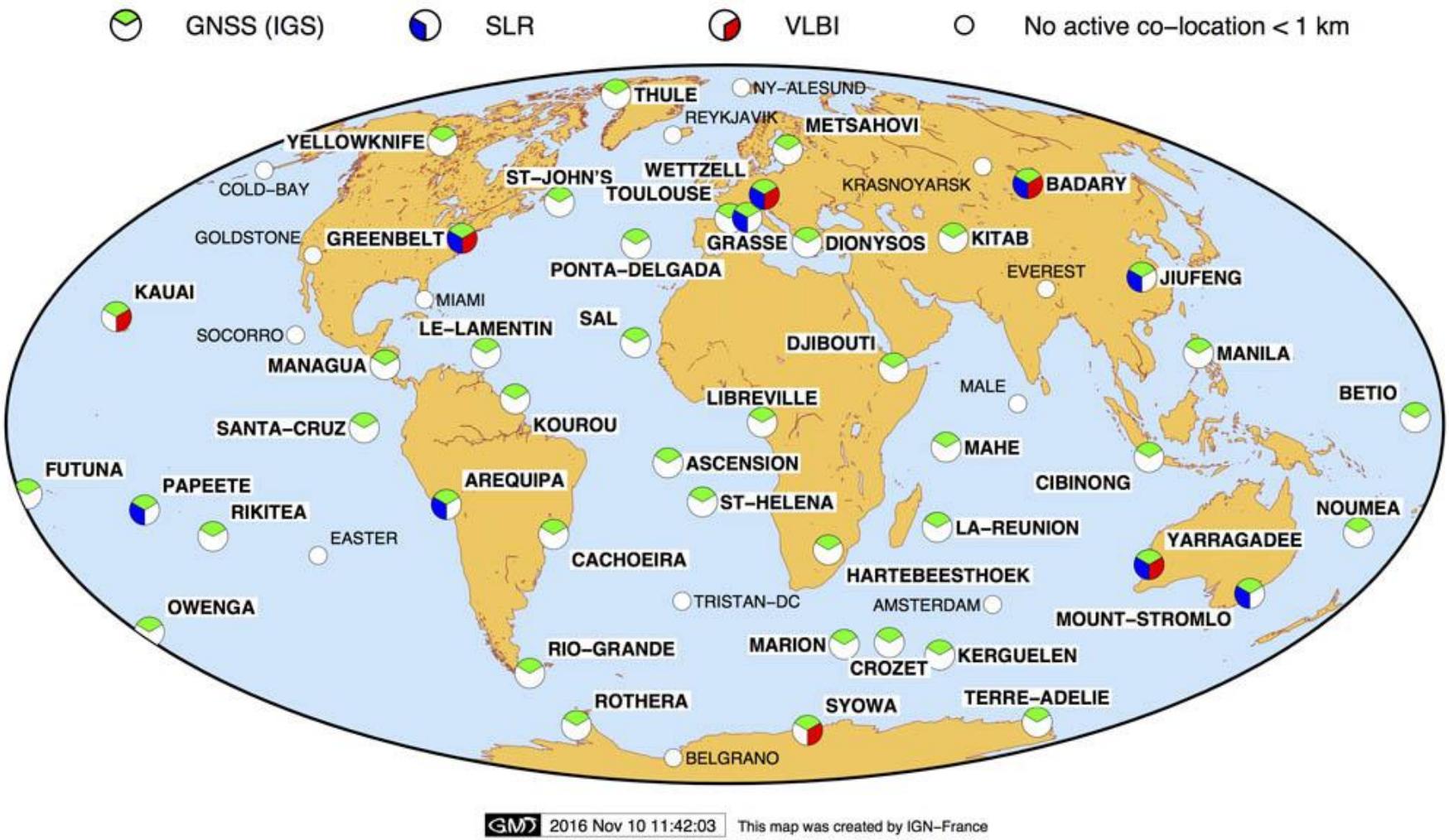
GGOS Bureau for Networks and Observations
New-Orleans, 14 December 2017

Doppler
Orbitography
and **R**adiopositioning
Integrated
by **S**atellite

Prepared by JEROME SAUNIER, IGN (IDS representative to GGOS-BNO)

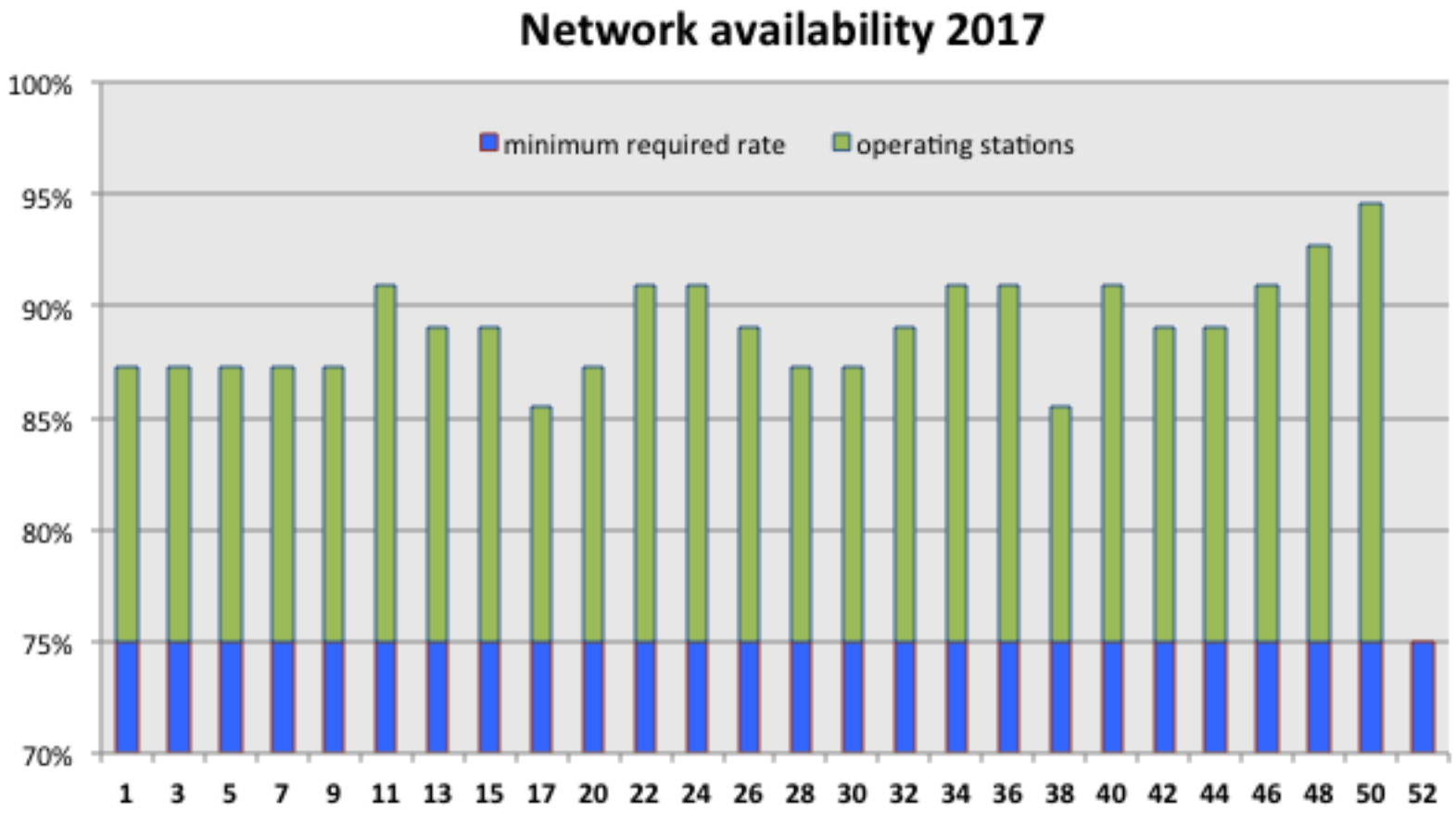
NETWORK STATUS

- 45 CO-LOCATIONS OUT OF 57 DORIS SITES



NETWORK STATUS

- RELIABLE SERVICE OF THE PERMANENT TRACKING STATIONS
- COVERAGE GAP IN SOUTH PACIFIC (3 STATIONS OUT OF ORDER)



NETWORK EVOLUTION

RECENT NETWORK EVENTS

- Aug. 2017: beacon replacement at Tristan da Cunha, South Atlantic, UK
- Nov. 2017: antenna verticality adjustment at Sal Island (Cape Verde)

SHORT TERM (2018):

- San Juan, AR: new station installing in place of Santiago (**3 techniques site**)
- Rothera, Antarctic: relocating 100m away (site refurbishment)
- Guam, US: new station to near IGS station, GUUG
- Ny-Ålesund, Spitzberg, Norway: relocating (new **4 techniques site**)
- Easter Island, Chile: relocating (hosting migration)

LONGER TERM:

- Katherine, AS: new station installing in place of Port-Moresby (**3 techniques site**)
- Changchun, CN: new station installing in place of Sakhalinsk (**3 techniques site**)
- Reykjavik, IS: relocating to improve performance
- Papenoo, Tahiti, FR: new **4 techniques site**

4TH GENERATION DORIS GROUND BEACON

- Prototype will be undergoing testing from next January. Delivery of the first batch of beacons planned in March 2019.

MEASURE LIMITATIONS

- **DORIS SYSTEM NOISE ESTIMATED AT A LEVEL OF 0,3MM/S**
  - Instrumental modeling accuracy
  - Dynamic models accuracy
- **GROUND ANTENNA CHARACTERIZATION**
  - 2013-2014: major work to characterize the ground antenna and initialize an error budget
  - Tourain, C., Moreaux, G., Auriol, A., Saunier, J., 2016. “DORIS Starec ground antenna characterization and impact on positioning”. Adv. Space Res. 58 (12), 2707–2716. http://dx.doi.org/10.1016/j.asr.2016.05.013
  - Saunier, J., Tourain, C., Auriol, A., 2016. « Initiating an error budget of the DORIS ground antenna position – genesis of the Starec antenna type C » Adv. Space. Res. 58 (12), 2717–2724. http://dx.doi.org/10.1016/j.asr.2016.02.013
- **STANDARDIZING INSTALLATIONS AND EQUIPMENT**
  - System requirements for a DORIS station (since 2007)
  - Monument stability steadily improved (since 2000)
  - Saunier, J., 2016. “Assessment of the DORIS network monumentation” Adv. Space Res. 58 (12), 2725–2741. http://dx.doi.org/10.1016/j.asr.2016.02.026

ERROR SOURCES IN POSITIONING

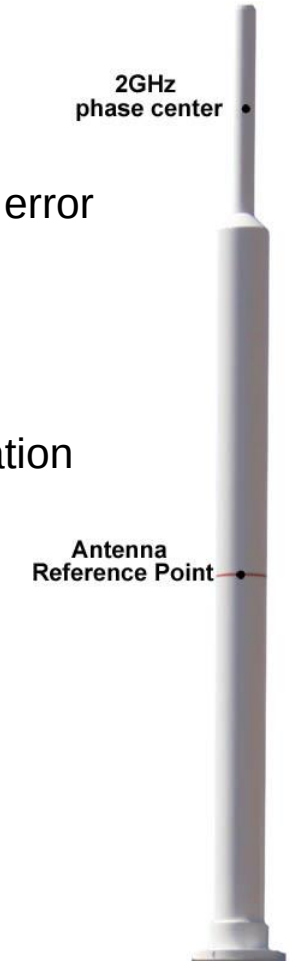
- **MAIN DIFFICULTY:** define the electronic reference point (2GHz) with respect to the conventional reference point (ARP)

- **MANUFACTURING**

1. Variability of the 2GHz phase center position w.r.t. antenna flange => vertical error
2. Centering of the 2GHz phase center w.r.t. radome => horizontal error
3. Alignment ARP/AMP w.r.t. antenna axis => horizontal error
4. Perpendicularity of the antenna flange w.r.t. antenna axis => cured by installation

- **SURVEY**

1. Antenna verticality adjustment => horizontal error
2. Local tie survey (ARP positioning) => horizontal and vertical error



ERROR BUDGET

- The work with the manufacturer helped to consolidate the antenna specifications and draw up an error budget:

Error Type	Error Source	Direction	Error Value	
Manufacturing	2GHz PC centering / radome	Horizontal	± 1 mm	± 2 mm
Manufacturing	Alignment ARP/AMP / axis	Horizontal	± 1 mm	
Manufacturing	2GHz PC position / flange	Vertical	± 1 mm	± 3 mm
Characterization	2GHz PC position and associated phase law	Vertical	± 2 mm	
Survey	Verticality adjustment	Horizontal	± 1 mm	± 2 mm
Survey	Local tie survey	Horizontal	± 1 mm	
Survey	Local tie survey	Vertical	± 1	± 1 mm

NB: this error budget is relating to **antenna Starec type C** (current DORIS antenna)

CURRENT NETWORK COMPONENTS

- **12 STAREC TYPE C:**
  - ADHC, GONC, JIWC, KEVC, KIVC, MNAC, OWFC, PDOC, ROWC, SARC, SOFC, WEUC
  - No systematic deployment but replacements are performed after any maintenance operation
  - 2 mm uncertainty in the horizontal plane; 2.5 mm for the vertical component

- **45 STAREC TYPE B:**
  - Before September 2014
  - Standard uncertainty of the 2GHz phase center in the vertical direction is 5 mm (vs. 1 mm)

LOCAL TIE SURVEY ACCURACY

- **ESTIMATED UNCERTAINTIES FOR EACH DORIS CO-LOCATED SITE**
  - Taking into account: the local tie survey method; the monument stability: the distance between instruments; the completion date
  - File available on ftp://ftp.ids-doris.org/pub/ids/stations/DORIS_ext_ties.txt
- **RECENT PUBLICATION (IERS TECHNICAL NOTE):**
  - “IGN best practice for surveying instrument reference points at ITRF co-location sites” Jean-Claude Poyard, with contributions by Xavier Collilieux, Jean-Michael Muller, Bruno Garayt and Jérôme Saunier 2017 (IERS Technical Note No. 39)
  - Available on line:https://www.iers.org/IERS/EN/Publications/TechnicalNotes/TechnicalNotes.html

IDS NEWS

- **IDS COMMUNICATION**
  - IDS website redesign (including web-services): http://ids-doris.org
  - IDS Activity Report 2016 available online
  - IDS Newsletter #4 available online

- **IDS RETREAT**
  - Currently under preparation for 2018
  - Define goals and objectives: Plan for the next 5-10 years

- **NEXT IDS MEETINGS**
  - IDS AWG in Toulouse in May 2018
  - IDS Workshop in Ponta Delgada, Azores (Portugal) during the symposium “25 years of Progress in Radar Altimetry” 24-29 September 2018