WORLD METEOROLOGICAL ORGANIZATION

DATA BUOY COOPERATION PANEL

THIRTY FIRST SESSION

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ITEM: 10.3(1)

ENGLISH ONLY

ARGOS SYSTEM OPERATIONS AND DEVELOPMENTS

(Submitted by Bill Woodward, Yann Bernard & Brice Robert (CLS Group))

SUMMARY AND PURPOSE OF DOCUMENT

This document provides for the summary report from CLS/Service Argos on the Argos System operations and improvements for the period 2014 – 2015.

ACTION PROPOSED

The Meeting is invited to note the information contained in this document when discussing how it organises its work and formulates its recommendations.

Appendix: A. Report on 2014 – 2015 Argos Operations and System Improvements

DISCUSSION

-A- DRAFT TEXT FOR INCLUSION IN THE FINAL REPORT

10.3(1).1

Argos is a global satellite-based location and data collection system dedicated to studying and protecting our planet's environment. CLS is the operator of the Argos system on behalf of NOAA, CNES, EUMETSAT and ISRO, and continues to maintain and improve an operational service for all Argos users, especially for the meteorology and ocean community, with a level of availability exceeding 99%.

Today the Argos space segment is comprised of six operational satellites, with three NOAA POES (15, 18, 19), 2 EUMETSAT spacecrafts (METOP-A & B) and 1 ISRO satellite (SARAL). The ground segment is made of 7 global receiving stations (6 in the northern polar region and 1 in Antarctica) and 62 local real-time stations worldwide.

Operational highlights from the last 12 months include major upgrades for both CLS France and CLSA processing centers, with reinforced security, upgraded cartography servers and Oracle database and improved traffic management, among other enhancements. In addition, the implementation of a new orbitography processing chain, of a new digital earth elevation model (ACE3) for Kalman location processing, of BCH-based message error detection and correction, and of new functionalities for ArgosWeb (observation, program/platform detail, PMT command) have been key achievements to keep improving the Argos system. In 2014-2015, the Argos real-time stations network was enhanced with 2 new stations (Ascension Island and Libreville, Gabon), and 3 stations were upgraded with Saral reception capability, in Muscat (Oman), Monterey and Hawaii (USA). In addition, 2 ground stations were removed: Manas (Kirghizstan), by order of the US Air Force, and Oslo (Norway) due to recurring technical issues. These actions combined with substantial progress in implementing the Real-time Antenna Upgrade Project (14 HRPT stations currently fully -A4 operational, 2 new stations scheduled in the coming months, and 7 upgrades scheduled for 2015-2016) all contribute to the continuous improvement of the global timeliness with Argos data collection. Major improvements in terms of data mean disposal time have been made over the past 12 months, due to the newly installed station of Ascension Island receiving all Argos satellites, which improves the real time coverage in South Atlantic Ocean, and due to the continuous enhancement of the HRPT Stations network. Our efforts will continue to improve and maintain the coverage of the real-time antennas in the regions where it is needed, namely in the South-East Pacific/South America area (where 2 new stations are planned before the end of 2015) and in the Indonesian/South-West Pacific area (upgrade plan in progress).

CLS continues to provide GTS processing for all DBCP Argos equipped drifters and moored buoys in compliance with WMO and DBCP TT-DM recommendations. A new BUFR sequence for drifting & moored buoys in the Argos processing chain was integrated in 2015. into the CLS GTS processing system. Additionally, the data quality of the entire Argos system performance is monitored 24/7.

The “Argos chipset” / SHARC project (Satellite High-performance ARGOS-3/-4 Receive/transmit Communication), implemented by a European consortium to minimize the power consumption requirements for Argos data communications, has made good progress during 2014-2015, despite some delays. The project objective is to design, build and test a miniature, low-cost ARGOS-3/4 chipset (Asic) that enables two-way data communications, and is fully backward compatible with Argos 2. A second batch of units which will include upgrades will be manufactured ,tested and certified. The Argos hand-held direction finder (RXG-134 Goniometer) manufactured by Xerius was upgraded in 2014 with an internal compass and now features GPS positions decoding capabilities.

10.3(1).6 **The meeting made the following recommendations**:

(i.) Rec1;

(ii.) Rec2;

(iii.) Rec3;

(iv.) Rec4;

(v.) Rec5.

10.3(1).7 **The meeting decided on the following action items**:

(i.) Action1 (**action; by; deadline**);

(ii.) Action2 (**action; by; deadline**);

(iii.) Action3 (**action; by; deadline**);

(iv.) Action4 (**action; by; deadline**);

(v.) Action5 (**action; by; deadline**).

-B- BACKGROUND INFORMATION:
Report on Argos 2014-2015 Operations and Developments

Report on Argos 2014 – 2015 Operations and Developments

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1 2014-2015 Argos Highlights

1.1 Operations

- Cartography servers have been upgraded and virtualized in 2015.
- The second phase of the upgrade of the Oracle database (to version 11GR2) with new optimizer has been carried out.
- The orbitography new processing chain is now running on Unix VM in replacement of the OpenVMS server
- BCH decoding by CTA for message correction (compatible coding to be implemented by Manufacturers)
- New earth elevation model (ACE3) for Kalman location
- Argos WebServices new functionalities (observation, program/platform detail, PMT command)
- CLSA: major upgrade of the system infrastructures (traffic management & security improved, processing center upgraded, virtualized servers implemented, etc.)

1.2 System developments

- SHARC (Satellite High-performance ARGOS-3/-4 Receive/transmit Communication) chipset development project - Work in progress
- 2 new ground HRPT Argos stations added in 2014-2015: Ascension Island & Libreville (Gabon), and 3 stations upgraded: Muscat (Oman), Monterey & Hawaii (USA)
- Integration of a new BUFR sequence for drifting & moored buoys in the Argos processing chain

1.3 Outlook

- Online Argos LOC reprocessing ordering/downloading. (LS/Kalman/Smoothing)
- New reference beacon monitoring component, to monitor the data reception quality.
- New Argos Loc Quality Monitoring Component, to control the quality of the Argos Doppler location system.
- End of 2015: the new Argos Web user interface and cartography systems should be released: entirely redesigned (responsive design compatible with all web browsers, tablets and smartphones), with new services, and upgraded functionalities.

- The Argos real-time antenna network upgrade project continues (planned stations) :
    - Athens (Greece): discussion with Eumetsat for using EARS station for Saral.
    - Mas Palomas (Spain): discussion with Eumetsat for using EARS station for Saral.
    - Kourou (French Guyana): new station scheduled for September.
    - Easter Island (Chile): new station scheduled for September 2015
    - Cape Ferguson (Australia / AIMS) : upgrade planned before end of 2015
    - Melbourne, Darwin, Davis and Casey (Australia / BOM): BOM has planned to replace the existing antennas with new ones, we are waiting to discuss with BOM about their integration in the HRPT network

2 Argos space segments

2.1 Operational status

On June 6th 2014, telecommand access to Noaa-16 (NL) was lost and no more telemetry received. NOAA-16 (NL) Argos-2 payload was decommissioned on June 9th, 2014 after 14 years of service.

Argos instruments are now onboard 6 POES's spacecrafts.
The status information on each spacecraft and its Argos various subsystems is described below:

Satellites	Launch date	Status	Real time data (HRPT)	Stored data (STIP)	Data AVHRR
SARAL (SR)	25-Feb-13	N/A	Ok	Inuvik, Kiruna	N/A
METOP-B (MB)	17-Sep-12	AM Primary	Ok	Svalbard, McMurdo	Ok
METOP-A (MA)	19-Oct-06	AM Backup	Ok*	Svalbard	Ok
NOAA-19 (NP)	06-Feb-09	Prime Services Mission (ADCS,SARSAT) *PM Primary is now Suomi-NPP for other products*	Ok	Gilmore, Wallops, Svalbard	Ok
NOAA-18 (NN)	20-May-05	PM Secondary	Ok	Gilmore, Wallops	Ok
NOAA-15 (NK)	13-May-98	AM Secondary	Ok	Gilmore, Wallops	Ok

** Scheduled activities are defined on Orbit Switch ON and Switch OFF (see below for more details).*

Figure 1 Argos Constellation

2.2 METOP-A HRPT Switch Zone

To minimize the risk of failure of the AHRPT-B unit whilst still offering the user community a service, EUMETSAT has implemented a "partial" AHRPT service in those areas where the risk of damage from heavy ion radiation is reduced.

For southbound passes, AHRPT side B is activated for all orbits over the North Atlantic and European area, starting at around 60°N. The AHRPT is switched off before the spacecraft reaches the Southern Atlantic Anomaly region at around 10°N.

In January 2011, EUMETSAT announced the extension of this activation zone while maintaining the same operational restrictions over the polar caps and South Atlantic anomaly. Furthermore, AHRPT operations is made in ascending orbits, but with more stringent risk reduction measures than for the descending passes, given the availability of data via the Fast Dump Extract System (FDES) to cover the Northern Hemisphere.

Figure 2 shows the extended activation zone of the AHRPT for both descending and ascending parts of the orbit. The extended AHRPT coverage is effective since 18 January 2011 as a pre-operational service.

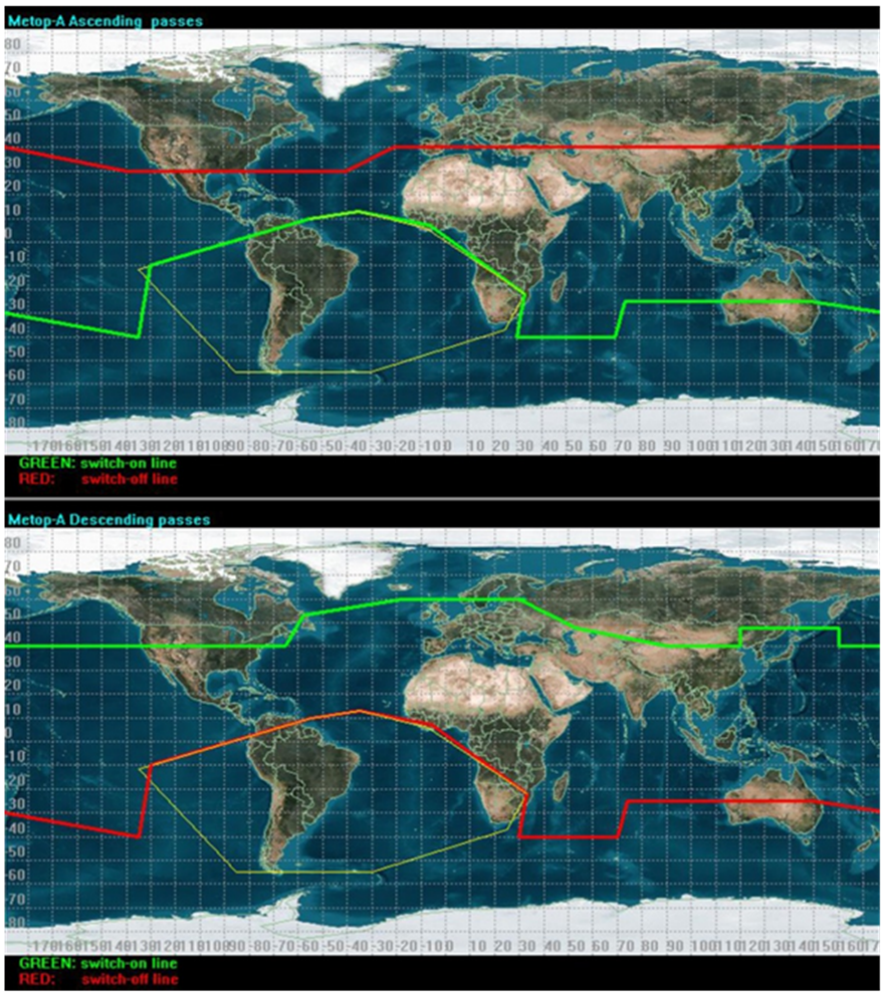


Figure 2 : METOP-A HRPT Extended Switch Zone (Descending and Ascending orbits)

2.3 Ascending Nodes Local hour

The following diagram presents the local time of ascending nodes in April 2015

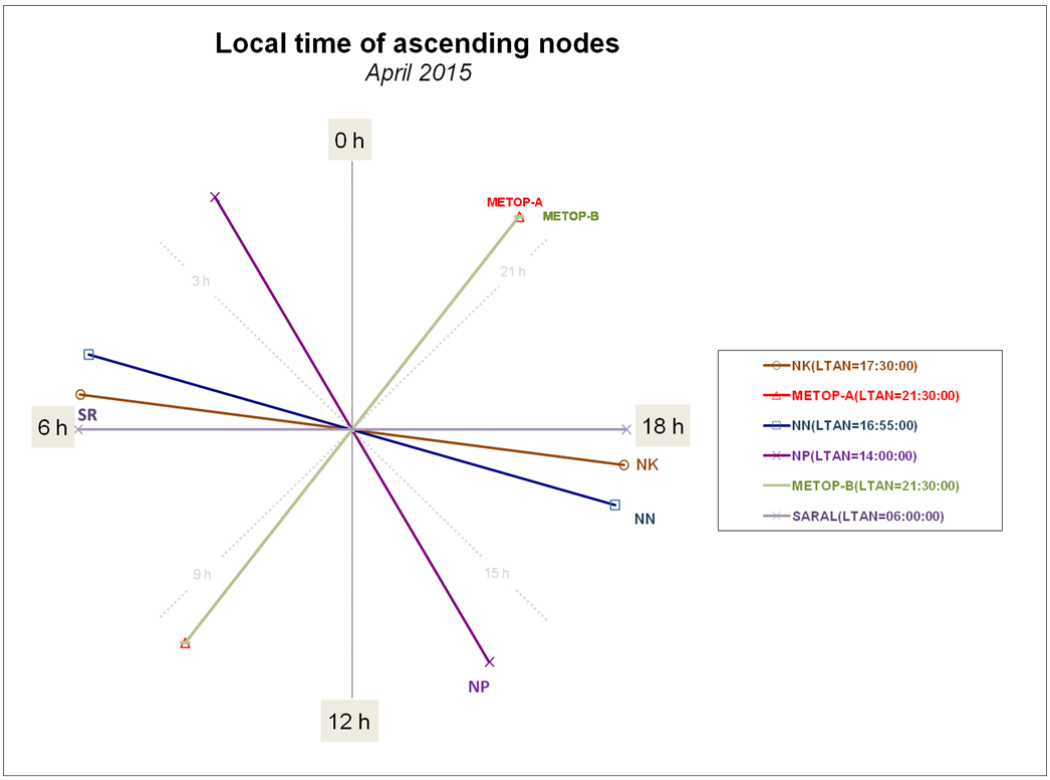


Figure 3: Local Equator crossing time in April 2015

2.4 Argos payloads anomalies in 2014-2015

METOP-A, METOP-B, NOAA-18, NOAA-15

- *0 Major* incidents

NOAA-19

- 2 Major incidents :

Date	Label	Impacts	Actions
10/02/2014 21h32	None HD message since September 2013 (Argos-Sarsat_FT_93)	Argos collection service close for 15 hours Argos location service close for 89 hours	On board Software Restart
01/07/2014 01h18	Watchdog	Argos collection service close for 21h30 hours Argos location service close for 54 hours	DSP On

NOAA-16

- 1 Major incident + Decommissioning

Date	Label	Impacts	Actions
06/06/2014 00h55	No more telecommand access with satellite	No telemetry	NOAA investigations
09/06/2014	Decommissioning	HS	None

SARAL

- 2 Major incidents

Date	Label	Impacts	Actions
27/01/2014 07h41	Decreasing of the rate of reception of good A3 messages (Argos-Sarsat_FT_92)	Partial loss of data. The Beginning of the anomaly is probably in December 2013.	Reset of DSP
6/10/2014 13h40	Safe Hold Mode	- No Downlink Way Services for 98 hours - No ARGOS collection for 97 hours. - No Argos location for 186 hours.	

2.5 Maneuvers in 2014 and 2015

METOP-A

Date	Label	Impacts	Actions
05/02/2014 13h29	In Plane Maneuver 1 burst of 5.4s	Degradation of the ARGOS locations quality for 16 hours	
26/03/2014 13h15	Out of Plane Maneuver 1 burst 640s	No ARGOS location for 51 hours	
09/04/2014 11h42	Out of Plane Maneuver 1 burst 682s	No ARGOS location for 44 hours	
29/10/2014 13h17	In-Plane Maneuver 1 burst de 13s	Degradation of the ARGOS locations quality for 15 hours	
14/01/2015 12h37	In-Plane maneuver 1 burst de 14s	Degradation of the ARGOS locations quality for 15	

		hours
28/04/2015 11h59	In-Plane maneuver 1 burst de 7s	Degradation of the ARGOS locations quality for 15 hours
15/07/2015 13h03	In-Plane maneuver 1 burst de 8s	Degradation of the ARGOS locations quality for 14 hours

METOP-B

Date	Label	Impacts	Actions
19/02/2014 12h59	In Plane Maneuver 1 burst of 7s	Degradation of the ARGOS locations quality for 17 hours	
29/04/2014 11h34	In Plane Maneuver 1 burst of 8.4s	Degradation of the ARGOS locations quality for 18 hours	
23/07/2014 12h48	In Plane Maneuver 1 burst of 4.8s	Degradation of the ARGOS locations quality for 14 hours	
08/10/2014 13h17	Out Of Plane Maneuver 1 bursts of 9 minutes	No ARGOS location for 44 hours.	
22/10/2014 11h46	Out Of Plane Maneuver 1 bursts of 9 minutes	No ARGOS location for 149 hours.	
16/12/2014 12h03	In Plane Maneuver 1 burst of 5s	Degradation of the ARGOS locations quality for 17 hours	
18/02/2015 14h11	In Plane Maneuver 1 burst of 2s	Degradation of the ARGOS locations quality for 15 hours	
02/06/2015 13h33	In Plane Maneuver 1 burst of 3s	Degradation of the ARGOS locations quality for 15 hours	
12/08/2015 11h25	In Plane Maneuver 1 burst of 3s	Degradation of the ARGOS locations quality for 17 hours	

SARAL

Date	Label	Impacts	Actions
28/01/2014 13h39	In-Plane Maneuver 1 burst of 2.2s	Degradation of the ARGOS locations quality for 15 hours	
03/03/2014 14h51	In-Plane Maneuver 1 burst of 3.17s	Degradation of the ARGOS locations quality for 14 hours	
26/03/2014 12h47	In-plane Maneuver 1 burst of 2.4s	Degradation of the ARGOS locations quality for 16 hours	
18/04/2014 12h24	In-plane Maneuver 1 burst of 2.4s	Degradation of the ARGOS locations quality for 16 hours	
19/05/2014 14h31	In-plane Maneuver 1 burst of 2.0s	Degradation of the ARGOS locations quality for 14 hours	
09/07/2014 12h47	In-plane Maneuver 1 burst of 1.6s	Degradation of the ARGOS locations quality for 14 hours	
13/08/2014 12h47	In-plane Maneuver 1 burst de 1.4s	Degradation of the ARGOS locations quality for 16 hours	
12/09/2014 13h45	In-plane Maneuver 1 burst de 1.5s	Degradation of the ARGOS locations quality for 16 hours	
6/10/2014 12h40	In-plane Maneuver 1 burst de 1.8s	N/A	
04/11/2014 12h27	In-plane Maneuver 1 burst de 2s	Degradation of the ARGOS locations quality for 16 hours	
21/11/2014 13h39	In-plane Maneuver 1 burst de 2s	Degradation of the ARGOS locations quality for 15 hours	
10/12/2014 13h47	In-plane Maneuver 1 burst de 2s	Degradation of the ARGOS locations quality for 16 hours	
26/12/2014 13h41	In-plane Maneuver 1 burst de 2s	Degradation of the ARGOS locations quality for 16 hours	
22/01/2014 14h31	In-plane Maneuver 1 burst de 2s	Degradation of the ARGOS locations	

		quality for 16 hours
21/02/2015 13h48	In-plane Maneuver 1 burst de 2s	Degradation of the ARGOS locations quality for 16 hours
31/03/2015 13h50	In-plane Maneuver Planned: 1 burst de 3s additional thruster firing during reverse rotation of the maneuver because of unavoidable selection of thruster mode to control attitude as one of the reaction wheel got stuck at 0 rpm	Anomaly during Maneuver: LOC processing turned off – from 31/03 15:00 to 01/04 15:00
09/04/2015 12h28	In-plane Maneuver 1 burst de 2s	Degradation of the ARGOS locations quality for 16 hours
26/05/2015 12h51	In-plane Maneuver 1 burst de 6s	LOC processing turned off – from 26/05/2015 11:00 to 27:/05/2015 13:00 (26 hours)
16/06/2015 13h30	In-plane Maneuver 1 burst de 1s	LOC processing turned off – from 16/06/2015 12:00 to 18/06/2015 06:00 (42h)
08/07/2015 13h41	In-plane Maneuver 1 burst de 4s	LOC processing turned off – from 08/07/2015 13:00 to 09/07/2015 07:00 (18h)

3 Argos ground segment

3.1 Global antennas (store and forward mode)

The Argos global antennas network comprises of seven stations:

- The two NOAA global stations of Fairbanks and Wallops acquire the global recorded telemetry transmitted by NOAA-15, NOAA-18 and NOAA19.
- The EUMETSAT global receiving station of Svalbard acquires the global recorded telemetry transmitted by Metop-A and Metop-B as well as the 2 daily blind orbits of NOAA-19 for NOAA stations.
- The NOAA Svalbard antenna that delivers NOAA-15 and NOAA-18 blind orbits for Fairbanks and Wallops when not in conflict with NOAA-19.
- Inuvik (Canada) and Kiruna (Sweden) stations for SARAL operated by EUMETSAT.

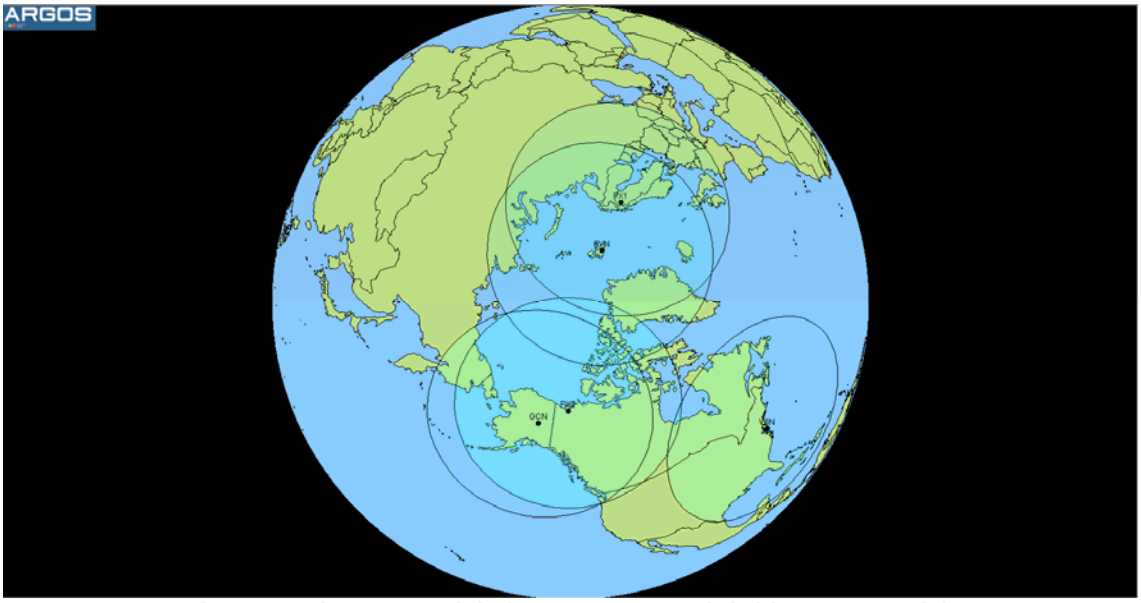


Figure 4 : The Argos Global antenna network (without McMurdo)

- Data recovery from MetOp-B will occur at Svalbard and McMurdo (ADA). Timeliness benefit of McMurdo data recovery is for MetOp-B only. MetOp-A data will continue to NOAA on a best effort basis and without the timeliness benefits of half orbit dumps at McMurdo.

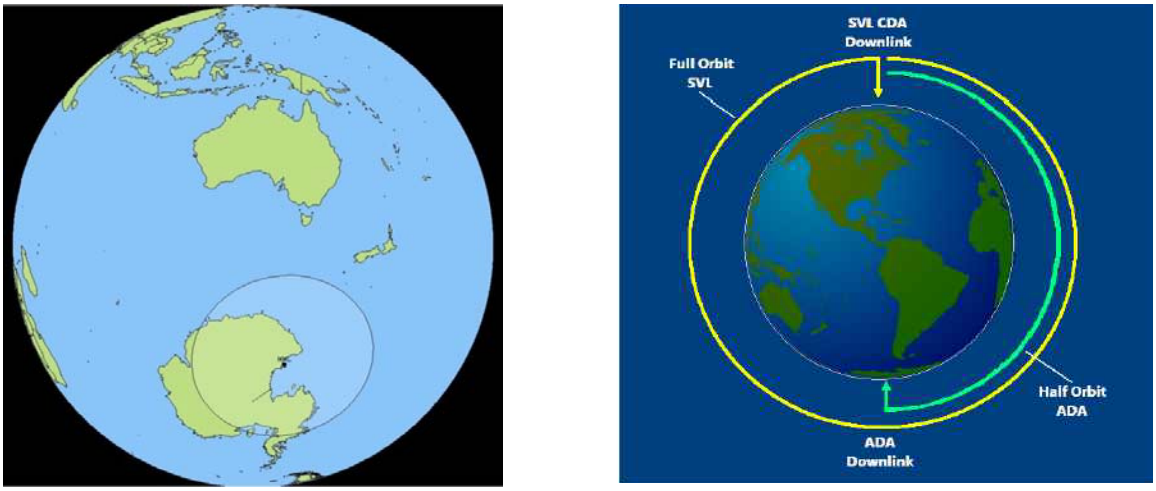


Figure 5 : METOP-B Mc Murdo Global antennas coverage and principle

3.2 Regional antennas (real-time mode)

3.2.1. *Operation and improvements*

In 2015, the real-time network was upgraded with 2 new ground stations added and 3 upgraded to receive Saral:

- Ascension Island station operated by CLS
- Libreville (Gabon) station operated by CLS
- Muscat (Oman) station operated by EUMETSAT/DGMAN (upgraded for Saral)
- Monterey & Hawaii (USA) stations operated by NOAA (upgraded for Saral)

2 ground stations have been removed :

- Manas (Kirghizstan): a USAF antenna
- Oslo (Norway): due to erratic operation, replaced by Tromsoe and Lannion stations

The real-time Argos ground stations network consists of about 62 antennas. Most of them are capable of receiving NOAA POES satellites data, 24 out of these 62 stations receive METOP satellites data and 14 receive also SARAL data.

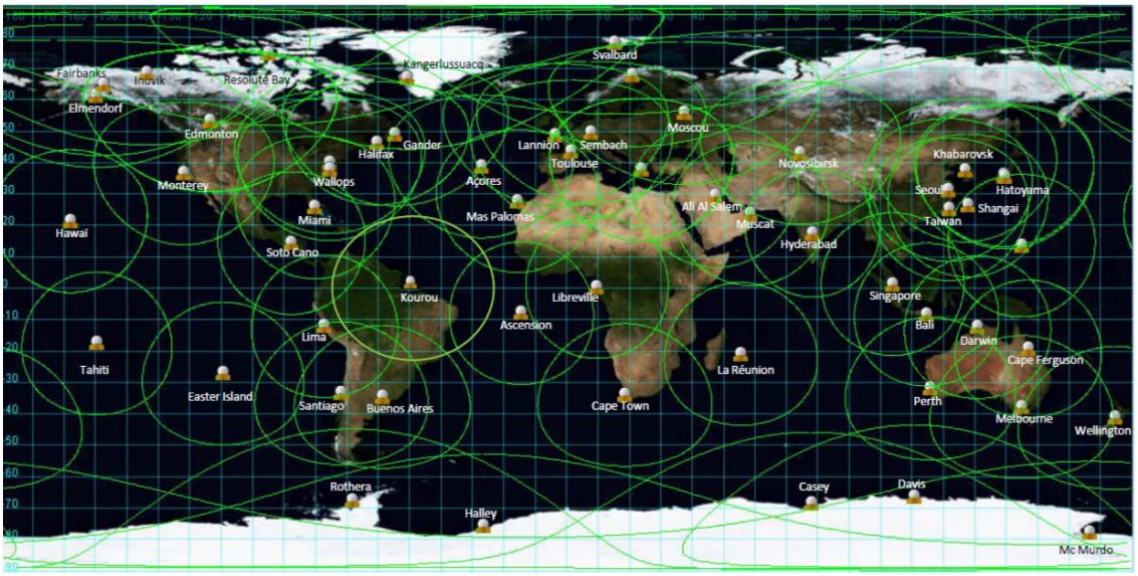


Figure 6 : May 2015 Argos Real-time coverage map

Name	Code	Country	Operator	Sat					
Ascension Island	AI	UK	ROYAL AIR FORCE	NK	NN	NP	MA	MB	SR
Andersen	AN	GU	US AIR FORCE	NK	NN	NP			
Ali Al Salem	AS	KW	US AIR FORCE	NK	NN	NP			
Buenos Aires	BA	AR	INTA	NK	NN	NP			
Bali	BL	ID	PT CLS INDONESIA		NN	NP	MA		SR
Casey	CA	AU	BOM	NK	NN	NP			
Cape Ferguson	CF	AU	NOAA NESDIS		NN	NP			
Santiago	CH	CL	METEO CHILE		NN	NP			
Darwin	DA	AU	BOM	NK	NN	NP			
Davis	DV	AU	BOM	NK	NN	NP			
Edmonton	ED	CA	ENVIRONNEMENT CANADA	NK	NN	NP			
Elmendorf - Anchorage	EL	US	US AIR FORCE	NK	NN	NP			
Lannion	FL	FR	METEO-FRANCE		NN	NP	MA	MB	SR
Reunion Island HRPT4	FR	FR	METEO FRANCE	NK	NN	NP	MA	MB	SR
Libreville - N Koltang	GB	GA	CLS	NK	NN	NP	MA	MB	SR
Gilmore Creek	GC	US	NOAA NESDIS	NK	NN	NP		MB	
Sondre	GR	GL	DMI	NK	NN	NP			
Halifax	HF	CA	CANADIAN COAST GUARD	NK	NN				
Hickam - Honolulu	HI	US	US AIR FORCE	NK	NN	NP			
Halley	HR	GB	British Antarctic Survey		NN	NP			
Hatoyama	HT	JP	Jaxa	NK	NN	NP	MA	MB	SR
Hawaïi	HW	US	NOAA NWS		NN	NP	MA	MB	
Hyderabad	HY	IN	INCOIS	NK	NN	NP			

Jamstec - Tokyo	JM	JP	CUBIC-I	NK	NN				
Kandena- Okinawa	KA	JP	US AIR FORCE	NK	NN	NP			
Lajes - Portugal(Acores)	LA	PT	US AIR FORCE	NK	NN	NP			
Lima	LM	PE	CLS PERU	NK	NN	NP	MA	MB	SR
Miami	MA	US	NOAA AOML	NK	NN	NP	MA	MB	
Melbourne	ME	AU	BOM	NK	NN	NP			
Miami Capture	MI	US	CLS FR				MA	MB	SR
Mc Murdo	MM	AQ	NOAA					MB	
Monterey	MO	US	NOAA NESDIS	NK	NN	NP	MA	MB	
Wellington	NZ	NZ	NIWA		NN	NP			
Perth	PE	AU	BOM	NK	NN	NP			
Lima	PR	PE	CLS PERU	NK	NN	NP			
Polar Bande-X Saral	PX	SE	Eumetsat						SR
Resolute Bay	RB	CA	Environment Canada	NK	NN	NP			
Reunion Island	RN	FR	METEO FRANCE		NN	NP			
Rothera	RO	GB	British Antarctic Survey	NK	NN	NP			
Ramonville	RV	FR	CLS	NK	NN	NP			
Cape Town	SA	ZA	SAWB	NK	NN	NP	MA	MB	SR
Soto Cano	SC	HN	USAF	NK	NN	NP			
Séoul	SE	KR	KMA	NK	NN	NP			
Singapore	SG	SG	SMM	NK	NN	NP			
Shanghai	SH	CN	EAST CHINA SEA FISHERIES	NK		NP			
Sembach	SM	DE	US AIR FORCE	NK	NN	NP			
Svalbard	SN	NO	NOAA			NP	MA	MB	
Svalbard	SV	NO	EUMETSAT				MA	MB	
Svalbard NOAA	SW	US	NOAA	NK	NN				
Papeete	TA	FR	METEO-FRANCE	NK	NN	NP	MA	MB	SR
CNES (test)	TE	FR	CLS		NN	NP			SR
Taïwan	TW	TW	NTOU	NK	NN	NP			
Valley Forge (Test)	UA	US	US AIR FORCE	NK	NN	NP			
Wallops Island	WI	US	NOAA NESDIS	NK	NN	NP		MB	
Athens EARS	XA	GR	EUMETSAT		NN	NP	MA	MB	
Edmonton EARS	XE	CA	EUMETSAT	NK	NN	NP			
Gander EARS	XG	CA	EUMETSAT	NK	NN	NP			
Kangerlussuaq EARS	XK	GL	EUMETSAT	NK	NN	NP		MB	
Maspalomas EARS	XM	ES	EUMETSAT	NK	NN	NP	MA	MB	
Muscat EARS	XO	OM	EUMETSAT EARS		NN	NP	MA	MB	SR
Moscou EARS	XR	RU	EUMETSAT	NK	NN	NP	MA	MB	
Svalbard EARS	XS	NO	EUMETSAT		NN	NP	MA	MB	

Figure 7 : List for Operational Antennas on April 2015 and tracked satellites

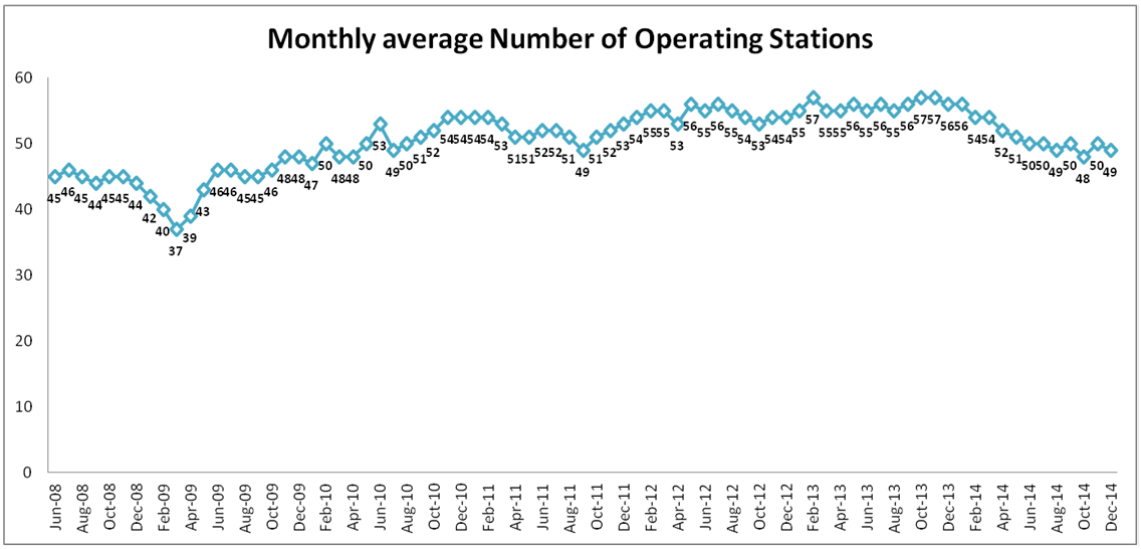


Figure 8 : Operational Argos real-time antennas since January 2008

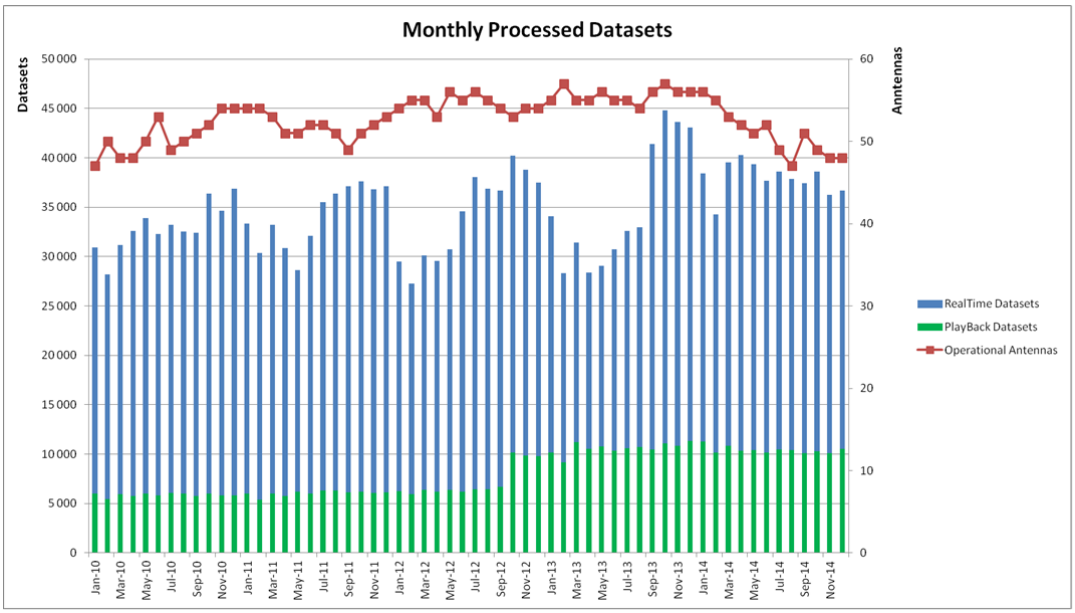


Figure 9 : NOAA/METOP/SARAL Playback and Real-time datasets processed per Month

3.2.2. *METOP real-time coverage*

All METOP HRPT compatible antennas were configured to track Metop-B except some of the EARS Station network.

- Metop-A by NOAA ESPC: Monterey, Ewa Beach, Miami
- Metop-B by NOAA ESPC: Monterey, Ewa Beach, Miami, Gilmore Creek, Wallops Island
- Metop-A by Eumetsat : EARS network except Kangerlussuaq
- Metop-B by Eumetsat : EARS network except Edmonton, Gander

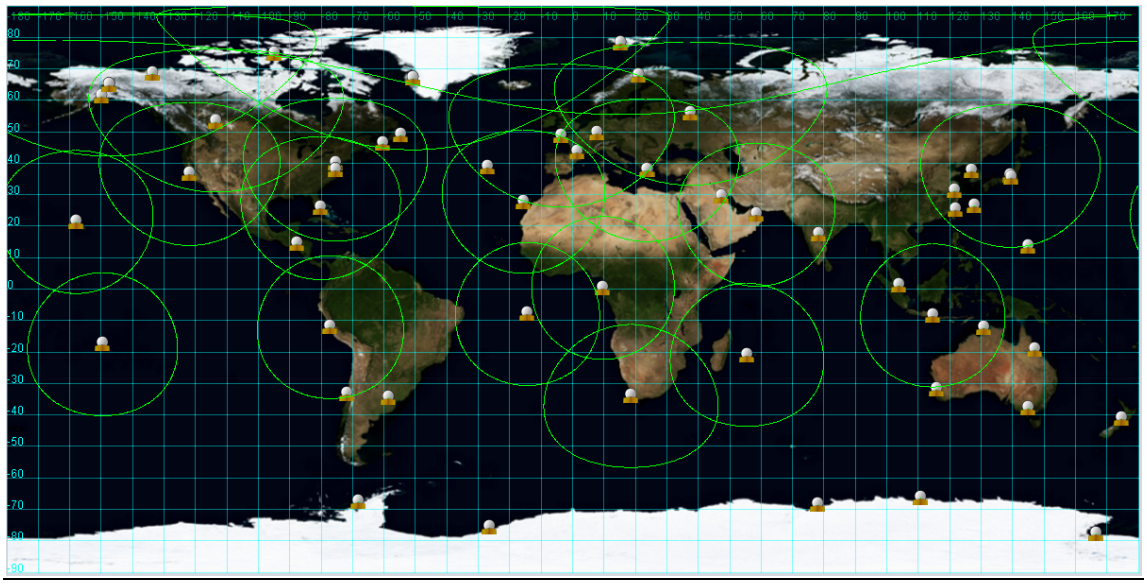


Figure 10 : Current METOP real-time coverage

3.2.3. *HRPT-A4 project*

This project was initiated in 2010 and presented for the first time at the 43rd Operation Committee. It consists in upgrading a significant part of the network so that it is capable of acquiring data from NOAA, METOP and SARAL satellites. The very flexible technology of the receiver should make it compatible with the future satellites which will carry Argos-4 payloads.

On the basis of a system study aiming at selecting the minimal subset of ground stations to be upgraded to get the better overall system performances, a group of 20 stations as shown on the map below have been chosen.

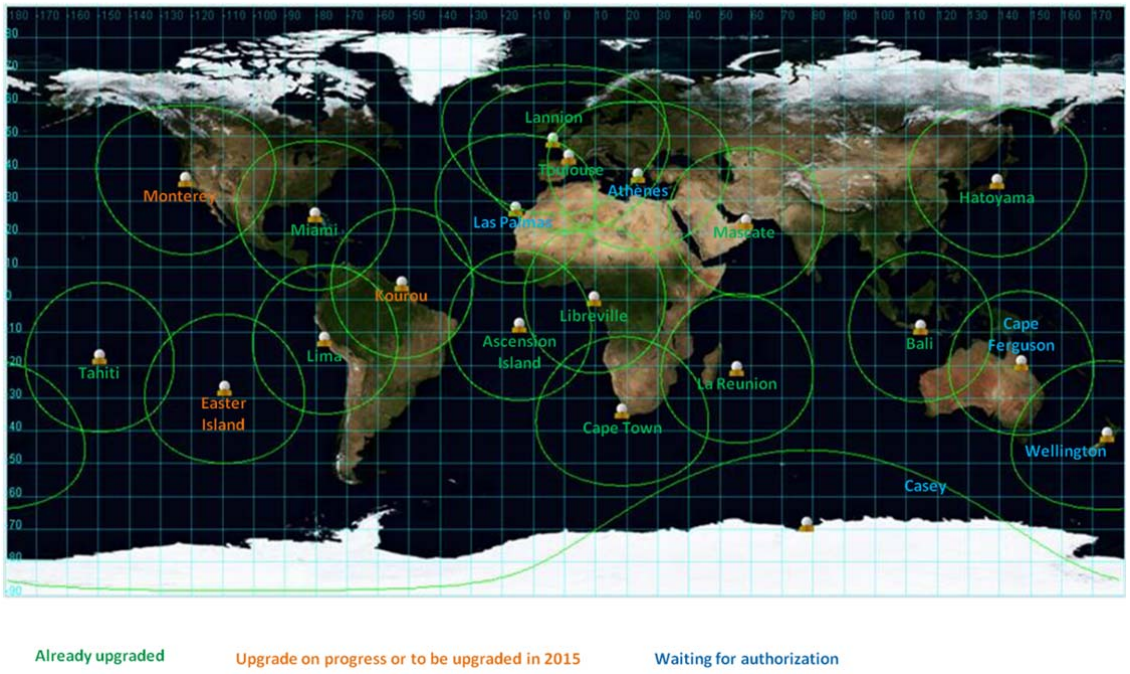


Figure 11 : Argos HRPT-A4 network

From an engineering point of view, all the equipment requested to upgrade an existing station has been tested and ready to be deployed. From a deployment point of view, the negotiations with the host organizations is taking much more time than expected at the beginning of the project.

In July 2015, the status of the deployment is as follows:

1. **Operational HRPT-A4 ground stations**

- Lima (Peru)
- Lannion (France)
- La Réunion (France)
- Hatoyama (Japan)
- Miami (USA)
- Cape Town (South Africa)
- Bali (Indonesia)
- Tahiti (France)
- Toulouse (France): spare equipment
- Muscat (Oman)
- Libreville (Gabon)
- Ascension Island
- Monterey (USA)
- Hawaii (USA)

2. Upgrade scheduled in 2015/2016

- Cape Ferguson (Australia / AIMS): upgrade planned before end of 2015
- Mas Palomas (Spain): under discussion with EumetSat, waiting for authorization
- Athens (Greece) : under discussion with EumetSat, waiting for authorization
- Melbourne, Darwin, Davis and Casey (Australia / BOM): BOM has planned to replace the existing antennas with new ones, we are waiting to discuss with BOM about their integration in the HRPT network.

3. New stations scheduled for 2015

- Kourou (French Guyana): due in October 2015
- Easter Island (Chile): due in September 2015

3.3. Processing centers

The two global processing centers in Toulouse and Lanham were nominal over 2014 and first semester of 2015. Redundancy is used at least once a month (up to two times on one month). Redundancy means all Argos users rerouted to CLS or CLSA during an anomaly on the nominal global processing center.

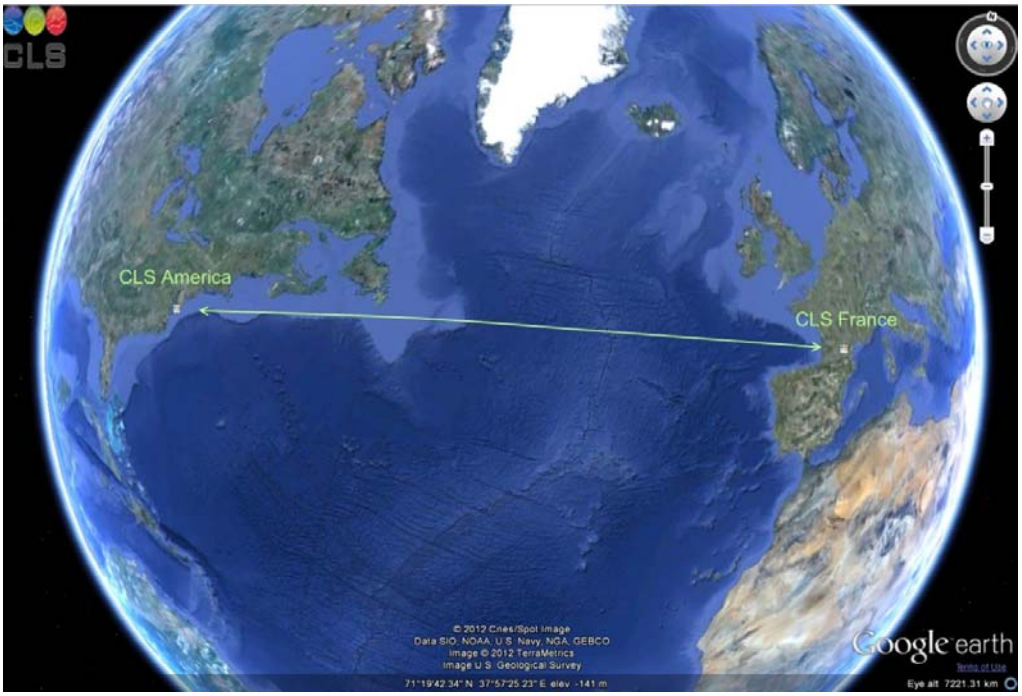


Figure 12 : Global and Regional Processing Centers

Figure 13 : CLS Toulouse new building

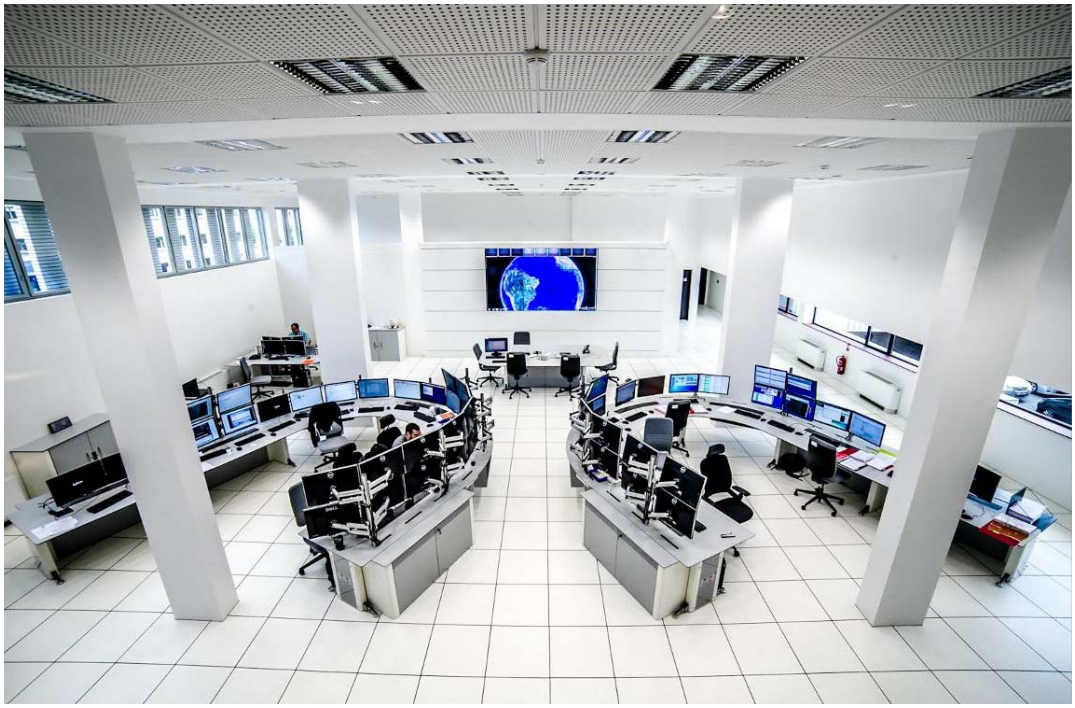


Figure 14 : CLS Toulouse Control Room

Figure 15 : CLS Global Processing Data Center

3.3.1. *Argos global processing centres architecture*

In 2014, most of the improvements regarding the Argos processing centers have concerned the US center, in order to ensure the same level of service as FR center:

- HA (High Availability) infrastructure was setup at CLSA (2 ESX with 2 HA LeftHand Storage and Qnap Storage for backup)
- Firewall and switch were upgraded
- F5 BigIP solution was setup for network traffic management and security.
- All Argos servers were virtualized to this architecture with new operating systems.
- Backup architecture/software were implemented (Veam for virtual servers and TSM for physical servers)
- New supervision solution was installed (Nagios EON – same as FR center)

Each global processing center is autonomous and can work alone. In normal mode, both processing centers receive, process and distribute Argos data to:
- North-American users for CLS America
- users of the rest of the world for CLS France

In case of problem with one of the two centers, the other one stays alive and is capable of receiving, processing and distributing Argos data to ALL users. The switch to the remaining alive center is completely transparent for the users. It means that the users continue to receive or to access to their data, without changing anything on their side, as if nothing has happened.

The figure here below represents the architecture of CLS France and CLS America global processing centers.

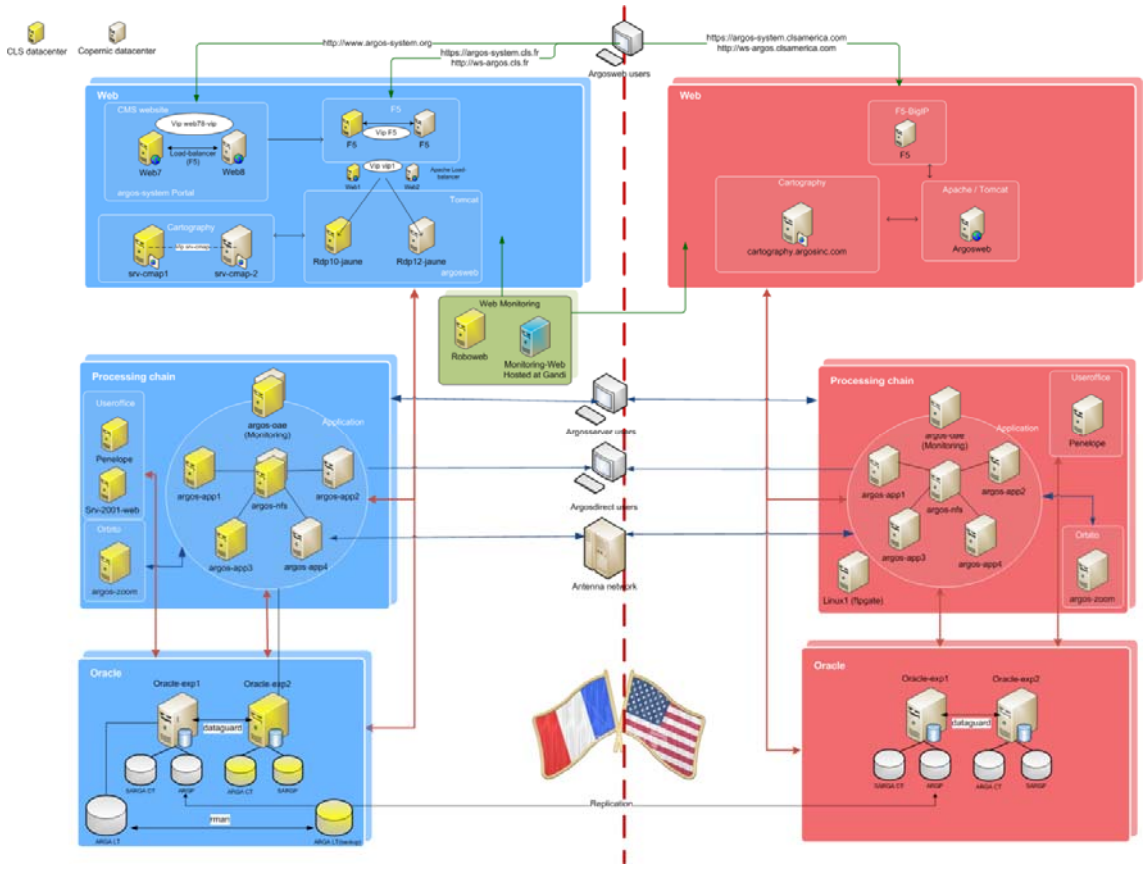


Figure 16 : CLS Toulouse and CLS America IT architecture

The architectures of CLS France and CLS America processing centers are quite similar and based on the same principle, with three main subsets:
- the processing chain
- the Oracle database service
- the Web distribution

3.3.2. *The CLS Argos processing chain*

Composed of different software modules, the processing chain is in charge of receiving and processing the Argos data issued from the satellites and acquired by the global and real-time ground stations networks.

Argos data are processed in terms of collect and positioning, and stored into a database.

The processing chain is also in charge of distributing the data by ADS (Automatic Distribution System) or allowing users to access to their data using Telnet, ArgosWeb or the web services.

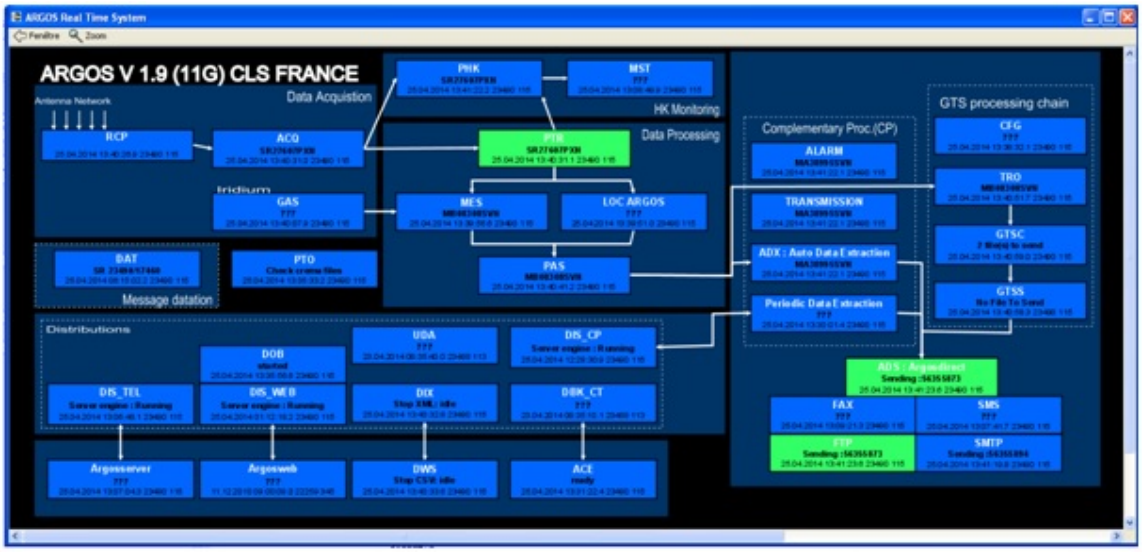


Figure 17: Synoptic of the CLS Argos processing chain

3.3.3. *The Oracle database*

At the heart of the computing architecture, the Oracle database is used to store the Argos declarative data as well as the processed data.

In order to keep a perfect coherency between CLS France and CLS America centers (mandatory to guarantee the redundancy between both centers), an automatic mechanism of replication is implemented between CLS France and CLS America databases.

3.3.4. *ArgosWeb site*

Based on a farm of Apache Web servers, the Web distribution allows the users to access their data using a Web cartographic interface. The service of maps is supported by two cartographic servers used by the mapping engines C-Map for the marine cartography and MapInfo for the terrestrial one. The application server is supported by Tomcat. ArgosWeb is a free web site for Argos users. They can access their data via the Internet, by logging on to a secure website (http://www.argos-system.org) with their username and password (assigned to them by User Services).

ArgosWeb gives users secure and easy access to Argos data via an attractive and user-friendly website. With ArgosWeb, users can view platform trajectories on land and marine maps. Users can also personalize data download formats (table or map format). Users have immediate access to information on their Argos account, as well as platform and program settings.

The annual availability of the French ArgosWeb site (FR) in 2014 is 99.77%
The annual availability of the U.S. ArgosWeb site (US) in 2014 is 99.50%

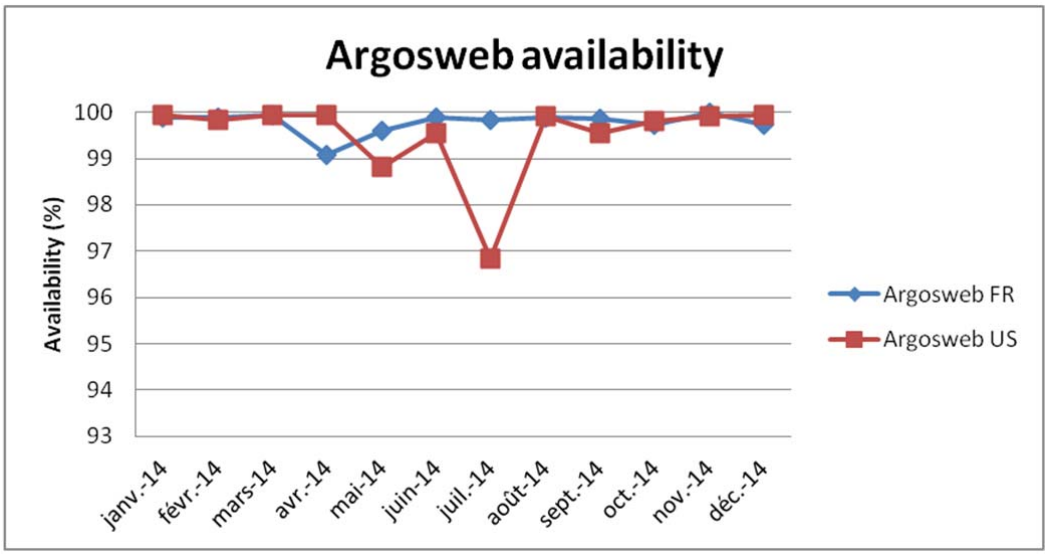


Figure 18 : ArgosWeb availability in 2014

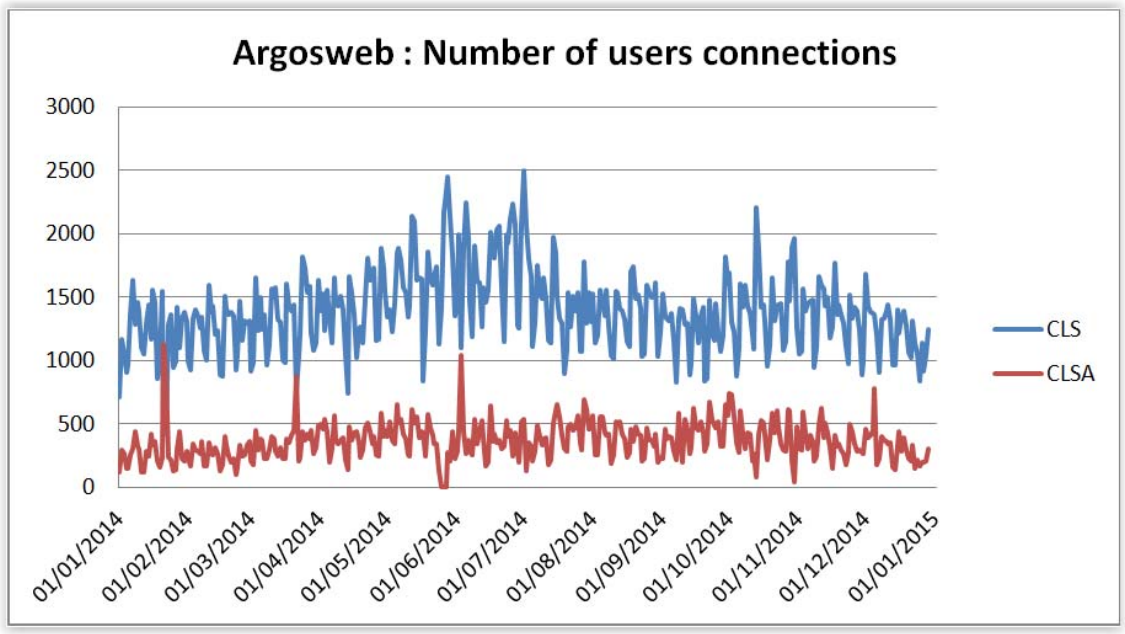


Figure 19 : Number of daily ArgosWeb visits in 2014

An entirely new version of ArgosWeb with a new cartography tool is being developed and due to be released at the end of 2015. This version will incorporate a responsive design, compatible with all browsers and smartphones & tablets, and will feature upgraded functionalities.

3.3.5. *ArgosServer*

With ArgosServer, the Argos users can logon to Argos Processing Centers and access their data via TELNET. TELecommunication NETwork is a network protocol used by all TCP/IP compatible networks. A Telnet session with CLS's servers can be opened by typing the "Telnet" command on

most operating systems (Windows, Unix...). Addresses of the two ArgosServers are:

- ArgosServer.cls.fr
- ArgosServer.clsamerica.com

The annual availability of the French ArgosServer site (FR) in 2014 is 99.87%
The annual availability of the U.S. ArgosServer site (US) in 2014 is 99.52%

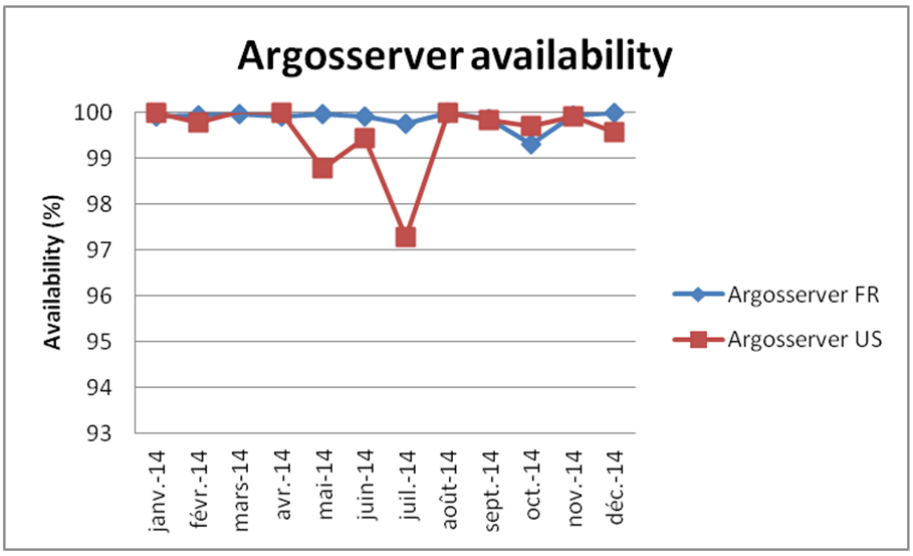


Figure 20 : ArgosServer availability in 2014

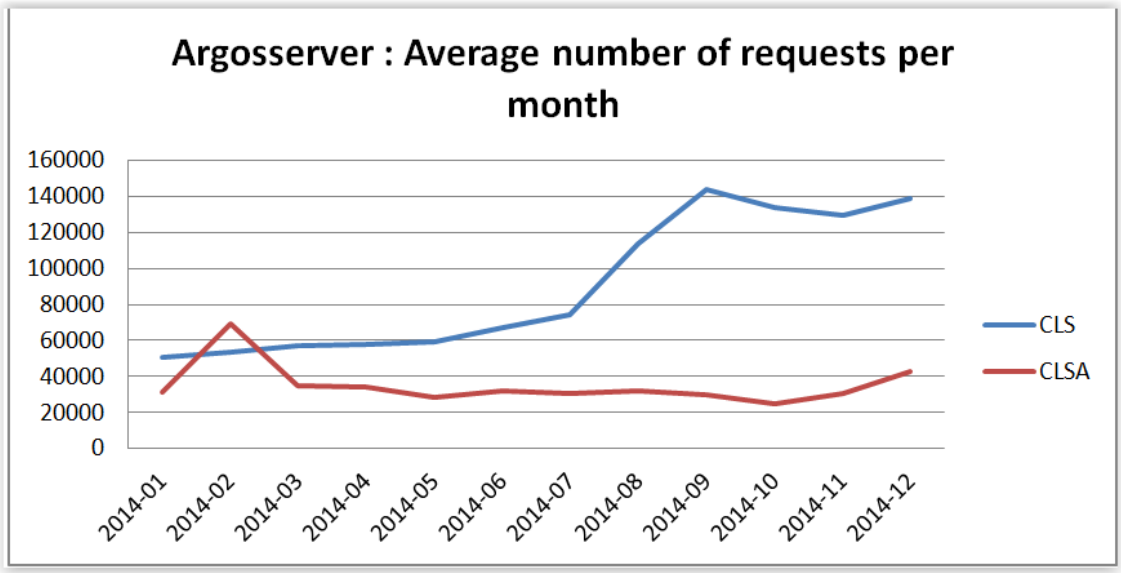


Figure 21 : Number of ArgosServer requests in 2014

3.3.6. *ArgosDirect*

ArgosDirect automatically sends data to users by e-mail, FTP or CD-ROM. ArgosDirect allows users to receive their data in several available formats (tabular, DS, DIAG…).

Backup periods (when one of the two Argos processing centers is down) are clearly identified on the graph below.

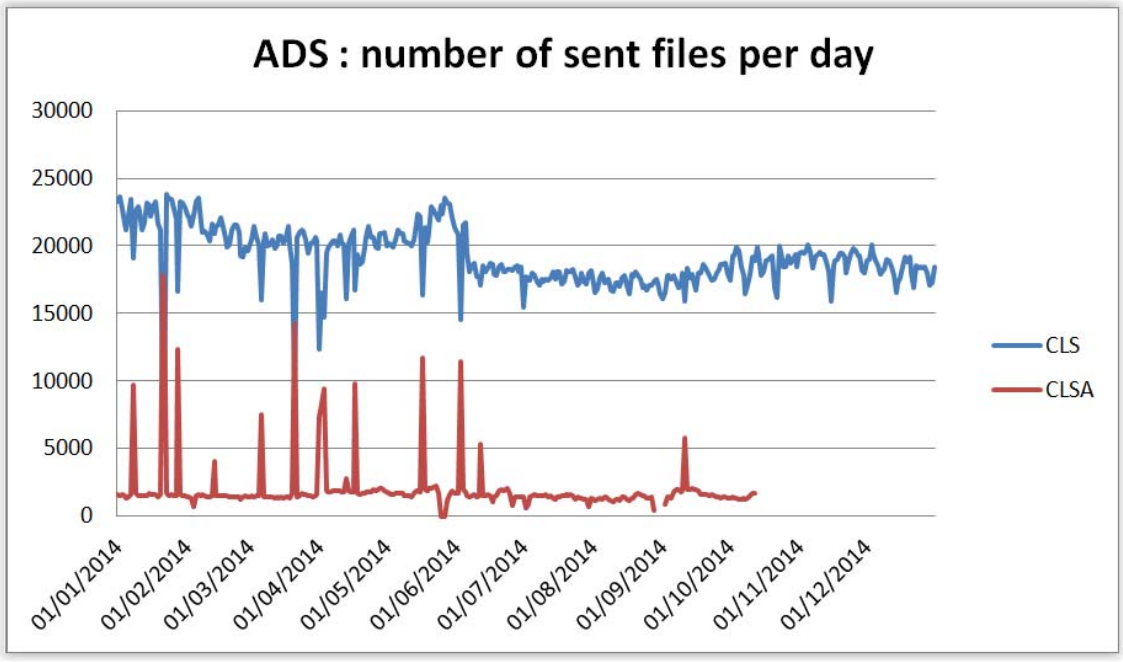


Figure 22 : Daily number of files sent by ArgosDirect in 2014

3.3.7. *Argos WebService*

Argos WebService is a machine-to-machine/automatic interface for Argos data distribution. This modern alternative to ArgosServer (Telnet) is free of charge and makes it possible for Argos users to contact CLS's database directly, via internet, and receive their data in **CSV, XML and KML (Google Earth) format**. The Argos WebService delivers useful information such as positions, error estimates, diagnostic data, raw messages, sensor data, etc. The user can choose the different types of data to download via filters.

The annual availability of the French WebService (FR) in 2014 is 99.81%
The annual availability of the U.S. WebService (US) in 2014 is 99.39%

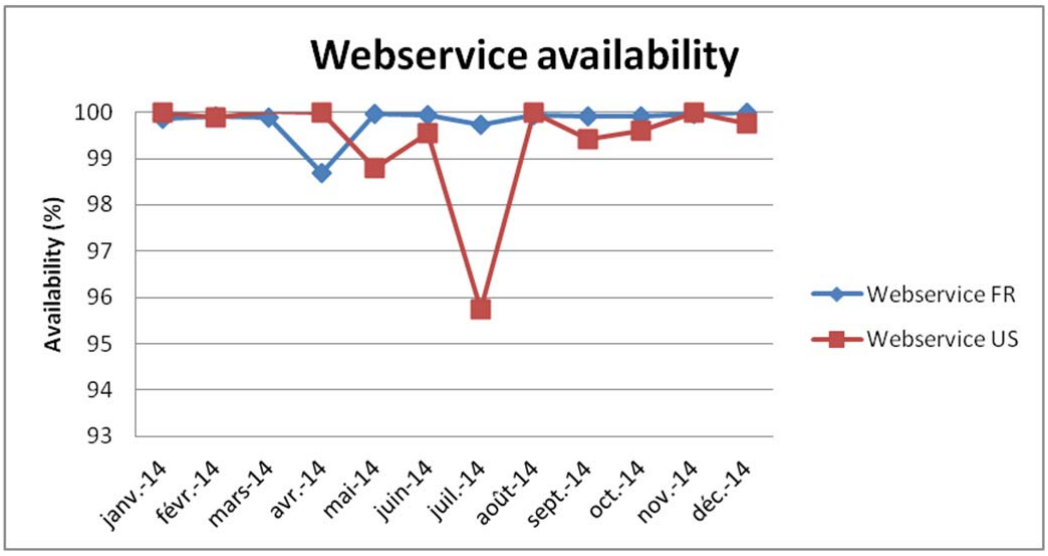


Figure 23 : Argos WebService availability in 2014

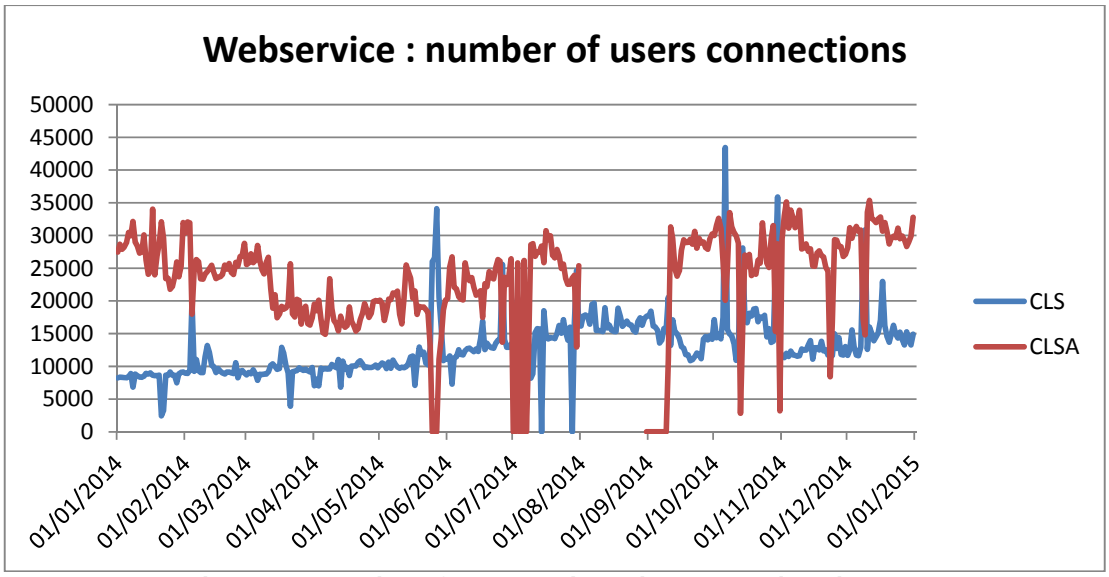


Figure 24 : Number of Argos WebService connections in 2014

3.3.8. *Disaster recovery architecture*

Disaster recovery architecture implementation is completed since 2012. The computer room is located into CNES Toulouse. Some of the Argos architecture components are DR compliant in order to improve services availability. However, the main backup is based on the 2 global processing centers (Toulouse & Lanham).

Figure 25 : Disaster Recovery Room located in CNES

3.3.9. *Data processing statistics*

The Argos Operations missions at CLS are:

- Availability and reliability of Argos products and services in accordance with the SLAs, supporting internal or external Argos projects, or proposals,
- Controlling and reducing operational risks and costs in order to ensure 24/7 operational services.

In order to monitor the Argos processing centers, statistics are produced in real-time:

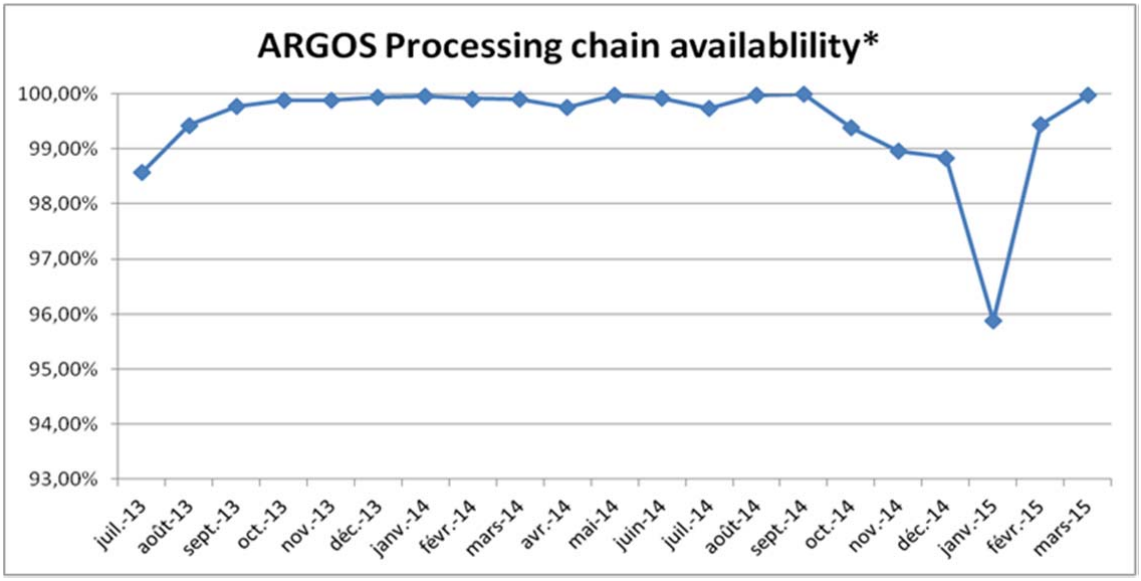
- on the availability of Argos data distribution tools,
- on the data delivery time for sample platforms,
- on Argos location delivery time for sample platforms,
- and on the percentage of data available in less than one hour.

For 2014, the processing performance indicator is 99,69 %.

This indicator corresponds to the percentage of real time datasets processed in less than 10 minutes (between pre-processing component PTR and PAS component in charge of inserting data in database for user requesting). This number does not include periods when the French site was in backup mode on the US site.

In this context, decreasing availability could be observed in case of pending datasets inside the processing chain. For example, when several global datasets are received at the same time, other datasets are queued and are waiting to be processed, which increases the time they spent between PTR and PAS modules. Priority to real-time datasets processing was added in July 2013 to avoid this queuing effect

The decreasing that we can observe from October to December 2014 is mainly due to an overloading of the Argos database. This problem has now been fixed.



*(percentage of Real-time datasets processed in less than 10 minutes)

Figure 26 : Argos processing chain availability in 2014

3.3.10. *Number of Argos messages and locations processed*

The average number of positions and messages computed daily by the Lanham and Toulouse Centers are:

Per day	2007	2008	2009	2010	2011	2012	2013	2014
Messages received	1 957 500	1 969 658	2 273 233	2 871 885	2 904 476	2 790 580	3 060 434	3 201 264
Distinct Messages received	972 000	1 164 717	1 272 459	1 470 953	1 451 938	1 443 247	1 513 630	1 580 910
Argos Locations	66 750	66 176	77 837	94 151	92 168	93 343	94 626	96 860
GPS Locations	163 150	187 829	185 496	205 259	212 587	224 857	243 366	273 034

Figure 27 : Argos messages and locations per day (table view)

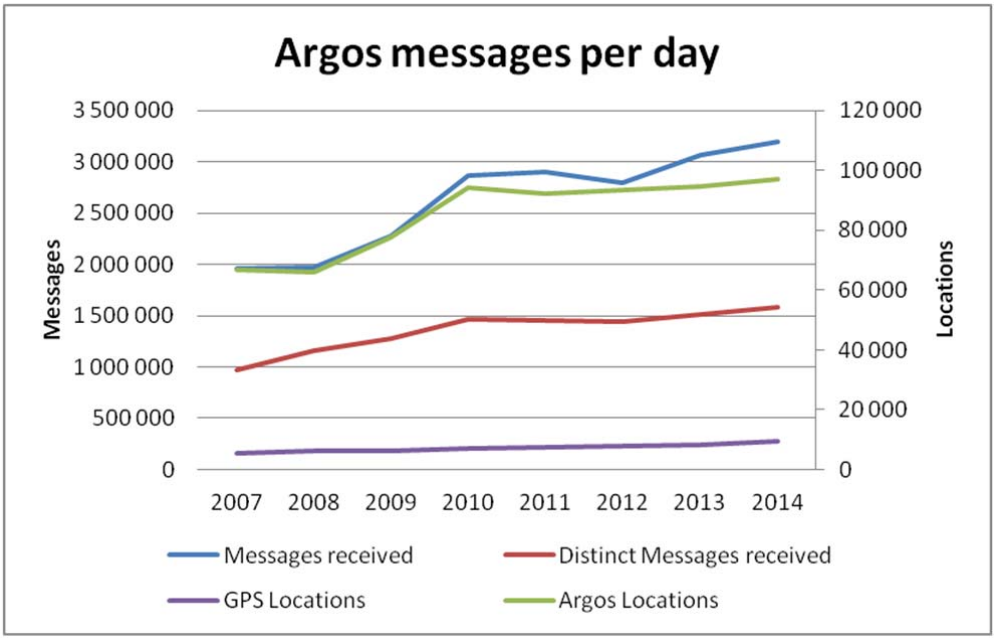


Figure 28 : Argos messages and locations per day (Chart view)

3.3.11. *Argos location and data collection latencies*

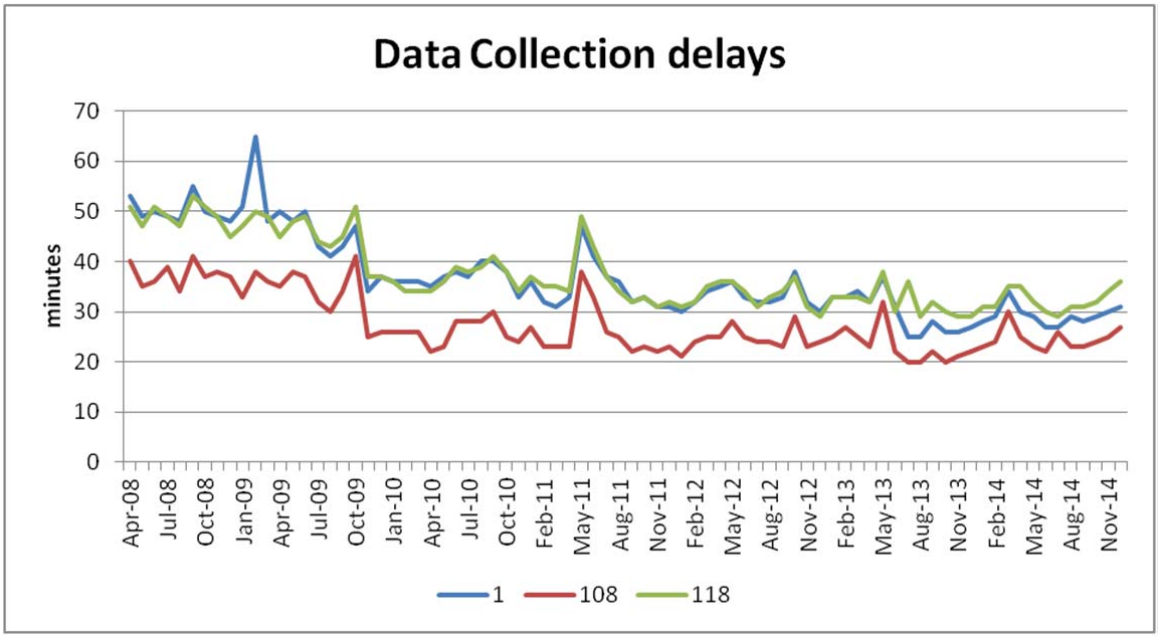


Figure 29 : Average latency on Argos data collection for sample platforms* since 2008

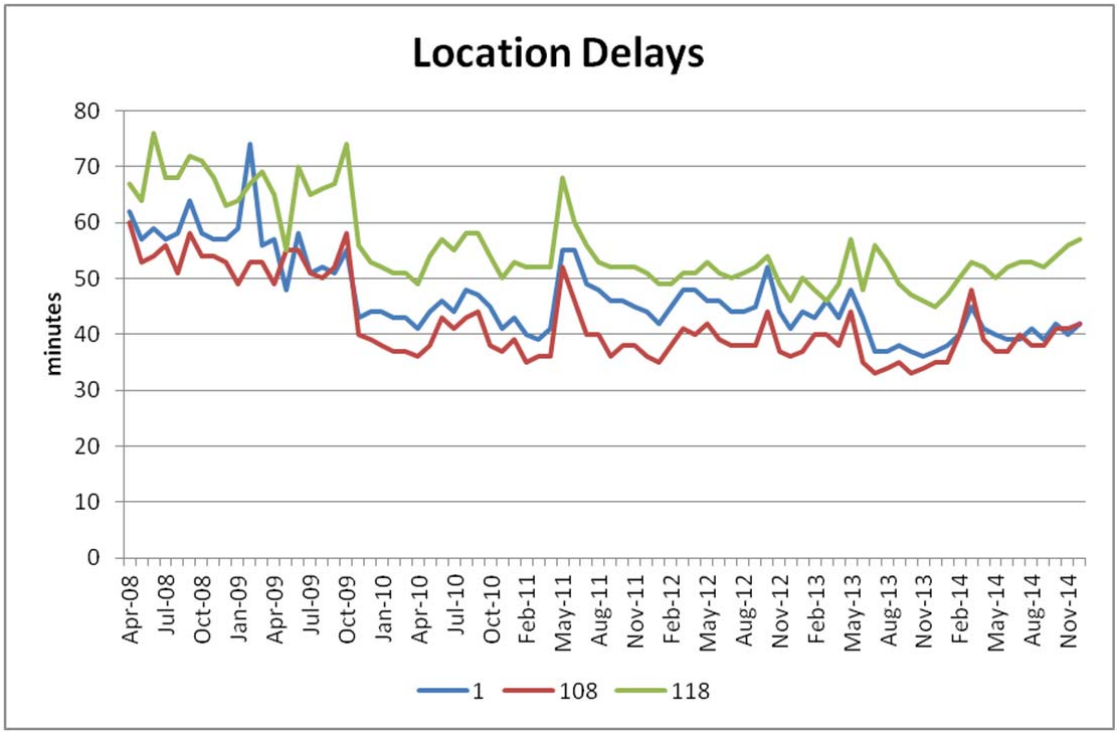


Figure 30 : Average latency on Argos locations for sample platforms* since 2008

* Sample platforms are timing and orbit determination platforms. Every hour, the last data collection and location times for these three platforms are controlled. Collection and location latency on ID 108 (Fairbanks) is under latency of Ids 1(Toulouse) and 118 (Wallops Island) due to the transmitter location and the higher number of passes over this transmitter.

We can see a major improvement on data and Argos location delivery time since 2008 due to a better real-time antennas network, new operational Argos satellites (NOAA-19, METOP-B and SARAL) and enhancements of the Argos data processing performance. Increase during May 2011 is due to processing issue (Database insertion driver issue). The average latency on Argos data collection in the Northern hemisphere is now under 30 minutes.

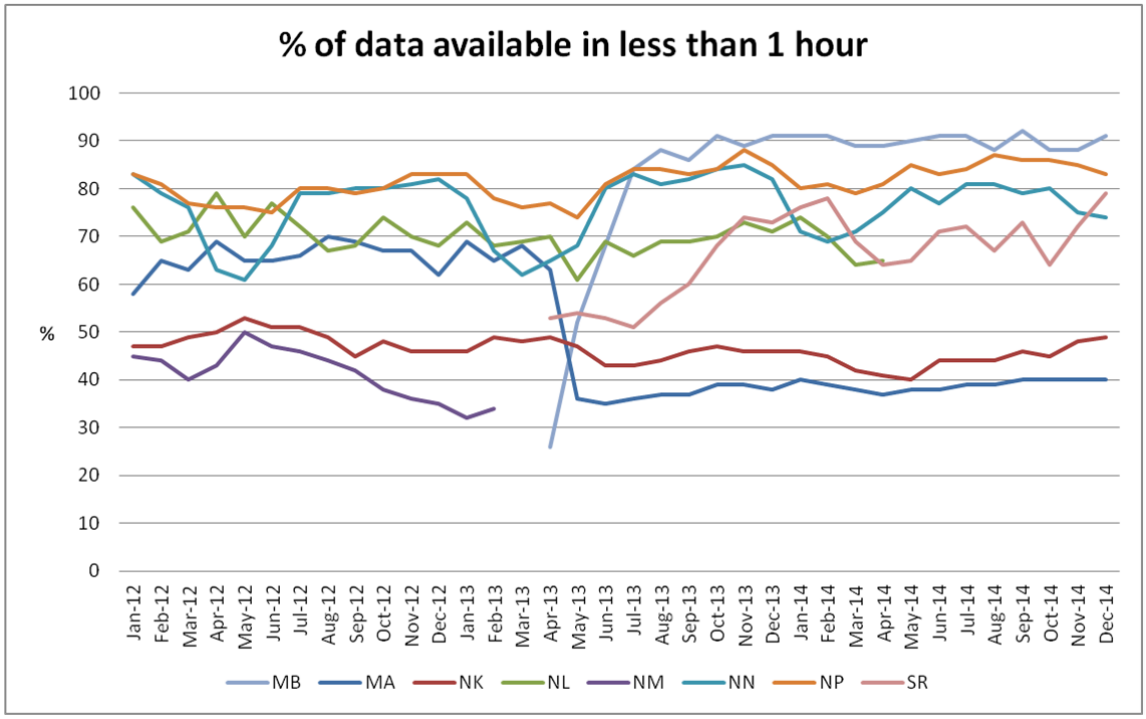


Figure 31 : Data available in 1 hour

The percentage of data available in less than one hour means the percentage of raw data that has been processed one hour after its recording on board of the Argos instrument. NOAA N, M and P operational satellites get a better coverage than NK and NL.

3.3.12. *Monthly active Argos platforms*

The number of Argos platforms operated has been relatively stable over 2014. There is still more activity in spring/summer due to the higher number of deployments at this period.

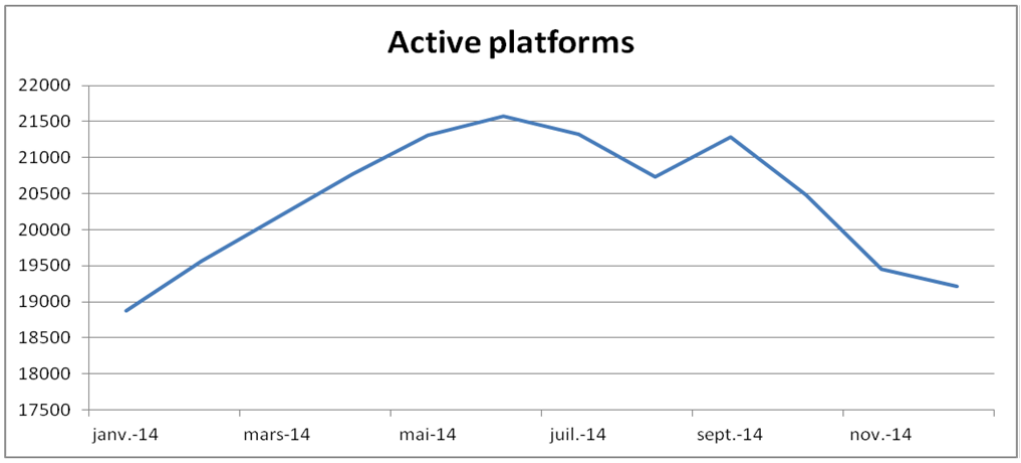


Figure 32: Monthly active Argos platforms in 2014

3.3.13. *GTS processing*

CLS is monitoring 24/7:
- the GTS processing system with real-time operational surveillance on the processing modules,
- the quality of the data,
- the system performance (time to process the data, number and size of bulletins)

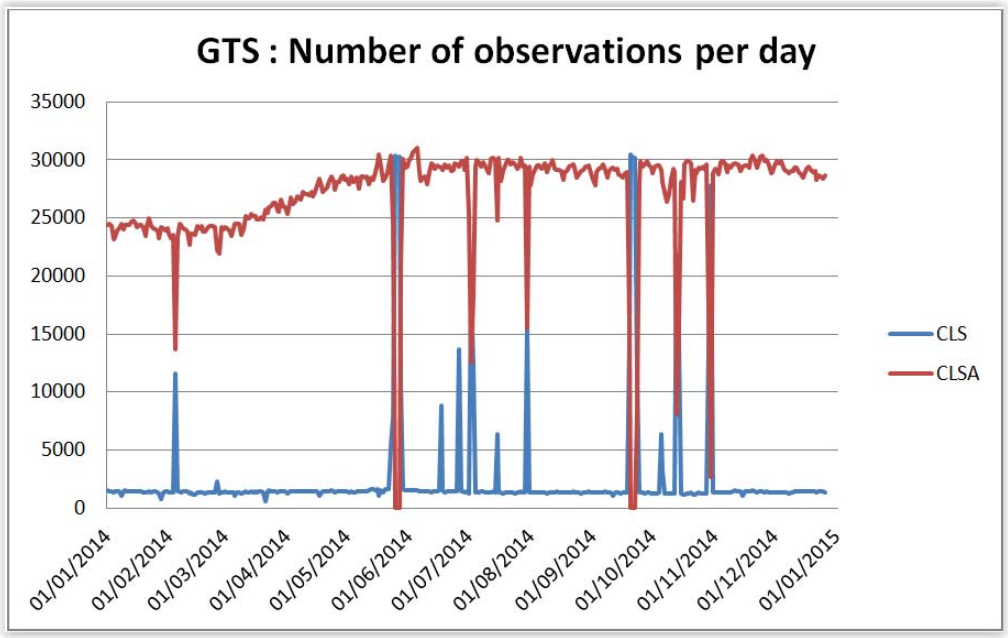


Figure 33: Number of GTS observation processed per day in 2014

Backup periods (when one of the 2 Argos processing centers is down) are clearly identified on the graph above.

CLS has a GTS monitoring tool, delivering the following daily statistics:
- number of GTS platforms (with a WMO id) processed,
- number of observations processed,
- average disposition time (time elapsed between the observation and the insertion onto the GTS)

These 3 statistics are provided for each:
- type of BUFR bulletins
- type of buoy (ATLAS, DRIFTERS, ICE, TRITON and OTHERS)
- WMO area

BUFR templates: The 2 new BUFR sequences for drifting buoys (TM 315009) and moored buoys (TM 315008) have been developed and qualified at CLS. These 2 new BUFR sequences have been applied on all active buoys processed by CLS and all processing templates in June 2015. Both Alphanumeric (BUOY, TESAC, SYNOP, and SHIP) AND BUFR bulletins are produced for each observation reported by ocean & meteorological platforms. Around 1200 active GTS platforms are processed every day at CLS & CLS America, including 1100 drifting buoys.

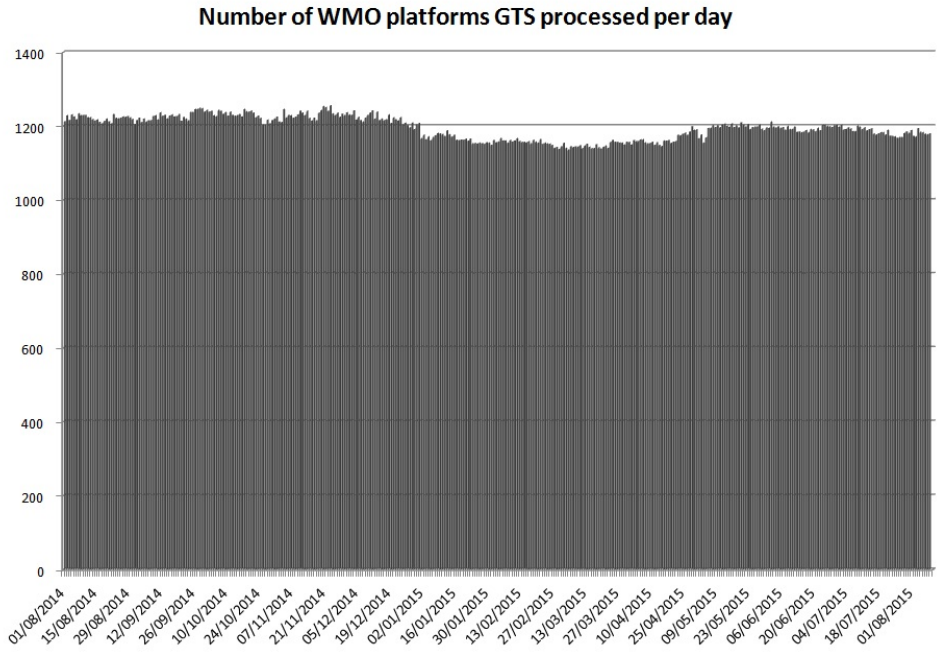


Figure 34: Argos platforms GTS processed per day from August 2014 to August 2015

The number of WMO numbers processed by CLS on the 2014-2015 period remained relatively stable with around 1 200 GTS platforms reporting daily observations on the GTS.

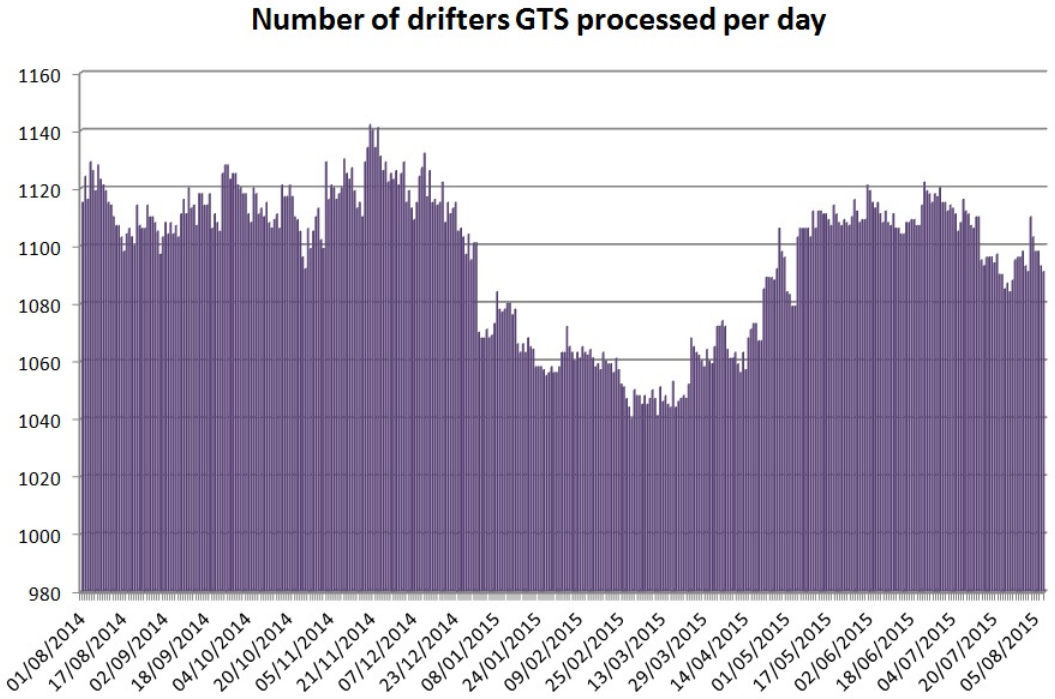


Figure 35: Argos drifters GTS processed per day from August 2014 to August 2015

We can see the seasonal impact on the number of drifters processed, with more active drifters in summer and autumn, during and after deployments.

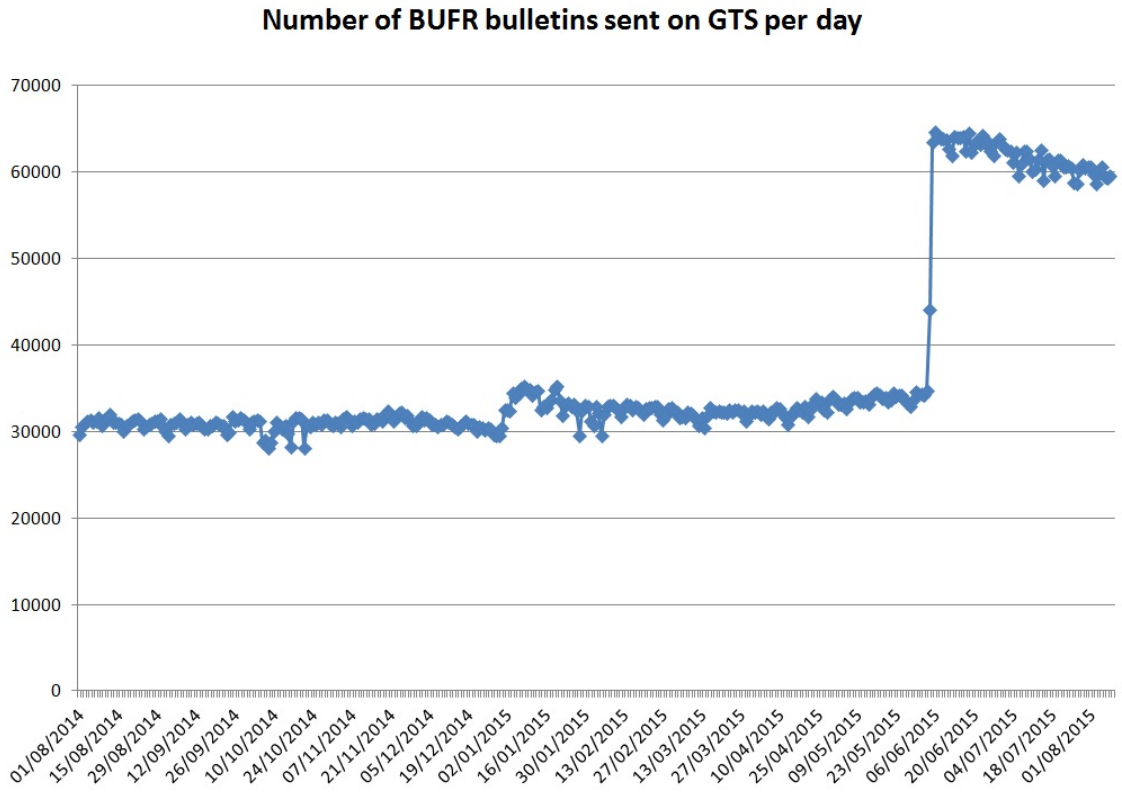


Figure 36: Daily number of GTS BUFR bulletins produced from August 2014 to August 2015

The number of BUFR bulletins displayed on the GTS by CLS has been multiplied by 2 in June 2015 for the transition period from the old to the new BUFR template. Météo-France asked CLS to send for at least 3 months BUFR bulletins with the previous and the new sequence for drifting buoys in the same time with 2 different headers.

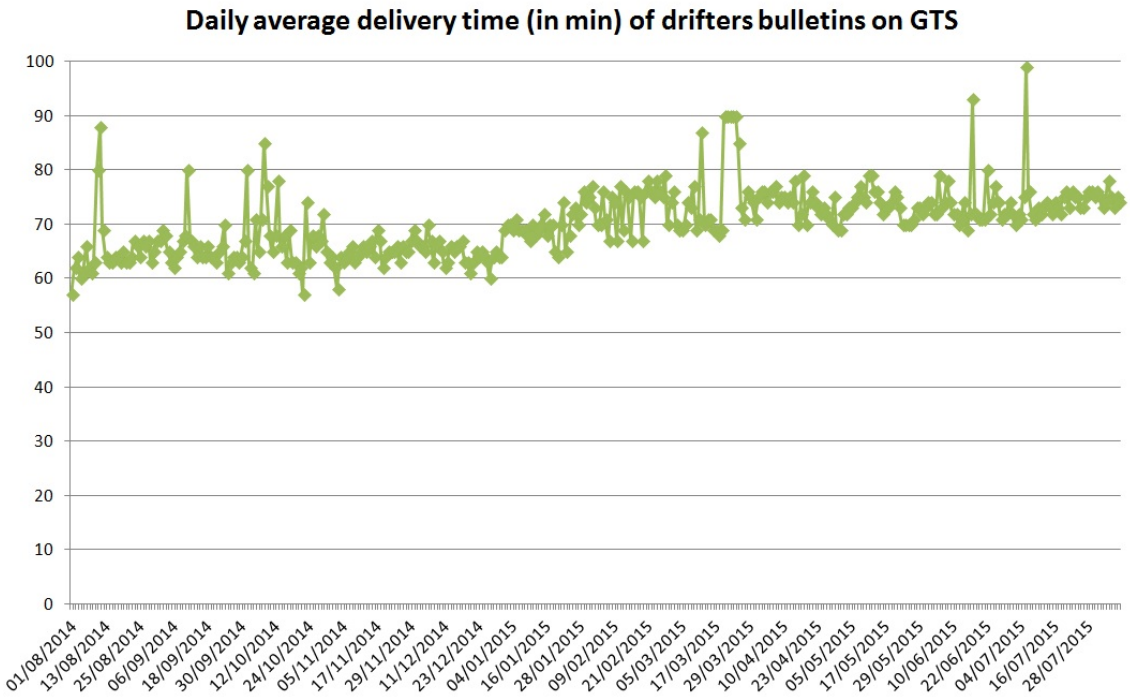


Figure 37: Daily average delivery time for all GTS platforms from August 2014 to August 2015

The daily average delivery time of drifters bulletins on the GTS has slightly increased from January 2015 due to a new method of time computing adding few minutes in the statistics numbers.

3.4. System improvements

As in previous years, several software improvements were implemented in 2014 in order to fit with the user requirements. During this year, 107 anomaly forms were treated as well as 151 system change proposals. These application improvements have mainly concerned:

- **A new earth elevation model**
  For Kalman location only, a new earth elevation model (ACE3) has been in operation since June 2014. It provides more precise locations in some areas, and gives better altitude accuracy.

- **The improvement of our web services for Argos-3**
  The Argos Web Service provides new capabilities. In 2014/2015, it concerned access to adapted orbit parameters, and the possibility to send user messages to PMTs.

- **The BCH-based message correction**
  The processing center is now able to correct Argos message bit transmission errors, based on the BCH algorithm. CLS is now working with platform manufacturers and provides support to integrate BCH code in the transmitted messages.

- **ArgosWeb**
  Report capabilities for ROC (Representative Of Country) have been integrated in ArgosWeb: program activity reports, unused platform id reports, platform activity graphs and statistics.

- **A new Argos Orbitography**
  The integration of the new orbitography module (ZOOM) in Argos processing center has been completed. The Argos Doppler location processing, on the CLS and CLSA processing centers, benefits from the new orbitography products since March 2015.

  The new Argos orbitography software includes 3 main improvements:
  - maneuvers are automatically accounted for which improves the continuity of the service
  - a better accuracy of the orbitography computation with a gain of approximately 50 meters (see figure below)
  - increased robustness and reliability with a software which is scalable and maintained

The figure below shows a comparison between the old and new orbitography software in terms of accuracy. The comparison was made on SARAL orbitography computation. The Doris orbit has been taken as a reference.

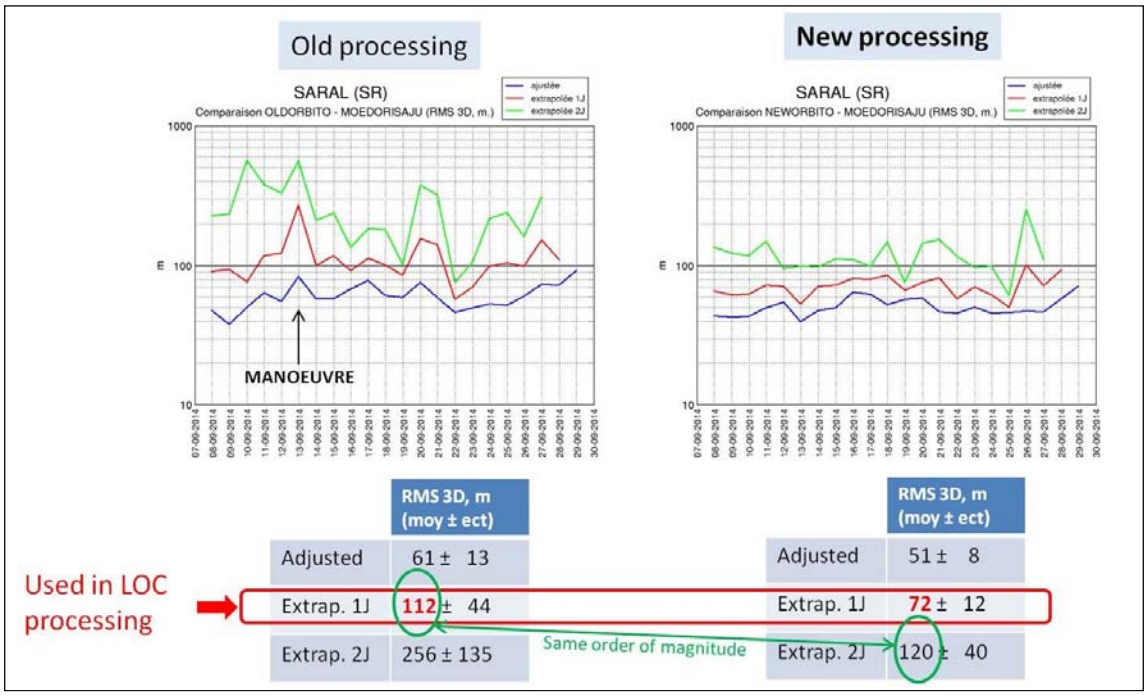


Figure 38 : Improvements of the orbitography accuracy

2015/2016 will see new improvements. Among the ones which are already planned, we can list:

- **The integration of a new BUFR sequence for drifting buoys**
  The BUFR table version 22 is now released. The 2 new BUFR sequences for drifting buoys (TM 315009) and moored buoys (TM 315008) will be operational end of 2015.

- **System monitoring services**
  CLS is developing two new services in order to improve the quality of Argos products:

  - The reference beacon monitoring service will control the Argos collection system in several world areas. Reference beacons will transmit Argos data periodically, on all system-supported modulations. The service will analyze the reception quality of the data and will report in real time system failures to operators. It will also produce statistics data for long term system monitoring.

  - The location monitoring service will control the quality of the Argos Doppler location system. It will analyze the quality of location of fixed stations, and will report in real time location process failures to operators.

The most important upgrade concerns the **complete renewal of the ArgosWeb user interface** (new version to be released at the end of 2015):

- The interface has been redesigned to be compatible with Android tablets and iPads.

- It will be compatible with various web browsers: Internet Explorer (from IE9), Chrome, Firefox, Safari, and IE360 - the Chinese browser.

- All previously existing ArgosWeb features have been renewed.

- The new ArgosWeb will provide new cartography capabilities, such as the ability to display various maps (marine map, road map, satellite imagery map), and the ability to superimpose meteorology and oceanography layers.

- This new version will make it possible for users to reprocess Doppler locations. As for the online data extraction, the users will create a location reprocessing request in ArgosWeb. The service will reprocess the Doppler locations using Least-Squares or Kalman algorithms. When the reprocessing is complete, an email will be sent to the user with a data download link (kml and csv formats).

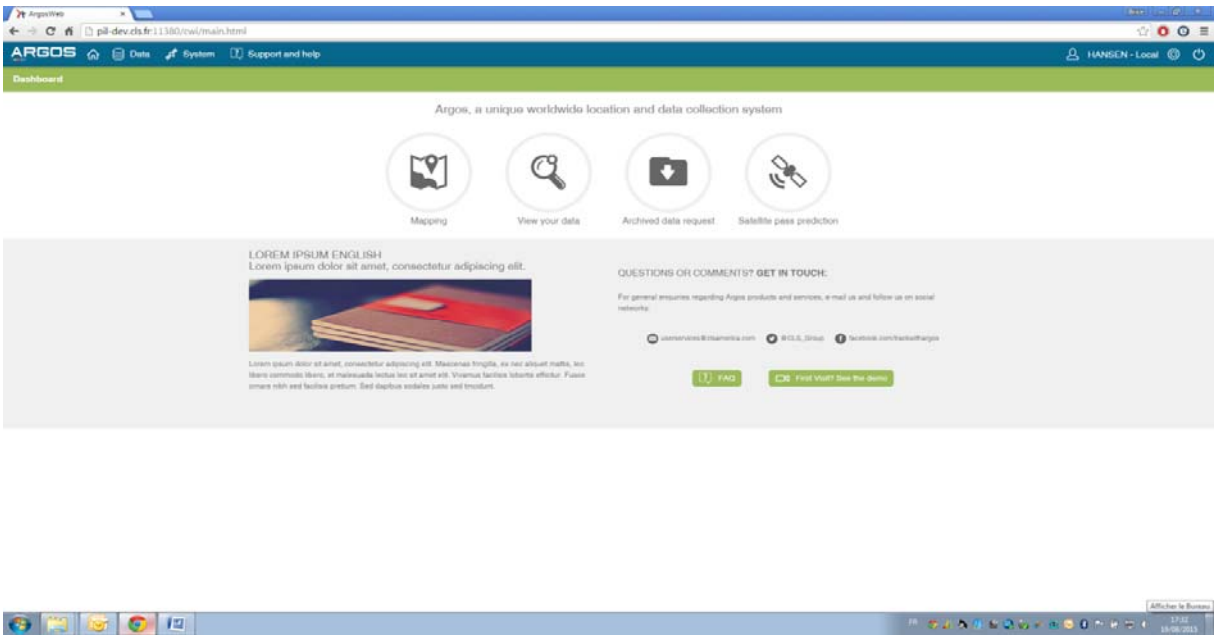


Figure 39 : Screenshot of the new ArgosWeb home page (test layout version, still being developed)

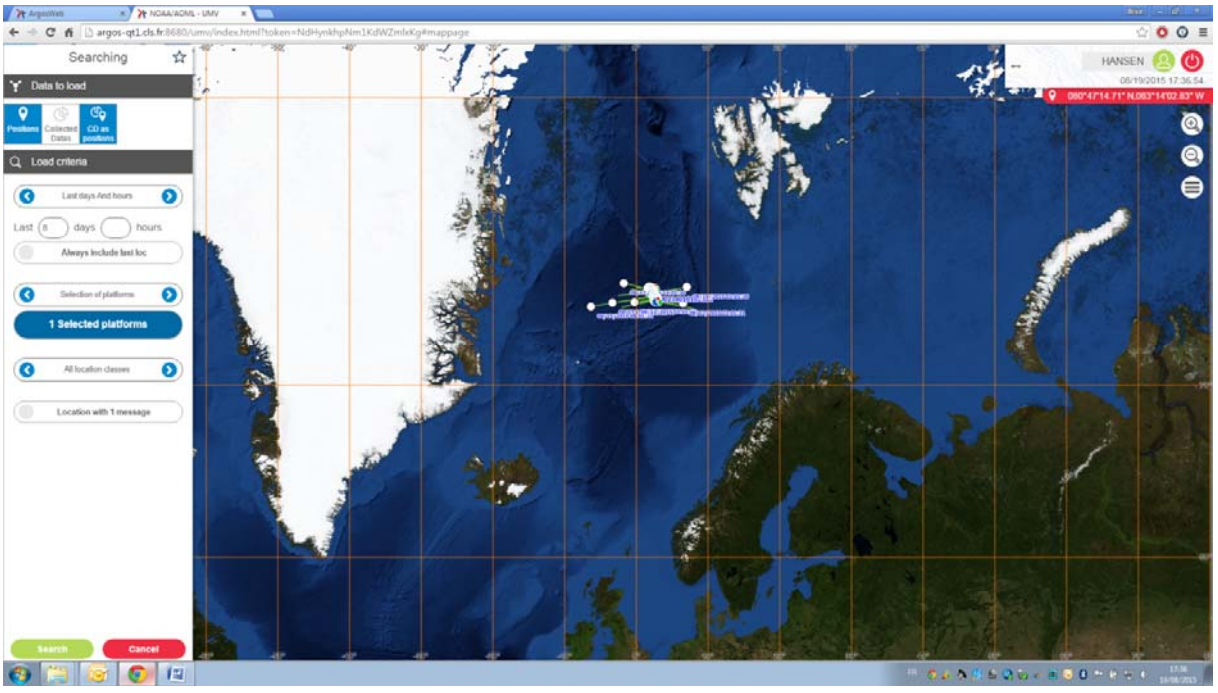


Figure 40 : Screenshot of the new web mapping tool (test layout version, still being developed)

3.5. ARGOS-4 ground segment upgrade

This project is aiming at identifying and implementing all the modifications of the existing Argos ground segment to take into account the new generation of Argos-4 instrument as well as a general enhancement of the Argos ground segment. This activity has been delegated to CLS by CNES.

Despite the fact that we do not know when the first Argos-4 payload will fly, the decision to start the Argos-4 ground segment upgrade was made, at least for the part dedicated to the general enhancement of the Argos ground segment. The project includes the following activities:

Developments:

- The major developments will concern the Argos Processing Center, which will be able to manage all the operational Argos instruments.
- New Master Beacons will be produced. They will have to be compatible with Argos-2, Argos-3 and Argos-4 instruments. They will replace the current Master Beacons.
- New Reference Beacons will be produced. They will be compatible with Argos-2, Argos-3 and Argos-4 instruments.

Qualification on a dedicated Argos Processing Center instance:

- The ground segment technical qualification will follow the development phase. It will include the qualification of technical specifications, the compatibility tests with Argos-2 and Argos-3 processing. In order not to disturb or impact the existing and operational Argos processing centers, all the qualification operations will be performed by using an Argos Processing Center specifically built for the Argos-4 project. This dedicated center will be available for CNES compatibility tests.
- Next step will be the ground segment operational qualification. The processing center performances will be checked; the operational documentation will be upgraded for Argos-4; the operational team will be trained. The dedicated Argos-4 Processing Center will be available for CNES end-to-end tests.
- Final step will concern the system operational qualification, which will start after the satellite launch. The system performance will be validated; the operational procedures will be conducted; the operational instrument monitoring will start. During this phase, CNES will use the Argos-4 Processing Center for the instrument in-orbit commissioning.

Operation:

- Before the satellite launch, the new Master Beacons will be deployed, probably at Svalbard, Fairbanks, and Toulouse.
- After the instrument in-orbit commissioning and the system operational qualification, the production Argos Processing Center will be upgraded and configured.
- Argos-4 (and of course Argos-2 and Argos-3) routine processing will start
- After the CNES to CLS handover, CLS will operate the instrument and distribute the Argos-4 products.

Status of the project:

The Argos Processing Center development is composed of two phases:

The first phase consists in making durable the existing Argos Processing Center, to ensure operation for the next decade at least, and to prepare the development and integration of Argos-4 specific functionalities. The main functionalities to be developed during this first phase are the following:

Functionalities	Status
New user services	
Argos Web Interface	In progress
Smartphone application	Done
Data extraction on-demand	Done
Data reprocessing (location)	To be done
Web services	Done
Location	
Digital Elevation Model	Done
Smoothing	In progress
Initialization	In progress
Automatic maneuvers	Done
Processing	
GTS software	In progress
User Guidance Office	To be done
Archiving	Done
Downlink Messaging Management Center	To be done
Orbitography	Done
Facilities	
Master beacons	To be done
Reference beacons	To be done
Ground stations	In progress
Processing centers	In progress

The second phase is the integration of Argos4 data and the development of Argos-4 specific functions. This phase has been paused since 2014, waiting for better visibility of Argos-4 system schedule. However, the new cooperation CNES/ISRO has changed the deal. With the expected launch of Argos-4 on Indian satellite OceanSat-3 in 2018, this second phase will start by the end of 2015.

In parallel, CNES and CLS have started the development of new Master Beacons and Reference Beacons. These beacons are multi-mission, and the Argos-3 system will benefit from the new master beacons as soon as they are deployed on-site, waiting for the Argos-4 instrument launch.

4. Argos Users applications

4.1. Monitoring Argos platforms

The number of active Ocean/Met Argos platforms has increased by nearly 5% in 2015. This is due primarily to the larger number of active drifting buoys using Argos in the Global Drifter Program.

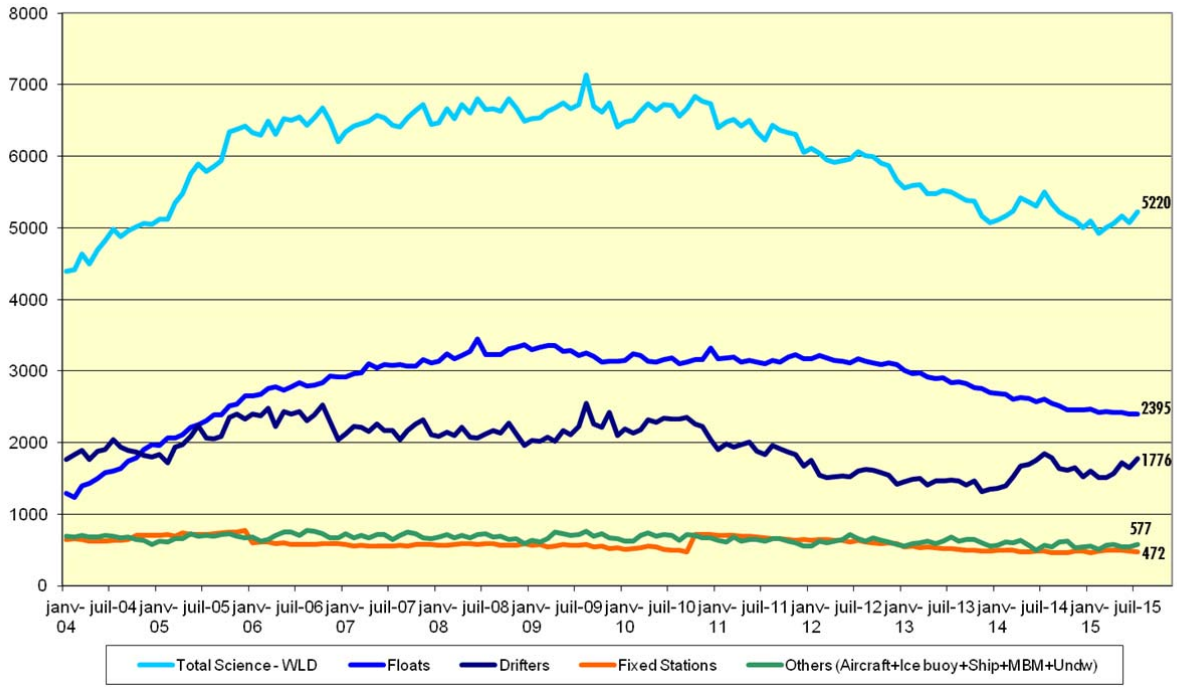


Figure 41: Monthly active ocean Argos platforms statistics

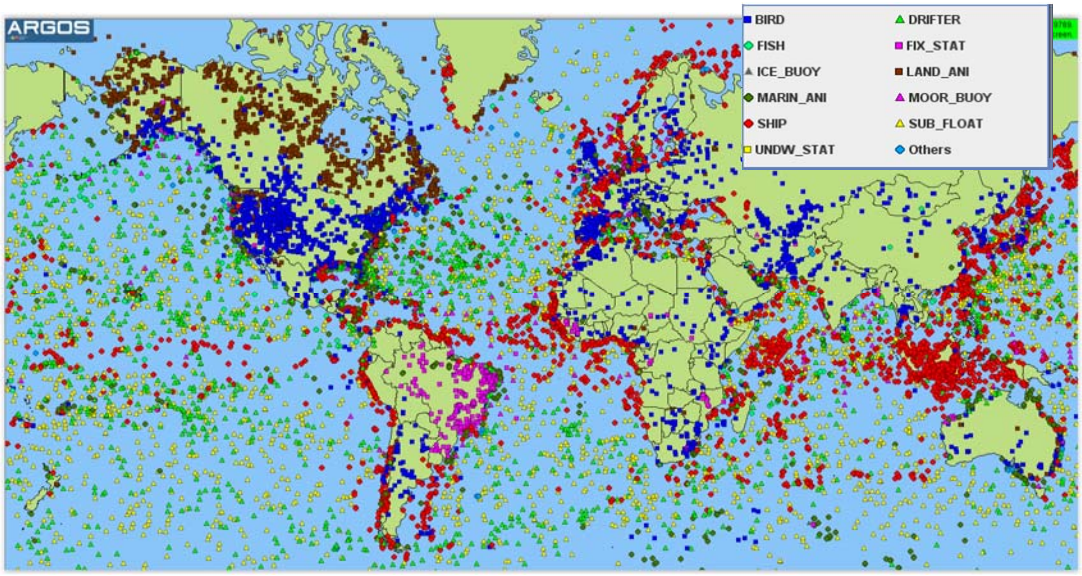


Figure 42 : Active Argos platforms repartition (June 2015)

4.2. CLS Argos report for JCOMMOPS

CLS continues to submit quarterly reports to JCOMMOPS which include the following information:

- All new ocean and meteorological Argos programs created
- All new ocean and meteorological Argos ID numbers created
- Active Argos platforms without WMO ID number assigned
- All Iridium ocean/met platforms processed by CLS

4.3. Argos data timeliness

The Argos Data disposal time is defined as the elapsed time between when an observation is collected by an Argos platform and when it is available to the user.

The Argos Data Mean Disposal Time is composed of four delays:

- T1 = the revisit time (time for a platform to be seen by one of the Argos satellites),
- T2 = the time for the data to be downloaded to a ground station (nearly instantaneous for an HRPT station or corresponding to the time for the satellite to reach a global station),
- T3 = the data retrieval time (average time for the data to be transmitted to the Argos Data Processing Centers),
- T4 = the processing time (time required for the data to be processed in the Argos Data Processing Center and to be available for the users).

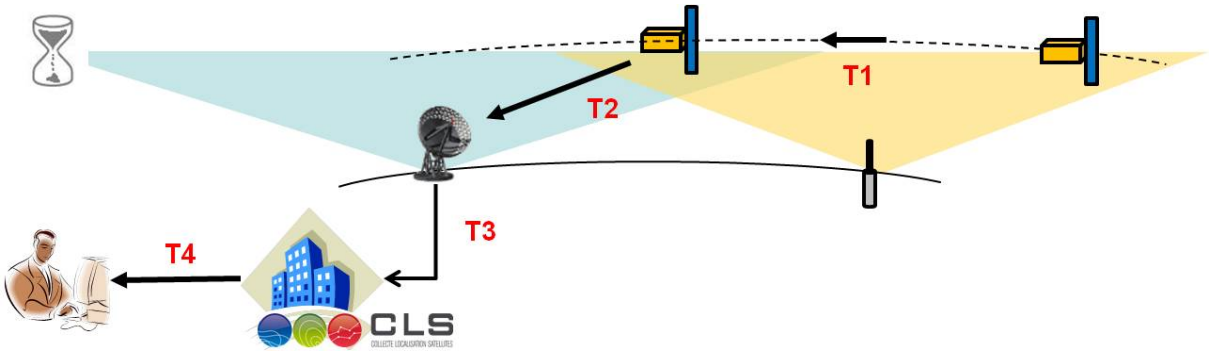


Figure 43 : Argos data mean disposal time diagram

The following figures represent the simulated Global Argos Data Mean Disposal Time. The simulation tool that generates these maps takes into account the Argos satellite constellation, the distribution of actual Argos platforms, and in the case of these maps, the actual performance of the Argos ground stations and data processing centers in May 2014 and May 2015:

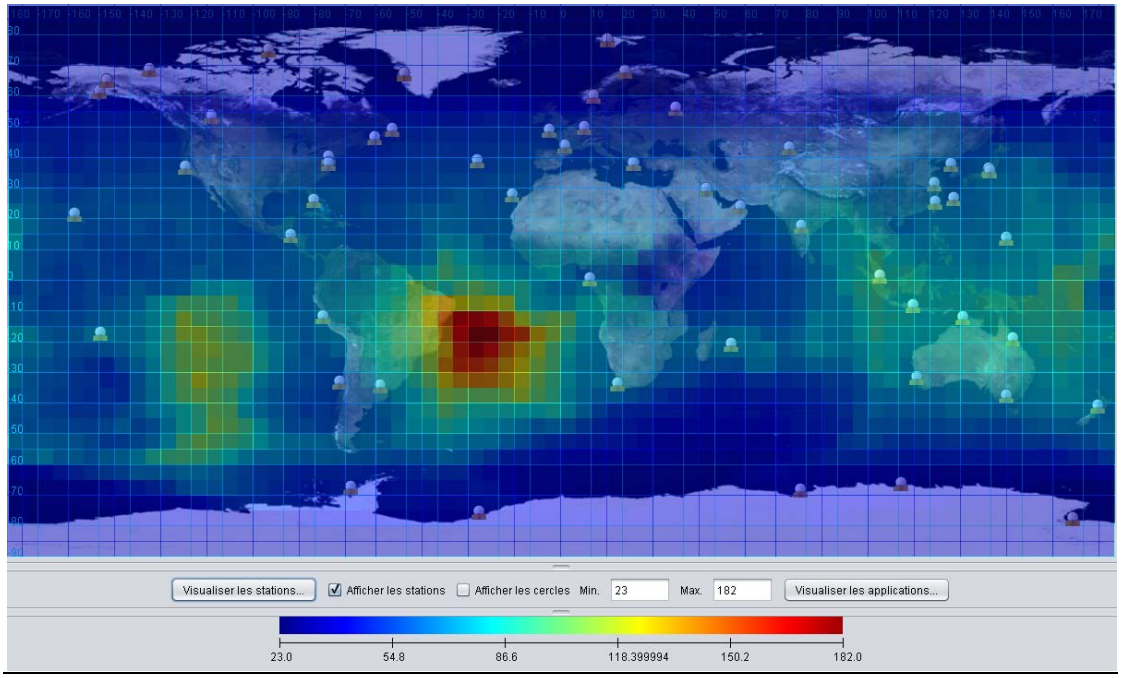


Figure 44 : Argos Data Mean Disposal Time in May 2014 (in minutes)

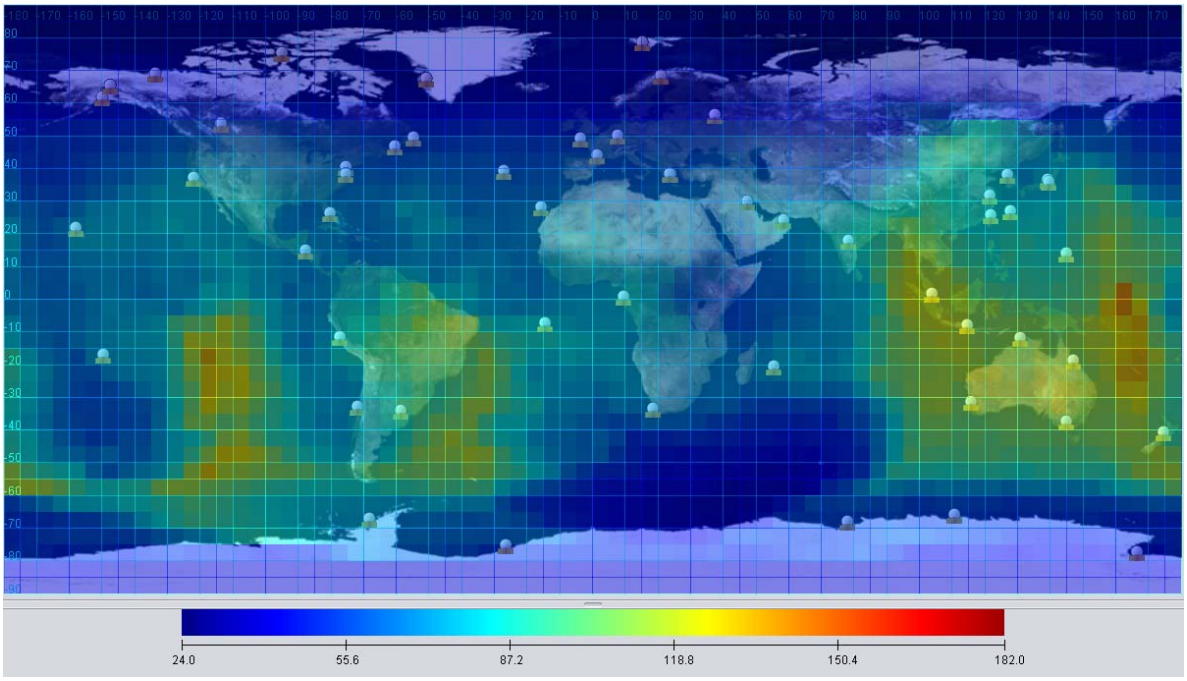


Figure 45 : Argos Data Mean Disposal Time in July 2015 (in minutes)

The improved performance in terms of data mean disposal time is mainly due to:

- the newly upgraded station of Ascension Island receiving all Argos satellites, improving real time coverage in South Atlantic Ocean.
- More HRPT Stations receive MetOp and Saral Satellites data (Monterey, Hawaii, Lannion, Lima, Cape Town, Hatoyama, EARS Stations, La Réunion…).

We will continue to maintain and improve the coverage of the real-time antennas in the regions where it is needed.The primary two areas of focus are: South-East Pacific/North-East South America and Indonesia and South-West Pacific.

For the Southeast Pacific/North-East South America area:
2 new stations are planned before the end of 2015 to improve real-time coverage in these areas (Easter Island in cooperation with Meteo Chile and Cayenne, French Guyana)

For the Indonesian and South-West Pacific area:
Key points are: maintaining the Indonesian coverage operational (Bali station currently in and out of maintenance) and ensuring the upgrade plan for South-West Pacific area (to be discussed with BOM).

4.4. Background noise measured in the Argos frequency band

The minimal received power measured by the in-flight Argos payloads allows us to determine the geographical areas where background noise is present in the Argos frequency band.

The figure below shows that the spatial extent of the interference in 2015 is significantly less that it was in 2007, particularly in the western Europe, northern Africa and eastern Asia regions. Additionally, the measurements indicate that the amplitude of the noise in those regions where it was originally the strongest has been reduced by as much as 4 - 10 *dBm*, depending on the specific region. Consequently, Argos users are finding improved conditions in these regions for receiving more data from the low power Argos transmissions.

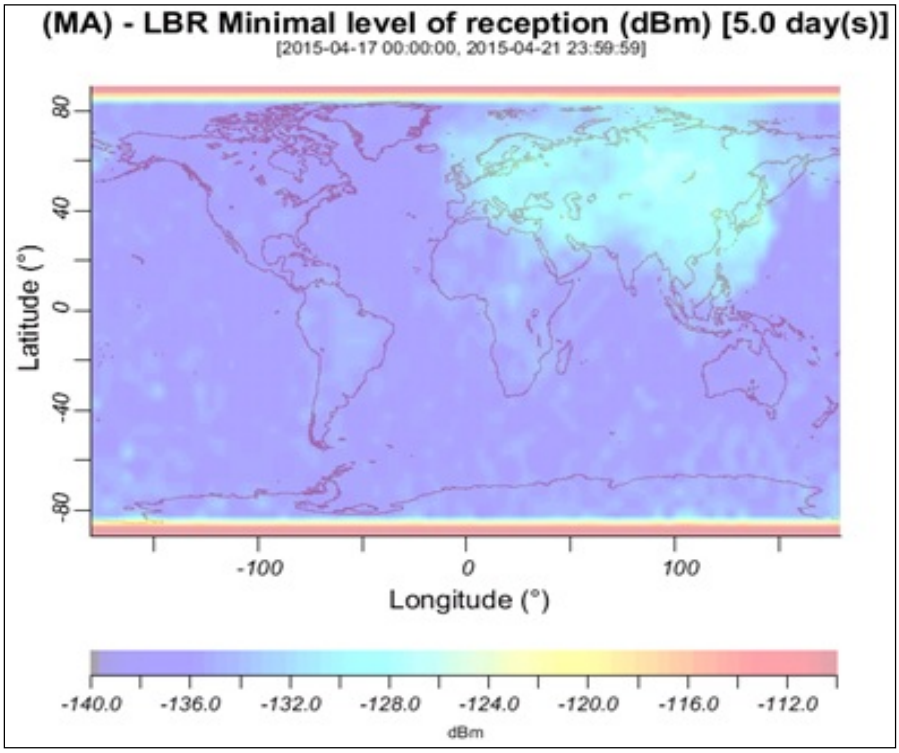


Figure 46 : Minimal level of reception in the Argos frequency band in April 2015

4.5. Argos Platforms and related System Occupancy

There are approximately 22,000 global active Argos platforms transmitting every day.

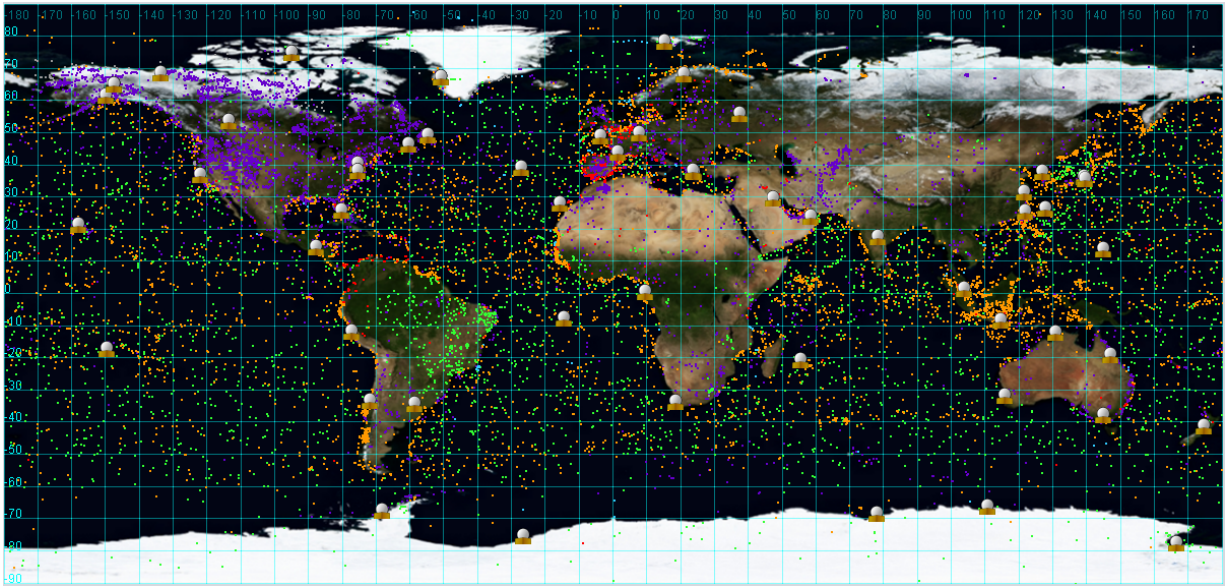


Figure 47 : Map of Argos platforms deployment

The system occupancy, which is measured in Erlang, (1 Erlang is equivalent to a PTT transmitting continuously) is represented as follows:

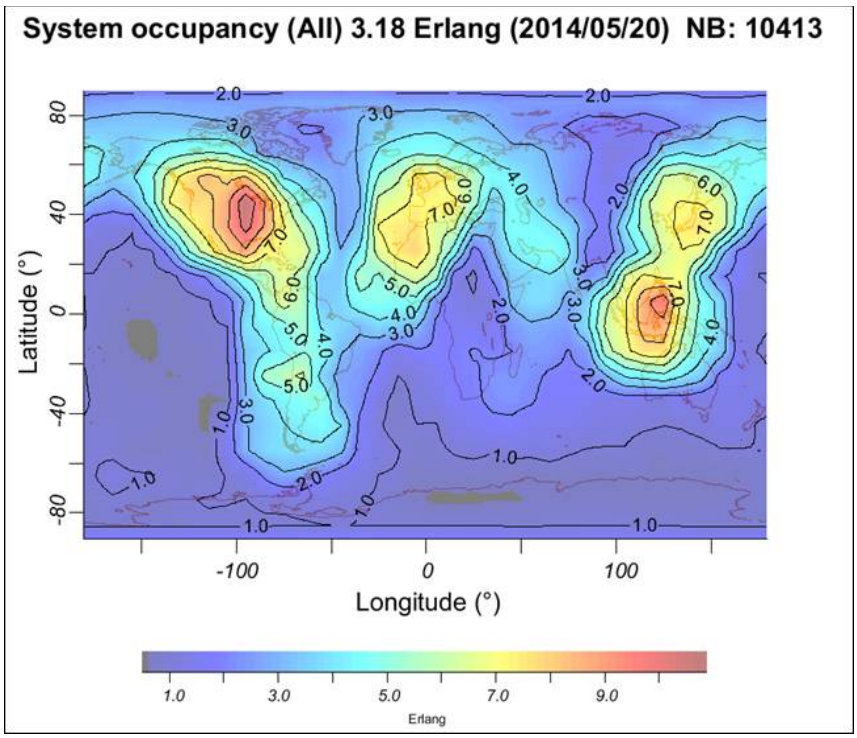


Figure 48 : System Occupancy on 20/05/2014

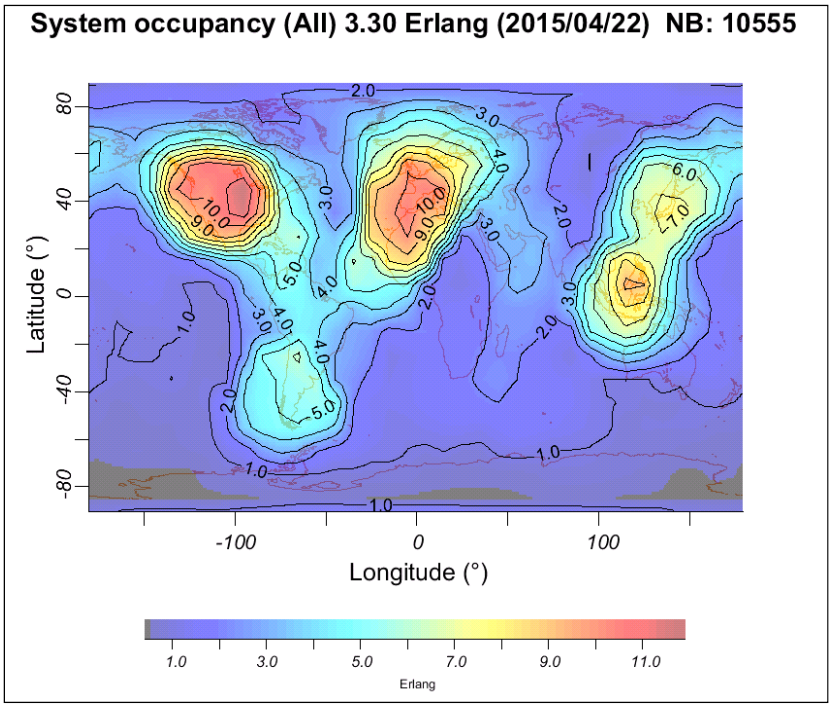


Figure 49: System Occupancy on 22/04/2015

Three constant peaks can be observed:

- Indonesia/Japan (6 to 9 Erlang)
- North America (6 to 12)
- Europe (6 to 10 Erlang)

For the 2014-2015 period, the above figure illustrates a systematic increase in occupancy primarily over the USA and Europe, which is due primarily to the manufacturers' transmission tests.

4.6. Argos-3 in DBCP

The use of the Argos-3 technology is now mature in the DBCP program with approximately 1 000 active drifters monthly, as illustrated by the figure below. The Kenwood PMT units have been regularly integrated into DBCP drifting buoys for several years. The PMTs are using the downlink messaging function to receive the satellite ephemeris information as well as the location of the buoy calculated by the global processing center. The ephemeris data combined with the buoy location are then used to schedule the transmission of the buoy's mission data only when a satellite is predicted to be flying over the platform, thereby saving energy and increasing the drifting buoys' operational lifetime. The DBCP is watching closely the lifetimes of these buoys in order to quantitatively evaluate the application of Argos-3 for drifting buoy communications.

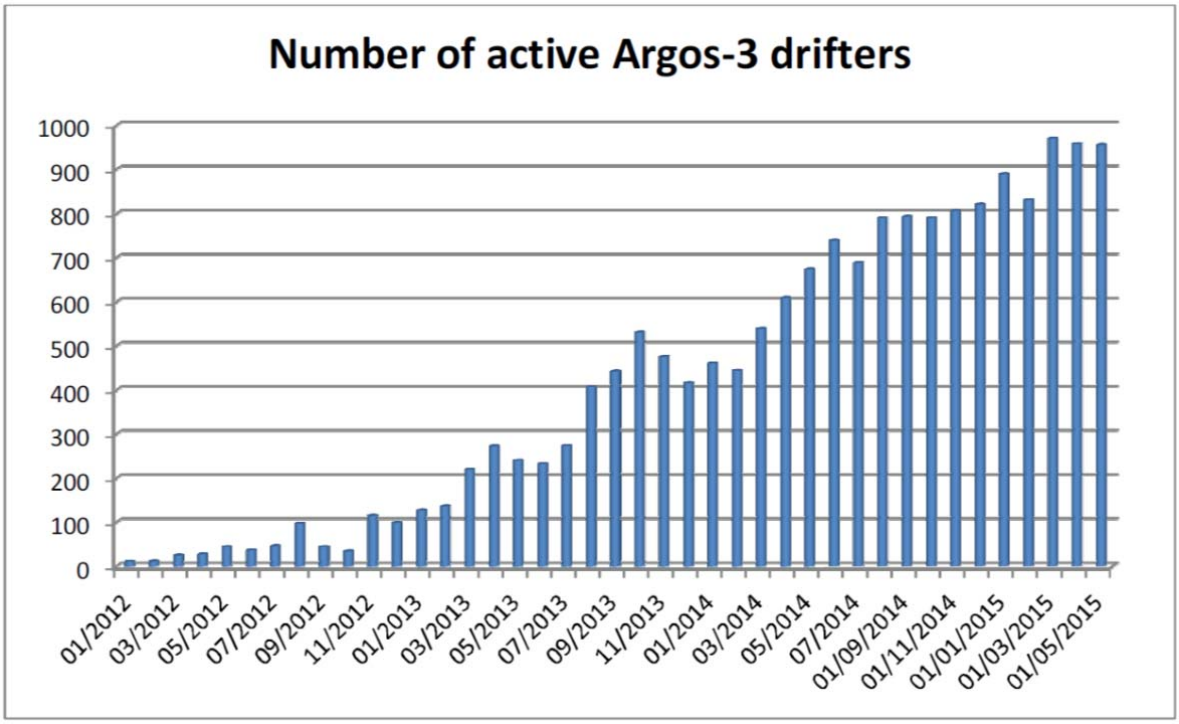


Figure 50 : Number of monthly active Argos-3 drifters in DBCP

4.7. Argos-3/Argos-4 chipset

During the multi-year Argos-3 implementation project, we discovered how important both low power consumption PMTs, as well as an Argos-3/Argos-4 receiver are for the Argos buoy community

Consequently, CLS has implemented a project to develop a miniaturized, low power consumption Argos transceiver called SHARC. SHARC (**S**atellite **H**igh-performance **A**RGOS-3/-4 **R**eceive/transmit **C**ommunication) is an ESA project managed by ANSEM, a Belgian company specializing in chipset design and manufacture, in partnership with:

- CLS
- Star-Oddi: an Icelandic company specializing in sensors and miniaturized data storage solutions for oceanographic and marine wildlife research
- A Wildlife tracking organization: APECS (specialized in shark tracking), WWF/Mediterranean (tuna)

The objective of this "Argos chipset" project is to design, manufacture and test a prototype of a miniaturized, low-cost, low power consumption ARGOS-3/-4 satellite chipset (ASIC) with two way communications capabilities (Argos-3, Argos-4), and to demonstrate its applicability by integrating it into a low-cost pop-up tag as part of the SHARC project.

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Despite some delays, the project is progressing well:

- the Chipset has been fully designed and the first factory run of several units has been successfully accomplished
- Successful tests have been conducted at the ANSEM facility
- The popup tag that will support the field application has been fully designed by StarOddi

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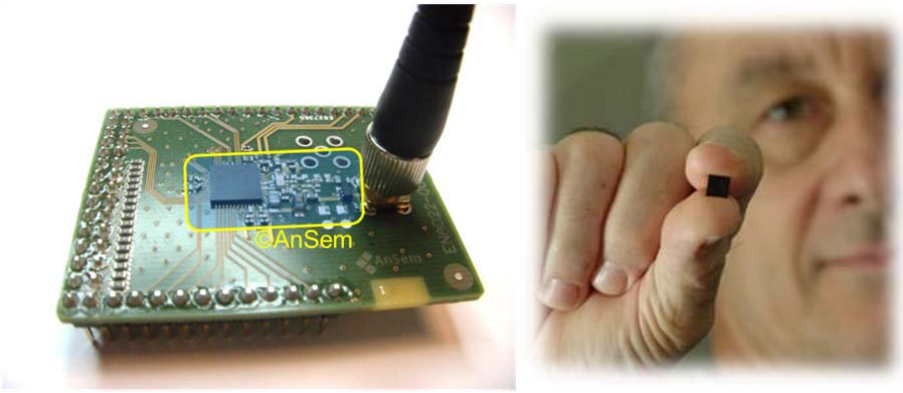

Figure 51 : Argos-3/4 chipset pictures

Remaining Work:

- Finalize the software implementation of the Tx/Rx A3 and A4 functionalities
- Second run of chipset manufacture to be carried out
- Full set of tests and certifications

The project has been delayed by several months due to some technical difficulties encountered by ANSEM and Star-Oddi. We have strengthened our collaboration and support with them to ensure the success of the project in the shortest possible time.. Prototypes are expected to be availalbe for evaluation by manufacturers in the Fall of 2015.

4.8. The RXG-134 Argos Goniometer

Figure 52 : The new Argos goniometer

At the request of the Argos users who want to be able to retrieve their Argos transmitters (animal tracking, floats, drifting buoys, etc.) CLS contracted with the company Xerius, located in Toulouse to develop a new Argos direction finder.

After one year of study and development, the first prototype was delivered to CLS in March 2013. The tests and validation performed since April have been successful. SHOM, the French Navy, has already tested and approved the new Argos goniometer.

Depending to the goniometer antenna altitude, the Argos platform transmission power and the environmental conditions, the Argos signal can be received by the RXG-134 from few meters to more than 100 km.

Received Argos demodulated messages and Argos platform transmitter terminal (PTT) reception angle are displayed on the screen and available on the serial port.

The CLS goniometer is fully compatible with all Argos transmitter generations: from Argos-1 to Argos-3 including the PMT.

Early 2014, an upgraded version of the RXG-134 was released, with two major improvements:

- The RXG-134 now features an internal compass with on-screen display of the cardinal directions

- The system can now decode GPS positions in real-time, when the platform is fitted with a GPS. The absolute position is then displayed on screen.