WORLD METEOROLOGICAL ORGANIZATION
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INTERGOVERNMENTAL OCEANOGRAPHIC COMMISSION (OF UNESCO)
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DATA BUOY COOPERATION PANEL

DBCP-29/ Doc. 10.3
(27-Aug-13)

TWENTY-NINTH SESSION

ITEM: 10.3

Paris, FRANCE
23-27 SEPTEMBRE 2013

ENGLISH ONLY

Argos operations and developments

(Submitted by CLS)

Summary and purpose of the document

As for past DBCP meetings, this document contains, in consolidated form, the summary report from CLS/Service Argos, covering report on 2012 – 2013 Operations and System Improvements.

ACTION PROPOSED

The Panel will review the information contained in this report and comment and make decisions or recommendations as appropriate. See part A for the details of recommended actions.

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Appendices: **A**. Report on 2012 – 2013 Argos Operations and System Improvements

-A- DRAFT TEXT FOR INCLUSION IN THE FINAL REPORT

10.3.1 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 at a >99% level of availability

10.3.2 Today the Argos is composed by a space segment of 7 operational satellites with 4 NOAA POES (15, 16, 18, 19) 2 EUMETSAT spacecrafts (METOP-A & B) and 1 Indian satellite (SARAL). The ground segment has 7 global receiving stations (6 in North Pole and 1 in Antarctica) and 68 local real-time stations worldwide.

10.3.3 Operational highlights from the last 12 months include the start of METOP-B and SARAL Collection and Localization services since April 29, 2013 and following almost 11 years of service, the decommissioning of NOAA-17 (NOAA-M prior to launch) on April 10, 2013. The French Argos processing center successfully moved to the new CLS building on October 20th, 2012. In 2012-2013, the Argos real-time stations network were quite steady with 2 new US Air Force NOAA satellite local stations added: Ali al Salem in Kuwait and Soto Cano in Honduras. These actions combined with substantial progress in implementing the Real-time Antenna Upgrade Project (7 stations already upgraded, 6 scheduled in 2013 and 4 additional upgrades scheduled in 2014) all continue to improve the global timeliness for data collected using the Argos system.

10.3.4 Improved performances in terms of data mean disposal time observed during the last 12 months have been observed and they are mainly due to the 2 new satellites in the system (METOP-B & SARAL) more HRPT Stations receiving METOP-A and B (Miami, Monterey, Hawaï, Lannion, Lima, Cape Town, Hatoyama, La Réunion, EARS Stations) and the upgraded real-time stations to track SARAL Satellite with the TM_100min capability. Indeed SARAL is downloading to compatible Argos real-time stations all datasets acquired in the last 100 minutes improving Argos data timeliness. CLS efforts will continue to improve the coverage of the real-time antennas in the regions where it is needed with new local antennae implementation projects: Ascension Island for the South Atlantic and Easter Island for the South Pacific.

10.3.5 CLS continues to provide the GTS processing for all DBCP Argos equipped drifters and moored buoys in compliance with WMO and DBCP TT-DM recommendations. The CLS GTS processing system as well as the quality of the data and the entire Argos system performance is monitored 24/7.

10.3.6 An "Argos chipset" project called SHARC (Satellite High-performance ARGOS-3/-4 Receive/transmit Communication) has been implemented by an European consortium to design, manufacture and test a prototype of a miniaturized and low-cost ARGOS-3/-4 satellite chipset (Asic) that enables two way communications (Argos-3, Argos-4) and provides improved battery lifetime. This project started in October 2012 and will end in March 2015.

10.3.7 At the request of the Argos users who want to be able to retrieve their Argos transmitters (animal tracking, floats, drifting buoys,…) CLS contracted with the company Xerius, located in Toulouse to develop a new Argos direction finder called a Goniometer. This new, hand-held Goniometer will be available for sale/lease in the Fall of 2013.

10.3.8 The meeting made the following recommendations:

Rec1;

Rec2;

Rec3;

Rec4;

Rec5.

10.3.9 The meeting decided on the following action items:

Action1 (action; by; deadline);

Action2 (action; by; deadline);

Action3 (action; by; deadline);

Action4 (action; by; deadline);

Action5 (action; by; deadline).

-B- BACKGROUND INFORMATION (if necessary, provide additional material to further explain the information in part A but that will not be included in the report of the meeting)

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Appendix: 1

Appendix A

Report on Argos 2012 – 2013 Operations and System Improvements

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1 2012-2013 Argos Highlights

1.1 Operations

- Following almost 11 years of service NOAA-17 (NOAA-M prior to launch) was decommissioned on April 10, 2013
- Collection and Localization Processing/Distribution is operational for METOP-B and SARAL since April 29, 2013
- 2 days of service interruption on the Argos US processing center due to violent storms in the Washington D.C. area (July 2012)
- 5 hours of distribution service interruption (Web/Telnet/Web services) on the Argos French processing center due to air conditioning problems
- The French Argos processing center successfully moved to the new CLS building on October 20th, 2012
- Set-up of an Argos-3 platforms activity monthly report for JCOMMOPS
- VGTS tool (GTS processing statistics tool) upgrade to be BUFR format compatible
- Development of a new tool to improve the real-time monitoring of the Argos HRPT antennae network

1.2 System improvements

- 2 new satellites operational with Argos payload:
    - METOP-B (MB) launched September 17, 2012
    - SARAL (SR) launched February 25, 2013
- SHARC (**S**atellite **H**igh-performance **A**RGOS-3/-4 **R**eceive/transmit **C**ommunication) chipset development project
- Argos Real-Time Antenna Network Upgrade Project continues
- The installation of an Argos reference beacon network
- The upgrade of the Argos ground segment for SARAL
- The upgrade of the Argos ground segment for ARGOS-4
- The moving of the Toulouse data center into new facilities
- Argos computed trajectories downloadable on ArgosWeb since July, 2013
- Observations data available via the Argos WebServices since April, 2013
- Development of a new Argos direction finder (goniometer)
- New Argos orbitography module to not use OpenVMS anymore

1.3 Outlook

- Continue optimization of Real-Time Antenna Network
- Online Archive data downloading feature through ArgosWeb (last 12 months available)
- Upgrade of the Oracle database version: Migration to the Oracle 11GR2 version
- The last 20 days of data available on ArgosWeb instead of 10
- A new Android application available for all Argos users to consult on Smartphone/pad their Argos platforms positions
- Development of a low-cost Argos-3/4 chipset (SHARC project)
- Development of a BCH (Bose, Ray-Chaudhuri et Hocquenghem) message coding/decoding to improve Argos message transmission in noisy regions
- Argos Doppler location algorithmic improvements
- Study to improve the Argos orbitography accuracy

2 Argos space segments

2.1 Operational status

During 2012, Argos instruments were onboard 6 POES's spacecrafts.

During beginning of year 2013, two spacecraft with Argos-3 payload were launched (METOP-B, SARAL) and one with Argos-2 payload was decommissioned (Noaa-17, NM).

Figure 1: METOP-B launched by Soyuz (left) and SARAL launched by PSLV-C20 (right)

The current status information on each spacecraft and its Argos various subsystems is described as follow:

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	Ok
METOP-A (MA)	19-Oct-06	AM Backup	Ok/Nok*	Svalbard	Ok
NOAA-19 (NP)	06-Feb-09	PM Primary	Ok	Gilmore, Wallops, Svalbard	Ok
NOAA-18 (NN)	20-May-05	PM Secondary	Ok	Gilmore, Wallops	Ok
NOAA-17 (NM)	24-Jun-02	DECOMMISSIONED on 10 April, 2013			
NOAA-16 (NL)	21-Sep-00	PM Secondary	Ok	Gilmore, Wallops	Ok
NOAA-15 (NK)	13-May-98	AM Secondary	Ok	Gilmore, Wallops	Ok

Figure 2: Argos Constellation

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

2.2 METOP-A HRPT Switch Zone

To minimize the risk of failure to 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 was activated for all orbits over the North Atlantic and European area, starting at around 60°N. The AHRPT will then be 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 will also be made in ascending orbits, but with more stringent risk reduction measures than applied for the descending passes given the availability of data via the Fast Dump Extract System (FDES) to cover the North Hemisphere.

Figure 3 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.

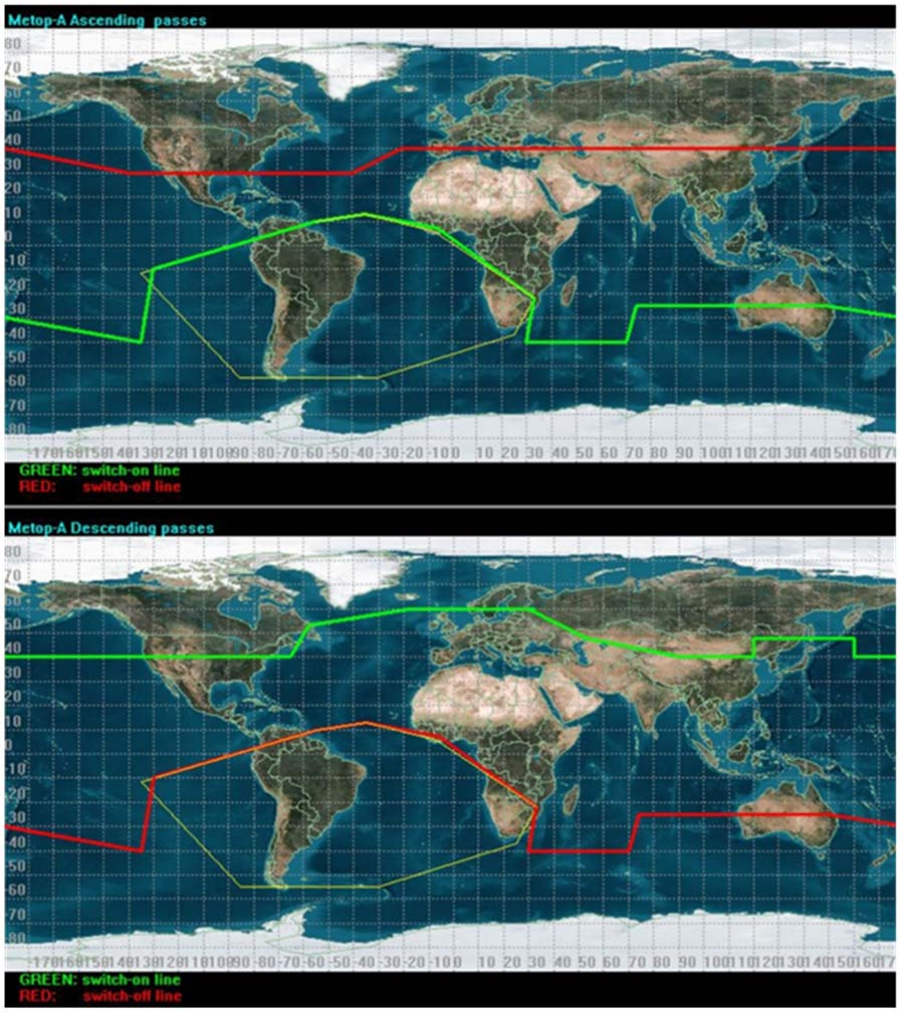


Figure 3 : METOP-A HRPT Extended Switch Zone (Descending and Ascending orbits)

2.3 Ascending Nodes Local hour

The diagram here below presents the local time of ascending notes in April 2013

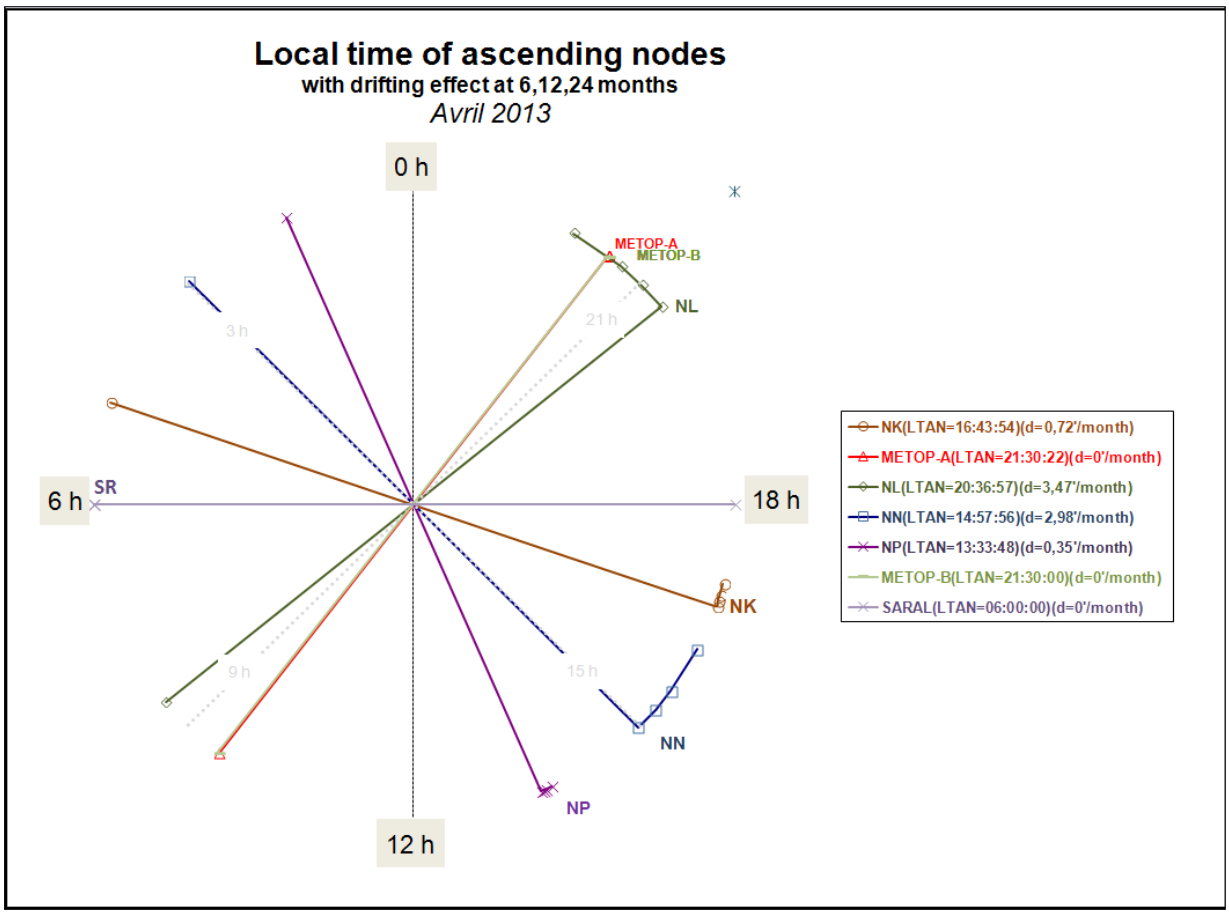


Figure 4: Local Equator crossing time in April 2013

2.4 Anomalies in 2012

METOP-A

21/03/12: Processor failure. No data during 4 minutes.

08/04/12: Processor failure. No data during 4 minutes.

02/06/12: Processor failure. No data during 4 minutes.

04/07/12: Processor failure. No data during 2 minutes.

04/11/12: Increase of memory software failure. No impact. As the value of the counter of simple error was at its max value (65535), so sending of the directive to reset the counter (05/11/2012 09h42).

METOP-B

Not Operational in 2012.

NOAA-19

11/07/12: Increase of memory software failure (max=65535) and WATCH_DOG. No Data during 10 hours. Dataset Processing switch on.

02/09/12: Processor failure. No data during 4 minutes.

30/09/12: Processor failure. No data during 4 minutes.

NOAA-18

21/02/12: NOAA-18 was placed for an enhanced GYE flight software on-orbit test. 2 global datasets lost (from 21/02/2012 16h40 to 21/02/2012 19h45).

NOAA-17

NA

NOAA-16

NA

NOAA-15

24/01/12: NOAA-15 was placed into the Gyroless Mode for a baseline on-orbit test. No dataset from NOAA during this period so the loss of data is around 50%.

SARAL

Not Launched in 2012.

2.5 Maneuvers in 2012

METOP-A

02/03/12: Emergency In-Plane Manoeuvre. 1 burst of 3s (high risk of conjunction). ARGOS Location service closed for 5 days and 19 hours.

14/04/12: Emergency In-Plane Manoeuvre. 1 burst of 6.25s (high risk of conjunction). ARGOS Location service closed for 2 days and 20 hours.

18/07/12: In Plane Manoeuvre. 1 burst of 7 seconds. Degradation of the ARGOS locations quality for 24 hours.

21/11/12: In Plane Manoeuvre. 1 burst of 7.5s. Degradation of the ARGOS locations quality for 24 hours.

METOP-B

Not Operational in 2012.

SARAL

Not Launched in 2012.

2.6 Next launches of satellites with Argos instrument

- METOP-C (EUMETSAT) with an Argos-3 instrument in 2017

3 Argos ground segment

3.1 Global antennas (store and forward mode)

The Argos global antennas network is composed by seven stations:

- The two NOAA global stations of Fairbanks and Wallops acquire the global recorded telemetry transmitted by N15, N16, N18 and N19.
- 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 N19 for NOAA stations.
- The NOAA Svalbard antenna that delivers NOAA 15/16/18 blind orbits for Fairbanks and Wallops when not in conflict with NOAA-19.
- Inuvik (Canada) and Kiruna (Sweden) stations for SARAL operated by EUMETSAT.

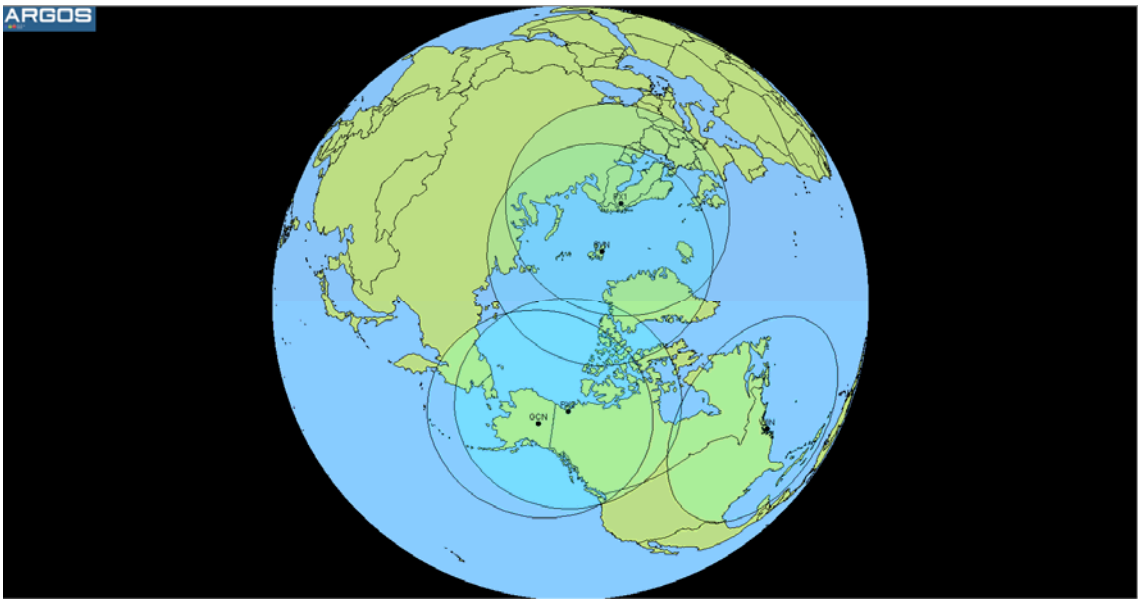


Figure 5 : The Argos Global antenna network (without McMurdo)

- 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.

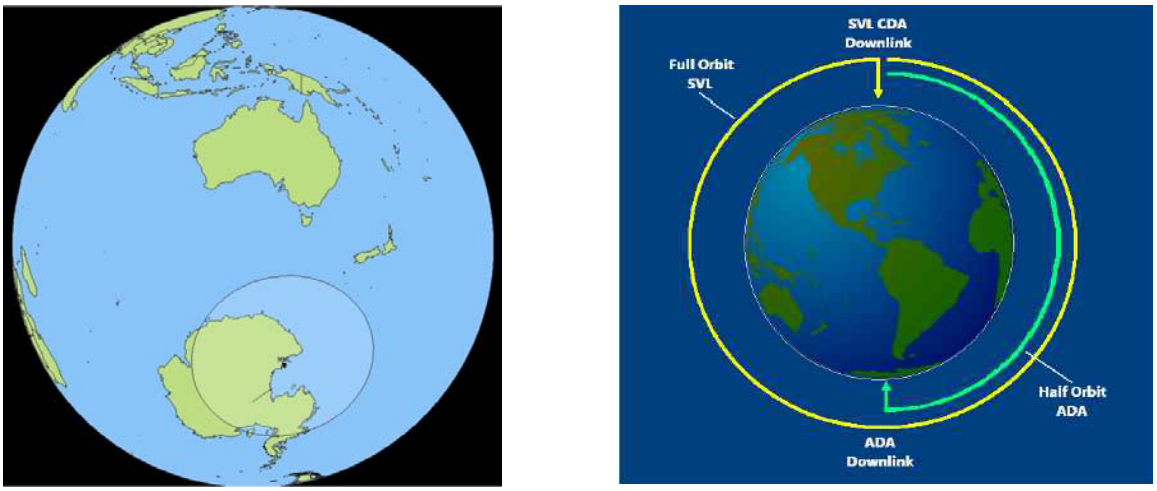


Figure 6 : METOP-B Mc Murdo Global antennas coverage and principle

3.2 Regional antennas (real-time mode)

3.2.1. *Operation and improvements*

Improvements are still focused on redundancy locations and coverage extension. Today, both Toulouse and Lanham processing centers receive Argos real-time data from 68 stations located all over the world.

In 2012, CLS was still focused on the Real-Time Antenna Upgrade Project that consists of upgrading selected antennas in order to be compatible with NOAA, METOP and SARAL. This project also aims to optimize in terms of performance the real-time receiving stations network.

In 2012-2013, the real-time network is quite steady with 2 new ground stations added :
- Ali al Salem in Kuwait operated by US Air Force
- Soto Cano in Honduras also operated by US Air Force

These both new stations acquire real-time datasets from all NOAA satellites.

Today, the real-time Argos ground station network consists of about 65 antennas. If all of them are capable of receiving NOAA POES satellites data, only 19 receives METOP satellites data and, for the moment, 7 out of these 19 receives also SARAL data.

Here below are displayed the Argos HRPT coverage world map and the list of the 68 operational stations part of the Argos real-time antennas network in 2013.

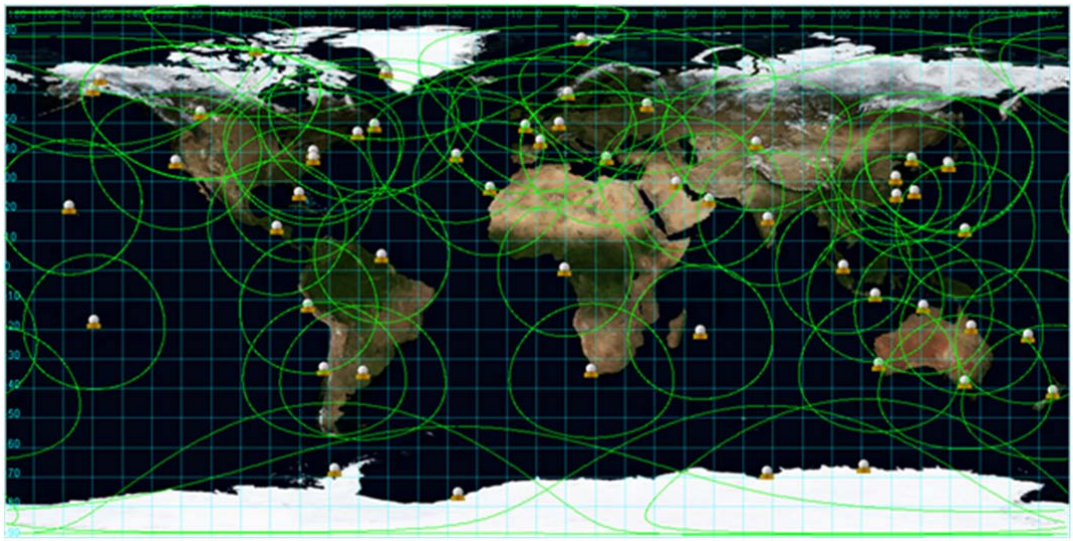


Figure 7 : May 2013 Real-time coverage map

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

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

Figure 8 : List for Operational Antennas on May 2013 and tracked satellites

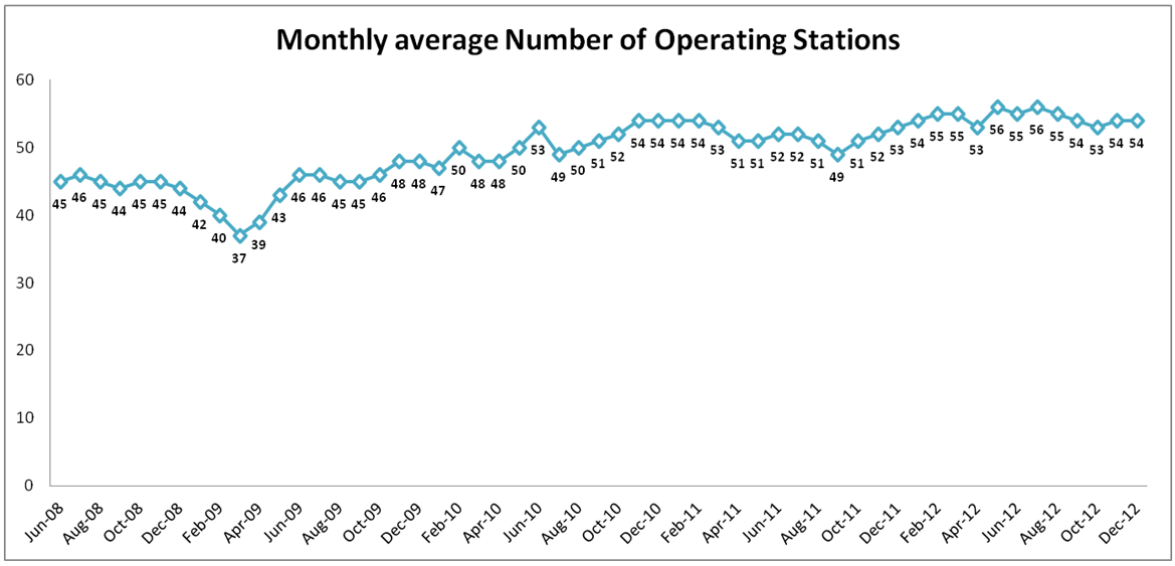


Figure 9 : Operational Argos real-time antennas since January 2008

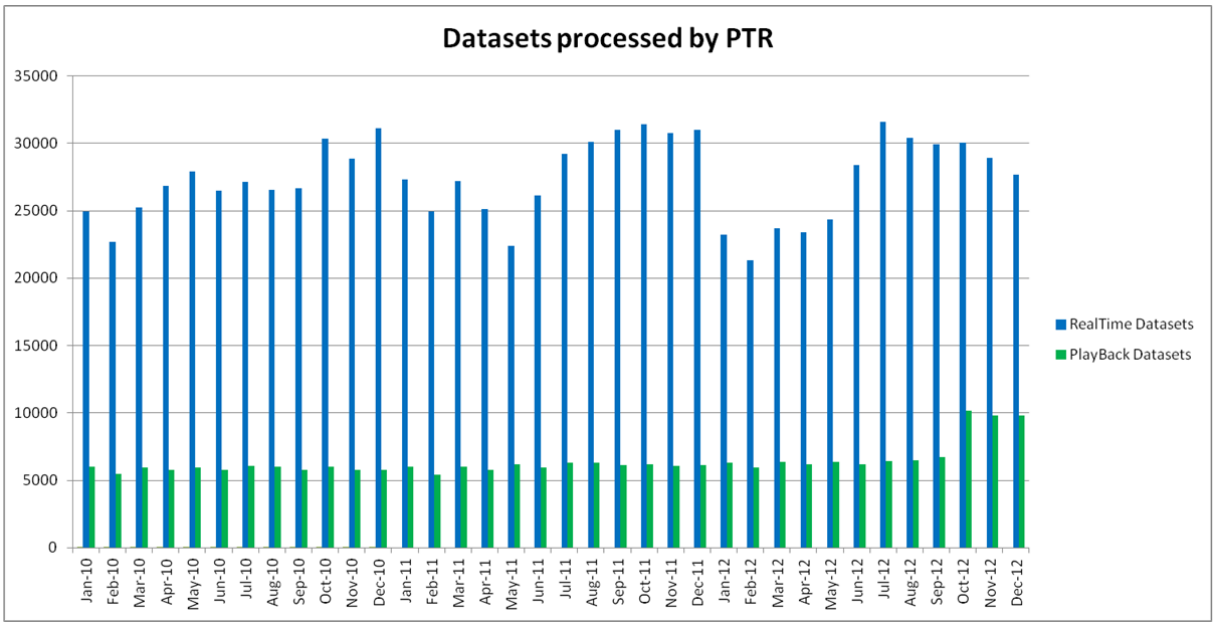


Figure 10 : NOAA and METOP Playback and Real-time datasets processed per Month

3.2.2. *METOP real-time coverage*

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

- Metop-A by NOAA ESPC: Monterey, Ewa Beach, Miami
- Metop-B by NOAA ESPC: Ewa Beach, Miami, Gilmore Creek, Wallops Island
- Metop-A by Eumetsat : EARS network
- Metop-B by Eumetsat : In August 2013 only Svalbard, Maspalomas, and Athens are tracking Metop-B. Others EARS stations will be updated soon.

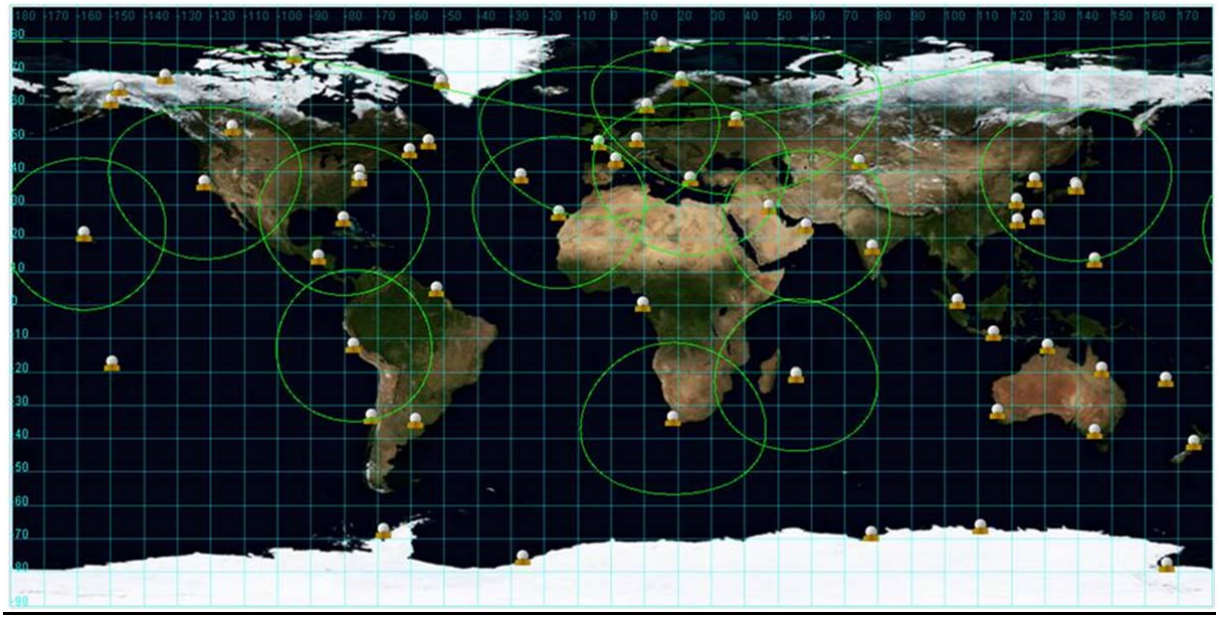


Figure 11 : Current METOP-A (and soon METOP-B) coverage

3.2.3. *HRPT-A4 project*

This project had been initiated in 2010 and was presented for the first time during 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 17 stations as shown on the map below have been chosen.

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

We have to notice that the upgrade of the station of Resolute bay has been given up to be replaced by the antennas of Inuvik and Kiruna. The Davis antenna has been be replaced by the one of Casey.

On the date of May 2013, the status of the deployment is as follows:

- Operational ground stations (surrounded by green on the map below):
  - Lima
  - Lannion
  - La Réunion
  - Hatoyama
  - Miami
  - Bali
  - Cape Town

- Upgrade scheduled in 2013 (surrounded by blue on the map below):
  - Mascate
  - Las Palmas
  - Athens
  - Monterey
  - Tahiti

- Upgrade scheduled in 2014
  - Ascension Island (Under discussion with ESA)
  - Cape Ferguson (Under discussion with BOM)
  - Wellington (Under discussion with BOM)
  - Casey (Under discussion with BOM)

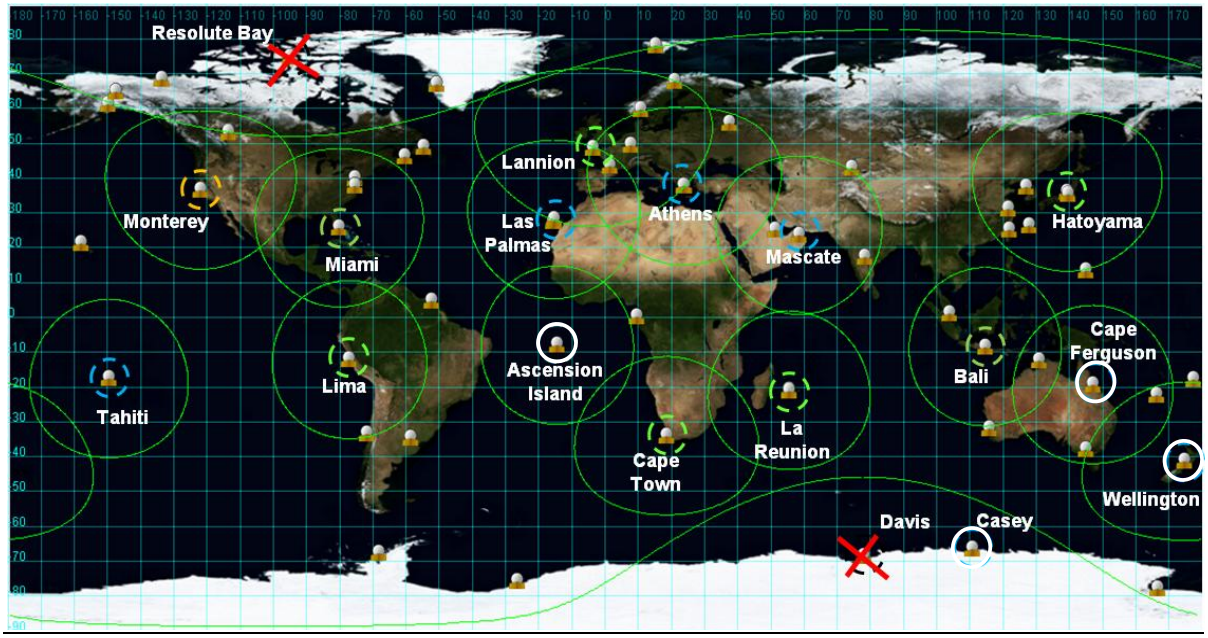


Figure 12 : May 2013 HRPT-A4 network status

3.3. Argos reference beacon network

This project has been initiated in 2010 and consists in developing, validating, deploying and testing the reference beacon network. Following these phases, the network will be operated at CLS. The main goal of the reference beacons is to estimate the performances of the Argos System in several worldwide places. In that goal, the reference beacon will be able to transmit and receive following scenarios representative of user applications.

The reference beacon is based on PMT equipment compatible with Argos 2 and Argos 3 satellites meaning that it will be able to transmit using all the existing modulation scheme (A2 = BPSK, A3 = QPSK, HD = GMSK). The parameters which will be observed are:

- the transmitted frequency,
- the transmitted power,
- the repetition period,
- the message length.

These parameters will be observed following 7 defined scenarios which are:

- Continuous Random transmission
- Cycled Random transmission
- Random transmission only during satellite passes
- Random transmission using pseudo acknowledgment
- Interactive mode transmission
- Continuous Random transmission on Argos 2 satellites and interactive transmission using A3 or HD on Argos3 satellites
- Cycled Random transmission on Argos 2 satellites and interactive transmission using A3 or HD on Argos3 satellites

The first Argos reference beacon has been produced and validated in 2012. The phase of deployment of the Argos reference network will start in 2013 by installing around 10 beacons in the following sites (chosen according the level of noise):

- Jakarta, Taipei, Seoul, Toulouse for Asia and Europe in which the noise is really important
- Svalbard for Europe which is a moderately quiet area
- Washington for America which is a really quiet area.

3.4. Processing centers

The two global processing centers in Toulouse and Lanham were nominal over 2012 and first semester of 2013. 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.

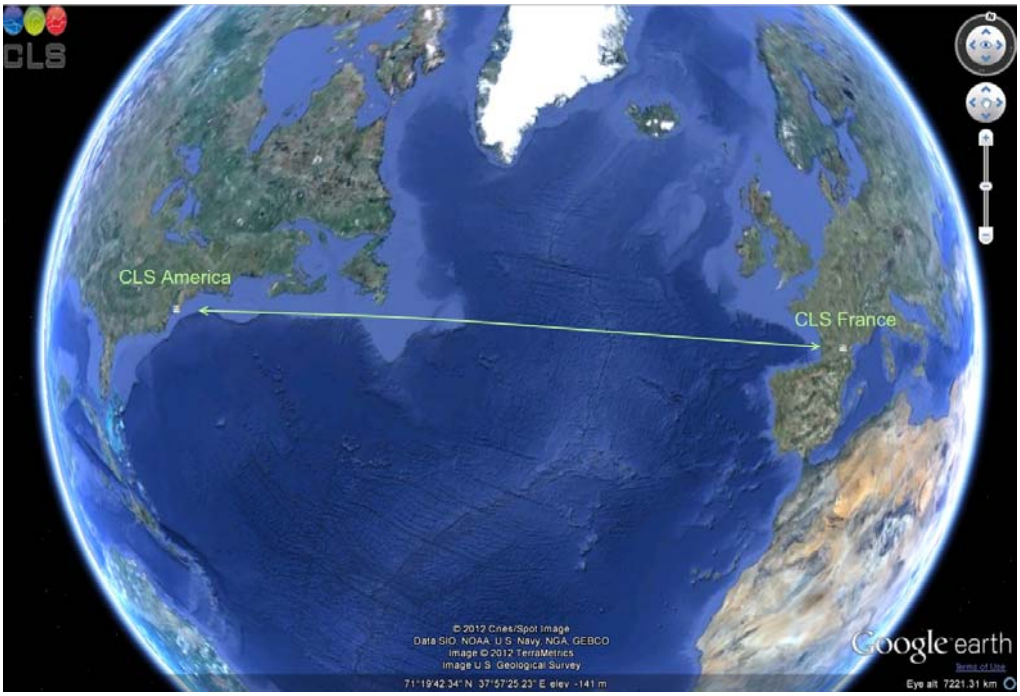


Figure 13 : Global and Regional Processing Centers

In October 2012, to face the increase of its activities, CLS has built a new building which includes a new control room and a new data center as well.

Personnel, IT infrastructure and all operations staff moved in September/October 2012 into the new facility. All Operations staff was mobilized in order to satisfy all Customer services and minimized the operations' impacts. This moving has been transparent for the Argos users.

Figure 14 : CLS Toulouse new building

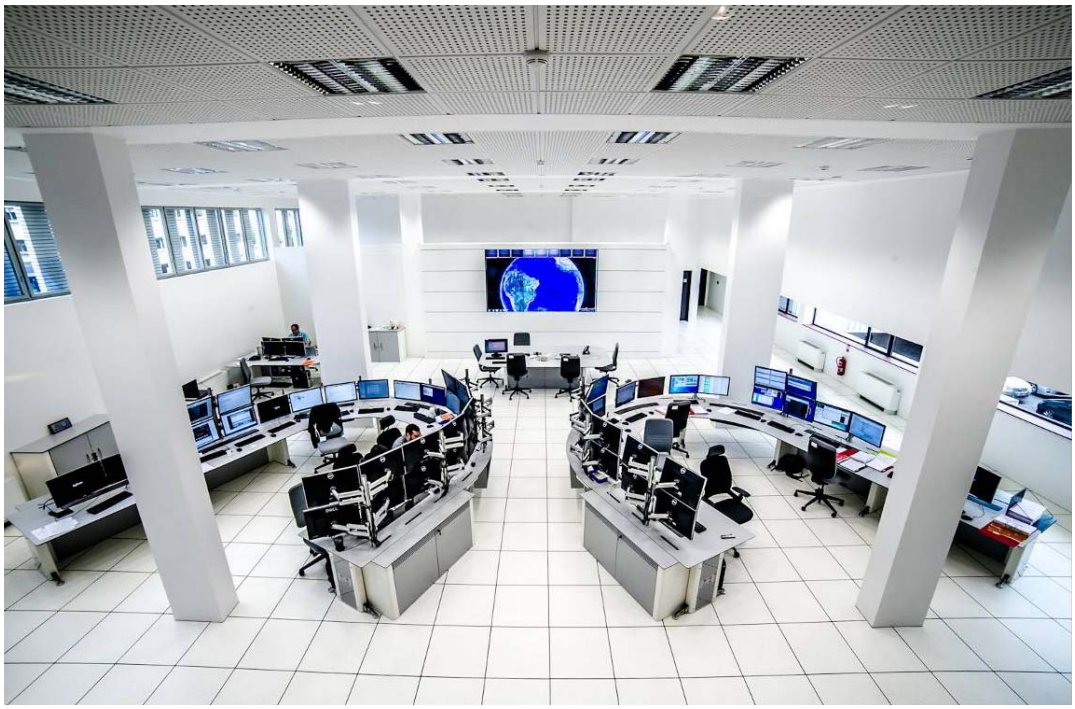


Figure 15 : CLS Toulouse Control Room

Figure 16 : CLS Global Processing Data Center

3.4.1. *Argos global processing centres architecture*

In 2011, https architecture in CLS France was updated and CLS America firewalls were replaced to get the same hardware and software version as CLS France. CLS also initiated a rebuilt of ARGOS application servers, in order to prepare the next decade. This process started on the development configuration in CLS France. The application server is now based on CentOS Linux release 6.0, 64 bits (rather than RedHat, 32bits).

In 2012, these changes on operating systems have been propagated up to the operational configurations, both in CLS America and CLS France datacenters. In order to address the increase of quantity of data to be processed (due to the launch of METOP-B and SARAL spacecraft), space disk have been increased and few processing servers have been added. The databases backup mechanism has been optimized and updated.

In 2013, the servers of Argos the processing chain will be virtualized on a VMWARE solution. In both CLS and CLS America sites.

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.

Hereafter is the IT architecture schema of the CLS Toulouse (on the left) and the CLS America (on the right) infrastructure. We try to preserve a similar architecture on both sites in order to avoid issues when deploying new versions of switching users from one center to another. The architectures of CLS France and CLS America processing centers are quite similar and based on the same principle. We find three main subsets:

- the processing chain
- the Oracle database service
- the Web distribution

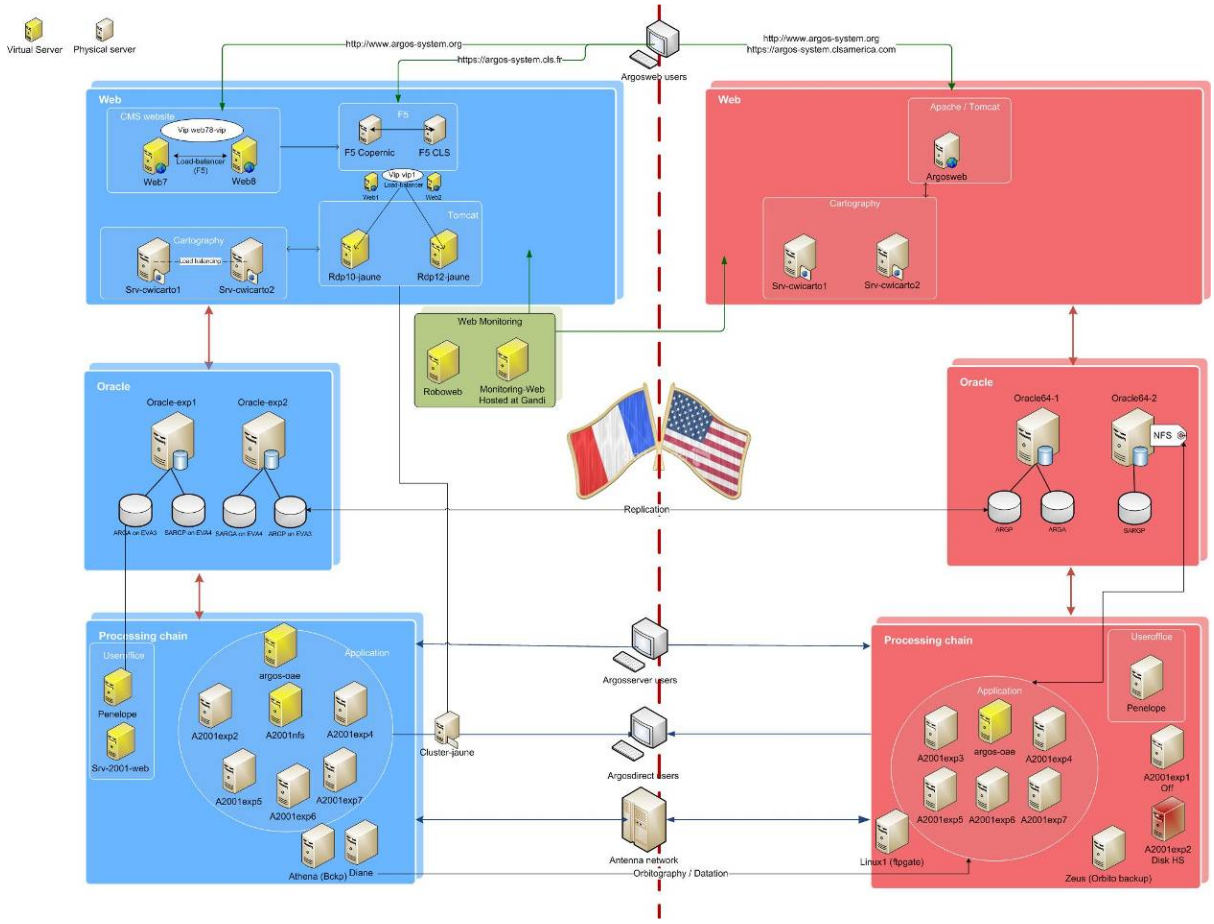


Figure 17: IT architecture schema of the both Argos processing centers

3.4.2. *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 location, 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.

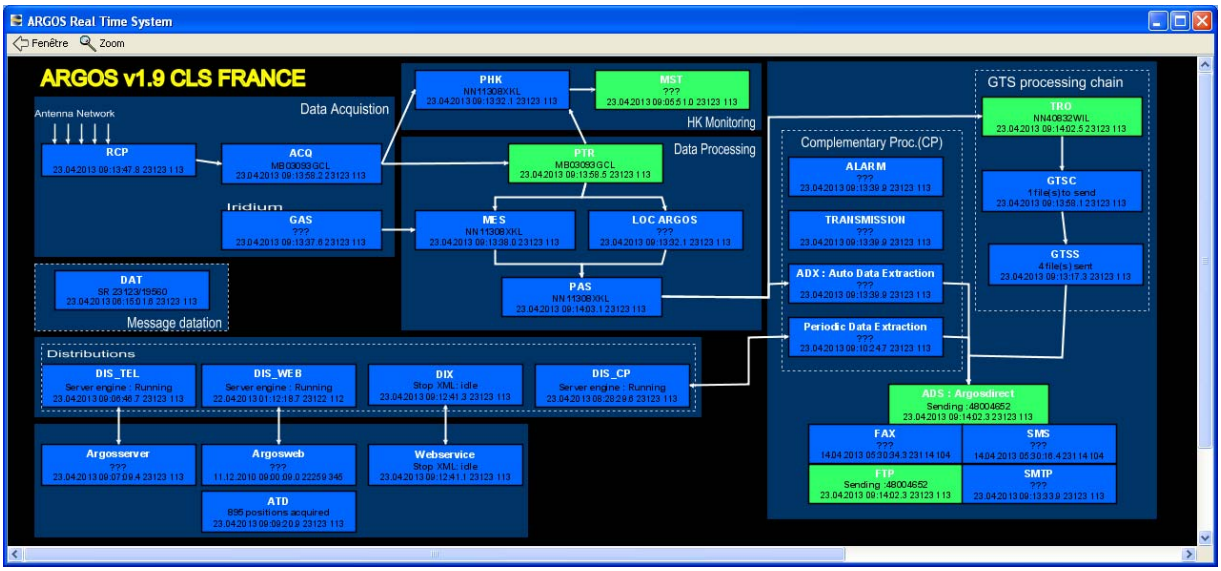


Figure 18: Synoptic of the CLS Argos processing chain

3.4.3. *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.

3.4.4. *The Argos data distribution*

3.4.4.1. 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 on which are running 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 2011 is 99.61%
The annual availability of the U.S. ArgosWeb site (US) in 2011 is 99.27%

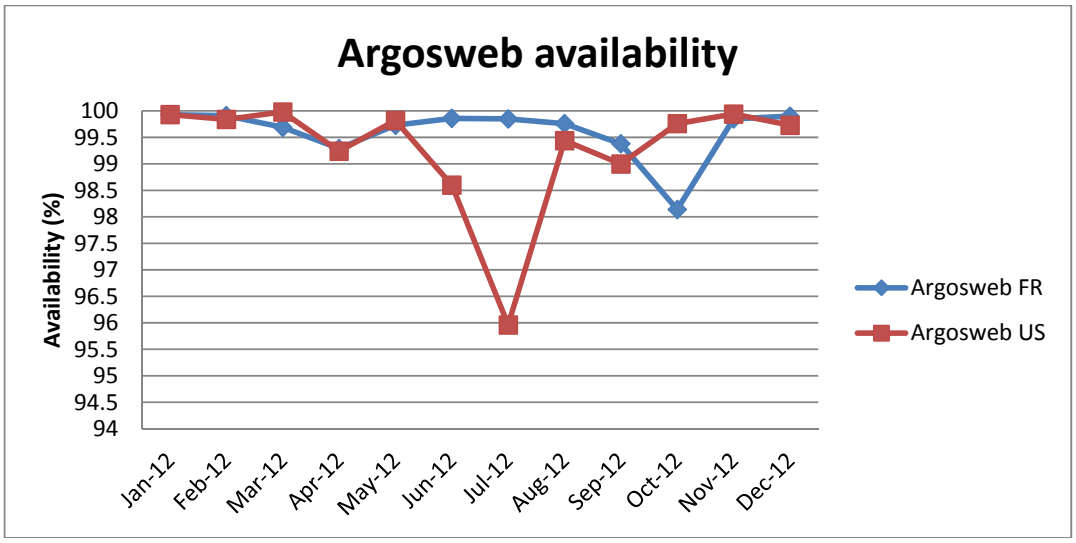


Figure 19 : Argosweb availability in 2012

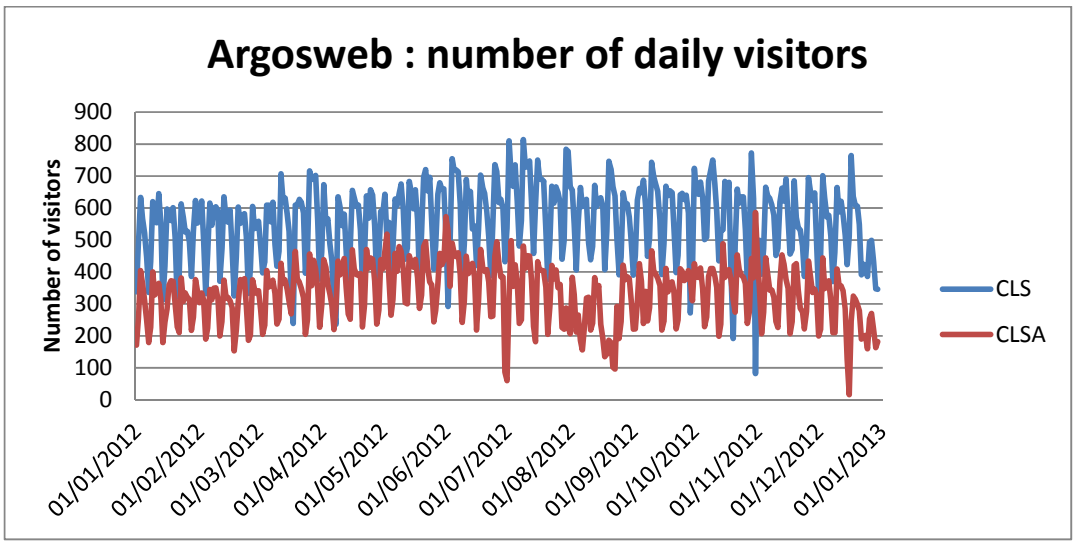


Figure 20 : Number of daily Argosweb accesses in 2012

3.4.4.2. 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 both ArgosServers are:

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

The annual availability of the French ArgosServer site (FR) in 2012 is 99.73%
The annual availability of the U.S. ArgosServer site (US) in 2012 is 99.27%

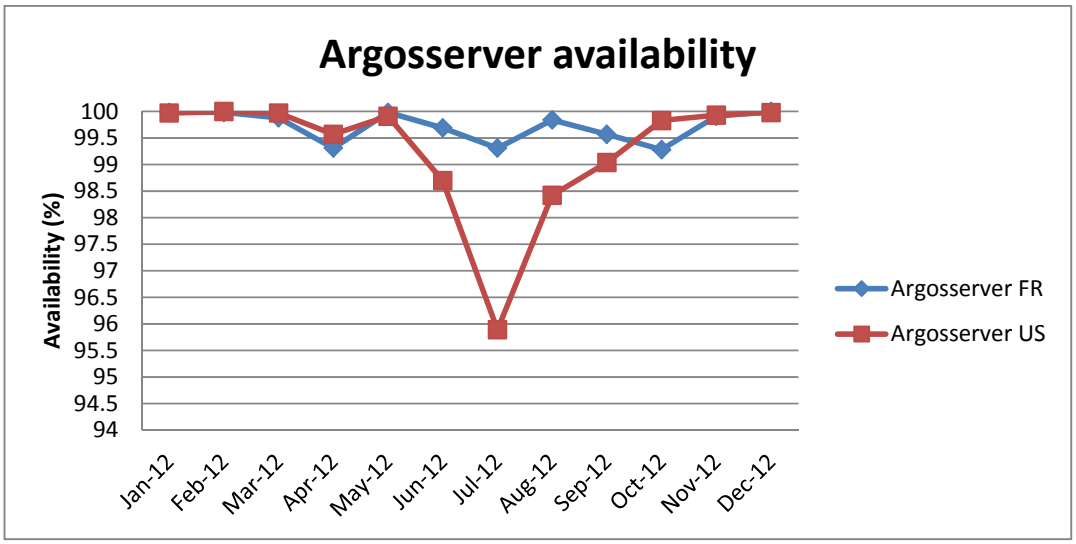


Figure 21 : Argosserver availability in 2012

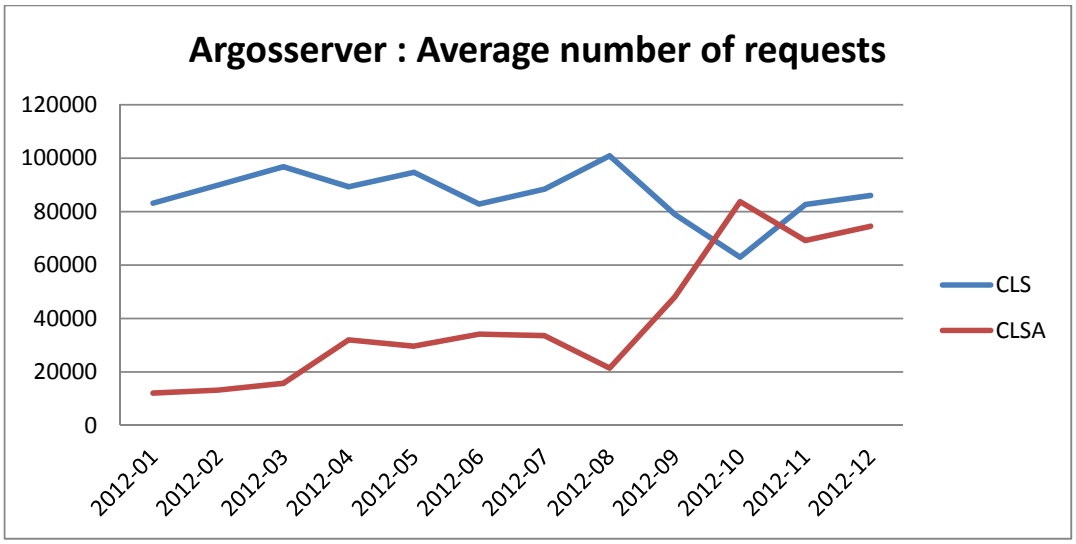


Figure 22 : Argosserver number of requests in 2012

3.4.4.3. ArgosDirect

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

The annual availability of the ArgosDirect service in 2012 is 99.91%

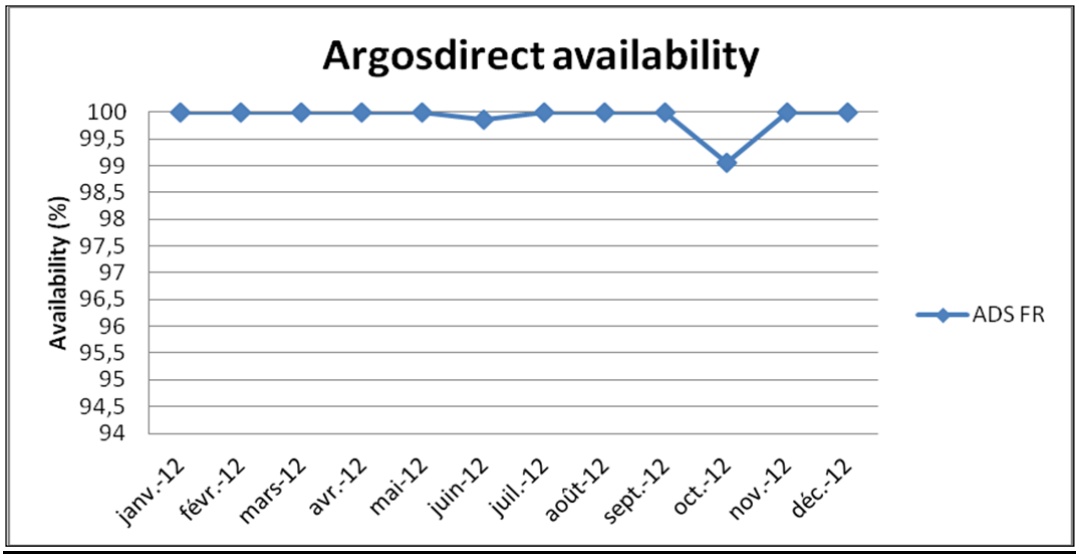


Figure 23 : ADS availability

ADS unavailability corresponds to periods where no sendings have been made (excluding the backup periods). The cause could be ADS, but actually, unavailability is mainly due to CTA related issues (no datasets processed => no datasets to be sent). In October, an air-conditioning system outage on the new CLS datacenter impacted all services.

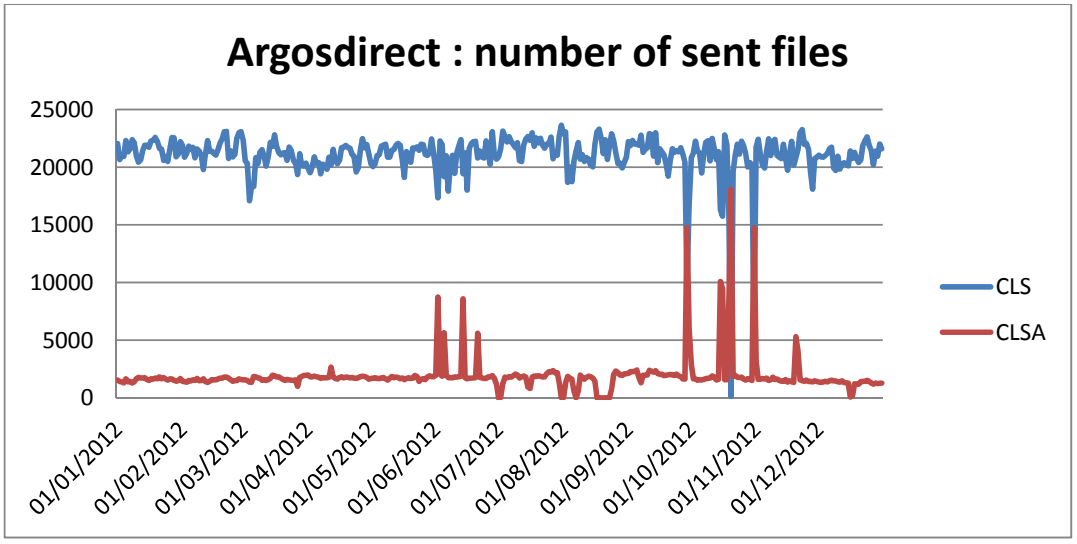


Figure 24 : ADS sendings in 2012

3.4.4.4. Argos WebService

CLS has developed a new machine-to-machine/automatic interface called WebService in order to distribute Argos data. This modern alternative to ArgosServer (Telnet) is free of charge and makes it possible for Argos users to contact CLS's data base directly, via internet, and receive their data in **CSV, XML and KML (GoogleEarth) 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 2012 is 99.89%
The annual availability of the U.S. Webservice (US) in 2012 is 98.87%

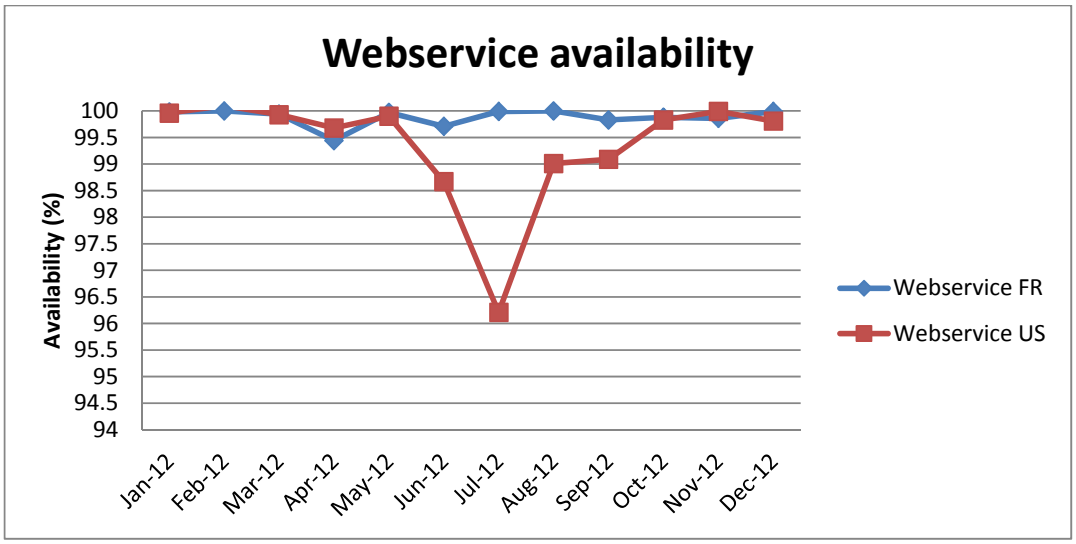


Figure 25 : Webservice availability in 2012

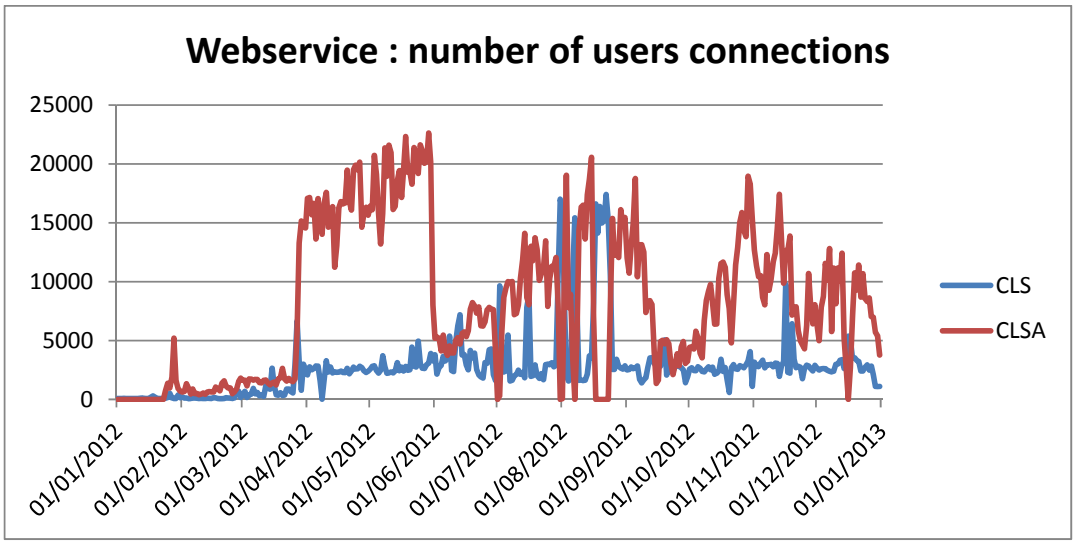


Figure 26 : Webservice number of connections in 2012

3.4.5. *Disaster recovery architecture*

Disaster recovery architecture implementation is completed. 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 27 : Disaster Recovery Room located in CNES

3.4.6. *Data processing statistics*

The Argos Operations missions at CLS are:

- Availability and reliability of Argos Products and Services in accordance with the SLAs,
- Support internal or external Argos projects, or proposals,
- Control and reduce operational risks and costs in order to ensure 24h/24, 7 days per week 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.

In 2012, the processing performance indicator was 97,57%. 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 doesn't include periods when 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, during these periods, other datasets are queued and are waiting to be processed increasing the time they passed between PTR and PAS modules.

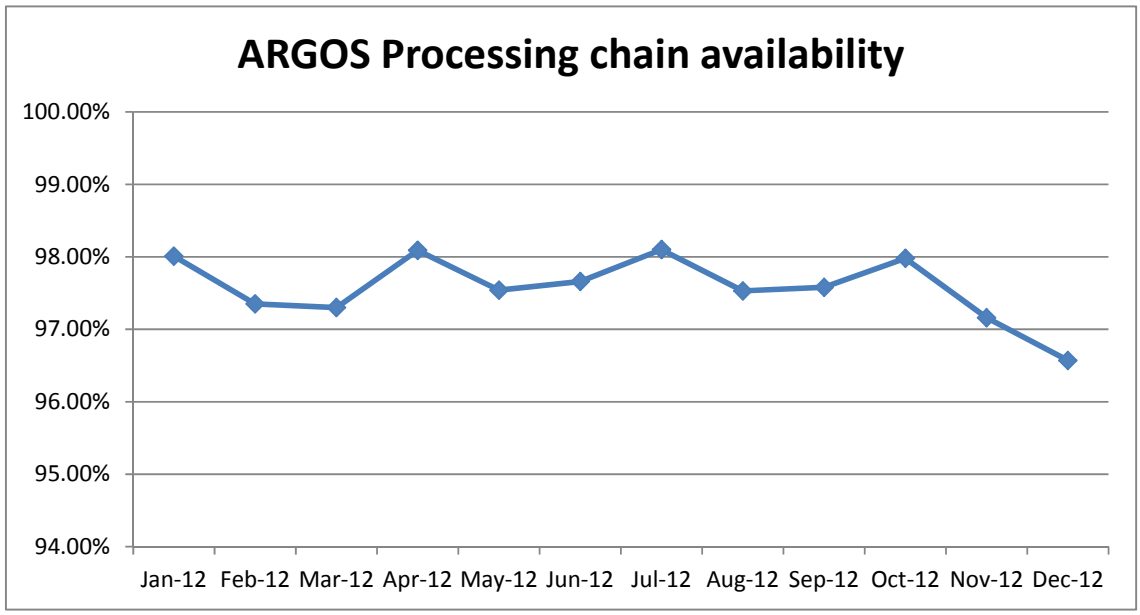


Figure 28 : 2012 Processing chain availability

3.4.7. *Number of Argos messages and locations processed*

Number of locations and messages computed every day by the Washington and Toulouse Centers are, in average:

Number Per day	2008	2009	2010	2011	2012
Messages received	1 969 658	2 273 233	2 871 885	2 904 476	2 790 580
Distinct Messages received	1 164 717	1 272 459	1 470 953	1 451 938	1 443 247
Argos Locations	66 176	77 837	94 151	92 168	93 343
GPS Locations	187 829	185 496	205 259	212 587	224 857

Figure 29 : Argos messages and locations per day (table view)

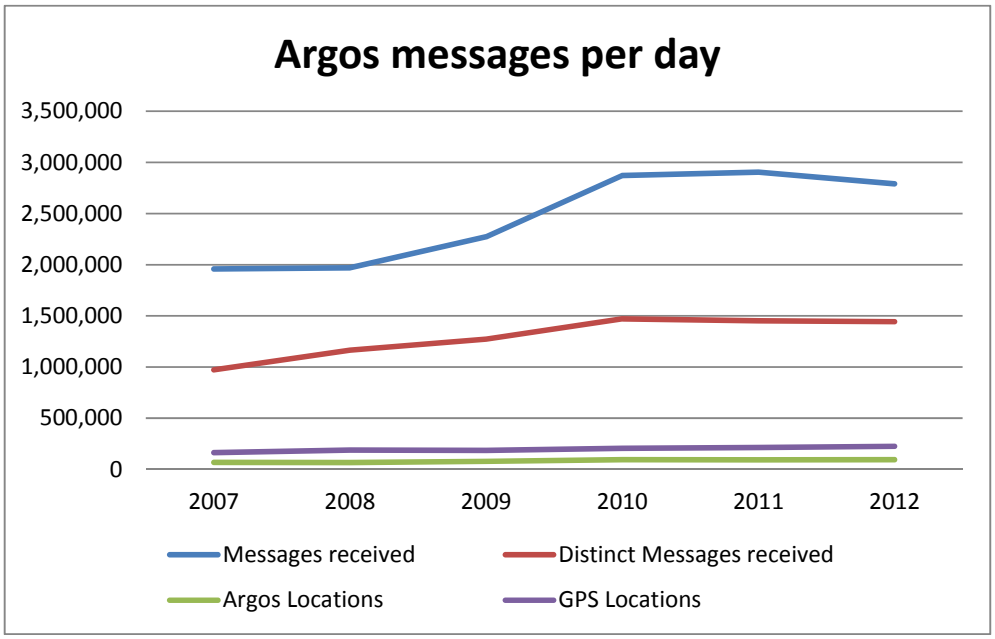


Figure 30 : Argos messages and locations per day (Chart view)

3.4.8. *Argos location and data collection latencies*

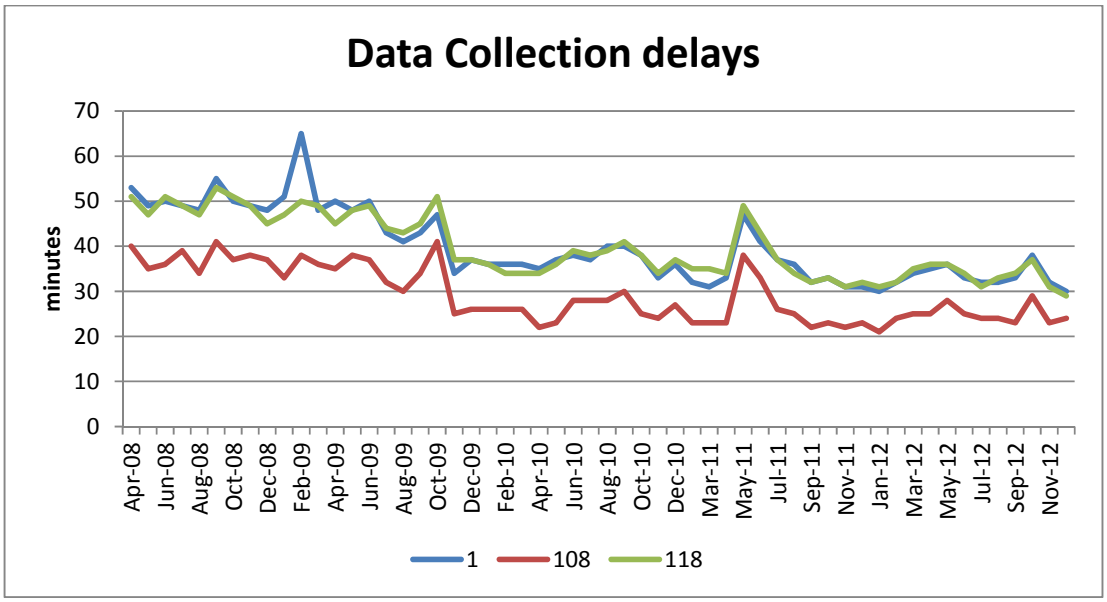


Figure 31 : Average latency on Argos data collection for sample platforms* since 2008

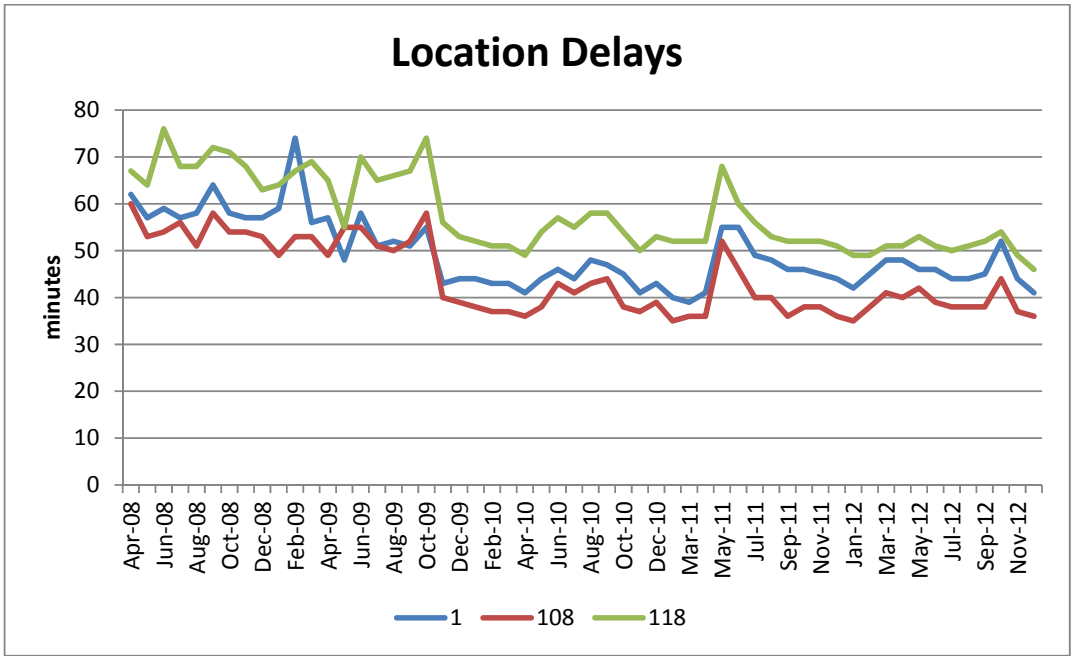


Figure 32 : Average latency on Argos locations for sample platforms* since 2008

* 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 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 Northern hemisphere is now less than 30 minutes.

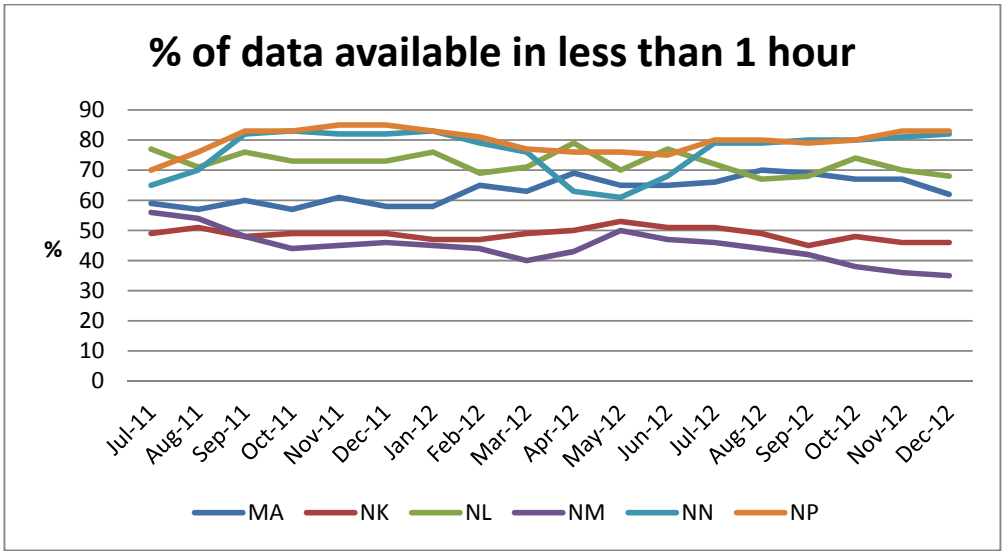


Figure 33 : Data available in 1 hour

Percentage of data available in less than one hour means which percentage of raw data 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. For clarification, the Data Timeliness calculations include this metric plus the satellite revisit time.

3.4.9. *Monthly active Argos platforms*

The number of Argos platforms operating is quite stable in 2012. There is still more activity in Spring/Summer due to the higher number of deployments.

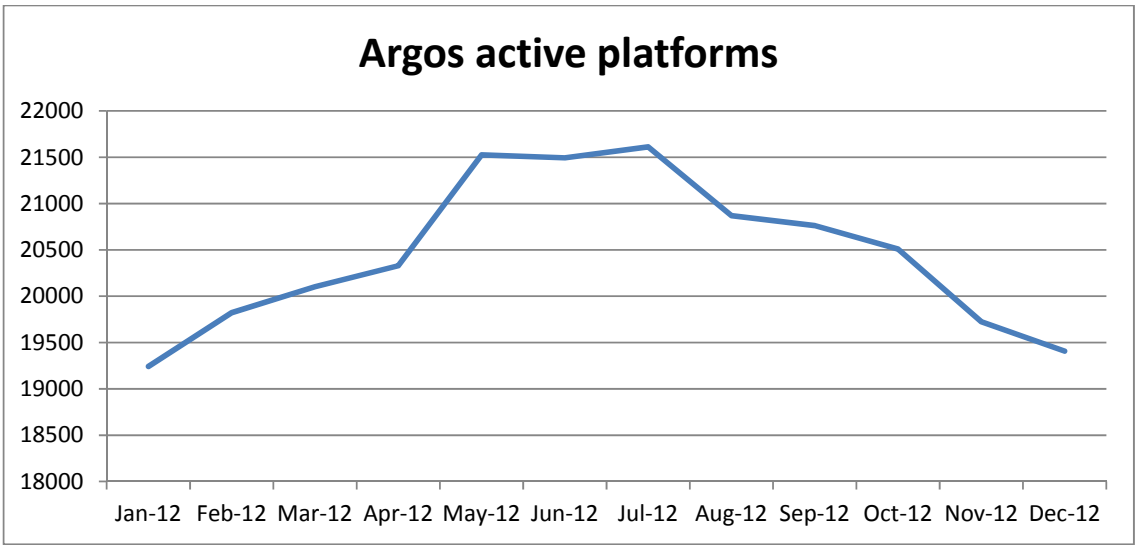


Figure 34: Monthly active Argos platforms in 2012

3.4.10. *GTS processing*

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

In 2009 developed a GTS monitoring tool, with following statistics computed each day:
- Number of GTS platforms (with a WMO id) processed,
- Number of observations processed,
- Average disposition time (observation time –time inserted onto the GTS)

These 3 statistics are provided for:
- All types of bulletins
- Each type of text bulletins (BUOY, SHIP, TESAC, and SYNOP)
- Each type of buoy (ATLAS, DRIFTERS, ICE, TRITON and OTHERS)

In 2010, CLS has developed improvements on this GTS monitoring tool with same statistics provided now by WMO area. CLS is closely working with the DBCP TC to find a solution to publish these statistics on the JCOMMOPS website.

GTS BUFR version upgraded to V4 on September 18, 2012 on both CLS processing centers (France and US)

Both Alphanumeric (BUOY, TESAC, SYNOP, SHIP) AND BUFR bulletins are produced for each observation reported by ocean & meteorological platforms.

Around 1000 active GTS platforms are processed every day at CLS & CLS America including 700 to 900 drifting buoys. An average of 25 000 GTS BUFR bulletins inserted per day into the GTS

GTS delays in May 2013 increased due to a disk bay issue between May-27 and May-30 (solved now) on the entire Argos data processing at CLS. Several GTS backups (between CLS France and CLS America) happened during this period due to CLS America architecture maintenance and the CLS France issues on disk bay. Consequently some old bulletins have been resent onto the GTS (duplicates) end of May resulting in calculations of some very long, non-realistic delays. Procedures and hardware solutions have been setup to avoid this kind of issue in the future.

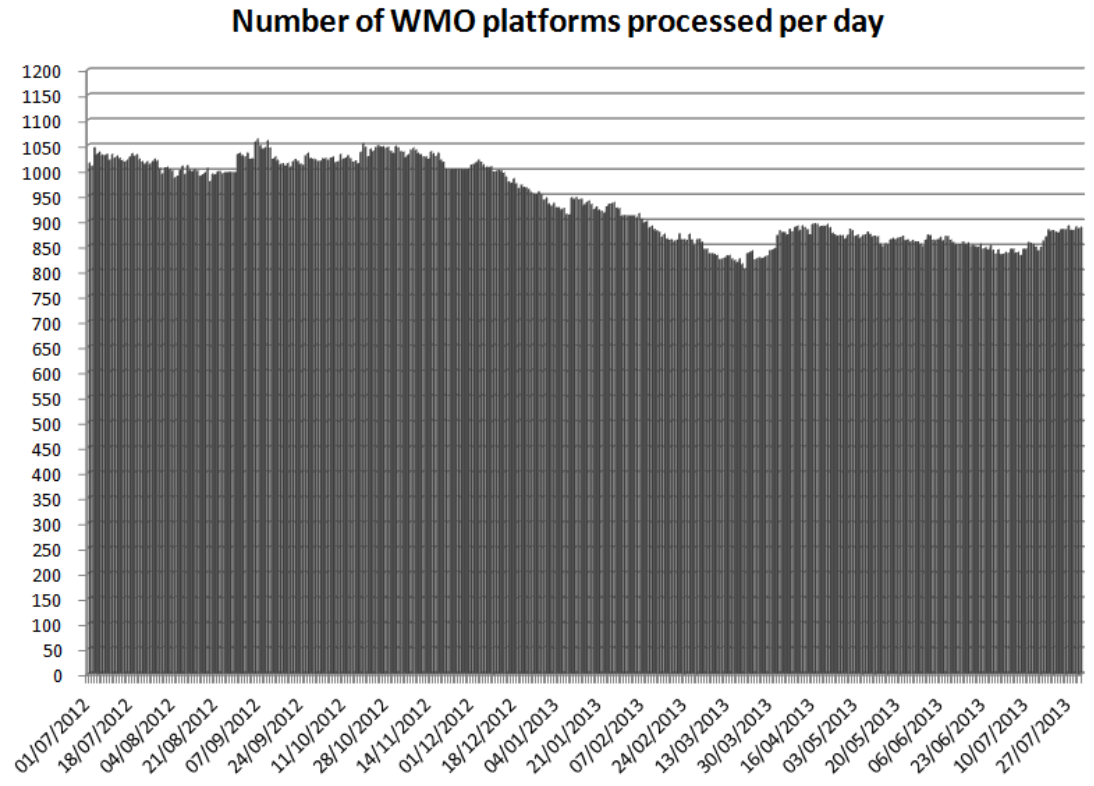


Figure 35: Argos platforms GTS processed per day from July 2012 to July 2013

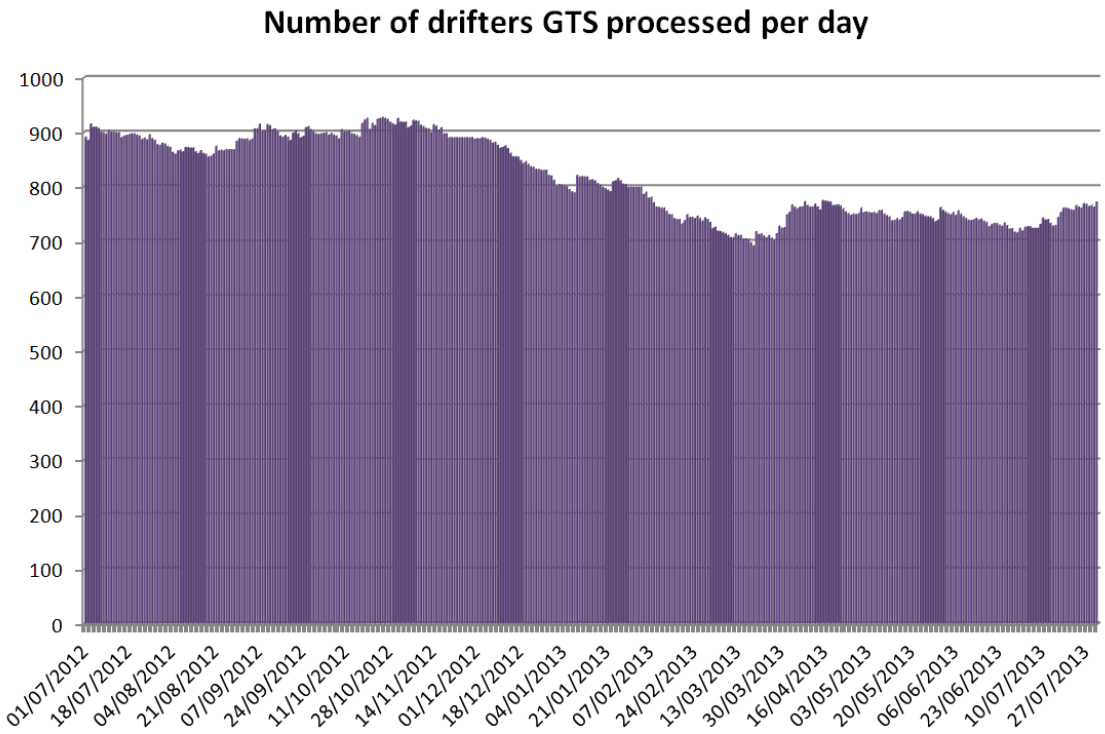


Figure 36: Argos drifters GTS processed per day from July 2012 to July 2013

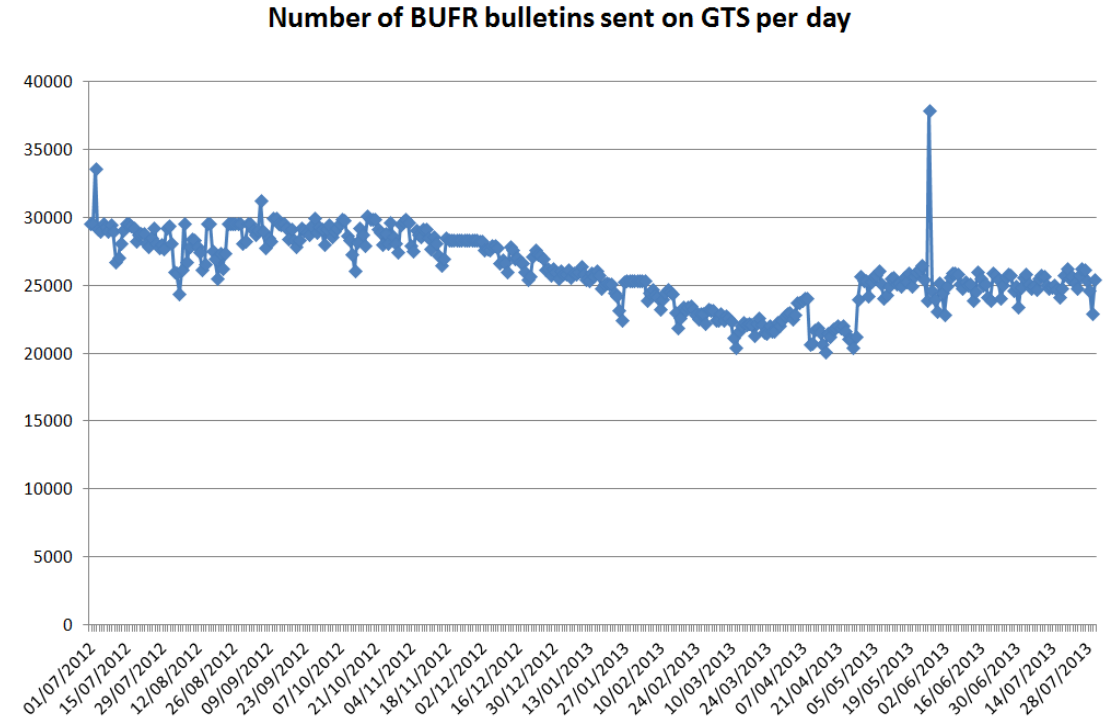


Figure 37: Daily number of GTS BUFR bulletins produced from July 2012 to July 2013

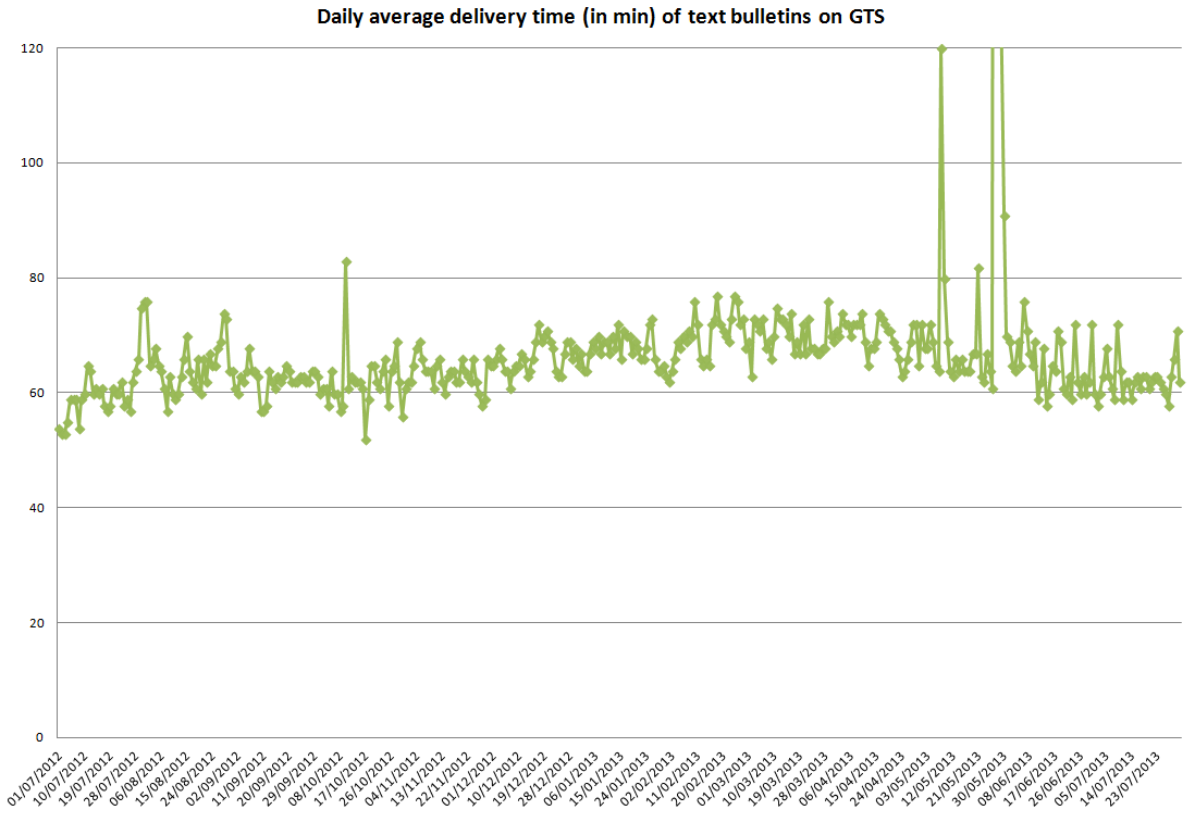


Figure 38: Daily average delivery time for all Argos GTS platforms from July 2012 to July 2013

3.5. System improvements

As every year, several software improvements were implemented in 2012 in order to fit with the user requirements. During this year, 85 system anomaly forms have been addressed as well as 63 system change proposals. Main application improvements have concerned the following topics.

3.5.1. *METOP-B and SARAL*

The integration of these two new satellites in the processing chains of the Argos processing centers has been prepared during the previous year with a quite long qualification period to make all the tests, verifications and last adjustments. The opening of the service for these 2 new satellites has been made during last April (29th).

A new module has been developed to process automatically the SARAL maneuvers. This module is currently in qualification and will be put in operation at the end of the second quarter of 2013. In a next step, it will be also used for METOP maneuvers as long as we can get a standardized maneuver configuration file.

3.5.2. *Iridium GTS platforms*

As a reminder, the data collected by Iridium platforms (drifting buoys and profiling floats) are first converted into an Argos format and are then processed and distributed onto the GTS network. The processing of these Iridium GTS floats has been improved, especially in terms of data disposal time, by better managing the priority of the data.

3.5.3. *Switch BUFR V3 top BUFR V4*

The switch between BUFR V3 to BUFR V4 was effective on September 11th, 2012.

3.5.4. *Studies status*

Several studies have been scheduled for year 2012. The status of the following studies is as follows:

- Migration of Argos operating system (OS): the migration has been done for development and technical qualification environments. This migration is ongoing for validation environment.
- Migration of the Argos useroffice HMI (Human Machine Interface) originally developed with the middleware Forms (Oracle software) to Java technology: a try of automatic conversion of 5 out of the major useroffice forms has been performed. The results are encouraging but require human adjustments. The migration will go on in 2013.
- Migration of Oracle 10g to Oracle 11g: This new version of the database software is major with expected impacts on the Argos application software. A study at making an inventory of these impacts is in progress.
- Alternative to the Argos orbitography software: The current orbitography software was developed in 1986 and is still running under the OpenVMS operating system which is no longer supported. For this reason and also for synergy aspects, we have decided to use a software developed by CNES which is operated by CLS to compute the Doris orbit. We need to adapt this software to interface it with the Argos application software.

3.5.5. *2013 planned improvements*

2013 will see new improvements. Among the ones which are already planned, we can list:

- migration of Argos operating system (CentOS) for validation and operational environments,
- end of the study regarding the migration from Oracle 10g to Oracle 11g,
- integration of the new Argos orbitography software, to improve operations and fix the obsolescence risks,
- development of off-line tool to allow users to extract their data from archive database,
- modify Argos web and web service to allow users to access on-line to 20 days of data instead of 10 days,
- development of a BCH message coding to improve Argos message transmission in noisy regions.

4 Argos user's applications

4.1. Monitoring Argos platforms

The number of science Argos platforms (except animals) operating is slightly decreasing due primarily to the decrease of Argos platforms in the GDP. In June 2013, 5525 platforms were active in the month (5957 in June 2012).

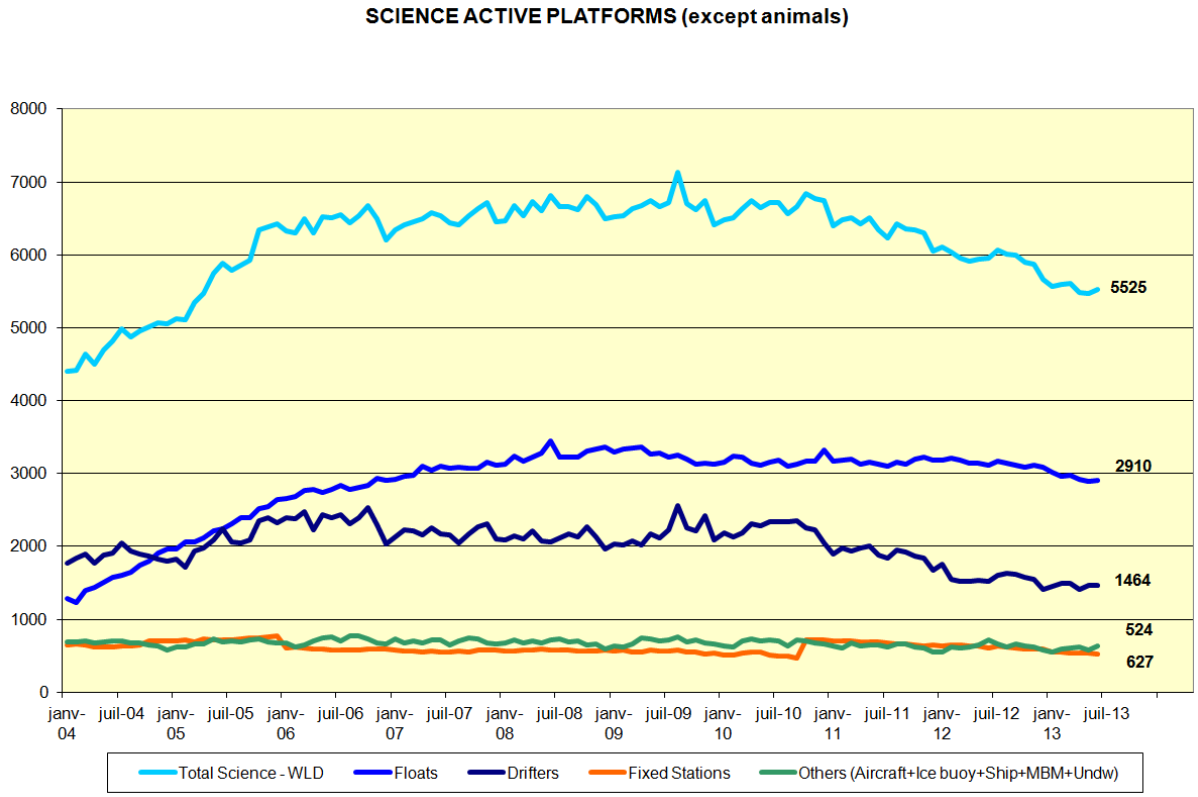


Figure 39: Monthly active ocean Argos platforms statistics

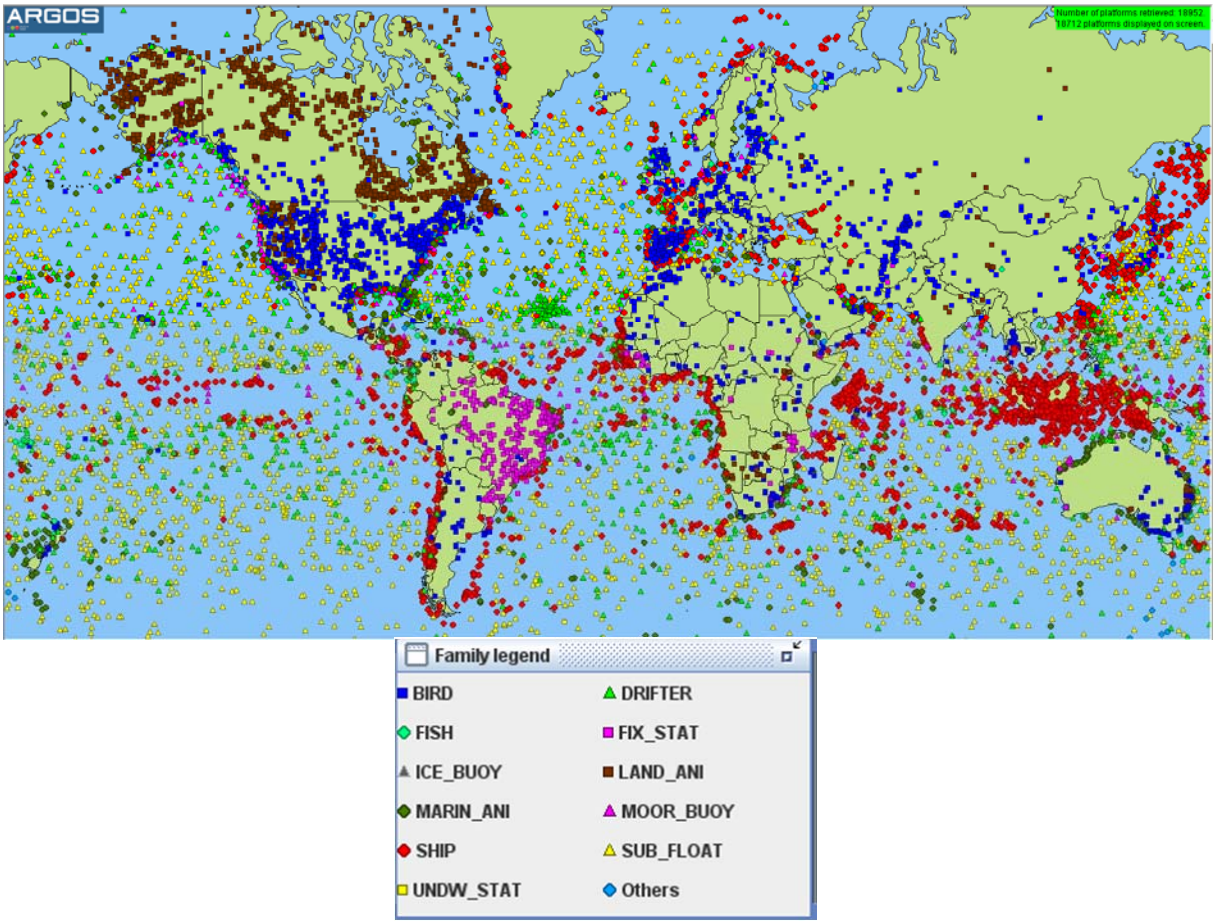


Figure 40 : Active Argos platforms repartition (April 2013)

4.2. CLS Argos report for JCOMMOPS

CLS in close collaboration with JCOMMOPS will begin to submit a report on quarterly basis beginning 09-2012 including 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 allocated
- All Iridium platforms processed at 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 is available to the user.
The Argos Data Mean Disposal Time is composed of four typical delays:

- T1 = the revisit time (time for a platform to be seen by one of the Argos satellite),
- T2 = the time for the data to be downloaded to a ground station (it's nearly instantaneous for an HRPT station or it's 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 (requisite time for the data to be processed in the Argos Data Processing Center and to be available for the users).

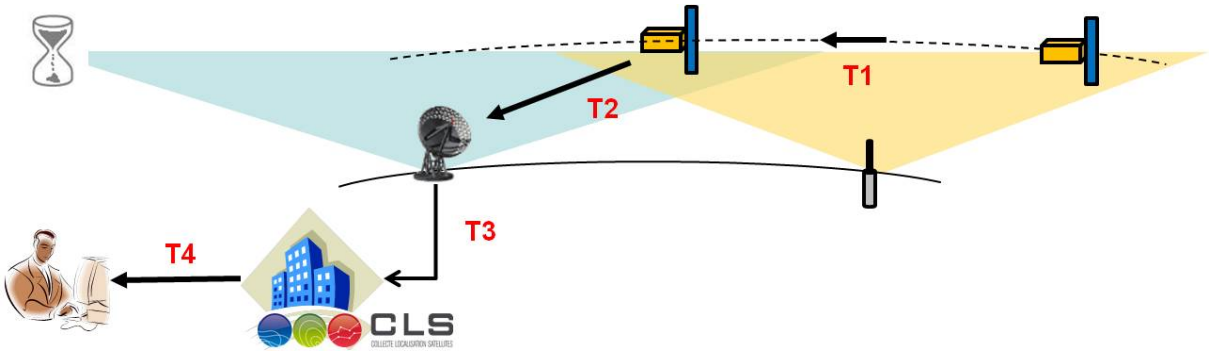


Figure 41 : Argos data mean disposal time diagram

The next figures represent the simulated Argos Data Mean Disposal Time taking into account the Argos satellites constellation, the Argos ground stations and data processing centers' performances in May 2012 and May 2013.

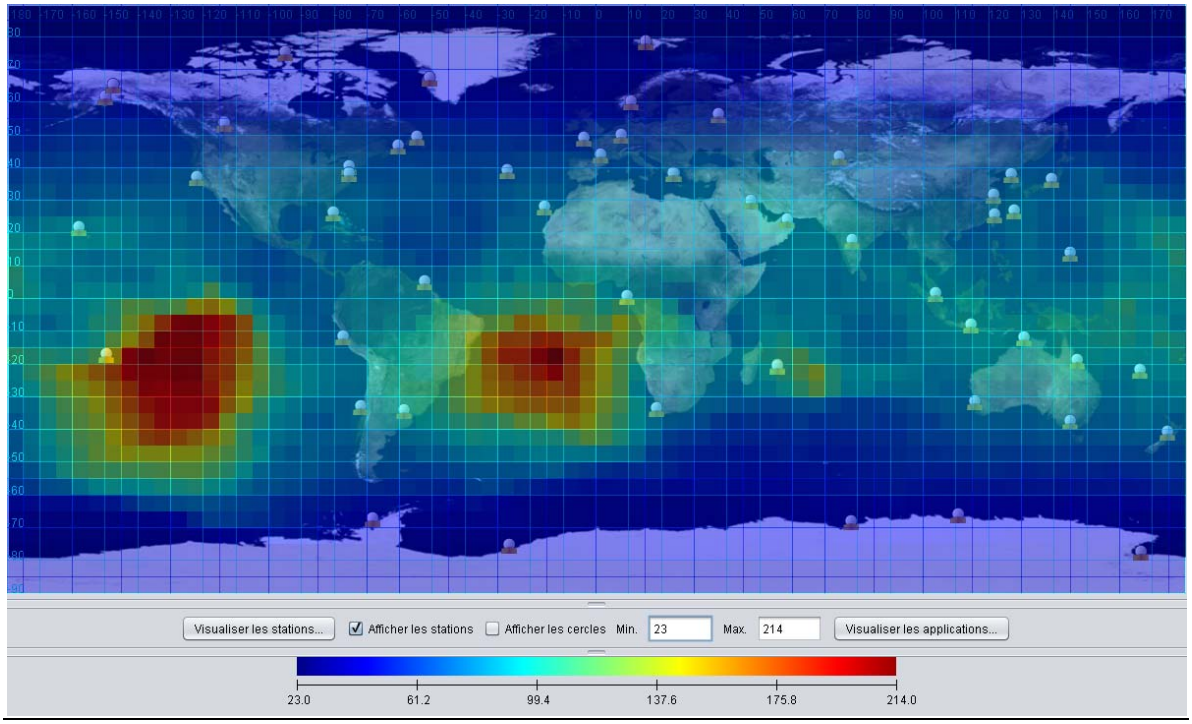


Figure 42 : Argos Data Mean Disposal Time in May 2012 (in minutes)

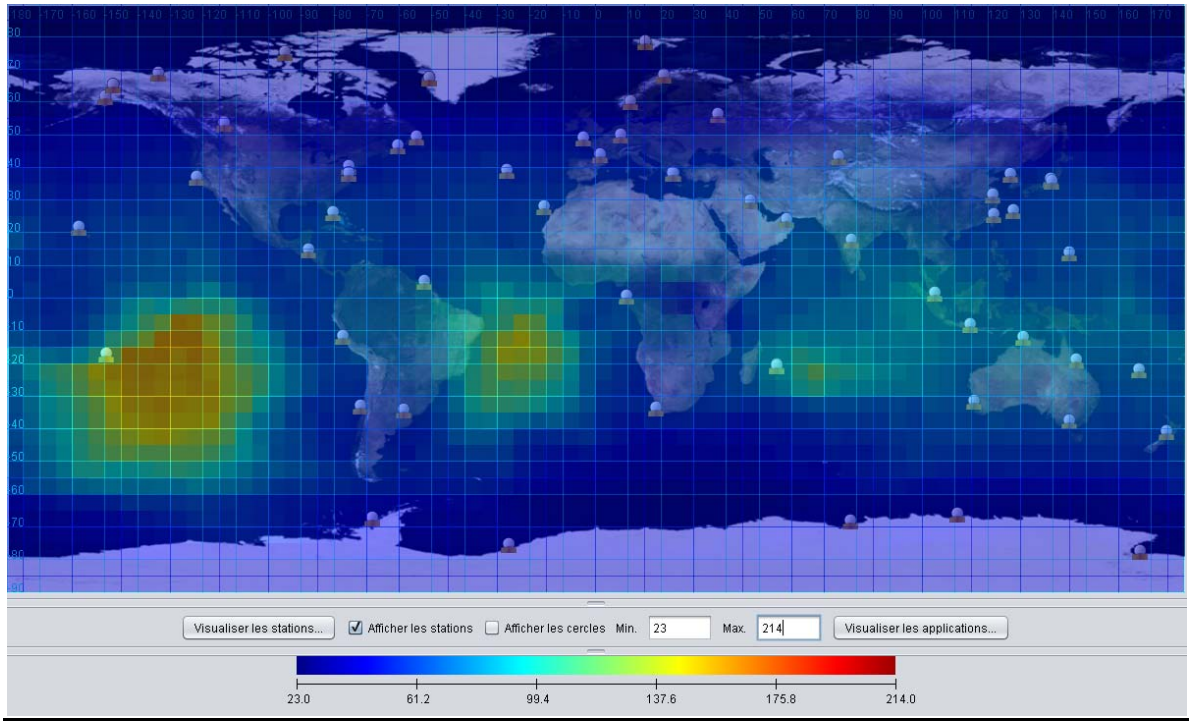


Figure 43 : Argos Data Mean Disposal Time in May 2013 (in minutes)

The improved performances in terms of data mean disposal time observed during the last year are mainly due to:

- New satellites in the system: MetOp-B & Saral
- More HRPT Stations receiving MetOp-A and B (Miami, Monterey, Hawaï, Lannion, Lima, Cape Town, Hatoyama, La Réunion, EARS Stations,…)
- Upgraded HRPT Stations to track Saral Satellite: strong improvements with the TM_100min capability. Indeed SARAL is downloading to compatible HRPT stations all datasets acquired in the last 100 minutes.

Our efforts will continue to improve the coverage of the real-time antennas in the regions where it is needed. Two areas are concerned : South Atlantic and South Pacific.

Concerning the south Atlantic area, an agreement between CNES and ESA is currently studied to install a ground station in Ascension island. This installation is planned during the first quarter of 2014.

Concerning the South Pacific area, discussions have started with WMO (Mr Lafeuille) which is very interested in having, in the frame of the RARS project, a ground station in Easter island. This station should be bi-band (X and L).. If CNES and CLS have the capability of funding the ground station, WMO would be ready to collaborate/negotiate regarding the costs of installation, operation and data transmission.

4.4. Minimal received power measured by MetOp-A Argos-3 payload

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

After the one highlighted on Eastern Europe and Mediterranean Sea since the beginning of 2000's, a new large spot appeared and slightly increased for 5 years on Eastern Asia. An improvement can be observed over Europe. The level of noise is fluctuating does undergo geographical variations. Because it is likely that a part of the noise was coming from radio and hand-held communication devices, which are now using higher frequency bands than the Argos band, we may see continuing reductions in the level and the geographic regions affected by the noise.

Studies at CLS and experiments with our partners are currently in progress in order to understand the origin of these potential interferers and to find applicative solutions to prevent impacts on deployed platforms missions in these areas.

The following maps show the minimal level of reception in dBm measured by METOP-A in May 2012 and May 2013. We can see the decrease in the level of the noise over the eastern part of the Mediterranean Sea.

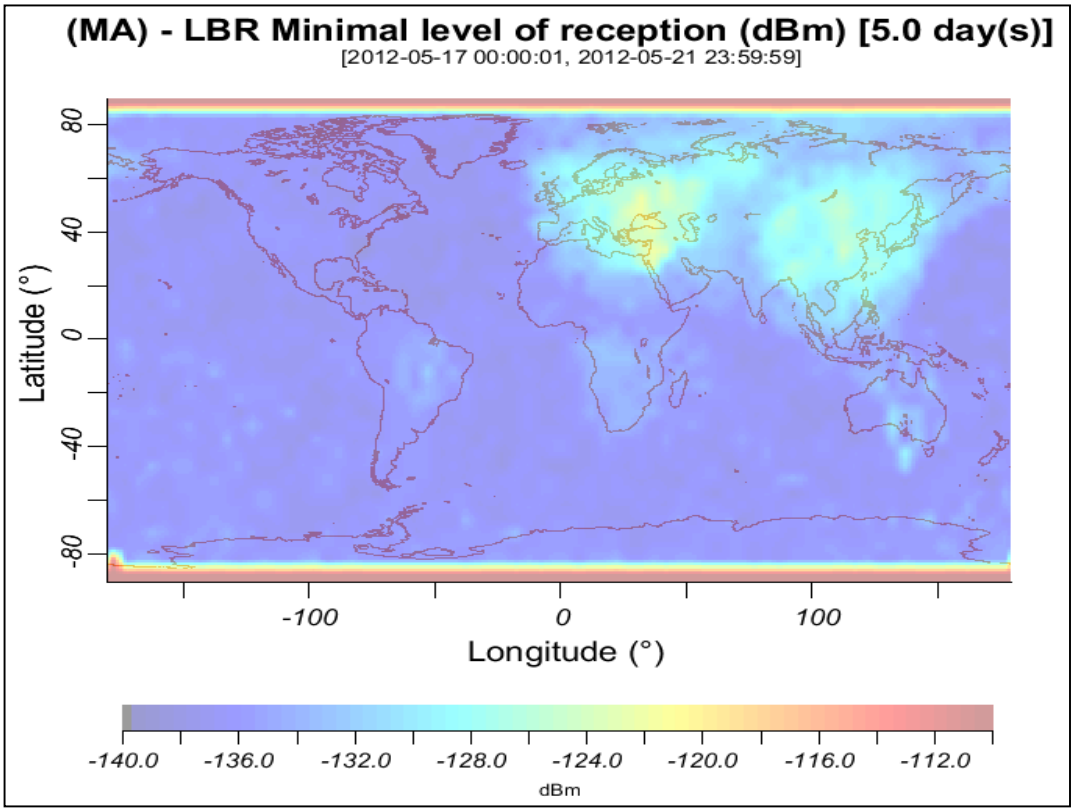


Figure 44 : Minimal level of reception in the Argos frequency band in May 2012

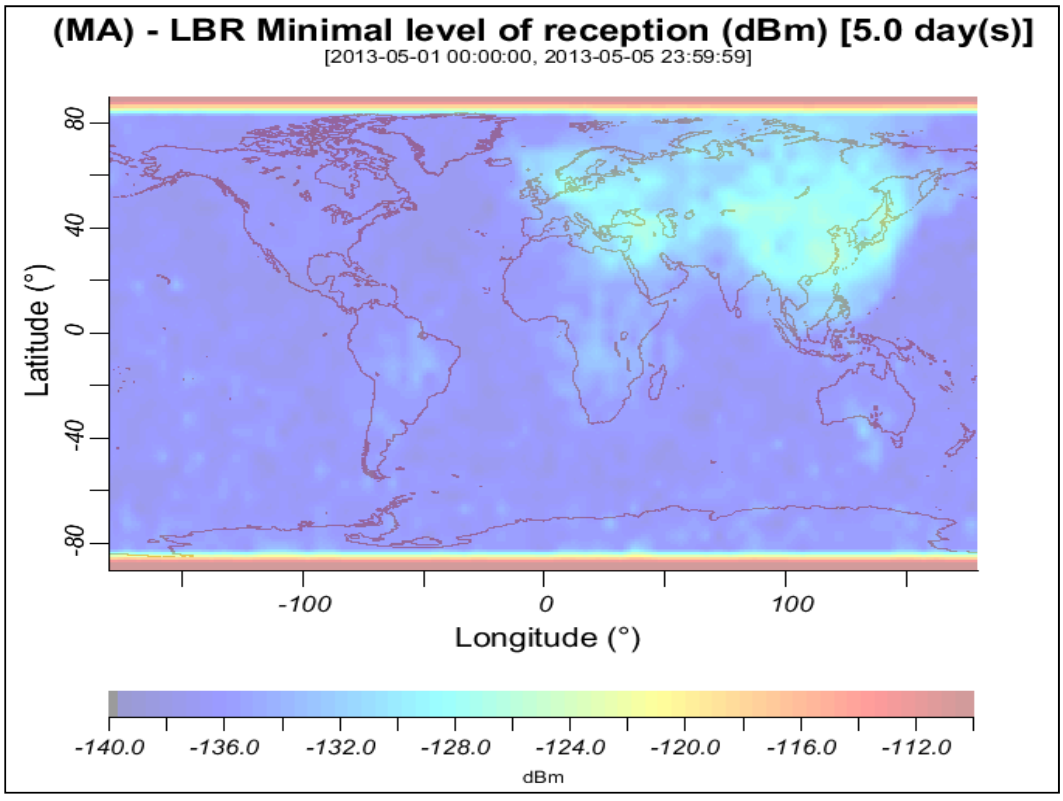


Figure 45 : Minimal level of reception in the Argos frequency band in May 2013

4.5. Argos-3

The third generation Argos system, Argos-3, is functioning 100%. It continues to be operationally available on the METOP-A and SARAL satellites. The Argos-3 downlink signal on NOAA-19 and METOP-B is currently turned off.

The Argos-3 implementation plan project supported by CNES ended mid 2012 following successful development of various programs that used Argos-3 either to reduce the energy consumption by limiting the transmissions to satellite passes and/or transmitting more data by using the handshaking protocol. Highlights of this project are:

A. Demonstration of the ability to:
   - Develop two-way communication solutions
   - Propose solutions for reducing significantly the energy consumption thanks to pass predictions computed by PMTs
   - Receive commands from satellites
   - Capability to transmit large sets of data either in low data rate mode or in High data rate

B. Successful training of those manufacturers interested in the Argos-3 technology

C. Technical conclusions:
   - PMT power consumption is a major concern due to the very low power consumption of existing Argos-2 solutions,
   - Satellite network must offer a complete operational two-way coverage,
   - PMT unit cost is an important concern,
   - Implementation of the downlink must keep the system as simple as possible,
   - Need for low cost dual-band antenna solutions,
   - Need for a simple and low energy solution to detect satellites equipped with a downlink signal

Many manufacturers have already integrated the Argos-3 PMT transceivers into their products and others are encouraged to do the same. Users are strongly encouraged to evaluate the Argos-3 capabilities for their data collection needs. To date, over 3 500 Argos-3 Kenwood PMTs have been sold to Argos manufacturers, mainly in the US.

4.5.1. *Argos-3 in SVP drifters*

The DBCP implemented a dedicated project to assess the Argos-3 system. The Argos-3 benefits for drifters are:

- High performance for collecting hourly sensor acquisitions (>95%) for those buoys that are operating
- A large reduction (~75%) of the power consumption used for the data transmission, allowing a reduction in the size of the battery pack and/or increasing the drifter lifetime,
- Improved synoptic measurements (on average, more than 22 hourly observations collected per day),
- Optimization of the transmission leading to a better use of the satellite network and then better performance for users,
- Secure uplink transmission with an automatic checksum control,
- Remote commands via the Argos-3 downlink to change the mission parameters.

Figure 46 : Argos-3 Kenwood PMT integrated in a SVP drifter

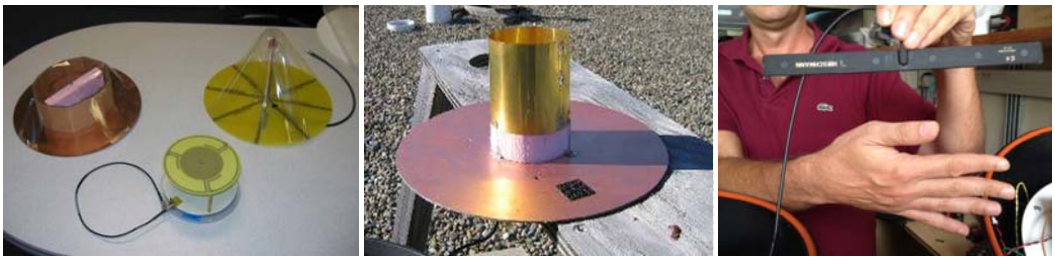


Figure 47 : Bi-frequency antennas for SVP drifter

Drifters with the Argos-3 Kenwood PMT have been built by: SCRIPPS, Pacific-Gyre, Clearwater, Data Buoy Instrumentation and Marlin-Yug.

Belowis a chart showing the number of monthly active Argos-3 drifters by the DBCP since January 2012:

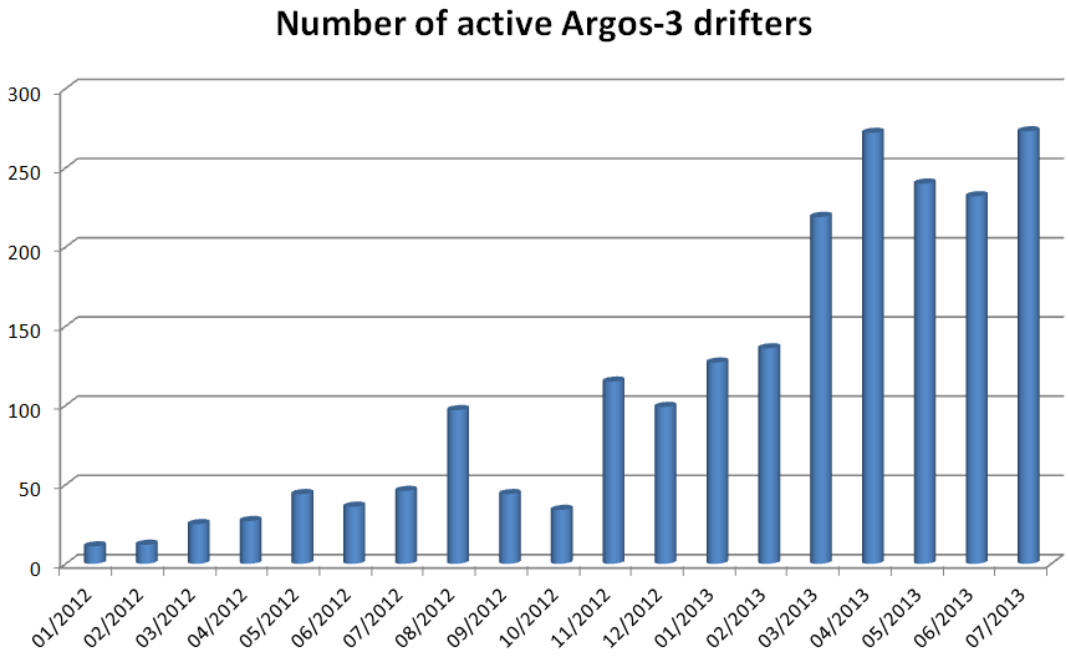


Figure 48 : Number of monthly active Argos-3 drifters in DBCP

4.5.2. *Argos-3 in CO2 drifters*

A new type of drifter developed by JAMSTEC in Japan is using the Argos-3 technology: the CO2 buoy. Four Argos-3 CO2 drifters are currently transmitting in the Pacific Ocean.

Thanks to the interactive low data rate mode, number of hourly CO2 surface measurements with salinity and temperature are no more limited to four per day.

In addition, the Argos-3 downlink capability allows the user to make measurements at anytime by simply sending a command from the ArgosWeb portal especially when the drifter is in an area of interest. If, for example, JAMSTEC notices some events by satellite (e.g. chlorophyll increase in the surface ocean) around the buoy during a measurement interval, they can send a command to the buoy and thus measure the event in situ.

Moreover, the Argos-3 system only transmits when a satellite is in view, which reduces the transmission time, helps in conserving energy and thus in extending buoy lifetime.

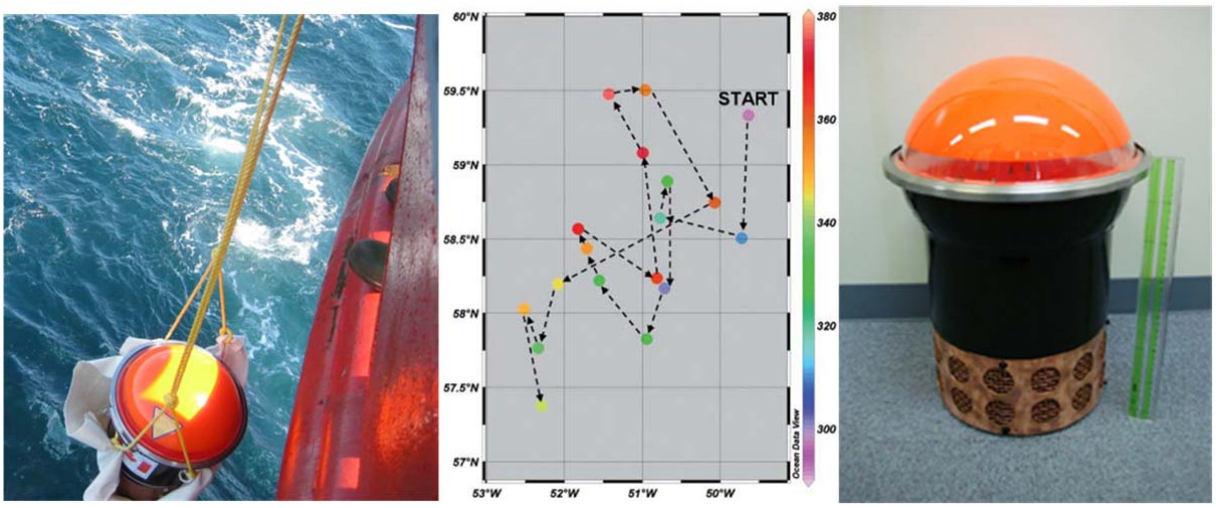


Figure 49 : CO2 Argos-3 drifter and results

4.5.3. *Argos-3 in moored buoys*

The Japan Agency for Marine-Earth Science and Technology (JAMSTEC) is using high-speed data transmission by the ARGOS-3 system into the m-TRITON buoy. 3 m-TRITON buoys are deployed.

The transmission system with the PMT-HD, which can provide a two-way communication and high data-rate uplink, has enabled a large transfer of data, allowing greater efficiency in data acquisition.

The Argos-3 m-TRITON buoy collects 27.6 kbytes per day which is 15.3 times more than a TRITON buoy equipped with an Argos-2 transmitter and energy consumption due to transmission is divided by 6 as the PMT is synchronized with the satellite and transmits only during satellite passes.

The high-speed data transmission achieved by the PMT-HD can provide real-time and continuous observational data that has no missing values.

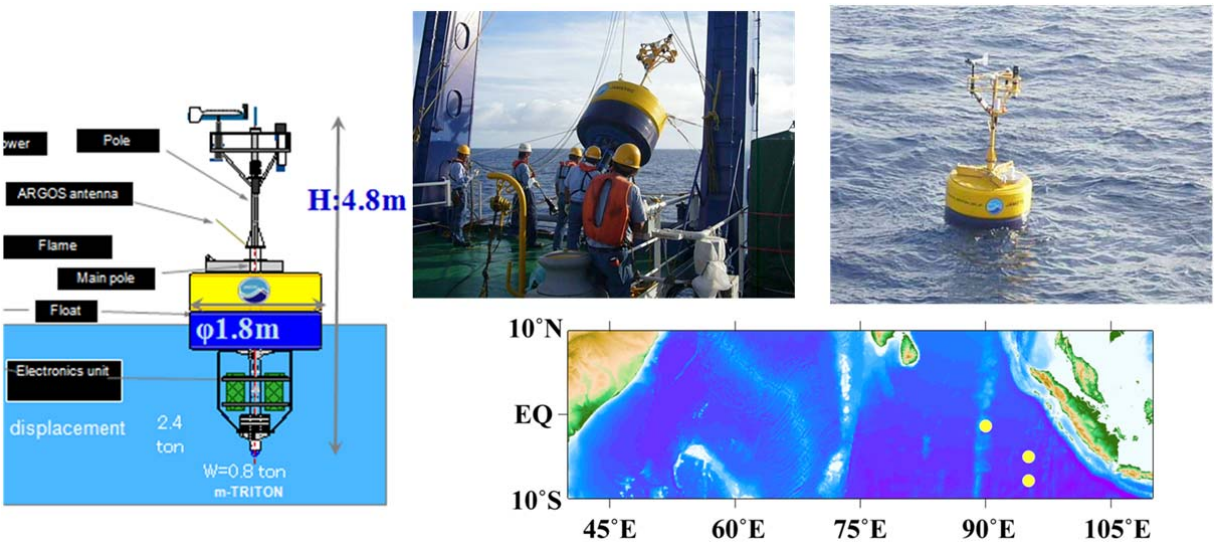


Figure 50 : m-Triton buoy using Argos-3 high data rate

The Oceanography Department of the Canaries Institute of Marine Sciences (ICCM) is using the bidirectional data link Argos-3 system of into its own custom observing system (moored buoy) for real-time met-ocean monitoring at the ESTOC site (European Station for Time-series in the Ocean Canaries, 60 Nm North of the archipelago at 29°10'N – 015° 30'W and over 3670 meters depth).

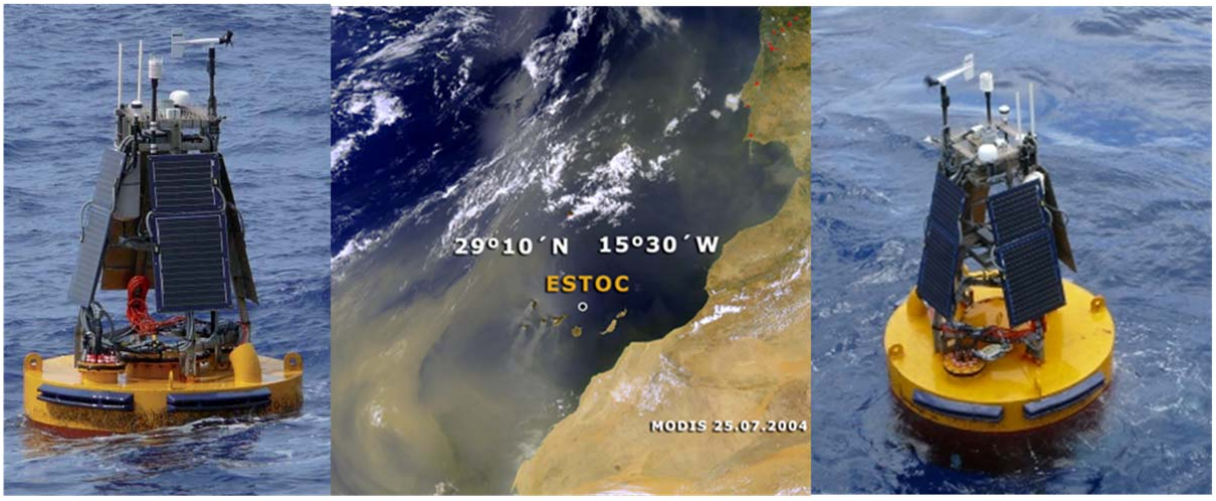


Figure 51 : ESTOC moored buoy using Argos-3 interactive mode

The ESTOC moored buoy is using an Argos-3 Kenwood PMT in interactive low data rate mode to transmit ocean and meteorological data in real-time.

Argos-3 system provides the stable and powerful satellite link telemetry required.

4.5.4. *Argos-3 in Argo profiling floats*

The Argos-3 technology was integrated for the first time in 2010 in an Argo profiling float, the ARVOR float, thanks to collaboration between CLS, Ifremer and NKE under the NAOS project (Novel Argo Ocean observing System).

The first successful objective of this integration was to reduce the time spent on surface from 6-8 hours for and Argos-2 float to 40 minutes. In using the Argos-3 interactive transmission mode, the ARVOR float is able to transmit a full Argo profile (150 CTD levels) in only one satellite pass (10-15 minutes).

Furthermore, the Argos-3 ARVOR float is able to set a rendezvous with an Argos-3 satellite for its next rise to the surface by using the satellite pass prediction information broadcast via the Argos-3 downlink. Thus, the Argos-3 float is only transmitting when a satellite is in range.

Four prototypes using the downlink signal and the interactive transmission mode have been deployed in the Mediterranean Sea and North Atlantic in 2011 and 2012.

The next objective is to use the high data (HR) rate uplink of the 3rd & 4th Argos instrument generation which can provide a transmission rate at 4 800 bps instead of 400 bps for the Argos low data rate (LR). Using a transmission power of 5 Watts, the HR mode enables a large transfer of data, allowing greater efficiency in data acquisition.

With a maximum length of 580 bytes, one HR message is equivalent to 18 Argos low data rate messages. Last transmission tests made by Ifremer in June 2012 demonstrated the capability to transmit until 36 Argos HR messages (648 LR messages) equivalent to 2 000 CTD levels) in one Argos-3 satellite pass in 13 minutes.

This HR mode will allow an Argo float to transmit a multi-sensor or a high resolution (1000 CTD levels) in one satellite pass. 2 HR float prototypes will be deployed end of 2013 by Ifremer.

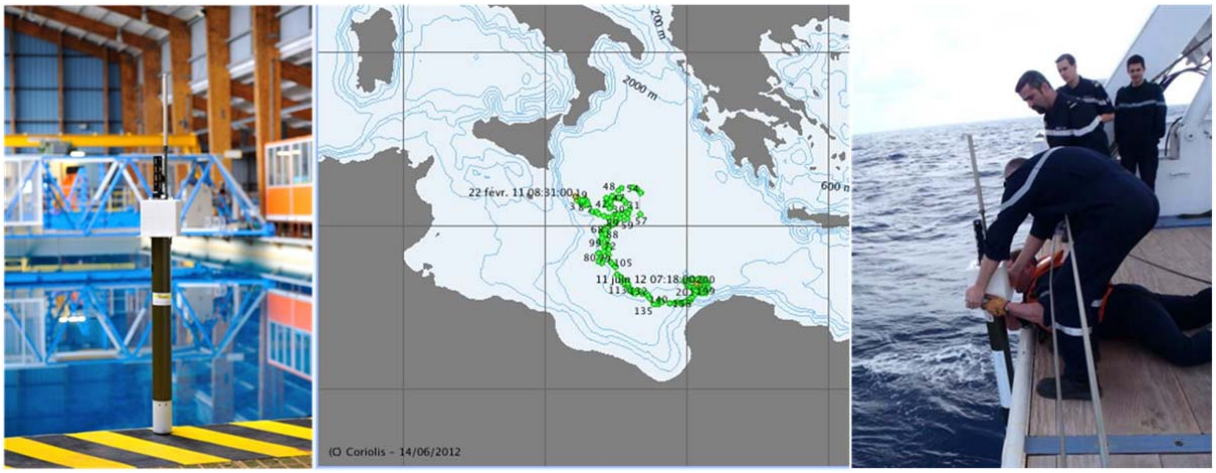
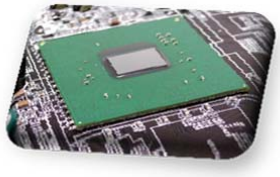


Figure 52 : Argos-3 ARVOR profiling float deployed in 2012 in Med. Sea

4.6. Argos-3/Argos-4 chipset

An "Argos chipset" project has been implemented by an European consortium to design, manufacture and test a prototype of a miniaturized and low-cost ARGOS-3/-4 satellite chipset (Asic) that enables two way communications (Argos-3, Argos-4) and provides improved battery lifetime.



Under the auspices of the European Artes-5 Program, the Belgium Space Agency together with CNES are supporting a 2 M€ contract for this project.

The project is called SHARC (**S**atellite **H**igh-performance **A**RGOS-3/-4 **R**eceive/transmit **C**ommunication) and is aimed at:

- Developing a low-cost Argos-3/4 chipset
- Developing a Low cost (400 $) pop-up tag which uses the Argos chipset

The consortium includes the following companies :

- ANSEM, a Belgium company, is as prime of the consortium. Ansem is specialized in design and development of miniaturized electronic devices
- CLS will bring to Ansem the Argos “culture” as well as all the user requirements. Non Governmental Organizations such WWF and APEC will be contributors to feed the project with their requirements
- STAR-ODDI Subcontractor of CLS, STAR-ODDI is an Icelandic company specialized in design and development of miniaturized sensors for marine environment.

The project started in October 2012 and will end in March 2015. We expect the chipset to be 5mm X 5mm. It will include the Rx and Tx RF modules to benefit of Argos-3 and Argos-4 capabilities.

4.7. Argos goniometer

Figure 53 : 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,…) 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 serial port.

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