APPENDIX A

REPORT ON 2008 – 2009 OPERATIONS

1. 2008 OPERATIONS HIGHLIGHTS

- 30 years of ARGOS (October 1978 – October 2008),
- METOP HRPT ON/OFF since September 29th, 2008 on European zone,
- New Argos GTS processing system in operation since May 20th, 2008,
- No Power outage test done in 2008
- Successful launch of NOAA N Prime (February 2009) with an Argos-3 instrument
- NOAA N Prime delivered to all ARGOS users on August 3rd, 2009
- ARGOS3 (Downlink) into operation
- 3 New antennae with EARS network
- Disaster Recovery implementation
- Monthly Argos operation and GTS monitoring reports available

2. CONTENT

3. SPACE SEGMENT

During 2008, Argos instruments were onboard 5 POES's spacecrafts. The current status information on each spacecraft and its Argos various subsystems is described as follow:

Satellites	Launch date	NOAA status	Real time data (HRPT)	Stored data (STIP)	Data AVHRR
NOAA-19 (NP)	06-Feb-09	PM Primary	ok	Gilmore, Wallops	ok
METOP-A (MA)	19-Oct-06	AM Primary	Ok/Nok*	Svalbard	ok
NOAA-18 (NN)	20-May-05	PM Secondary	ok	Gilmore, Wallops	ok
NOAA-17 (NM)	24-Jun-02	AM Secondary	ok	Gilmore, Wallops	ok
NOAA-16 (NL)	21-Sep-00	PM backup	ok	Gilmore, Wallops	ok
NOAA-15 (NK)	13-May-98	AM Backup	ok	Gilmore, Wallops	ok
NOAA-14 (NJ)	30-Dec-94	Decommissioned 23 May 2007			
NOAA-12 (ND)	19-Oct-06	Decommissioned 10 August 2007			
NOAA-11 (NH)	24-Sep-88	Decommissioned 16 July 2004			

Figure 1. Argos Constellation

Figure 2 shows the regional service coverage of Europe and the North Atlantic. A-HRPT scheduled activities are defined on Orbit Switch ON and Switch OFF.

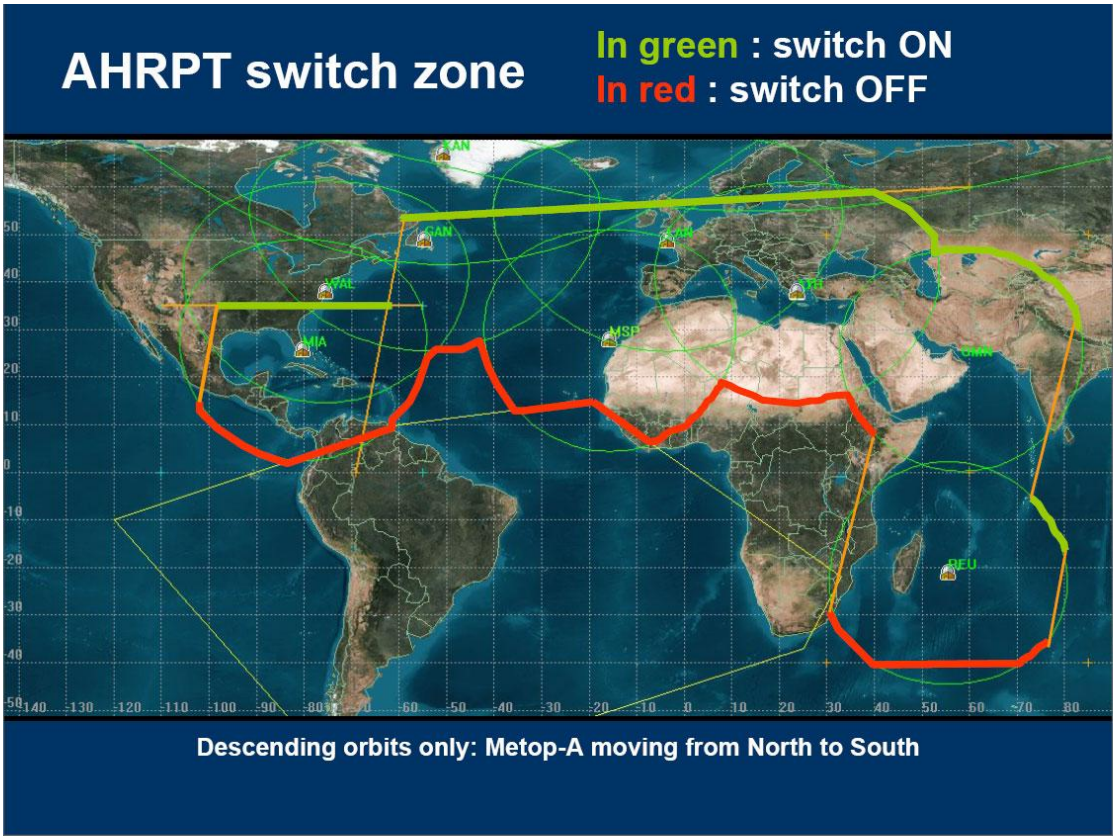

Figure 2. A-HRPT Switch Zone

Figure 3 shows Local Equator crossing time (ascending node) and associated predictions for 6, 12 and

24 months in February 2009.

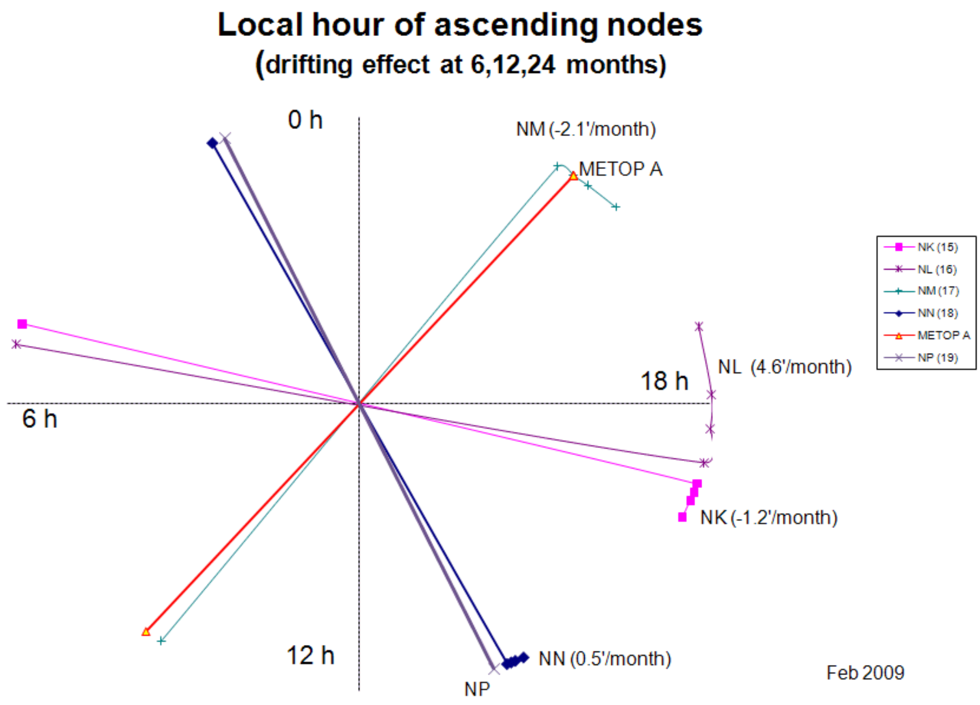

Figure 3. Local Equator crossing time

4. GROUND SEGMENT

4.1 Ground receiving stations

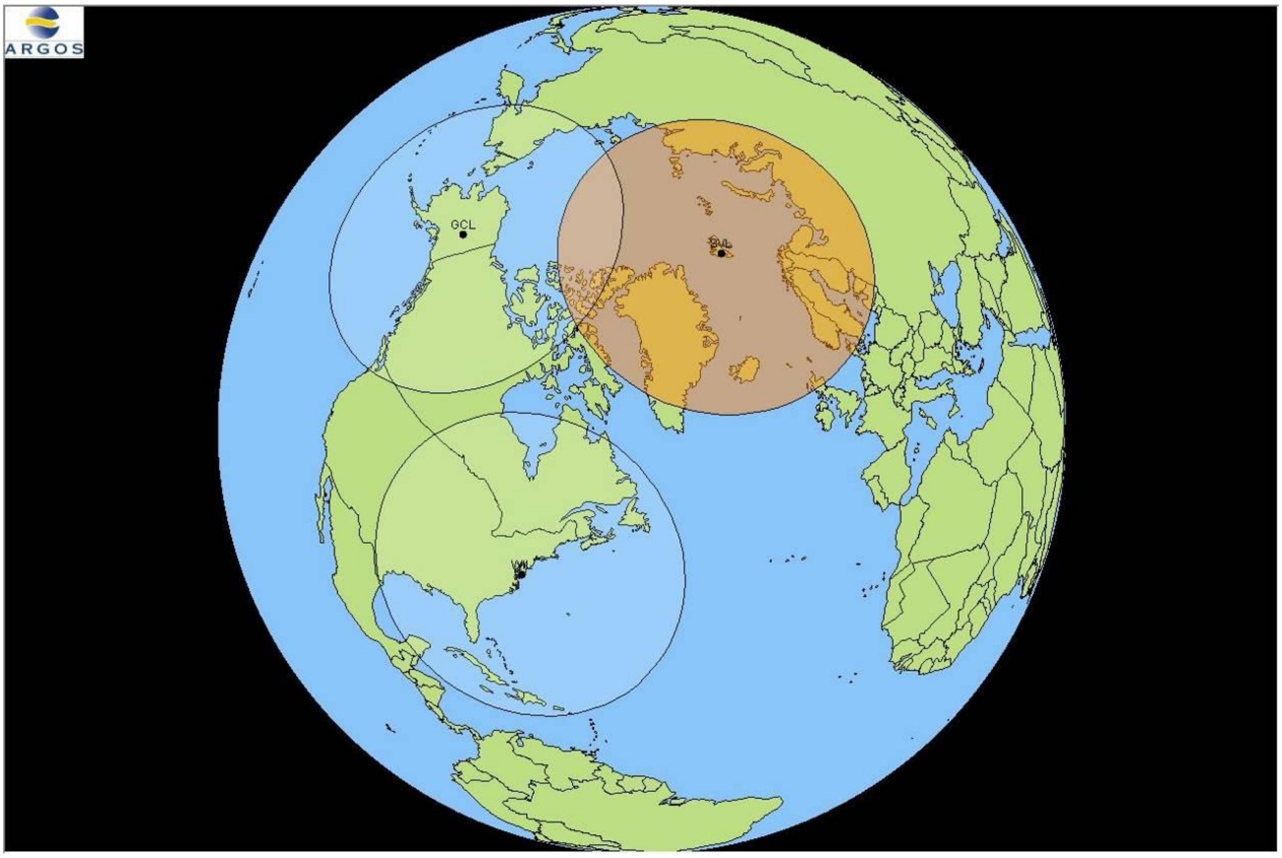

Figure 4. Global stations

Operations were nominal on the two NOAA global stations (Fairbanks (AK, USA) and Wallops Island (VA, USA)) able to acquire the STIP telemetry from NOAA satellites.
NOAA-15, NOAA-16, NOAA-17 and NOAA-18 STIP data were delivered by these 2 global stations (14 datasets per day in average).

EUMETSAT global station (Svalbard (NO)) has acquired ADCS data from METOP-A and NOAA-18 (replaced by NOAA-19 from August 2009) and relaying these data through EUMETCAST network to CLS and CLSA (through NOAA/NESDIS) on a nominal mode during 2008.

Figure 5 shows daily NOAA and METOP global and real-time dataset acquisition by the Global Processing Centre in November 2008

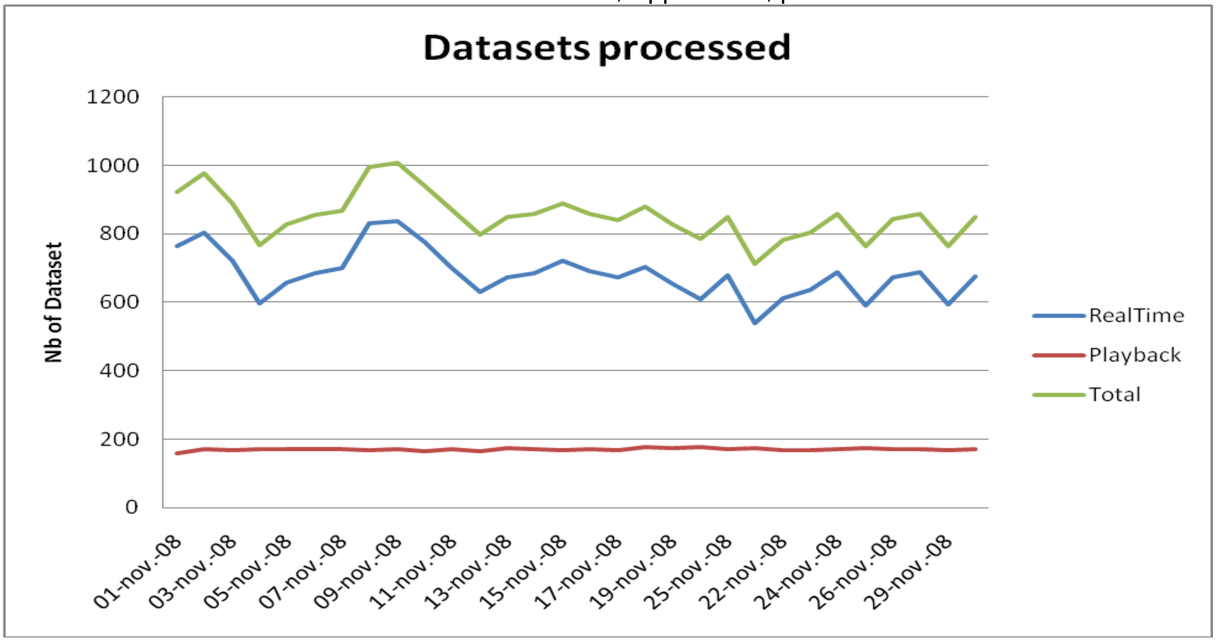

Figure 5. NOAA and METOP playback and real-time datasets processed per day in Nov. 08

Figure 6 shows monthly NOAA and METOP global and real-time dataset acquisition by the Global Processing Centre in 2008.

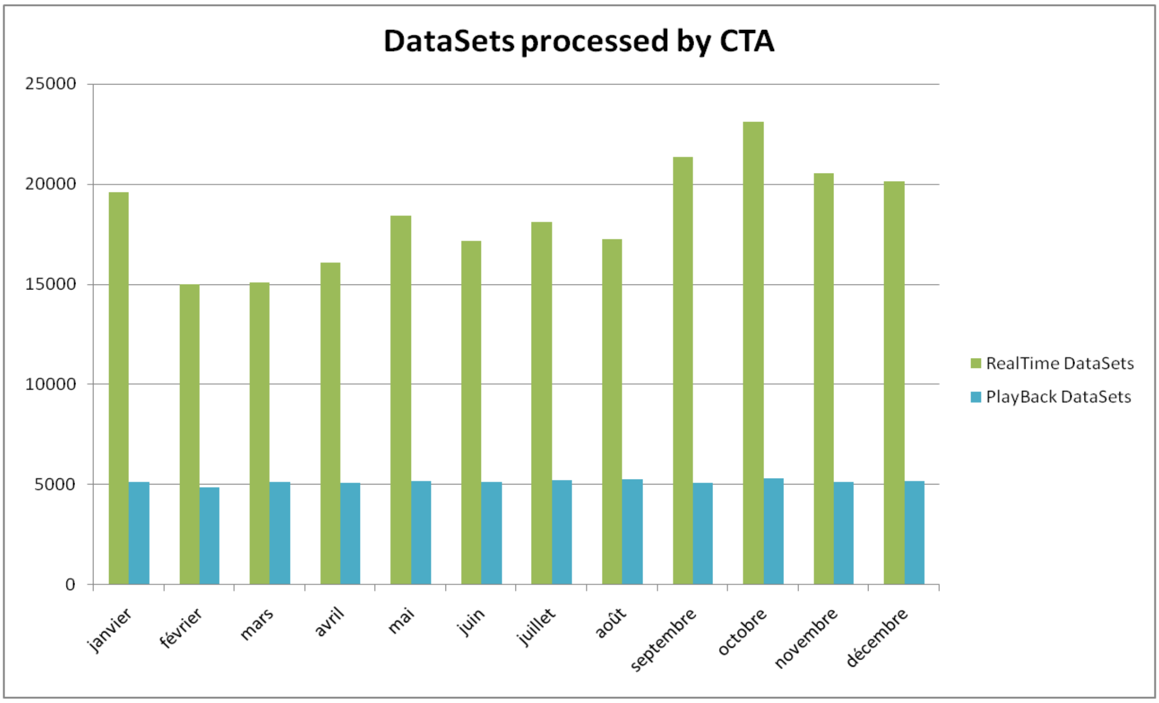

Figure 6. NOAA and METOP playback and real-time datasets processed per Month in 2008

Figures 7 shows global dataset arrival times on November 30th, 2008 into a Global processing Centre.

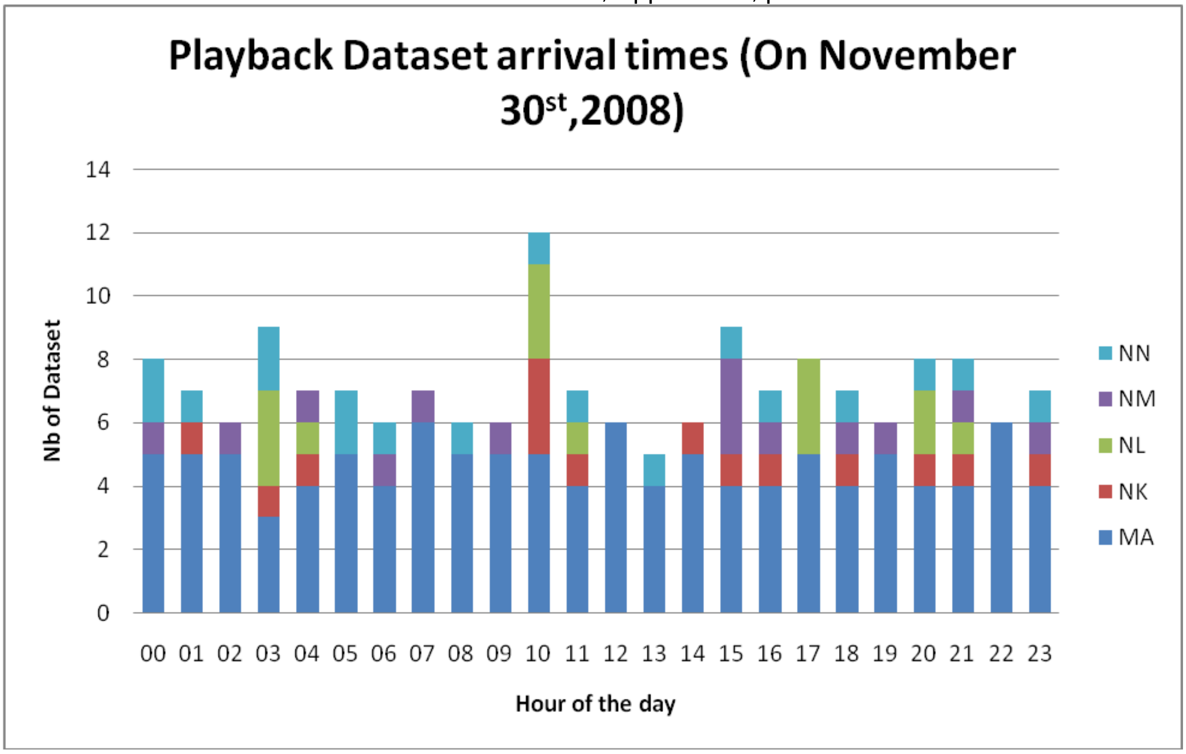

Figure 7. Playback Dataset arrival times on Nov. 30th, 2008

4.2 Regional stations

Figure 8 shows the 2008/2009 ARGOS real-time coverage.

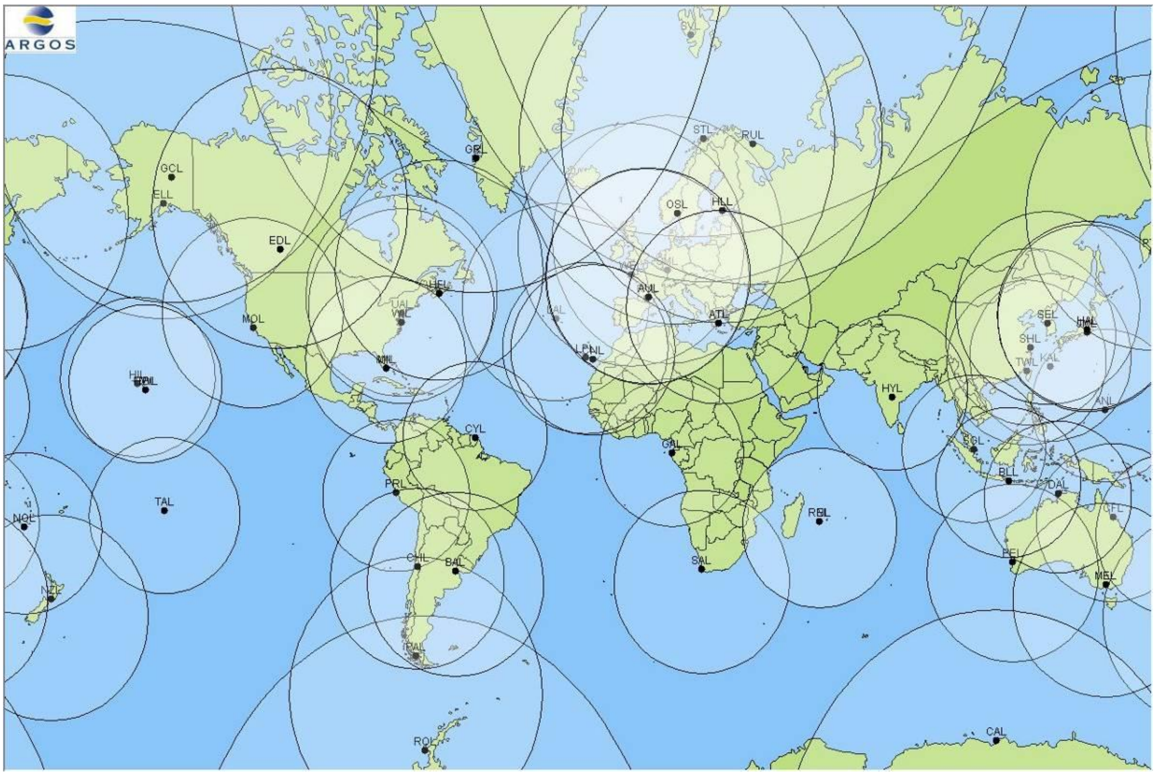

Figure 8. Realtime Coverage Map

CLS and CLS America Inc. pursued their efforts in 2008 and 2009 to consolidate the number of recei ving stations able to provide TIP data sets from the NOAA and METOP satellites.

4 new stations were added to the Argos real time network:

- Fiji (FIJI) reactivated since July 9th, 2009
- Athens (GREECE) belongs to EARS network, activated since May 6th, 2009
- Kangerlussuaq (GROENLAND) belongs to EARS network, activated since May 6th, 2009
- Maspalomas (SPAIN) belongs to EARS network, activated since May 6th, 2009.

There are currently 56 stations delivering real-time datasets (TIP) to CLS and CLS America Inc. Most of them process data from NOAA satellites allowing us to maintain a good throughput times for results delivery.

List of regional receiving stations:

Antennas	Sigle	Country	Operator	Possible satellites
Andersen USAF	AN	UNITED STATES	CLS	NK,NM,NL,NP
Athenes	AT	GREECE	CLS	NK,NL,NM,NN

Aussaguel	AU	FRANCE	CLS	NM,NN
Buenos Aires*	BA	ARGENTINA	INTA	NK,NN,NM
Bali	BL	INDONESIA	PT CLS	NK,NL,NM,NN
Casey	CA	AUSTRALIA	BOM	NK,NM,NP
Cape Ferguson NOAA	CF	AUSTRALIA	NOAA	NK,NL,NM,NN
Santiago	CH	CHILE	Meteo Chile	NK,NN,NP
Las Palmas	CN	SPAIN	CLS	NK,NL,NM,NN
Cayenne	CY	FRANCE	IRD	NK,NN,NM
Darwin	DA	AUSTRALIA	BOM	NK,NM,NN,NP
Davis	DV	AUSTRALIA	CLS	NK,NL,NM,NP
Edmonton	ED	CANADA	Envir. Canada	NK,NN,NM
Elmendorf USAF	EL	UNITED STATES	CLS	NK,NL,NM,NN,NP
Fidji	FI	FIJI	CLS	NK,NM,NP
Libreville	GB	GABON	CNES/CLS	NK,NL,NM,NN
Gilmore	GC	UNITED STATES	NOAA/NESDIS	NK,NL,NM,NN,NP
Sondre	GR	GREENLAND	DMI	NK,NL,NM,NN
Halifax	HF	CANADA	Can. Coast Guard	NK,NL,NM,NN
Hickam USAF	HI	UNITED STATES	CLS	NK,NL,NM,NP
Hatoyama	HT	JAPAN	JAXA/EOC	NK,NL,NM,NN,MA
Hawai	HW	UNITED STATES	NOAA/NWS	NK,NL,NM,NP
Hyderabad	HY	INDIA	INCOIS	NK,NL,NM,NN
Tokyo	JM	JAPAN	Jamstec	NK,NM,NN
Kandena USAF	KA	JAPAN	CLS	NK,NL,NM,NN,NP
Lajes USAF	LA	SPAIN	CLS	NK,NM,NN
Lima METOP	LM	PERU	CLS Perou	NK,NL,NM,NN
Las Palmas	LP	SPAIN	Univ. Las Palmas	NK,NL,NM,NN
Miami NOAA	MA	UNITED STATES	NOAA/AOML	NK,NL,NM,NN,NP
Melbourne	ME	AUSTRALIA	BOM	NK,NL,NM,NN,NP
Montererey	MO	UNITED STATES	NESDIS/NWS	NM,NN
Noumea Meteo France	NC	NEW CALEDONIA	Meteo France	NK,NM,NN
Noumea IRD	NO	FRANCE	IRD	NK,NM,NN
Wellington	NZ	NEW ZEALAND	Met Office	NK,NN,NM
Oslo	OS	NORWAY	NMI	NK,NL,NM,NN
Perth	PE	AUSTRALIA	BOM	NK,NM,NN,NP
Lima	PR	PERU	CLS peru	NK,NL,NM,NN
Petropavlosk	PT	RUSSIAN FEDERATION	Complex System	NK,NL,NM,NN
Ile de la Reunion	RE	FRANCE	IRD	NK,NN,NM
Ile de la Reunion	RN	FRANCE	Meteo France	NM, NP
Rothera	RO	INDONESIA	PT CLS	NK,NL,NM,NN
Toulouse, Lanion	RS	FRANCE	CLS	MA
Cape Town	SA	SOUTH AFRICA	CLS/SAWB	NK,NL,NM,NN
Seoul	SE	KOREA, REPUBLIC OF	KMA	NK,NM,NP
Singapore	SG	CHINA	SMM	NK,NL,NM,NN,NP
Shangai	SH	CHINA	East China Sea Fisheries	NK,NL,NM,NN
Sembach USAF	SM	GERMANY	CLS	NK,NM,NN
Tromsoe	ST	NORWAY	KSAT	NL,NM,NN

Papeete	TA	FRANCE	IRD	NL,NM,NN
Taiwan	TW	TAIWAN, REPUBLIC OF CHINA	National Taiwan Ocean Uni	NK,NM,NN,NP
Valley Forge USAF	UA	UNITED STATES	CLS	NK,NL,NM,NN
Toulouse, Lannion	WE	FRANCE	Météo France	NM,NN,NP
Wallops	WI	UNITED STATES	NOAA/NESDIS	NK,NL,NM,NN,NP
Athens	XA	GREECE	EARS	NK,NL,NM,NP
Kangerlussuaq	XK	GROENLAND	EARS	NK,NL,NM,NN
Maspalomas	XM	SPAIN	EARS	NK,NL,NM,NN,NP

Antennas under agreement
CLS and subsidiaries antennas
Customer antennas under CLS maintenance contract
Antennas without written agreement ("Best effort")

Future METOP Real-time coverage is shown on Figure 9.

Figure 9. Future METOP-A realtime Coverage

In 2008, Gilmore, Wallops, Lannion and Hatoyama were fully operational for METOP real-time datasets.

4.3 Orbitography network

Figure 10 displays CLS Orbitography beacons location.

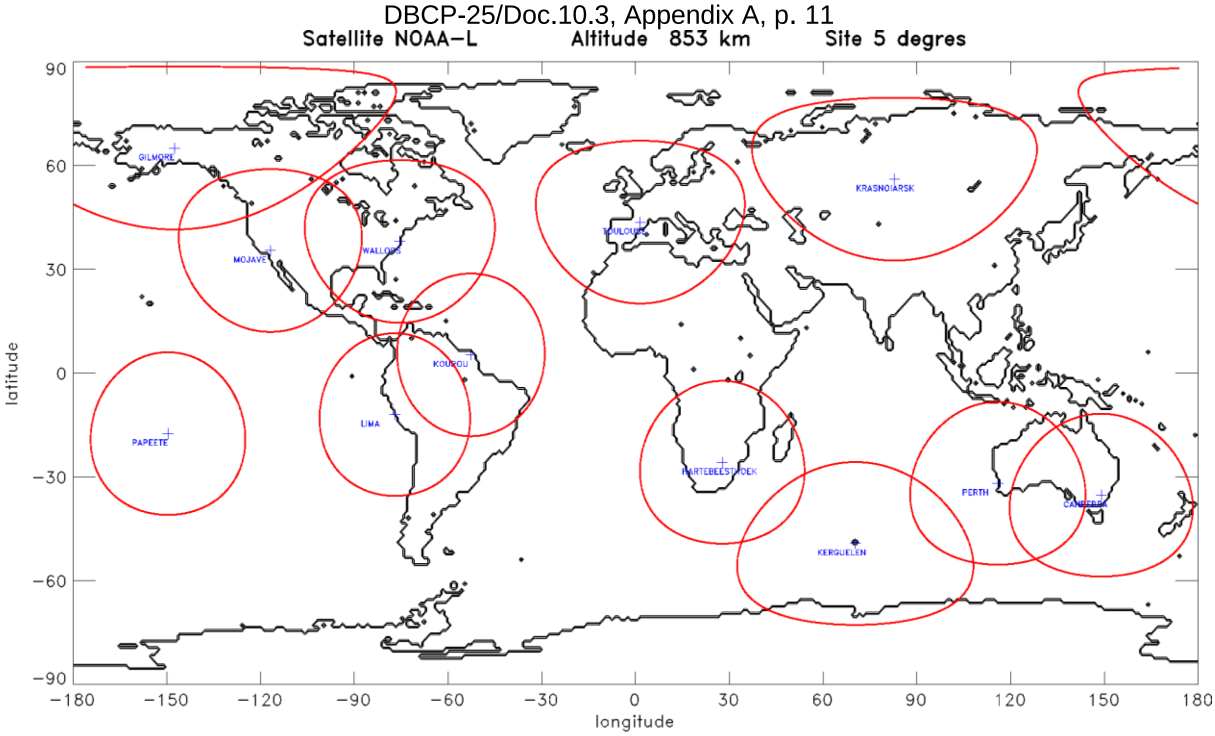

Figure 10. Orbitography PTT Network

1- TOULOUSE	OK
108 - GILMORE_N	OK
109 - KOUROU_N	OK
111 - HARTBEES_N2	Small amount data on NOAA 12
112 - CANBERRA_N	OK
113 - LIMA-N	OK
114 - KRASNOIARSK	Stopped on 01/26/06. Expecting administrative paper in order to restart this PTT. A. Salman in charge.
116 - PAPEETE	OK
118 - WALLOPS	OK
119 - KERGUELEN_N	OK
149 - PERTH	OK
110 - MOJAVE	OK.

4.4 Processing centers

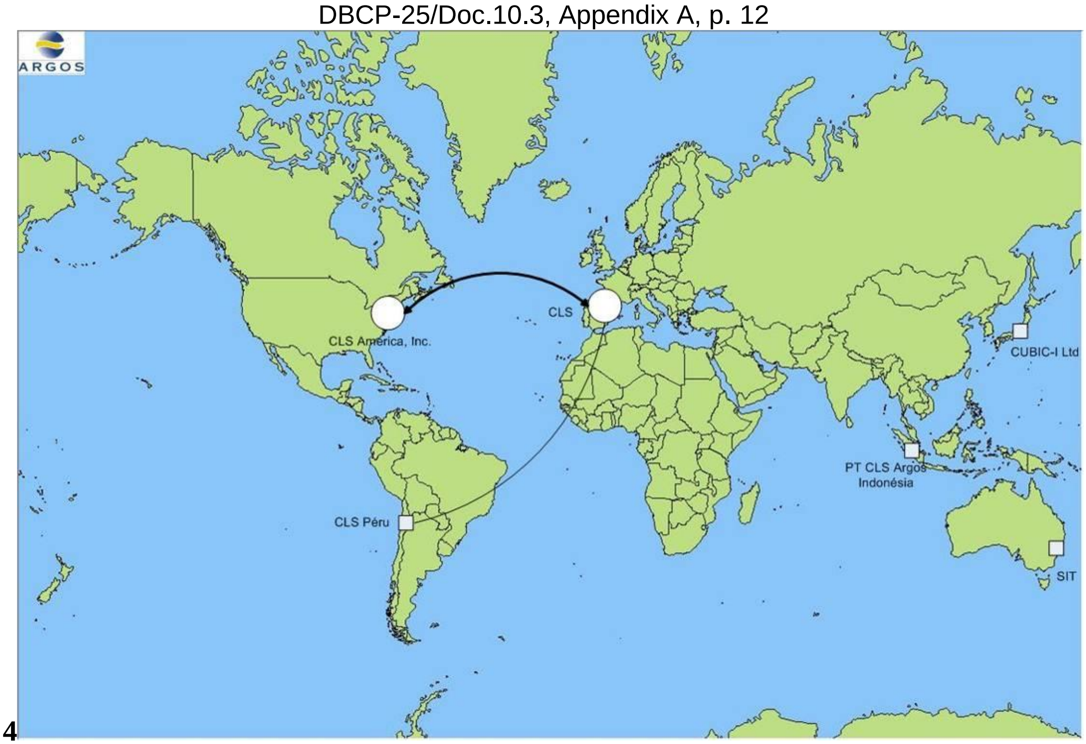

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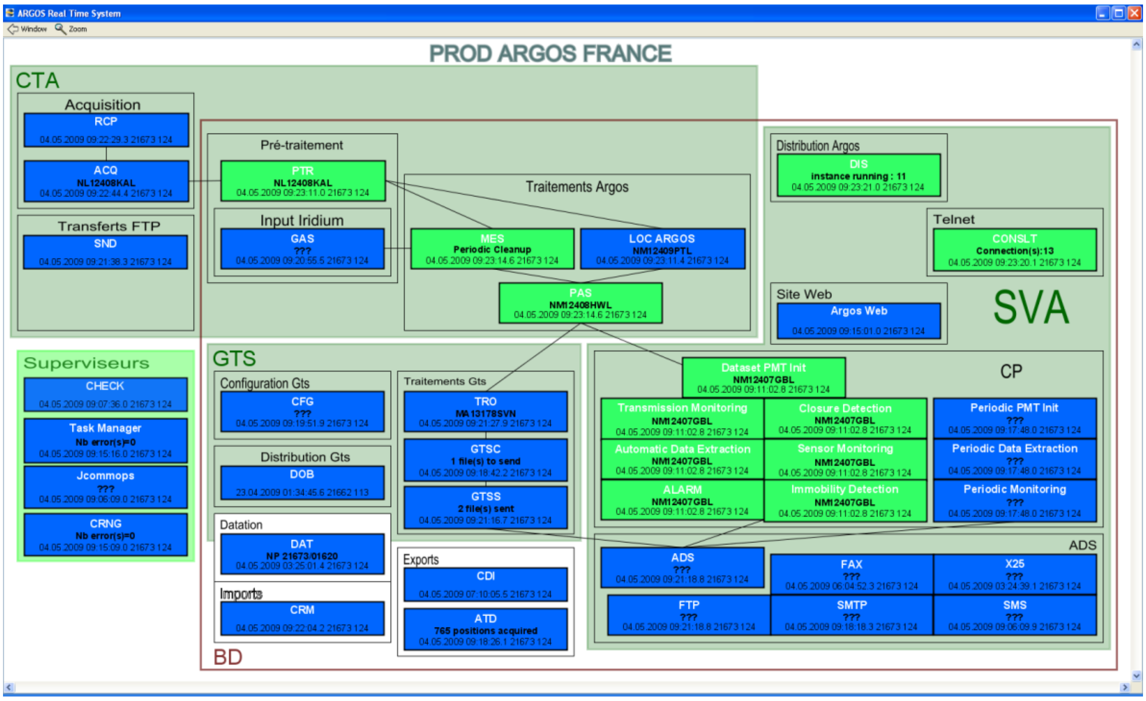
Figure 11. Global Processing Centers and Regional Processing Centers

Figure 12. CLS America, Inc. Global Processing Center

The two global processing centers in Toulouse and Largo were nominal over 2008.

A major software change was done into both global processing centers in May 2008. ARGOS2001 Ph ase3B (GTS) is now in place and operated by CLS and CLS America, Inc. Operational teams.



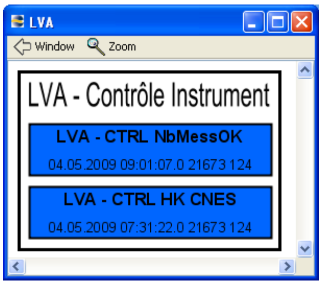


Figure 13. ARGOS Synoptic

CLS is monitoring JCOMMOPS Web Services and its computer architecture since December 2007.

Redundancy was used at least twice a month during 2008. Redundancy means all Argos users were re routed to CLS or CLSA during an anomaly on the nominal GPC.

4.5 Regional processing centers

Figure 14. CLS Peru Regional Processing Center

Lima (Peru) center was nominal over 2008. All Argos architecture will be replaced at the end of 2009.

5. COMMUNICATION LINKS

CLS has improved his Internet link and are now connected each other to 2 different providers: Two li nes (10M each) with Bandwidth Tunneling by application.

Internet is still the main communication link used to distribute processed data to users and to retrieve data sets from receiving stations. Security functionalities are available SSH, PGP, HTTPS.

The X25 protocol is only used and maintained by the Toulouse center to send data to a few users (less than 20) concerned by security reasons.

6. STATISTICS

6.1 Daily and Monthly Active PPT

The number of Argos platforms operating continues to increase. In June 2008, more than 10400 platforms were seen on average per day. Each of the two global centers processed data from 18 500 individual platforms during this month.

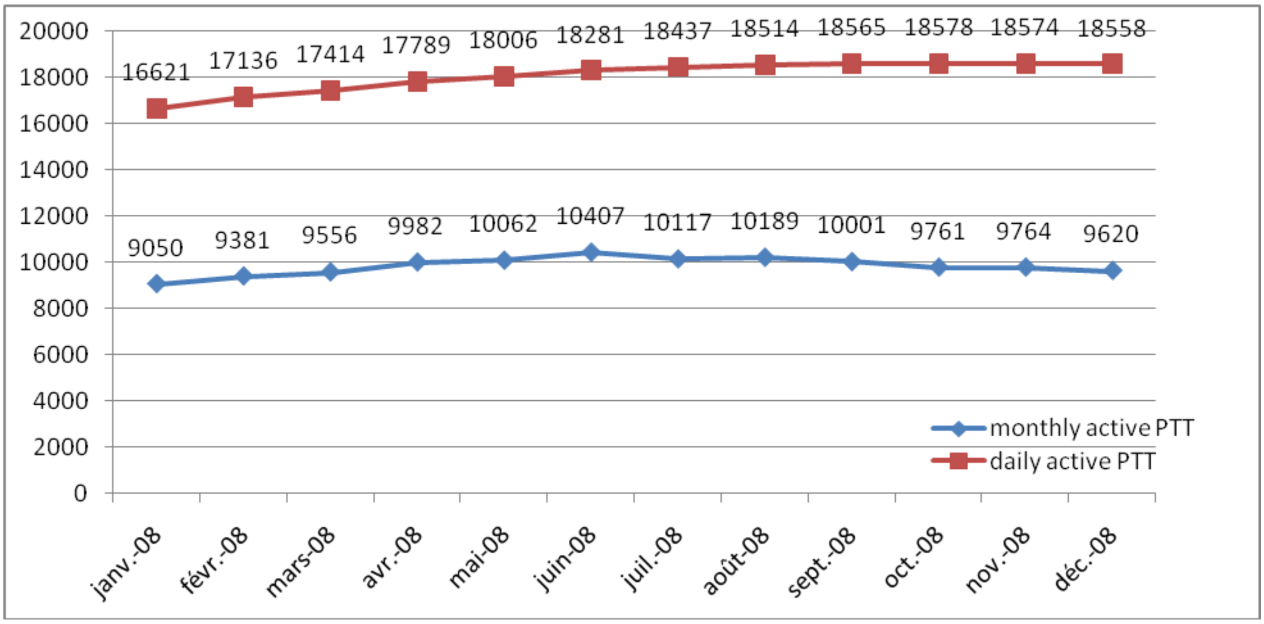


Figure 15. Daily and Monthly Active PTT in 2008

6.2 TELNET access

35000 average connections per day on TELNET (in CLS). This number is increasing compare to 2007 (32000) and to 2006 (30000).

20000 average connections per day on TELNET (in CLS America, Inc.)

6.3 ArgosWeb access

150 average connections per day on ARGOSWEB. 100 average connections per day over the week-end.

6.4 ARGOS Message

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

Items per day	2007	2008
Messages received	1,957,500	1,969,658
Distinct Messages received	972,000	1,164,717
Argos Locations	66,750	66,176
GPS Locations	163,150	187,829

6.5 Access availability

The average availability is 99,39 % in 2008. During the unavailability of the services in CLS, CLS A merica, Inc. was on backup. June and July were impacted by database server crashes. December was impacted by CLS Firewall problem.

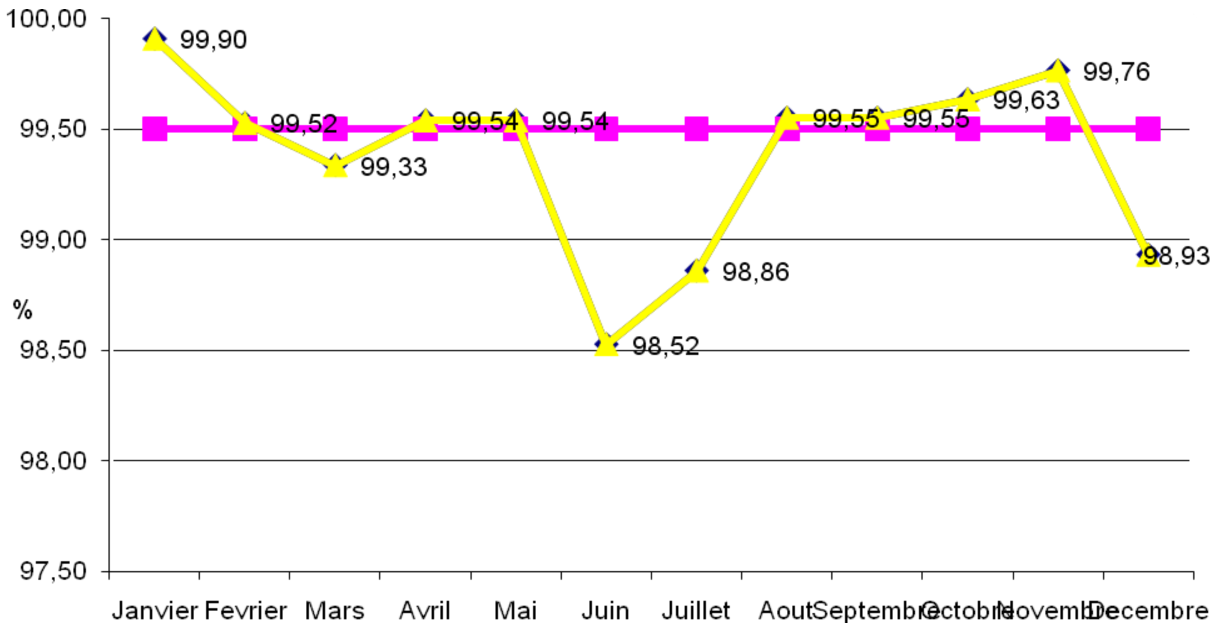


Figure 16. ARGOS Processing Chain availability

No major anomalies have impacted the ARGOS data availability.

7. 2009 – 2010 PERSPECTIVES

- Two ARGOS3 instrument (Downlink) into operation
- Implementation of METOP compatible network of LUT antennas
- NOAA N Prime delivered to all ARGOS users on August 3rd, 2009

- 3 New antennas with EARS network
- ARGOS3 (Downlink) into operation
- Improving delivery times
- Argos system monitoring : implementation of a reference platforms network
- Disaster Recovery implementation
- Implementation of observation processing (delivery of physical values)
- A new XML format of distribution
- Web services and new distribution formats
- Improvements on ArgosWeb (more days of locations available, Implementation of program activity n d Unused ID reports, …)
- Alarms and Alert A2001 compatible
- Downlink Messaging Monitoring Center upgrade and related web interface
- GTS Subsystem adjustments and developments (open action item)
- Successful launch of NOAA N Prime (February 2009) with an Argos-3 instrument
- Implementation of GDOP in Argos Location calculation for better estimation of location accuracy
- New Argos location algorithm for applications running under harsh conditions (animal tracking for in stance)
- Argos ID on 6 digits

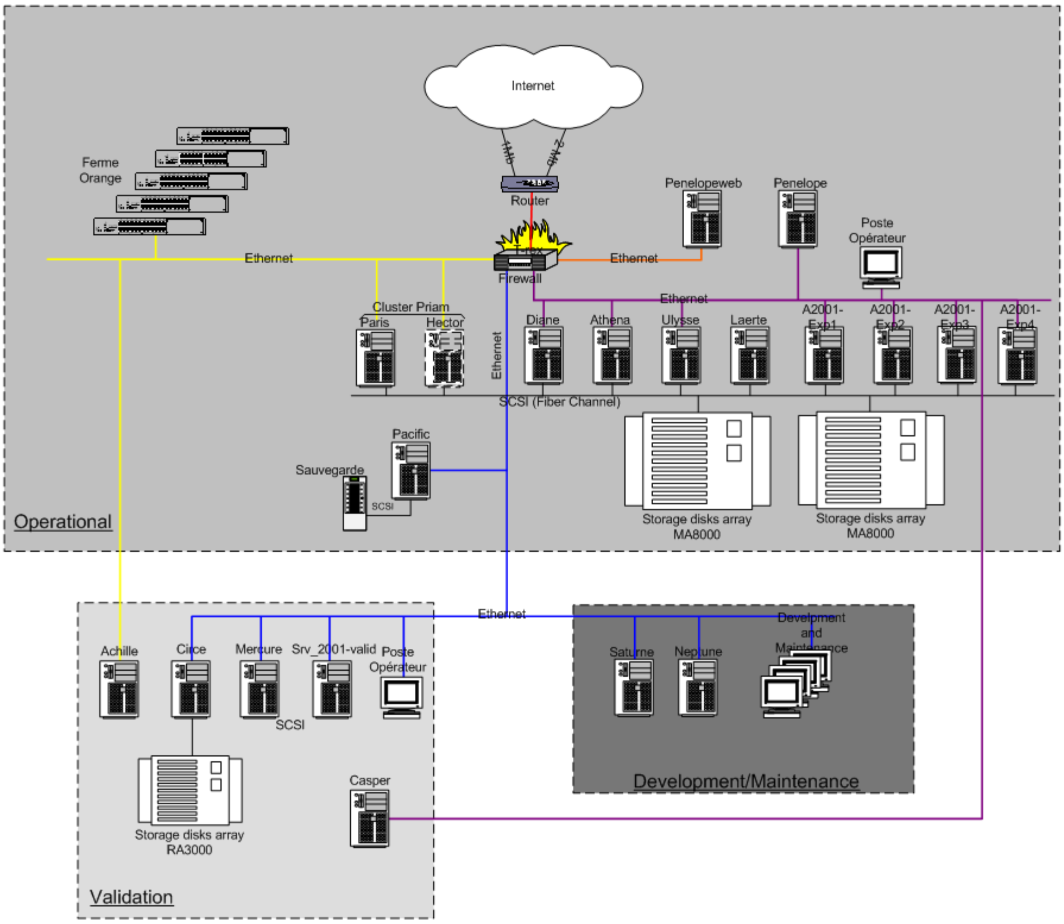
APPENDIX B

REPORT ON 2008 – 2009 SYSTEM IMPROVEMENT

1. PROCESSING IMPROVEMENT

1.1 Hardware configuration

The computing architecture dedicated to the Argos system is steady. A few words to recall the principle of the Argos computing centre architecture.



In the middle of the architecture, there are two high performance SAN disk storage arrays on which are connected, via fiber channel links, the servers involved in the processing of the Argos data.

The operational configuration is dedicated to the acquisition, the processing and the dissemination of the Argos data, 24 hours a day, all along the year. In 2008, all the old OpenVMS servers, which still existed, have been discarded. Today, it means that all the Argos servers run on Linux and Windows (a few).

The development and the maintenance of the Argos software are performed on a dedicated architecture. The third configuration, the validation configuration, is used to validate all the software modifications and corrections before being installed at the level of the operational configuration.

1.2 Argos control and processing centre

The project Argos 2001, which consisted in renewing all the hardware and software components of the Argos Control and Processing centres, is now finished. The purpose of the Argos 2001 project was vital for the long-term continuity of the Argos system in order to offer a better level of services to our users in terms of new functionalities, reliability, availability and responsiveness to their requests.

1.3 GTS processing enhancements

Here, the list of GTS enhancements done in 2008 and 2009:

- Implementation of a GTS processing monitoring tool

Development of software modules to GTS process University of Wisconsin AWS Stations (24 new w eather fixed stations are now processed).

- GTS processing improvements:

- Filtering of all default GPS locations (0;0 or 90;0 …)
- Automatic switch on Argos location when GPS is failed.
- The sending period of GTS bulletins to Météo-France/NWS has been improved: 2 min instead of 5 min.

- Development of a software module to process SBD ASCII Iridium messages in the GTS Iridium data processing for IPP (only SBD format) with a gateway between CLS Iridium chain and Argos-GTS system.

- Implementation of BUFR codes for TESAC and SHIP bulletins. Next step BUFR for SYNOP.

2. GROUND SEGMENT IMPROVEMENTS

2.1 Ground segment architecture

The Argos ground segment is composed of:

- the global acquisition network
- the real time acquisition network
- the orbitography network
- the Global Argos Control and Processing centre
- the regional processing centers
- the PTTs and PMTs

2.2 The global mode acquisition network

It is composed of the two NOAA global stations (Fairbanks, Wallops Island) for the acquisition of the NOAA satellites data and the Eumetsat antenna (Svalbard) for the acquisition of the MetOp and NOAA-18 data.

2.3 The real time acquisition network

4 stations were added to the Argos network in 2009. With 56 stations in operation, this network provides a very good coverage of the earth. For DBCP needs, it is important to enhance the coverage of the south part of the Indian Ocean as well as the middle of the Atlantic Ocean. These are very remote areas where it is difficult to find sites and infrastructures. The possibility of using the site of St Helena has been abandoned (no band-L station exists and very poor communication links). Contacts were made to check if any antennas operated by US Navy were available in Diego Garcia or other islands in same area. Unfortunately, such capability doesn't exist.

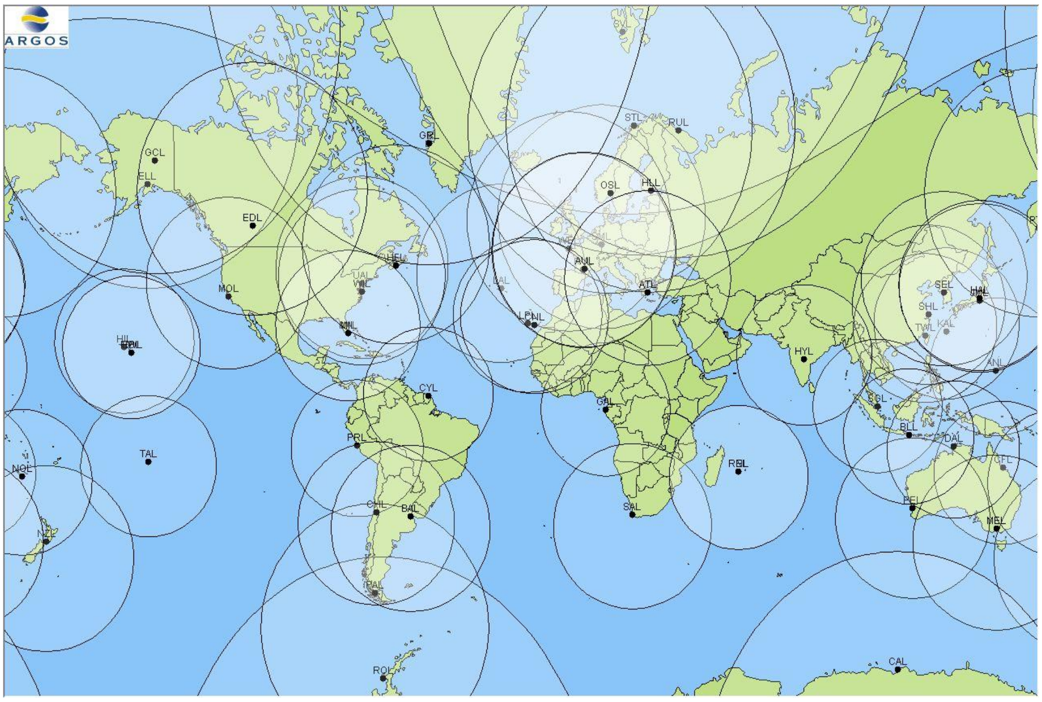


Figure 17. Argos real time acquisition network

Most of the ground stations which compose the Argos network are only capable of acquiring data from NOAA satellites. This is the reason why we wanted to focus our efforts on adding new ground stations compatible with NOAA and METOP satellites.

In July 2007, the failure of METOP-A HRPT transmitter stopped the implementation of this network. Despite the restart of the transmitter over the North Atlantic in 2008, the ground stations owners decided not to invest in the upgrade of their station. CLS bought and installed two NOAA/METOP stations (Lima, Hatoyama) which are only used, for the time being, for the NOAA satellites.

To prepare the future, CLS has continued to negotiate with Eumetsat in order to be connected to the EARS network. This connection is effective since March 2009. On another side, CLS initiated, with the help and the cooperation of CNES, the upgrade of the Argos ground stations network so that a part of the stations can acquire data issued from NOAA, METOP, SARAL and NPOESS satellites. The network must be dense enough to deliver data to users as rapidly as possible.

A number of tasks must be completed to develop a ground station network that meets the above criteria.

1. System design studies and engineering

- Studying the existing network
- Identifying applications where data delivery time is a particularly sensitive issue
- Identifying geographical areas requiring priority coverage
- Defining the optimum network to be set up to meet requirements
- Defining the station network upgrade strategy
- Identifying stations qualifying for upgrade
- Studying these stations (in terms of upgradability)
- Conducting negotiations with the owners of these stations.

2. NOAA/METOP/SARAL/NPOESS receiver development

    - Taking the CNES feasibility study and making any necessary adjustments
    - Selecting the upgrading contractor
    - Negotiating the upgrading contract
    - Monitoring upgrading work
    - Conducting test, validation and acceptance activities.

3. Upgrading the three CLS stations ("Konsberg")

    - Implementing the new receiver
    - Implementing the new station control software
    - Conducting test, validation and acceptance activities.

4. Upgrading non-CLS stations (about eight)

    - Eight is an approximate figure and must be confirmed during the first-phase system study.
    - This activity comprises the following tasks:
        - ✓ Procuring a receiver
        - ✓ Upgrading the station control software
        - ✓ Implementing the new receiver
        - ✓ Implementing the station control software
        - ✓ Conducting test, validation and acceptance activities.

5. Procuring and installing new ground stations (around two)

    - Two is an approximate figure and must be confirmed during the first-phase system study. The new stations, which will join the existing network, will be installed in spots where they are most likely to improve performance for users (geographical coverage, density of beacons in area, real-time advantages, etc.)
    - Issuing the invitation to tender, selecting the contractor and negotiating station procurement contracts
    - Preparing installation sites
    - Installing the stations
    - Conducting test, validation and acceptance activities.

A CLS-led project incorporating tasks 1, 2 and 3 described above was started in May 2009 and should be completed by July 2010. A detailed review and in-depth examination of operating feedback will then be carried out before commencing tasks 4 and 5, which are scheduled for completion in time for the launch of SARAL. We will then have a network of stations capable of handling NOAA, METOP, SARAL and NPOESS satellite data.

2.4 PTT/PMT for users

The Argos-3 instrument generation allows users to benefit from two-way communications as well as larger data bandwidth. To access these new capabilities, user platforms need t o integrate a PMT (Platform Message Transceiver) in place of their current PTT.

The PMT module, working as a modem, supports:

- Transmission of uplink messages using several possible modulation links as well as satellite pass predictions
- Reception and processing of downlink messages (commands, predefines messages, satellite acknowledgement,…)
- Communication with the platform for the acquisition of sensors and the delivery of an acknowledgement when data string has been correctly transmitted and acknowledge by satellites.

Today, two manufacturers, Kenwood and Elta, successfully fulfilled the certification process and delivered their final product version in December 2007. This development has reached its goals in terms of product definition and constrains (size, consumption,..) as well as on costs.

Elta PMT RFM

Kenwood PMT RFM

The first 500 Kenwood PMT units have been received by CLS in May 2008.

In order to convince users and manufacturers to use these PMTs and the Argos-3 functionalities, it has been decided, with the help and the cooperation of CNES, to create an Argos-3 implementation plan.

The objectives of this project are to:

- Enhance knowledge and control of the Argos-3 system
- Promote the Argos-3 system

In terms of organization, the project was split in two distinct and consecutive phases.

A first phase, called <u>Evaluation</u> phase, intended for:

- Enhancing knowledge and control of the system through the deployment of a network of Argos-3 reference platforms

- Listing the advantages and the constraints of the system, from a user point of view,
- Gathering all the elements needed to promote the system
- Developing Argos-3 platforms prototypes which are representative of the user applications in order to validate optimized usage scenario of transmission and take advantage of the new Argos-3 functionalities

A second phase, called Promotion phase, intended for:

- Raising awareness, encouraging, involving and convincing users and manufacturers to use the Argos-3 system
- Developing, from the return of experience obtained with the Argos-3 platform prototypes, operational user platforms (Argo floats, drifting buoys, animal platforms). This involves development contracts signed with manufacturers.
- Making these platforms available for the users in order to include them in pilot projects
- Following up these Argos-3 platforms during a significant period (about 9 months) and comparing their performance with the Argos-2 ones of the same program
- Organizing an Argos-3 forum where will be presented to the Argos user community the results of the promotion phase.

First phase is almost completed while the second phase is now taking shape and should be significantly developed by the end of 2009.

2.5 Argos-3 and PMT CLS implementation projects

The following paragraphs provide an insight of the Argos-3 projects carried out in the different metocean applications in addition to the DBCP Argos-3 Pilot Project.

2.5.1 TRITON/JAMSTEC moored buoys

The first Argos-3 TRITON buoy was deployed last March in the eastern Indian Ocean from the Japan Agency for Marine-Earth Science and Technology (JAMSTEC) research vessel KAIYO during its cruise from March 10 to 31, 2009. JAMSTEC integrated the Argos-3 PMT modem into an m-TRITON moored buoy. The buoy uses the Argos-3 high data rate uplink and interactive data collection mode. It has sent 27.6 Ko of data per day without any loss and error free, thus collecting 15.3 times more than a classical TRITON buoy equipped with an Argos-2 transmitter. In addition, energy consumption has been divided by 6 as the PMT is synchronized with the satellite and messages are transmitted only during satellite passes. These first results are very promising as the Argos-3 TRITON proves to be low power consumption and more efficient in data collection and transmission.

Parameters	TRITON buoy with Argos-3	TRITON buoy with Argos-2
Repetition of a message	1.4	72
Max length of a message	4 608 bits	248 bits
Transmission power output	5W	1W
Collected data per day	27.6 kbytes	1.78 kbytes
Data sampling	10 minutes	60 minutes

Deployment of the Argos-3 m-TRITON buoy by JAMSTEC

2.5.2 ICCM: Moored buoy in the Canary Islands

The Marine Science Institute of the Canaries in Spain (Instituto Canario de Ciencias Marinas – ICCM) has integrated a PMT into a moored buoy for real time monitoring of meteorological and oceanographic parameters for long-time series in open ocean at the ESTOC site (European Station for Time Series in the Ocean at the Canary Islands) under the framework of -Red ACOMAR Canarias- and -EUROSITES- projects. The European program EUROSITES is coordinated by the National Oceanography Centre (Southampton, UK) and involves 13 partners across Europe and the Cape Verde Islands. The aim of the program is to form an integrated European network of deep ocean (>1000 m) observatories in order to have a better understanding of the impact of the changing global Ocean and Earth on mankind and ecosystems at large. A second buoy with Argos-3 is planned for this fall.

Moored buoy equipped with a PMT modem in the Canary Islands

2.5.3 TANGO/Drifter deployment by IMEDEA

On July 23rd, IMEDEA (Mediterranean Institute for Advanced Studies) deployed two Argos-3 SVPB manufactured by Clearwater within the framework of the European project TANGO. The deployment took place in the south of Majorca in the Mediterranean Sea.

Deployment of Argos-3 drifter by IMEDEA

Unfortunately one of the buoys was lost a few days after the deployment, probably hit by a boat while the other SVPB buoy could send its positions and data during two weeks before being picked up by a fisherman near Cala Figuera harbor. The little time those two buoys were at sea could not provide enough results for us to evaluate the Argos-3 system. However IMEDEA managed to recover one of the SVPB-G buoys and plan to deploy it again next September.

2.5.4 CO_2 Buoys/JAMSTEC

The Japan Agency for Marine-Earth Science and Technology (JAMSTEC) is currently developing an Argos-3 drifter with CO_2 sensors. The objective is to provide simplified and automated measurements of pCO_2 over all the world's oceans in order to understand the consequences of the climate change on the oceans. Thanks to the new Argos-3 capabilities, JAMSTEC will be able to measure pCO_2 in seawater anytime they want by simply sending a command to the PMT. This will thus allow JAMSTEC to remotely manage the sampling according to the places where the buoy is. In addition Argos-3 capabilities will help optimize data transmission to satellites and therefore extend the buoy lifetime thanks to the Argos-3 interactive data collection mode. The first deployments are expected by the end of 2009.

Dr. Nakano with a small drifting buoy with CO_2 sensors

2.5.5 ARGO floats

Within the Argo program, float manufacturers started to integrate the Argos-3 PMT into their platforms. Ifremer and NKE made good progress and proceeded to the first Argos-3 tests for the ARVOR float. A dual frequency antenna (401 and 466 MHz) was developed and the work is no w focused on the transmission strategies with the objectives of:

- Staying less than 45 minutes at the surface
- Being able to program the arrival time at the surface
- Transmit a full Argo profile (T,S,P) in one Argos-3 satellite pass (15 minutes)
- Compute a "good" Doppler Argos location (class 3 or 2)
- Receive downlink messages such as the PMT positions, system broadcasts and user commands

German float manufacturer Optimare has already integrated the PMT modem into their NEMO floats. They are currently using it as an Argos-2 transmitter. The next step will be the implementation of Argos-3 capabilities which could start in 2010.

PMT integrated into a NEMO float

Finally the University of Washington is working closely with CLS on the integration of Argos-3 into Apex floats. The Webb Apex antenna is Argos-3 dual band compatible. In parallel, SCRIPPS (SOLO floats) should soon implement the Argos-3 high data rate solution within their SOLO-2 floats.

2.5.6 LEGOS: Tracking a glacier in Antarctica

A project of ice thawing monitoring was initiated with the LEGOS at the end of 2008, further to the announcement of an imminent parceling of a glacier in Antarctica. This application was an opportunity for the CLS technical support team to get familiar with the Kenwood PMT. The project foresaw the installation of about ten GPS stations along the break line to study its evolution. Some PMTs were integrated in order to transmit GPS positions via the Argos system.

Unfortunately the project was postponed to October 2009 due to harsh meteorological conditions and ship engine breakdown. The deployment of 4 stations is planned for this summer 2009.

3. DBCP REQUIREMENTS

3.1 Monitoring data timeliness

"To offer solutions for improving data timeliness and to develop data timeliness and to develop monitoring tools" (5.2)

Data timeliness depends on:

- The number of satellites,
- The real time antenna network and the performance of each antenna

- The recovery of the global dataset at each orbit (elimination of blind orbits)
- Ultimately, the data processing time.

3.1.1 Monitoring system time response

Delivery times are now closely monitored with the new processing system implemented at the end of June 08.

3.1.2 Global delivery times

The next table shows the throughput time for the global datasets result delivery from NOAA-18, NOAA-17, NOAA-16 and NOAA-15 in July 2009:

Satellite delivery	**2009**	2008
< 1 h	**21%**	18%
< 1 h 30	**38%**	37%
< 2 h	**58%**	58%
< 2 h 30	**73%**	77%
< 4 h	**91%**	91%

Stored data availability for NOAA-18, -17, -16 and -15

The throughput time for stored data result delivery from MetOp-A:

Satellite delivery	**2009**	2008
< 2 h	**26%**	25%
< 2 h 30	**50%**	50%
< 4 h	**99%**	99%

Stored data availability for MetOp-A

3.1.3 Real time datasets

Next table shows the throughput time for real-time delivery from NOAA-18, NOAA-17, NOAA-16 and NOAA-15 in July 2009:

Satellite delivery	**July 2009**	August 2008
< 10 minutes	**19%**	12%
< 15 minutes	**54%**	42%
< 30 minutes	**93%**	87%
< 45 minutes	**97%**	91%

Real-time data availability

The CLS and Argos real time antennas partnerships efforts are rewarded by a visible improvement of the real time data availability.

3.1.4 Monitoring by platform types

In 2009 CLS developed a GTS processing monitoring tool; the following statistics are computed each day:

- Number of GTS platforms (with a WMO id) processed,
- Number of observations processed,
- Average disposition time (observation time – sending time on the GTS)

These 3 numbers are provided for:

- All types of bulletins
- Each type of text bulletins (BUOY, SHIP, TESAC, and SYNOP)
- Each type of buoy (ATLAS, DRIFTERS, ICE, OTHERS, and TRITON).

3.1.5 Monitoring antenna network performance

"To develop further the tool regarding status of local receiving stations (percentage of time they are operational) so that to display additional information such as what operational satellites are being received via each station." 5.10-iv

Delivery times are affected primarily by the coverage and the performance of each real time receiving station.

The table below displays the antenna performance characteristics:

Name	**City**	**Country**	**Antenna**	**# satellites processed**	**% datasets received/ expected**	**Mean dataset availability at CLS**	**Comments**
AN	Andersen	USA	CLS	3	61	00:22:39	**Software problems between February and May 09**
AT	Athens	GREECE	CLS	4	37	00:15:31	**Electrical problems during the year**
AU	Aussaguel	FRANCE	CLS	4	33	00:26:13	**Problem of connection since June 09**
BA	Buenos Aires	ARGENTINA	INTA	3	24	00:23:44	**Frequent connection problems**

BL	Bali	INDONESIA	PT CLS	4	25	00:20:21	**Hardware problem**
CA	Casey	AUSTRALIA	BOM	4	20	00:22:03	**No data from January to June 09**
CF	Cape Ferguson	AUSTRALIA	NOAA	5	62	01:01:52	
CH	Santiago	CHILE	Meteo Chile	2	63	00:29:00	**No data from Mars to July 09**
CN	Las Palmas	SPAIN	CLS	4	14	00:17:23	**Computer problem from December 08 to August 09**
CY	Cayenne	FRANCE	IRD	3	34	00:56:15	
DA	Darwin	AUSTRALIA	BOM	4	59	00:18:45	
DV	Davis	AUSTRALIA	BOM	4	65	00:21:12	
ED	Edmonton	CANADA	Envir. Canada	4	69	00:12:10	
EL	Elmendorf - Anchorage	USA	CLS	4	18	00:32:10	**Server transfer in progress since May 09 on USAF stations**
FI	Fiji	FIJI	CLS	3	83	00:21:05	
GB	Libreville - N Koltang	GABON	CNES/CLS	4	51	00:19:00	
GC	Gilmore Creek	USA	NOAA/NESDIS	4	63	00:17:52	
GR	Sondre	GREENLAND	DMI	4	70	00:14:08	
HF	Halifax	CANADA	Can. Coast Guard	3	76	01:02:29	
HI	Hickam - Honolulu	USA	CLS	3	56	00:25:09	**Server transfer in progress since May 09 on USAF stations**
HT	Hatoyama	JAPAN	JAXA/EOC	4	43	00:11:04	**Antenna problem since May 09**
HW	Hawaïi	USA	NOAA/NWS	4	40	00:32:54	**Server transfer in progress since May 09 on USAF stations**
HY	Hyderabad	INDIA	INCOIS	3	52	02:29:54	**Antenna problem**
JM	Jamstec - Tokyo	JAPAN	Jamstec	4	43	00:15:15	**Problem update 2lines with NP satellite from February to May 09**

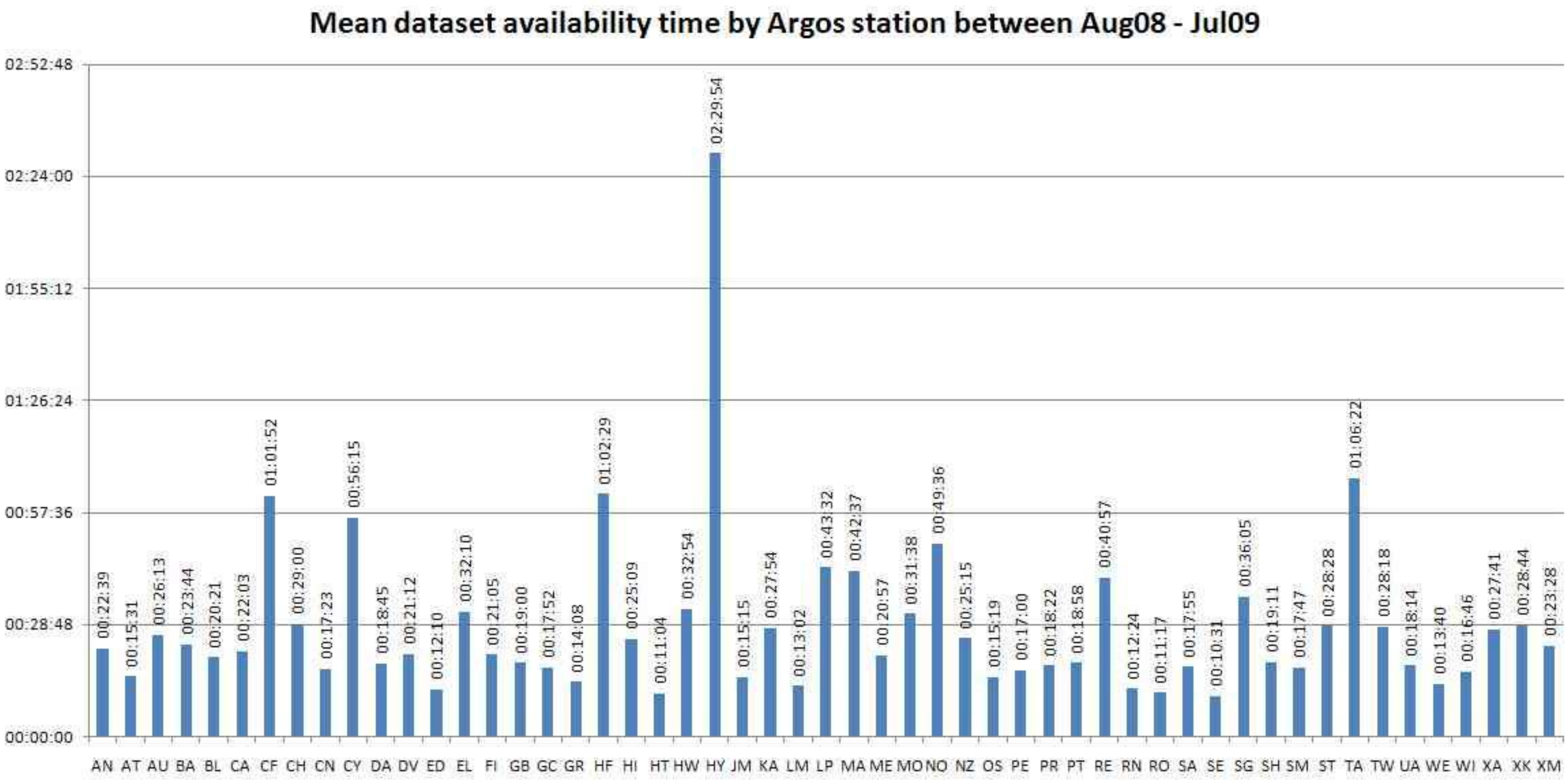
KA	Kandena-Okinawa	JAPAN	CLS	4	48	00:27:54	
LM	Lima	PERU	CLS Perou	4	67	00:13:02	
LP	Las Palmas	SPAIN	Univ. Las Palmas	4	43	00:43:32	
MA	Miami	USA	NOAA/AOML	4	70	00:42:37	
ME	Melbourne	AUSTRALIA	BOM	5	68	00:20:57	
MO	Monterey	USA	US Navy /NWS	2	71	00:31:38	
NC	Nouméa	NEW CALEDONIA	Meteo France	3	0		**PC problem since July 2008**
NO	Nouméa	FRANCE	IRD	3	42	00:49:36	
NZ	Wellington	NEW ZEALAND	Met Office	4	49	00:25:15	
OS	Oslo	NORWAY	NMI	2	28	00:15:19	
PE	Perth	AUSTRALIA	BOM	4	68	00:17:00	
PR	Lima	PERU	CLS peru	4	69	00:18:22	
PT	Petropavlovsk	RUSSIA	Complex System	4	64	00:18:58	
RE	Reunion Island	FRANCE	IRD	3	36	00:40:57	
RN	Reunion Island	FRANCE	Meteo France	2	91	00:12:24	
RO	Rothera	INDONESIA	PT CLS	3	43	00:11:17	
SA	Cape Town	SOUTH AFRICA	CLS/SAWB	4	46	00:17:55	
SE	Séoul	KOREA	KMA	3	37	00:10:31	
SG	Singapore	CHINA	SMM	4	40	00:36:05	
SH	Shanghai	CHINA	East China Sea Fisheries	4	33	00:19:11	
SM	Sembach	GERMANY		3	23	00:17:47	**Server transfer in progress since Mars 09 on USAF stations**
ST	Tromsoe	NORWAY	KSAT	3	57	00:28:28	
TA	Papeete	FRANCE	IRD	3	23	01:06:22	**No data since December 08**
TW	Taïwan	TAIWAN	National Taiwan Ocean Uni	4	32	00:28:18	
UA	Valley Forge	USA	CLS	4	1	00:18:14	**Test station**
WE	Lannion	FRANCE	Meteo France	3	71	00:13:40	
WI	Wallops Island	USA	NOAA/NESDIS	4	89	00:16:46	

XA	Athens	GREECE	EARS	4	83	00:27:41	
XK	Kangerlussua q	GROENLAN D	EARS	4	65	00:28:44	
XM	Maspalomas	SPAIN	EARS	5	88	00:23:28	

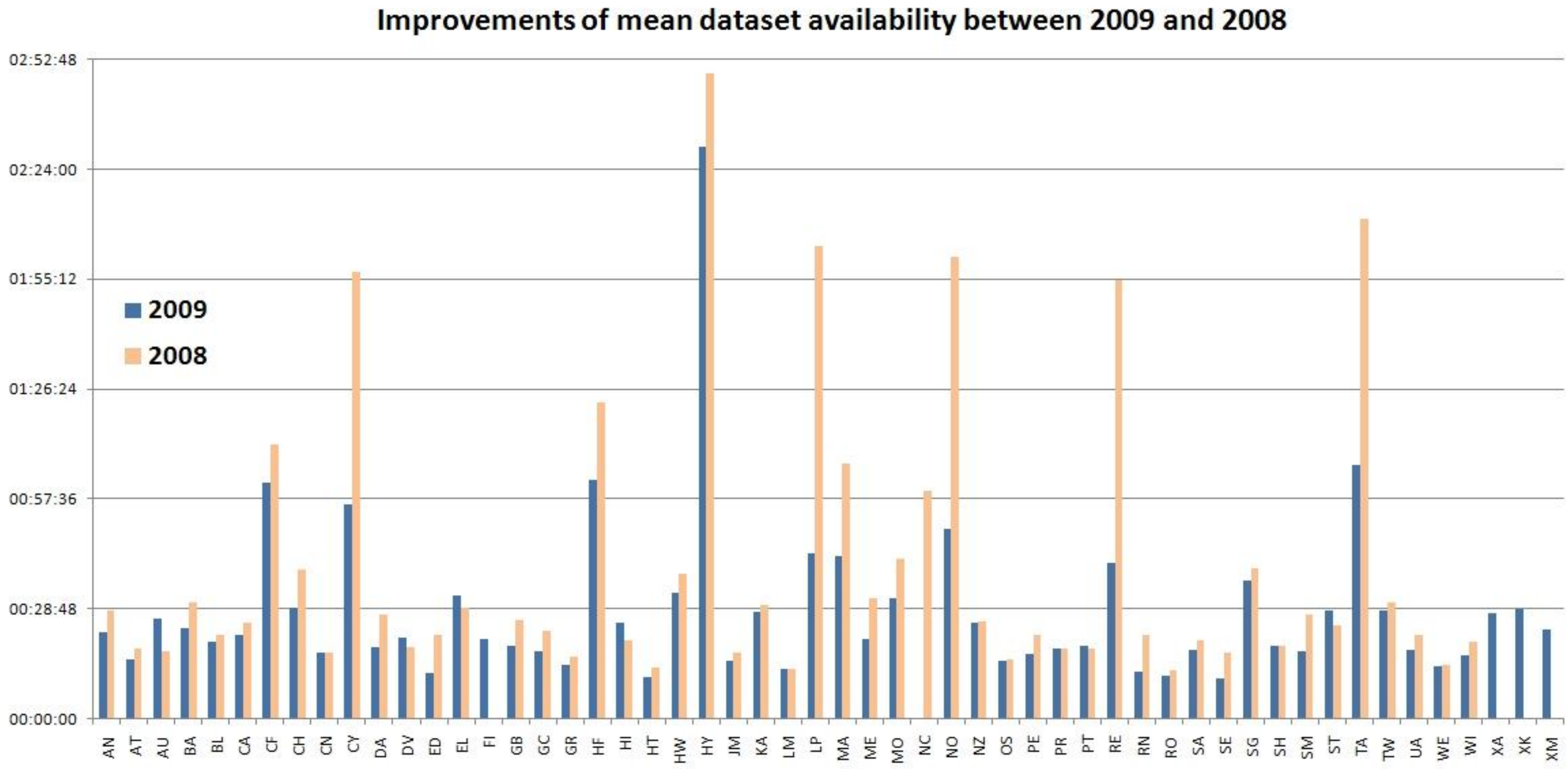
Real time receiving stations 2008-2009 performance (August 08 - January 09)

Top performers are indicated in green. Explanations on poor performance are given in "comment" column when available.

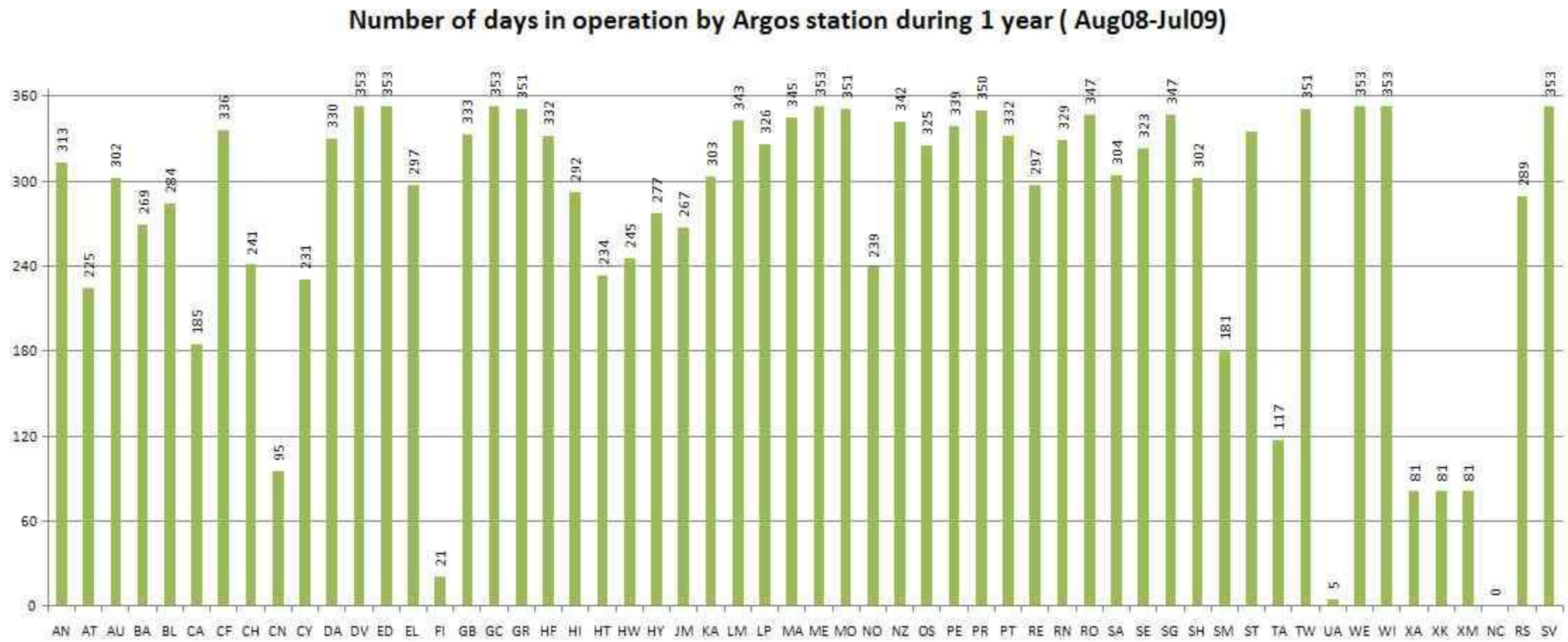
Following picture shows the mean dataset availability time at CLS for each antenna of the real time network between August 2008 and July 2009:



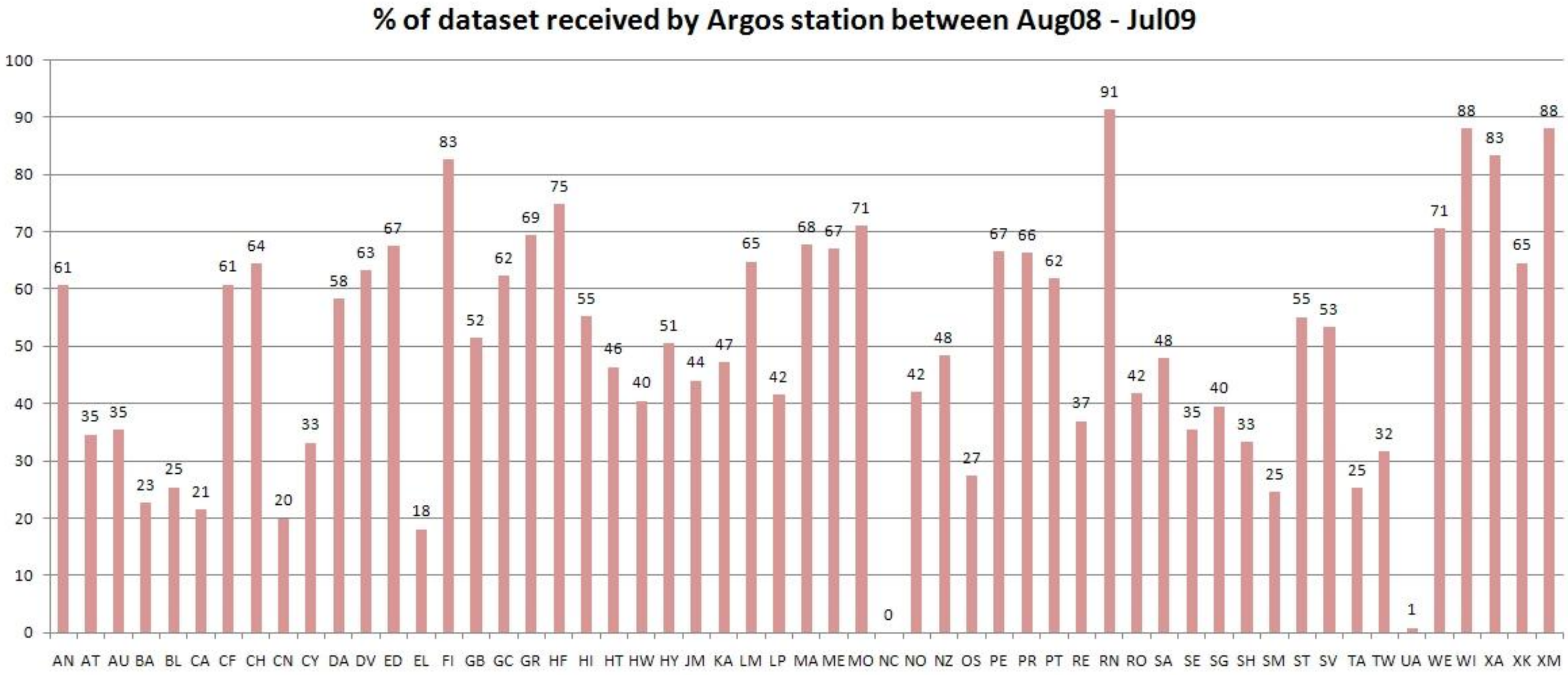
Following figure shows the improvements in term of time availability of regional dataset between 2009 and 2008:



Following picture shows the number of days in operation for each Argos antenna of the real time network between August 2008 and July 2009:



Following picture shows the percentage of dataset received at CLS for each antenna of the real time network between August 2008 and July 2009:



3.2 Improving data timeliness: DBCP requirements

3.2.1 Enhancing antenna network

A. Report on the 'Blind Orbit Support' to the OPSCOM by Mickey Fitzmaurice (JTA-XXVIII action item n°2)

The National Oceanic and Atmospheric Administration's (NOAA's) efforts to recover "backup" satellite's (NOAA-15, NOAA-16, NOAA-17, and NOAA-18) GAC data from the NPOESS Svalbard facility using the IJPS portals into the NOAA SOCC has been successfully demonstrated technically in 2005 and 2006. Since this time period, numerous delays in completing the effort have occurred due to the effort's reduced priority internal to the NOAA SOCC. The launch and activation of MetOp, the incorporation of Jason-2 into the NOAA SOCC, the preparation, launch and checkout of NOAA N-Prime all were higher priority efforts that delayed the blind orbit support effort. During the delay period, the automation of the data recovery effort, which required extensive modifications to the Polar program's scheduling software was completed and validated. With the successful launch of N-Prime a more extensive evaluation of the NPOESS blind orbit data recovery effort's impacts to primary satellite's (NOAA-19 and MetOp) GAC recovery from the IJPS Svalbard facility needs to be undertaken. This evaluation was mandated by NOAA's Polar Program manager in an effort to quantify the risks to operational data recovery from the IJPS Svalbard facility. Due to the current 6 satellite constellation, conflicts in ground station resources, especially at Fairbanks, could become an operational issue resulting in reduced data recovery. The checkout, validation and use of the NPOESS Svalbard facility would alleviate many of the conflict issues.

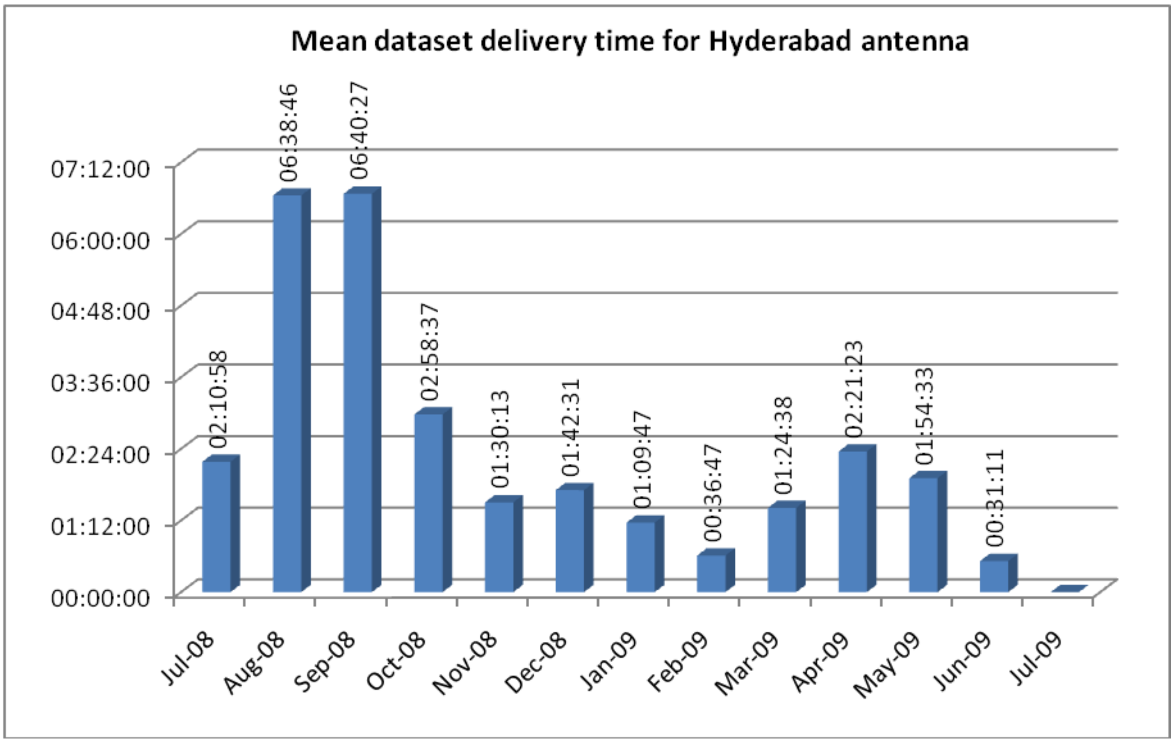
B.To pursue negotiation for the installation of new antennas to cover South Atlantic and Indian Ocean regions (JTA-XXVIII action item n°3)

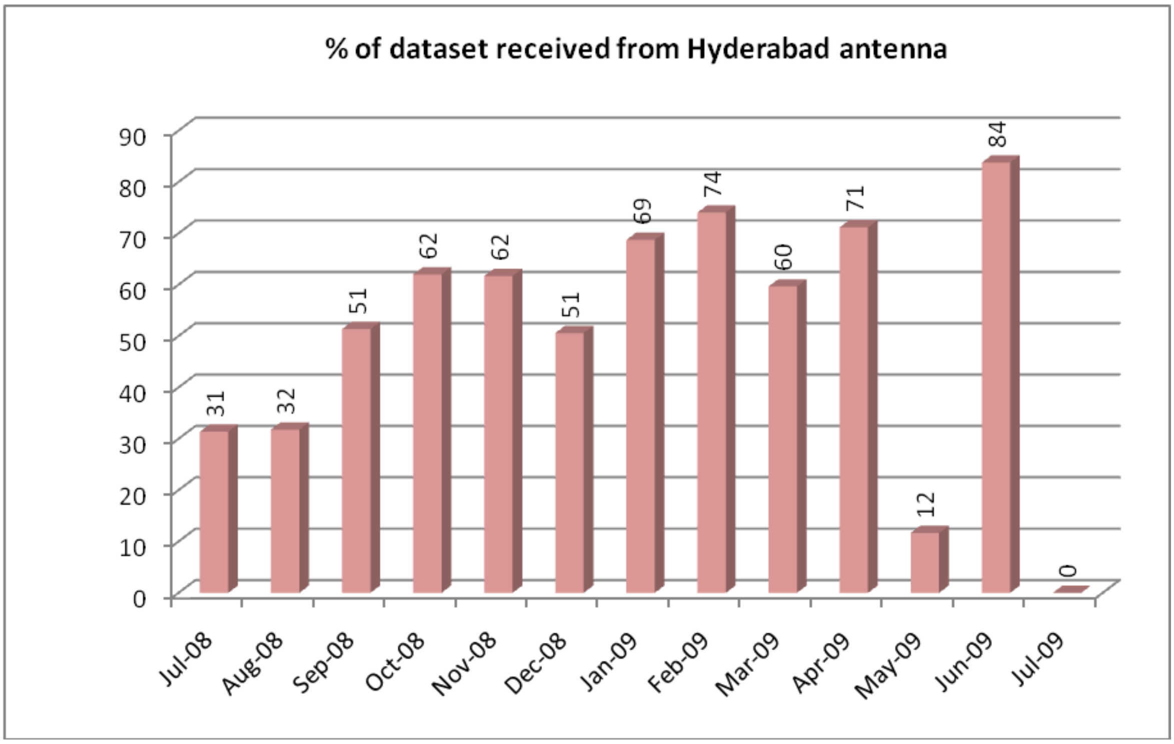
4 stations joined the Argos network during 2009 (Fiji, Athens, Greenland, Spain). There's a need to complete the Indian Ocean network.

In 2008 and 2009, CLS worked with SAWS to install antennas in Gough and Marion islands, and also upgrade the Cape Town one. CLS proposed to provide the third antenna if SAWS buys the first two. Unfortunately, because of budget restrictions, SAWS could not move forward in 2009, so there's no progress for 2009 on this matter

C. Enhance Hyderabad LUT station performance (JTA-XXVIII action item n°4)

Cooperation was built in 2008 between CLS and INCOIS to enhance Hyderabad LUT station performance. However some software and antenna problems met by INCOIS caused some delays on data delivery. The following figures present the average time response and % of datasets received from Hyderabad from July 2008 to July 2009.





Since July 09 no data received from Hyderabad station due to an antenna problem.

D. Ensure data from NOAA-15, 16, 17 and 18 are being received by IRD and MétéoFrance stations at la Réunion (JTA-XXVIII action item n°5)

Currently 3 NOAA satellites (N15, N17, N18) are received by the IRD antenna and 2 NOAA satellites (N17, and now N19) by the Météo-France antenna. The Météo-France antenna has the best performance with 91% of datasets received vs. expected, but it receives data from a fewer number of satellites – only N17 until N19 was declared operational.

E. Investigate on existing antennas in the Indian Ocean and study other possibilities to add antennas in the Indian Ocean ideally in central Indian Ocean (JTA-XXVIII action items n°6 and 7)

AND

Reduce the delays regarding the Indian Ocean and to inform the Panel on how well the region will be served by Argos-3 (DBCP-XXIV Action, Ref. 8.4(iv))

We have discovered this year that there are no existing U.S. Navy antennas anywhere in the Indian Ocean region. The Navy has essentially abandoned their Diego Garcia Base so there are no opportunities for antenna partnerships in the region with them. Consequently CLS has abandoned plans to locate existing antennas and is now concentrating on exploring islands which have the possibility of supporting a regional antenna technically, politically and financially.

In this context, a new project was launched (see Section 3 above) in 2009 with CNES with the aim to replace antennas in the existing Argos real-time network with antennas compatible with Argos-3 (NOAA & MetOp) + SARAL (Satellite with Argos and Altika) + Argos-4. Within this project, in view of the DBCP requirements, the first antenna is to be installed in the Indian Ocean. This could be done possibly by upgrading the station(s) at Reunion and/or Hyderabad as well as installing an antenna in a new location. There are very few suitable islands in the area though, especially in the central Indian Ocean. CLS is currently looking at the Seychelles, Socotra and the Cocos Islands as candidate sites.

F. To continue effort for making Brazilian satellites data available via the new Argos data processing system Study (JTA-XXVIII action item n°8)

Only one Brazilian satellite is still flying (SCD2). No policy agreement was obtained so far for the distribution of the (few) Argos data collected by this satellite to the community so the situation is still withheld.

G. To install new antennas according to the following priority areas: the South Atlantic, the Indian Ocean and Southwest Pacific Ocean (JTA-XXVII action item)

See Item B. above

3.3 Argos-3 / PMT-Pilot projects

"To implement PMT pilot activity as soon as possible and to reactivate the offer concerning new generation PMTs" (4.3, 5.8).

The purpose of the following paragraph is to give a global vision of the progress of the Argos-3 DBCP Pilot Project one year after its official kick-off.

3.3.1 Context

A DBCP Argos-3 evaluation project was established to evaluate the new system's capabilities for the buoy community. Four drifter manufacturers have participated so far in the project: Clearwater, Marlin-Yug, Metocean, and Pacific Gyre. It was agreed that with the support from CLS, manufacturers would develop an Argos-3 platform prototype, and then produce 10 drifters each for evaluation by the community. CLS offered to grant 50 SVP buoys to the DBCP (including 25 SVPB) that would be purchased from the ~~five~~ manufacturers. In return, participants' responsibilities would be to deploy the buoys, contribute to Argos service (Argos-2 current pricing) and evaluate the buoy performance.

3.3.2 Status of the DBCP Pilot project

As of today, four manufacturers completed the implementation of the Argos-3 PMT into their drifters: Clearwater, Marlin-Yug, Metocean and Pacific Gyre. These drifting buoys use the interactive data collection mode with Argos-3 and the "pseudo-ack" mode with Argos-2 (message transmitted N times under one satellite pass) since the PMT modem calculates satellite pass predictions. Preliminary studies showed that these improvements permit to reduce message transmissions by 75% (thus increasing the buoys' life expectancy).
The first Argos-3 SVP and SVPB were made available by Clearwater and Pacific Gyre early in March 2009, while Metocean and Marlin-Yug were ready to deliver the units in summer 2009.
Luca Centurioni (SCRIPPS), the chairman of the Argos-3 steering team, coordinated ship opportunities for deployment of the Argos-3 drifters by interested users.

Twenty-seven SVP and SVPB drifters are scheduled for deployment between August and October 2009.Luca Centurioni and Shaun Dolk organized deployment opportunities of Pacific Gyre and Clearwater Argos-3 drifters. At the time of writing, ten SVP units from Pacific Gyre were planned to be deployed in the Central North Atlantic, five Clearwater drifters in the central tropical/equatorial Pacific and three other Clearwater units either in the Pacific Ocean or the Antarctic area.

The ten drifters manufactured by Metocean are scheduled to be deployed in September-October 2009 in the Southern Hemisphere by Julie Fletcher from NZ Weather Services (five SVP-B buoys), Graeme Ball from the Australian Bureau of Meteorology (three buoys) and Johan Stander from SAWS (two buoys).

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