National Report of France to the XIth GLOSS Group of Experts Meeting, held at UNESCO, Paris, 13-15 May 2009

prepared by G. Wöppelmann[1], R. Créach[2] and L. Testut[3]

[1]Université de La Rochelle, UMR 6250 LIENSs, 2 rue Olympe de Gouges, F-17000 La Rochelle
[2]SHOM, 13 rue du Chatellier - CS 92803, F-29228 Brest Cedex 2
[3]LEGOS, 18 av. Edouard Belin, F-31401 Toulouse

1. Overview of French stations committed to GLOSS

There are 15 French tide gauge stations committed to the GLOSS program. Figure 1 highlights the geographical distribution of these stations around the world. We also report on an additional GLOSS station which is operated in collaboration with French organisms (Sao Tomé). The stations are namely:

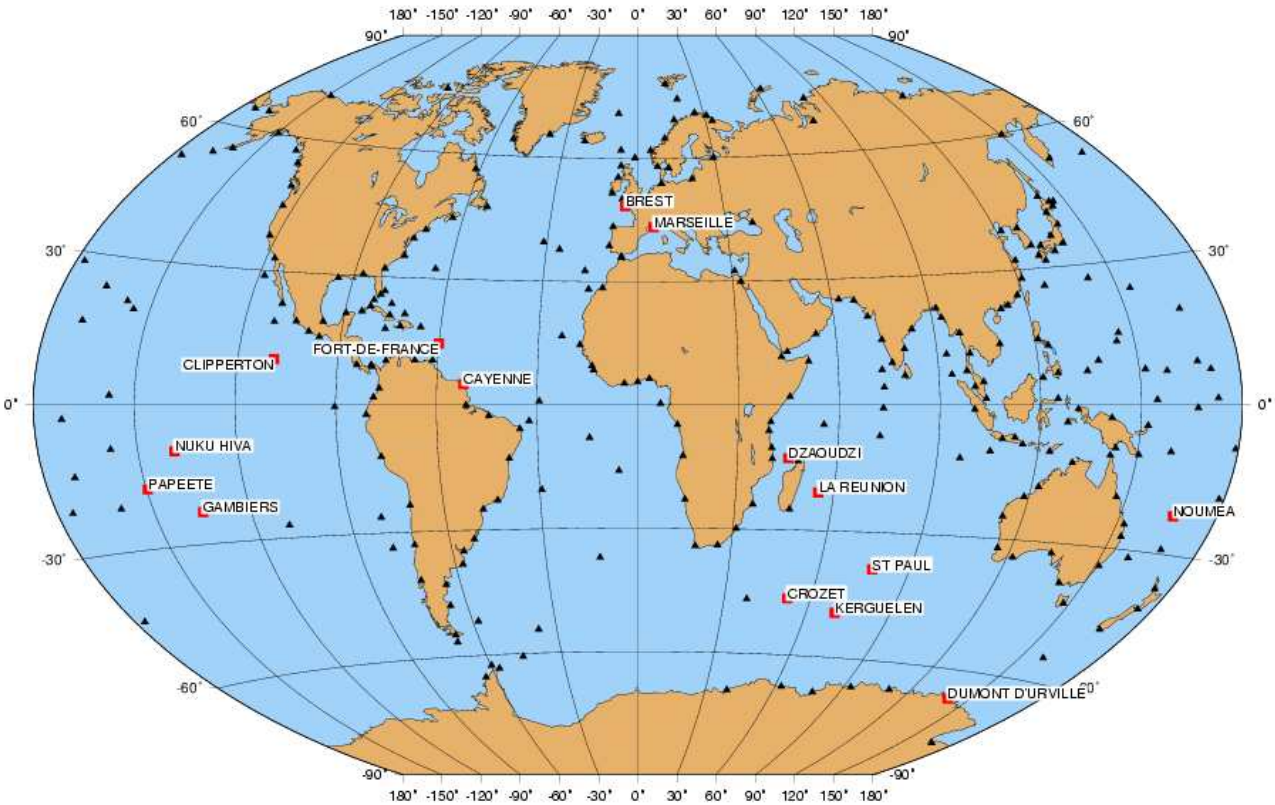

Fig. 1: Geographical distribution of the French stations committed to GLOSS

GLOSS Id.	Station Name	Operator	Network
017	Pointe des Galets (La Réunion)	SHOM / DDE La Réunion	RONIM
021	Crozet	LEGOS / INSU	ROSAME
023	Kerguelen	LEGOS / INSU	ROSAME
024	Amsterdam St Paul	LEGOS / INSU	ROSAME
096	Dzaoudzi (Mayotte)	SHOM / DE Mayotte	RONIM
123	Nouméa	SHOM / DITTT / IRD	RONIM
131	Dumont D'Urville	LEGOS / INSU	ROSAME
138	Rikitea (Gambier)	Univ. de Hawaii / CEA	
140	Papeete Fare Ute (Tahiti)	Univ. de Hawaii / CEA	
142	Nuku Hiva (Marquises)	PTWC / CEA	
165	Clipperton	SHOM	
202	Iles du Salut (Cayenne)	SHOM / DDE	RONIM
204	Fort de France (Martinique)	SHOM / MétéoFrance	RONIM

205	Marseille	SHOM / IGN	RONIM
242	Brest	SHOM	RONIM
260	Sao Tomé	LEGOS / IRD	

2. Status of French stations committed to GLOSS

GLOSS 242: BREST

Since January 2004, a radar gauge Krohne BM100 records the "official" data for Brest station. The previous MORS IEE acoustic tide gauge is still working alongside the radar in the same stilling well for comparison purposes. Calibration of the acoustic and radar tide gauges were performed. These experiments assessed the performances of the radar device (Martin Miguez et al., 2008a). Real-time data are available for this gauge through Internet.

The tide gauge benchmarks were first linked to the permanent GPS station by precise levelling in 1999. Six leveling operations were carried out between 1999, 2004 and 2006. The distance between the GPS and the tide gauge is about 350 metres. The levelling results show that the whole site is stable at the millimetre level. This ensures that the GPS is actually monitoring the vertical motion that affects the tide gauge. The GPS station is operating continuously since October 1998 and is committed to IGS TIGA pilot project (Schöne et al. 2009).

Last but not least, a data archaeology exercise is conducted for a couple of years following the rediscovery of ancient data. The rediscovered tide gauge data were submitted to a thorough process of quality control (Wöppelmann et al. 2006; Pouvreau 2008). In addition, the issue of a possible tide gauge datum discontinuity at Brest, caused by the bombing of the city in August 1944, was examined (Wöppelmann et al. 2008). No evidence of an offset affecting the datum continuity at Brest sea-level record could be detected by examining the documented historical first-order leveling surveys performed in the vicinity of the Brest tide gauge.

GLOSS 205: MARSEILLE

Although the original floating gauge is still operating in Marseille since February 1885, an acoustic tide gauge was installed in June 1998. It was replaced in April 2009 with a modern ELTA tide gauge using a Khrone radar sensor. TGBMs are levelled yearly. The results show a locally stable site at the millimetre level. The permanent GPS station is operational since July 1998 and is committed to TIGA. Real-time data are available for this gauge through Internet.

GLOSS 123: NOUMEA-NUMBO

A modern radar tide gauge was installed at Nouméa by SHOM in January 2005 to replace the floating and the acoustic gauges that were getting older. The new tide gauge is located at a site called Numbo, which is about 6 km distance from the older one (Chaleix). Unfortunately, the plan to operate both French old and new tide gauges simultaneously for at least a year was not carried out. Furthermore, the IGS station is now about 10 km distance, and it is set up on a different basement.

GLOSS 138 : RIKITEA

The University of Hawaii maintains these three stations (Rikitea, Papeete Fare Ute, Nuku Hiva).
Station 138 (Rikitea, Gambier) operates a

GLOSS 140 : PAPEETE FARE UTE

A permanent GPS station was installed by CNES on the top of the tide gauge. It is operating since August 2003 and is intended to be submitted to TIGA. A DORIS station is also operating about 7 km from the tide gauge since July 1995, alongside with an IGS station.

GLOSS 142 : NUKU HIVA

Station 142 (Nuku Hiva, Marquises) operates a Druck pressure sensor and a Vegapuls radar sensor for measuring water level. It transmits 1 minutes sampling rate data with a transmit interval of 5 minutes via the GOES satellite system. The UPF plans to install permanent GPS within the next two years.

GLOSS 021, 023, 024, 131, 260

The four stations of the South Indian Ocean are part of the ROSAME network. They are equipped with pressure sensor (water level pressure, seawater temperature, atmospheric pressure and conductivity. These stations transmit the data in real time through ARGOS. The hourly data, after validation, are transmitted to the Hawaii Centre. Real-time data for these four tide gauges on a monthly basis can also be seen on the LEGOS web page http://www.legos.obs-mip.fr/en/observations/rosame/

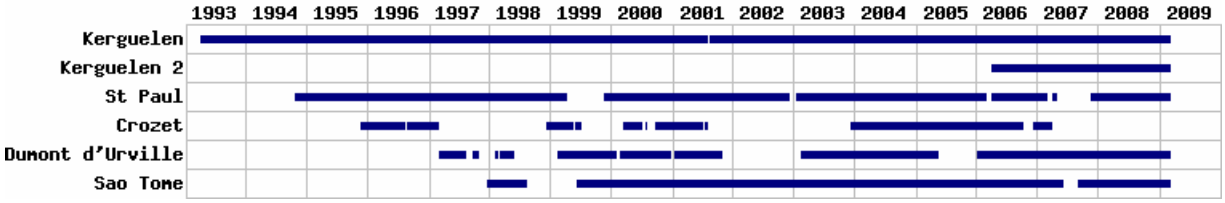

Figure 1 : Timeline of the available data for the ROSAME tide gauge network.

- **CLOSS-023**: Kerguelen is operational since April 1993, with only a short gap of a few days in January 2000. Monthly tide gauge calibrations were performed until 2003 in order to monitor the sensor drift. A new station was installed in 2006 in the frame of the Indian Ocean Tsunami Warning System (IOTWS). This new station is equipped with radar and pressure gauge. For this station high frequency data are available (at 2 minutes sampling). The TGBMs were connected in December 2003 by precise levelling and differential GPS to the IGS permanent station. This IGS station is located at a distance of about 3 km. It is operational since November 1994, close to a DORIS station, which is operational since January 1998. GPS buoy sessions are made few times a year in order to tie the instrumental references of all sensors.

- **GLOSS-021**: Crozet was installed in December 1994. It was destroyed end of July 2001. A new infrastructure was built in December 2003. It was destroyed again in February 2007. A new installation is scheduled in 2009. This site is particularly difficult to maintain.

- **GLOSS-024**: Saint-Paul is operational since October 1994, with a gap from April to June 1999. The station was rebuilt in 2007 and operated with a radar and a pressure gauge since November 2008.

- **GLOSS-131**: Dumont d'Urville was installed in February 1997. It has been operational from February 1997 to August 1997, from February 1998 to May 1998, and from February 1999, with a short gap in January and February 2000. It was reinstalled in January 2006 with high data acquisition frequency (2 minutes) but the data link was broken beginning of 2007 by an iceberg. The station was reinstalled completely in January 2008.

- **GLOSS-260**: Sao tomé was installed in 1989 by IRD. It is part of the French PIRATA network. Data are transmitted in real-time via the Argos system and processed by the LEGOS. The station is operational and data are available on the Hawaii Sea Level center and on the ROSAME ftp site.

GLOSS 165: CLIPPERTON

LEGOS moored two pressure gauges at Clipperton from January to March 2005. One inside the open sea on the other in the lagoon (Testut at al. 2008).French Navy moored a pressure tide gauge from SHOM at Clipperton from November 2006 to May 2008. It is not easy to install and maintain a real time station at Clipperton, partly for technical reason (large shore and breaking waves) and partly because of security problem.

GLOSS 204: FORT-DE-FRANCE, MARTINIQUE

The GLOSS station list still reports station Nr. 204 to be "Le Robert" (see GLOSS web pages), although there were no plans to install a tide gauge there for years and a proposal to change to Fort-de-France was submitted during the 9th group of experts meeting. We report on Fort-de-France here.

A radar tide gauge was installed by SHOM in October 2005. The station is part of the RONIM network. The tide gauge is operated in collaboration with the local authorities of Meteo-France and the French Navy.

GLOSS 202: CAYENNE-ILES DU SALUT, FRENCH GUYANA

A radar tide gauge was installed in November 2006 by SHOM. The station is included as part of the RONIM network. The tide gauge is operated with the collaboration of the local authority DDE Guyanne.

GLOSS 017: POINTE DES GALETS, LA REUNION

A radar tide gauge was installed in October 2007 by SHOM. The station is included as part of the RONIM network. The tide gauge is operated with the collaboration of the local authority DDE La Réunion.

The data are transmitted in realtime through Internet and contribute to IOTWS.

GLOSS 096: DZAOUDZI, MAYOTTE

A radar tide gauge was installed in November 2008 by SHOM. The station is included as part of the RONIM network. The tide gauge is operated with the collaboration of the local authority DE Mayotte. The data are transmitted in real-time both through Internet and GTS (Eumetsat) and contribute to IOTWS.

3. GLOSS criteria application at the French stations

The table below provides a synthetic view of the station status regarding the GLOSS criteria (IOC 2006, pp. 52).

Station	Type	Digital	Precision	Control	Meteo	Levelling	CGPS	Real-time
La Réunion	Radar	Yes	1 cm	Semestrial	Pressure	2008	No	ADSL
Crozet	Pressure	Yes	1 cm	Annual	Pressure	No	No	ARGOS
Kerguelen	Pressure Radar	Yes	<1cm	Monthly	Pressure	Yes	Yes	ARGOS ADSL GTS
Amsterdam St Paul	Pressure Radar	Yes	<1cm	Annual	Pressure	Yes	No	ARGOS
Dzaoudzi	Radar	Yes	1 cm	Semestrial	Pressure	2008	No	GPRS + GTS
Nouméa	Radar	Yes	1 cm	Semestrial	Pressure	2008	No	No
Dumont D'Urville	Pressure	Yes	1 cm	Annual	Pressure	2008	Yes	ARGOS ADSL
Rikitea	Radar Pressure Float	Yes	1 cm					GTS
Papeete	Radar Pressure	Yes	1 cm			2008	Yes	GTS
Nuku Hiva	Radar Pressure	Yes	1 cm					GTS
Clipperton	Pressure 2006-2008	Yes						
Iles du Salut	Radar	Yes	1 cm	Semestrial	Pressure	2005		No
Fort de France	Radar	Yes	1 cm	Semestrial	Pressure	2005		No
Marseille	Radar + Float	Yes	1 cm	Semestrial	Pressure	2008	Yes	ADSL
Brest	Radar +Acoustic	Yes		Semestrial	Pressure	2006	Yes	ADSL
Sao Tomé	Pressure	Yes	1 cm	Annual	Pressure	2006		ARGOS

4. Sea level data distribution

Hourly sea level data from the French stations Crozet, Saint-Paul, Kerguelen, Brest, Marseille, Papeete, Rikitea, and Nuku Hiva, committed to GLOSS, are provided to the University of Hawaii Sea Level Centre (UHSLC) which acts as GLOSS data centre. Raw data (10 min. sampling) from RONIM stations are retrieved weekly by SHOM and made available directly on SONEL data servers FTP and Web (see www.sonel.org for more details). In addition to the raw data, hourly data are provided after a quality control procedure. The latency of the latter data is about 2-3 months. It should be pointed out that a free data policy is applied for years at SHOM for scientific applications under conditions that the user has to accept before accessing the data:

- to register as user of SONEL ;
- to briefly describe the objectives of the study;
- to provide a copy of any result, either partial or final;
- to acknowledge SONEL and its relevant contributors as source of data;
- to inform SONEL contacts about any data problem;
- to agree not to transfer SONEL data to third parties (Instead of, provide the address of SONEL !).

The GPS data at the tide gauges are also available at SONEL data centre which acts as TIGA data centre for the IGS pilot project. SHOM and LEGOS real-time sea level data are displayed in the IOC sea level monitoring facility (http://www.vliz.be/gauges/). Last years (2007, 2008) of mean sea level data for SHOM stations were provided to PSMSL (http://www.pol.ac.uk/psmsl/). The data from the ROSAME network can be retrieved at the anonymous FTP server ftp.legos.obs-mip.fr/pub/soa/niveau_mer/rosame.

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