

**BRAZILIAN NAVY  
NAVY HYDROGRAPHIC CENTER**



**National Report of Brazil: The GLOSS-Brazil Program**

**22<sup>nd</sup> April, 2009**

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**1.0 Background**

The Diretoria de Hidrografia e Navegação (DHN) is the Brazilian Institution responsible for the coordination of IOC/UNESCO Ocean Services Programmes, such as GLOSS, one of the Brazilian contributions to the GOOS Program (GOOS-BR). The GLOSS-Brazil Implementation Plan, approved in 2004, is coordinated by the Brazilian Navy Hydrographic Center (CHM).

**2.0 The Implementation Plan for the GLOSS-Brazil Program, a Summary**

The main objective of this Plan (PIG) is to join efforts from the most relevant Brazilian Institutions that depend on sea level observations for monitoring, research and their application activities.

The objective of the Plan is to install and maintain 12 (twelve) tide gauges, on an operational basis, along the Brazilian coast and oceanic islands.

In this program, each member has their own responsibilities in maintaining one or more sea level stations as well as making available quality-controlled data for the international sea level centers. The following Brazilian Institutions take part in this Implementation Plan:

1. Diretoria de Hidrografia e Navegação (DHN) - Centro de Hidrografia da Marinha (CHM) - National Coordinator;
2. Instituto Brasileiro de Geografia e Estatística (IBGE)\*;
3. Instituto Oceanográfico da Universidade de São Paulo (IOUSP)\*;
4. Centro de Estudos do Mar da Universidade Federal do Paraná (CEM/UFPR);
5. Coordenação de Programas de Pós Graduação em Engenharia da Universidade Federal do Rio de Janeiro (COPPE/UFRJ)\*\*;
6. Fundação Universidade do Rio Grande (FURG)\*;

7. Gerência Geral do Porto de Ponta da Madeira (Companhia Vale)\*;
8. Terminal Especializado de Barra do Riacho (PORTOCEL);
9. Instituto Nacional de Pesquisas Espaciais (INPE)\*;
10. Instituto de Pesquisas Hidroviárias (INPH);
11. Universidade Federal de Pernambuco - UFPE;
12. Universidade Federal do Pará – UFPA; and
13. Universidade Federal do Espírito Santo – UFES.

\* Institutions that keep stations under operation

\*\* Institution that has contributed for specifications for tidal data processing in 2008

The Brazilian National Oceanographic Data Center (Banco Nacional de Dados Oceanográficos – BNDO), operated by CHM, is responsible for receiving data from GLOSS-Brazil stations and for delivering this data to UHSLC and PSMSL.

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### 3.0 Local Sea level Network

Sea level data has been systematically collected in Brazil during the last seven decades. Within this period, there have been over 300 tide gauge sites in Brazil, although the majority of those data sets were for very short periods (40% a year, 60% a month) and did not have tide staff readings or regular geodetic leveling and, therefore, do not meet GLOSS requirements.

The Ilha Fiscal (maintained by CHM) and Cananeia (maintained by IOUSP) sites can be assumed as the Brazilian GLOSS sites with a fairly continuous long record but without geodetic leveling too. From 2001, IBGE has installed tidal stations for updating national altimetry datum, with reference in Imbituba, so they are intended to be GLOSS stations with geodetic control.

Table 1 lists the situation of the principal and secondary stations of the GLOSS-Brazil Sea Level network, according to the Implementation Plan (2004), which locations indicated in Figure 1.



Figure 1: GLOSS-Brazil Network abril2009

n°	Station	Responsible	Classification	Situation in 2009	Expected Situation in 2010	Expected Situation in 2011	Observations about tide gauges/ meteorological sensors	Observations about GPS / Absolute Gravimetry	Data availability periods
1	Rio Grande (Cais da Praticagem)  Position to be defined	FURG	Secondary	To be installed in 2009	Under evaluation	Operational  Near real time automatic data transmission.  Meteorological sensors	Radar Kalesto/ Encoder SE200 with Logosens datalogger (OTT).  Daily downloads via GPS / software Hydras3 Basic_OTT	----	----
2	Imbituba (Porto de Imbituba)  28° 13,8 S 048° 39,0W	IBGE	Principal	Operational Tide gauge upgrade needed	Operational	Operational	(1) Absolute pressure sensor (Druck/GE 1880, with Squitter datalogger) installed in Aug./2001  (2) Conventional (float/ weekly chart) back-up gauge, installed in June/1998  - Meteorological sensors (atm. pressure/ temp./humidity, wind, precipitation) with Squitter datalogger  - Daily downloads via fixed phone line	- CGPS station installed in Dec./2006 (top of a 20m tower) TG-CGPS distance = 650m TG-CGPS leveling accuracy = 5mm  CGPS week solutions (Bernese 5.0) integrated to the IGS structure  ftp://geoftp.ibge.gov.br/SIRGAS/  - No AG station	- Tides (1) 2001-2009  Historical data (1948-1971) to be integrated to the current time series
3	Cananéia  25° 01,0 S 047° 55,5W	USP	Principal	Operational	Operational	Operational	(1) Convencional (float daily chart)  (2) Radar Kalesto (OTT) with datalogger Campbell CR10x installed in 2008 Under evaluation  Requesting funds for automatic data transmission  - Meteorological sensors	- CGPS station installed in Jan./2006 Belongs to IBGE  CGPS week solutions (Bernese 5.0) integrated to the IGS structure  - No AG station	-Tides (1) 1954-2009

							Vaissala		
4	Rio de Janeiro (Ilha Fiscal)  22° 53,8 S 043° 10,0W	CHM	Principal	Operational	Operational	Operational	(1) Convencional (daily chart)  (2) Radar Kalesto/ (3) Encoder SE200 with Logosens datalogger (OTT) installed in 2008. Daily downloads via GPS / software Hydras3 Basic_OTT	- no CGPS station  - no AG station	Tides: (1) 1963-2009 (GAP in 1979-1980, 1985-1987)  (2) (3) 2008-2009
5	Macaé (Imbetiba/ Terminal da Petrobrás)  22° 23,1 S 041° 46,2W	IBGE	Secondary	Operational  Instalation of a CGPS station  Tide gauge upgrade needed	Operational	Operational	(1) Absolute pressure sensor (Druck/GE 1880, with Squitter datalogger), installed in July/2001  (2) Conventional (float/ daily chart) back-up gauge, installed in Nov./1994, replaced by a (3) weekly chart gauge in 2007  - Daily downloads via phone line  - No meteorological sensors	- no CGPS station  - no AG station	Tides: (1) 2001-2009  (2)(3) 1994- 2008
6	A) Barra do Riacho 19° 50,3 S 040° 03,4W  B) Tubarão Harbor 20° 17,3 S 040° 14,6W It's intended to suggested for Brazilian GLOSS Committee to change to this station It will depend on Vale acceptance too.	PORTOCEL          Vale	Principal          Principal	Site under evaluation          Data transmission under evaluation	????          Operational	????          Operational	- Pressure absolute sensor model Vaissala installed in 2006 but stop to operate by lack of support    - Radar Kalesto/ Encoder SE200 with Logosens datalogger ( OTT ) , installed in 2008 following CHM specifications. Near-real time automatic data transmission - Meteorological sensors (atm pressure, wind, air temp, humidity, solar radiation, precipitation)	- no CGPS station  - no AG station    - no CGPS station  - no AG station	-----    -----
7	Salvador (Capitania)	IBGE	Principal	Operational	Operational	Operational	(1) Acoustic sensor installed in 2004 (stop in 2008)	- CGPS station installed in Apr./2007,	Tides: (1) 2004-2008

	dos Portos da Bahia)  12° 58,4 S 038° 31,0W						(2) a radar sensor (Vegapuls 62) and (3) Encoder with a Sutron Satlink datalogger without modem Installed in Apr./2008 by UHSLC  (4)Conventional (float/ weekly chart) back-up gauge, installed in Dec./2002  - Near-Real time automatic data transmission directly to UHSLC via GOES  - IBGE -Weekly downloads via direct (serial) connection	(top of a 4m mast)  - TG-CGPS distance = 150m  - TG-CGPS leveling not performed yet  - CGPS week solutions (Bernese 5.0) integrated to the IGS structure  ftp://geoftp.ibge.gov.br/SIRGAS  - no AG station	(2) (3) 2008-2009  Historical data (1948-1971) to be integrated to the current time series
8	Fortaleza (Porto de Mucuripe)  03° 42,9 S 038° 28,6W	IBGE	Principal	Operational	Operational	Operational	(1) Radar sensor (Vegapuls 62) and (2) Encoder with a Sutron Satlink datalogger, installed in Apr./2008  (3)Conventional (float/ weekly chart) back-up gauge, installed in Sept./2007  - Near-Real time automatic data transmission directly to UHSLC via GOES  - IBGE -Weekly downloads via direct (serial) connection  - No meteorological sensors	- CGPS station installed in Oct./2008, (rooftop of a two-story building)  - TG-CGPS distance = 600m  - TG-CGPS leveling accuracy = 1mm  - CGPS week solutions (Bernese 5.0) integrated to the IGS structure  ftp://geoftp.ibge.gov.br/SIRGAS  - no AG station	Tides:  (1) 2008-2009  Historical data (1948-1971) to be integrated to the current time series
9	Ponta da Madeira (Cais da Vale) 02° 33,9 S 044° 22,7W	Vale	Secondary	Operational	Operational  Operational Near-real time automatic data transmission	Operational	-(1) Convencional (Bi monthly chart)  -(2) Radar Kalesto/ (3)Encoder SE200 with Logosens datalogger, (OTT) ,will be installed in 2009 following CHM specifications.  Daily downloads via GPS / software Hydras3	- no CGPS station  - no AG station	Tides:  (1) 1998-2009  -----

							Basic_OTT		
							-Meteorological sensors (atm pressure, wind, air temp, humidity)		
10	Ilha da Trindade 20° 30,5S 029° 18,6W To be confirmed at the time of installation	INPE CHM	Principal	To be installed	Under evaluation	Operational	(1) Radar gauge Kalesto (OTT) with Vaissala datalogger  - Meteorological sensors Vaissala (atm pressure, wind, air temp, humidity, solar radiation, precipitation)  -Near-real time automatic data satellite transmission (SCD2 satellite -INPE)	- no CGPS station  - no AG station	-----
11	Ilha de Fernando de Noronha  To be defined at the time of installation	INPE CHM	Principal	To be installed	Under evaluation	Operational	(1) Radar gauge Kalesto(OTT) with Vaissala datalogger  - Meteorological sensors Vaissala (atm pressure, wind, air temp, humidity, solar radiation, precipitation)  -Near-real time automatic data satellite transmission (SCD2 satellite -INPE)	- no CGPS station  - no AG station	-----
12	Arquipélago de São Pedro e São Paulo 00° 55,2S 029° 20,6W	INPE CHM	Secondary	Under evaluation	Operational	Operational	(1) Radar gauge Kalesto(OTT) with Vaissala datalogger  - Meteorological sensors Vaissala (atm pressure, wind, air temp, humidity, solar radiation, precipitation)  -Near-real time automatic data satellite transmission (SCD2 satellite -INPE)	- no CGPS station  - no AG station	

Table 1: GLOSS-Brazil Network abril2009

The criteria used to select these sites were:

- (a) to avoid regions of rough surf or strong currents;
- (b) to avoid fresh water runoff (rivers);
- (c) to be away from very active port operations that may damage the station;
- (d) to be in adequately deep water;
- (e) have a solid foundation (wharf, pier, jetty, etc) for supporting the station;
- (f) to be protected against vandalism;
- (g) ease access for the tide observer and station technicians; and
- (h) gauge site spacing of roughly 1000 km.

#### **4.0 Conclusions and Future Work:**

During the last years, in spite of serious budget constraints, significant progress has been made regarding Brazilian participation in GLOSS, and as part of a national tide gauge network. The milestones are:

- The **GLOSS-Brazil Implementation** Plan was concluded in October 2004 and forwarded to the IOC Secretariat;
- **Tide gauges:** Salvador site was established in December 2002, jointly by CHM and IBGE, and was upgraded with an acoustic gauge, donated from NOAA and the University of Hawaii Sea Level Center (UHSLC), with near real automatic data transmission. In 2008 it was uninstalled and had a new upgrade with a radar and encoder supported by UHSLC;
  - Installed: radar and encoder in Fortaleza (2008) ), with near real automatic data transmission supported by UHSLC and Rio de Janeiro(2008), radar in Cananéia (2008) and ASPS(2008) with near real automatic data transmission, satellite;
- **C-GPS:** Imbituba was established in 2006, Salvador in 2007 and in Fortaleza in 2008. It's intended to install in Rio de Janeiro in 2010 (funds requested);
- **Data Delivery:**
  - Monthly and Annual MSL and observed data, associated documentation has been sent to the PSMSL and UHSLC, by July of the following data-year. Imbituba, Macaé , Ponta da Madeira and Ilha Fiscal data regarding 2007 has already been sent to UHSLC and PSMSL. Cananéia data regarding 2006 has already been sent to UHSLC and PSMSL
  - Ilha Fiscal monthly data has been sent to UHSLC.
  - Salvador, Fortaleza, sites operate in near real time data transmitting directly to UHSLC. SPSP site (under evaluation) operates in near real time transmitting to INPE and the data will be sent annually as soon as INPE has qualified the data;



Tidal stations of Ilha da Trindade, Fernando de Noronha, Rio Grande not installed and Barra do Riacho under evaluation.

- **Capacity building:** In 2003, 2004, 2005, 2006, 2007 and 2008 DHN provides short-term Training Courses on conventional tide gauge operations and maintenance for the Brazilian community. It was included training in radar and encoder in 2008. IBGE and DHN had a short-term course of geodetic control of tidal stations in March 2009;
- **Future Work** will consist in carrying on the GLOSS Brazil Implementation Plan scheduled activities, including the installation of four radar gauges in the next two years (Rio Grande, Ponta da Madeira, Ilha de Fernando de Noronha and e Ilha da Trindade) and probably to change Barra do Riacho by Porto de Tubarão (in which there are Radar and encoder SE200 installed just 53km far from Barra do Riacho); and
- In 2007 Brazil together with, Argentina and Uruguay, took part of a **regional network**, with plans to join the existing **tide gauge** networks, aiming the support to Operational Oceanography in the region (GOOS Regional Alliance in the Upper Southwest and Tropical Atlantic) among other applications (remote sensing, climate monitoring etc.). No practical actions done yet.