

**BRAZILIAN NAVY  
DIRECTORATE OF HYDROGRAPHY AND NAVIGATION  
NAVY HYDROGRAPHIC CENTER**

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

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## **1.0 Background**

Brazil has a vast coastline longer than 8000 km. Understanding variations in sea level is important for protecting life and property, supporting research in environmental sciences, and augmenting social and economic planning. Information regarding tidal variations and departures from the mean sea levels due to weather or ocean currents are utilized by a wide range of interests, such as port operations, fisheries, aquaculture, exploration of mineral resources, coastal development and recreation.

Recognizing the importance of sea level studies, the Diretoria de Hidrografia e Navegação (DHN), the Brazilian institution responsible for the coordination of IOC/UNESCO Ocean Services Programmes, such as GLOSS, called for a review of the Implementation Plan for the GLOSS-Brasil Program, under the aegis of the Global Ocean Observing System (GOOS). The GLOSS-Brasil Implementation Plan was finalized in October 2004.

## **2.0 The Implementation Plan for the GLOSS-Brasil 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 will have 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 complete group of Brazilian Institutions, which are taking part in this Implementation Plan, is composed by:

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);
5. Coordenação de Programas de Pós Graduação em Engenharia da Universidade Federal do Rio de Janeiro (COPPE);
6. Fundação Universidade do Rio Grande (FURG);

7. Gerência Geral do Porto de Ponta da Madeira (Companhia do Vale do Rio Doce - CVRD);
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.

The Brazilian National Oceanographic Data center (Banco Nacional de Dados Oceanográficos – BNDO), operated by CHM, will also receive all data sets related to the GLOSS-Brasil Program. BNDO already maintains a computer-ready data archive, a technical library as well as a warehouse of analog charts and paper documents.

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### **3.0 Local Sea level Network:**

Sea level data has systematically been collected in Brasil since the 1940s. Within this period, there have been over 300 tide gauge sites in Brasil, although the majority of those data sets were for very short periods and did not have tide staff readings or regular geodetic leveling, therefore not being applicable to GLOSS objectives

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.

Table 1 lists the principal and secondary stations of the GLOSS-Brasil Sea Level network, according to the Implementation Plan, which locations as shown in Figure 1:

n°	Station	Responsible	Classification	Situation in 2007	Expected Situation in 2008	Expected Situation in 2009	Observations
1	Rio Grande	FURG	Secondary		To be installed	Under evaluation	There is a plan to install a new radar gauge in 2008
2	Imbituba	IBGE	Principal	Operational	Operational	Operational	Needs gauge upgrade
3	Cananéia	USP	Principal	Operational	Operational	Operational	There is a radar gauge (Kalesto) with quasi-real time data transmission (PSMSL)
4	Ilha Fiscal	CHM	Principal	Operational	Operational	Operational	A radar gauge (Kalesto) will be installed in 2007
5	Macaé (Imbetiba)	IBGE	Secondary	Operational	Operational	Operational	Needs gauge upgrade
6	Barra do Riacho	PORTOCEL	Principal	Under evaluation (UHSLC)	Operational	Operational	A pressure gauge is already installed and its data has been sent to UHSLC to be evaluated
7	Salvador	IBGE-CHM	Principal	Operational	Operational	Operational	There is an acoustic gauge with -real time data transmission (UHSLC)
8	Fortaleza	IBGE	Principal	To be installed	Under evaluation	Operational	A radar gauge (Kalesto) will be installed in 2007 with -real time data transmission (UHSLC)
9	Ponta da Madeira	CVRD	Secondary	Operational	Operational	Operational	Needs gauge upgrade
10	Ilha Trindade	CHM	Principal	To be installed	Under evaluation	Operational	A radar gauge (Kalesto) will be installed in 2007/8 with quasi-real time data transmission
11	Ilha de Fernando de Noronha	CHM	Principal		To be installed	Under evaluation	A radar gauge (Kalesto) will be installed in 2008 with quasi-real time data transmission
12	Estação São Pedro e São Paulo	INPE	Secondary	To be installed	Under evaluation	Operational	A radar gauge (Kalesto) will be installed in 2007 with quasi-real time data transmission

Table 1: GLOSS-Brasil Network



Figure 1: GLOSS-Brasil Network

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 with regard to the Brazilian participation in GLOSS, and as part of a national tide gauge network. The milestones are:

- Salvador site was established in December 2002, jointly by CHM/DHN and IBGE, and was upgraded with an acoustic gauge, donated from NOAA and the University of Hawaii Sea Level Center (UHSLC), with automatic data transmission;
- Imbituba and Macaé (both maintained by IBGE) and Ponta da Madeira (maintained by CVRD) sites had their first data sets sent to UHSLC in 2004, and are now taking part of the GLOSS-Brasil Program. Its data regarding 2006 has already been sent to UHSLC and PSMSL, as well as Ilha Fiscal and Cananéia (now in a quasi-real-time mode);
- Monthly and annual MSL data, and associated documentation has been sent to the PSMSL and UHSLC, by July of the year following the data-year (Ilha Fiscal monthly data has been sent to UHSLC, while Salvador and Cananéia sites operate in real time data);

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- In 2003, 2004, 2005 and 2006 DHN committed resources to provide short-term Training Courses on tide gauge operations and maintenance for the Brazilian GLOSS community;
- There are plans to run training courses on radar gauges for the Brazilian GLOSS community;
- The GLOSS-Brazil Implementation Plan was concluded in October 2004 and forwarded to the IOC Secretariat;
- The existing permanent sea level networks ran by Argentina, Brazil and Uruguay will soon achieve regional status, and as part of the programme for the Regional Alliance in Oceanography for the Upper Southwest and Tropical Atlantic - OCEATLAN, that places higher emphasis on operational observations under the GOOS banner and to the benefit of other applications (remote sensing, climate monitoring etc.); and
- Future Work will consist in carrying on the GLOSS Brasil Implementation Plan scheduled activities, including the installation of five radar gauges (Kalesto) in the next two years (Ilha Fiscal, Fortaleza, Arquipélago de São Pedro e São Paulo, Ilha da Trindade e Ilha de Fernando de Noronha x Rio Grande).