

**BRAZILIAN NAVY
NAVY HYDROGRAPHIC CENTER**

National Report of Brasil: The GLOSS-Brasil Program

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1.0 Introduction

Brasil has a vast coastline longer than 7,400 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.

The Brazilian coast, mostly its southern portion, is often under the influence of synoptic and meso-scale meteorological systems, which induce significant disturbances in the ocean. Such disturbances basically occur in two forms: mean sea level changes (know as meteorological tide) and the generation of surface waves (swell and storm-surge). Both effects can bring serious implications for human activity on the seashore. Port closings due to adverse meteorological conditions, coastal erosion, destruction of seaside buildings, and anomalous flooding are but a few of the direct implications found in the event of synoptic and sub-synoptic meteorological systems passing by the coastal zone. Added to the problems related to natural coastline variations, which are commonly seen in the Brazilian shore, is the anthropic vector. Due to the fact that many of the coastal cities base their economies on beach tourism or the use of certain areas for development of other activities (ports, industries), the coastal zone have felt the direct effects of the demographic growth for years, with the increase in coastal occupation and the multiplication of conflicts (Marone et al., 2001).

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 by 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);
8. Terminal Especializado de Barra do Riacho (PORTOCEL);
9. Instituto Nacional de Pesquisas Espaciais (INPE), to be confirmed ; and
10. Instituto de Pesquisas Hidroviárias (INPH), to be confirmed.

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 yet to be digitized

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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 though can be assumed as GLOSS sites, with a fairly continuous long record since that date. 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 2004	Expected Situation in 2005	Expected Situation in 2006	Expected Situation in 2007
1	Rio Grande	FURG	Secondary	Under evaluation	Under evaluation	Operational	Operational
2	Imbituba	IBGE	Principal	Operational	Operational	Operational	Operational
3	Cananéia	USP	Principal	Operational	Operational	Operational	Operational
4	Ilha Fiscal	CHM	Principal	Operational	Operational	Operational	Operational
5	Macaé (Imbetiba)	IBGE	Secondary	Operational	Operational	Operational	Operational
6	Barra do Riacho	PORTOCEL	Principal	Under evaluation	Under evaluation	Operational	Operational
7	Salvador	IBGE-CHM	Principal	Operational	Operational	Operational	Operational
8	Fortaleza	IBGE	Principal		To be installed	Under evaluation	Operational
9	Ponta da Madeira	CVRD	Secondary	Operational	Operational	Operational	Operational
10	Ilha Trindade	CHM	Principal		To be installed	Under evaluation	Operational
11	Ilha de Fernando de Noronha	CHM	Principal			To be installed	Under evaluation
12	Estação São Pedro e São Paulo	INPE	Secondary		To be installed	Under evaluation	Operational

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.

The Salvador site was established in December 2002, jointly by CHM/DHN and IBGE. During the first semester of 2003, the structure to support the tide gauge in the Trindade island was also made, with plans for the installation of an automated tide gauge, which could provide fast delivery data for satellite altimeter calibration coming soon.

In October 2004, the first automated tide gauge, donated from NOAA and the University of Hawaii Sea Level Center (UHSLC), with automatic data transmission, has been installed in Salvador-Brazil. Imbituba and Macaé (both maintained by IBGE) and Ponta da Madeira (maintained by CVRD) sites had their data sets regularly sent to UHSLC in 2004, and are now taking part of the GLOSS-Brasil Program.

4.0 Conclusions and Future Work:

During the last two 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 became operational in December 2002, as a result of a joint effort between CHM and IBGE, and in 2004 it became a real time station, thanks to the donation of a new generation tide gauge by NOAA
- In April 2003 and 2004, DHN committed resources to provide short-term Training Courses on tide gauge operations and maintenance for the Brazilian GLOSS community;
- During the first semester of 2003, 03 cruises ran by DHN vessels, and with local financial resources made available, were instrumental to prepare the gauge basis for installing a new site on Trindade Island;
- The GLOSS-Brasil Implementation Plan was concluded in October 2004 and will soon be forwarded to the IOC Secretariat, seeking for your approval;
- There are plans to join the existing tide gauge networks ran by Argentina and Uruguay with the Brazilian one, under a regional network and in 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.); and
- Future Work will consist in carrying on the GLOSS Brasil Implementation Plan scheduled activities.

6.0 References

Marone et al., 2001. Quijote - a C-GOOS pilot project progressing to the operational stage. The Goos Data Products And Services Bulletin, Paris, France, v. 2, p. 1-8, 200.

The GLOSS-Brasil Implementation Plan, DHN, 2004.