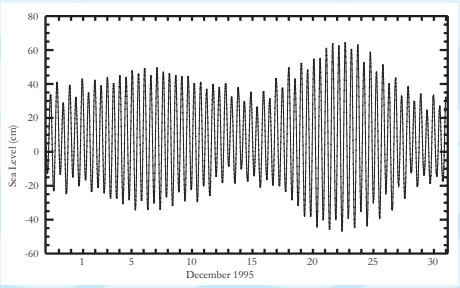
GLOSS

The Global Sea Level Observing System

INTERGOVERNMENTAL OCEANOGRAPHIC COMMISSION

Why Measure Sea Level?

People who live on the coast are familiar with the regular rise and fall of sea level caused by the tides. Many areas also experience rises due to air pressure and winds. If these storm surges combine with high tides there may be extensive flooding and damage. How can we plan to respond to these events?



Spring-Neap tidal variations at St. Helena in the South Atlantic

Flooding in New Brighton, NW England caused by a storm surge

Maldives International Airport only 1.5 metres above sea level

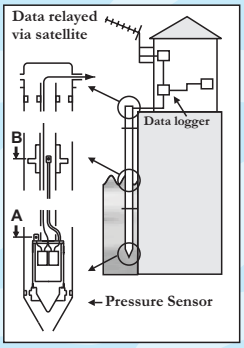
Monitoring Sea Level

Sea levels need to be monitored by means of 'tide gauges' at many locations along the world's continental coastlines, especially near to centres of population.

Measurements can be made in the deep ocean by bottom pressures obtained from sea bed devices and by satellite radar altimetry.

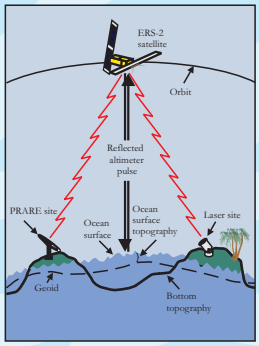
Float gauge in Venice

Acoustic gauge in Australia



Schematic of pressure sensing system at Ascension in the South Atlantic

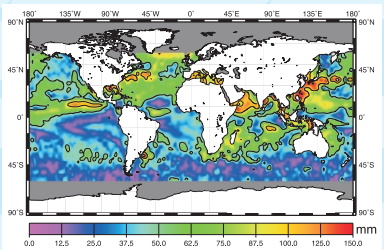
Bottom pressure sensing instrument MYRTLE, being deployed in the South Atlantic



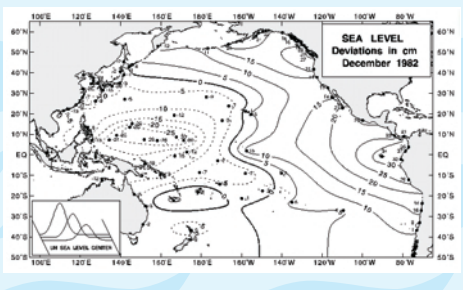
Schematic showing satellite monitoring system

Seasonal and Interannual Changes

The deep ocean changes tell us how the global 'ocean weather' varies from day to day, from season to season as its 'heat content' changes through the year, and from one year to the next.



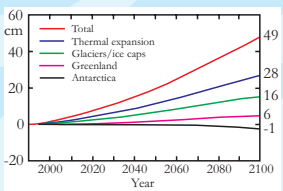
Topex map showing amplitude of the annual cycle of sea level (mm)



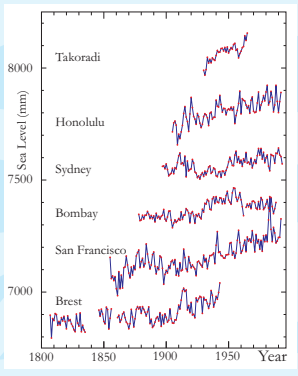
Some of the largest interannual changes in level occur in the Pacific every 3-4 years as a consequence of El Nino events. These can be seen in maps of tide gauge sea level anomalies.

Long Term Changes in Sea Level

On longer timescales, the Intergovernmental Panel on Climate Change (IPCC) has reviewed that, on the balance of available evidence, levels have risen globally by approximately 10-25cm during the past century, and may increase by typically 50cm in the next.



Projected individual contributions to global sea level change in the next century



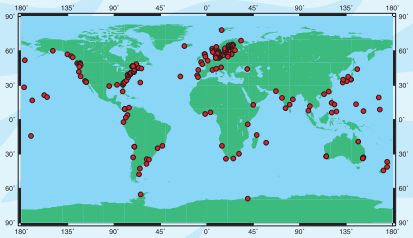
Long term sea level records from each continent

Such rises could add to problems of protecting against coastal flooding both at continental coastline sites and at ocean islands only a few metres above sea level.

The GLOSS Programme

The Global Sea Level Observing System (GLOSS) is a programme coordinated by the IOC for the establishment of global and regional networks of sea level stations, for the purposes of providing information essential to international oceanographic research programmes, including those dedicated to the study of aspects of climate change. GLOSS is a major contributor to IOC's Global Ocean Observing System (GOOS).

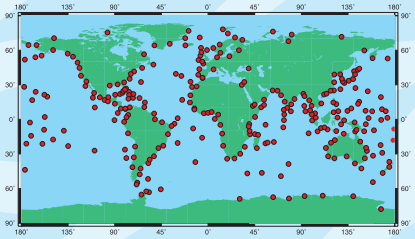
GLOSS is also concerned with the continuation of sea level recording at sites with very long historical records, whether those sites are formally in the GCN or not. Most of these stations, known collectively as the GLOSS Long Term Trends (LTT) set, are in the northern hemisphere.



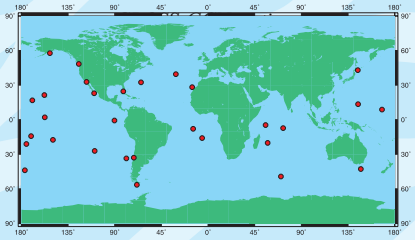
GLOSS-LTT stations

Within the World Climate Research Programme (WCRP), as the observation phase of the World Ocean Circulation Experiment (WOCE) comes to an end, planning for the next activity (the CLIVAR or Climate Variability and Predictability programme) is now commencing, emphasising the on-going need for the sea level data provided by GLOSS for ocean circulation (OC) and climate change (LTT) studies.

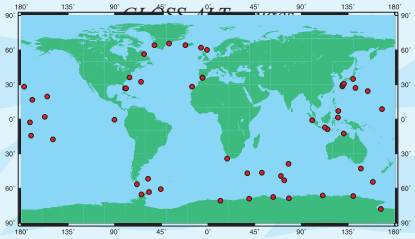
The main component of GLOSS is the 'GLOSS Core Network' (GCN) which comprises approximately 290 stations worldwide of which most are now operational.



GLOSS also concerns itself with the establishment of gauges at selected locations, mostly islands, for ongoing calibration of altimeters (the GLOSS-ALT set)....



....and with sites of special interest for ocean circulation studies (the GLOSS-OC set).



GLOSS-OC sites

Regional Developments

GLOSS has stimulated the development of several regional networks of gauges with greater spatial density than that provided by the GCN, to serve the particular oceanographic interests of those regions. Exampes include the IOCARIBE network in the Caribbean, and MedGLOSS in the Mediterranean and Black Seas. Special regional studies are also in progress for the Tropical Pacific, the Indian and the Southern Oceans.

National Activities

GLOSS aims to contribute to the activities of national agencies by improving the standards for sea level recording around the world. At the local level, charting and navigation in harbours requires immediate information in sea level, whereas harbour design depends on the statistics of sea level variations, measured over several years. Coastal defences against flooding are also designed on the basis of long-term statistics. Datum definitions for both hydrographic charts and land surveys are based on analysis of long periods of sea level. In addition, planning for coastal zone management, for example within the GOOS Coastal Module, depends on long term estimates of local sea level change.

Training

GLOSS has organised a number of workshops and training courses on the techniques of tide gauge operations, especially in environmentally hostile areas. Over a dozen workshops have been held in recent years in different countries and in different languages. Special attention has been to the need for the provision of high quality data to GLOSS.

Most recently, workshops have been held on the use of advanced geodetic devices, and especially the Global Positioning System (GPS), for the monitoring of rates of vertical land movement at gauge sites

GLOSS Data Availability

Data from GLOSS tide gauges are available from national oceanographic data centres and from the following international sea level centres:

Permanent Service for Mean Sea Level - see below.

University of Hawaii Sea level Center
E-mail caldwell@kapua.soest.hawaii.edu
Web: http;//www.soest.hawaii.edu/UHSLC/

National Tidal Facility (Australia) Southern Ocean Centre
e-mail: motid@pacific.ntf.flinders.edu.au
Web: http://www.ntf.flinders.edu.au

GLOSS sea level data and information on each gauge in the GLOSS Core Network are also contained in a CD-ROM available from the PSMSL.

Further Information on GLOSS

GLOSS-related sea level research extends into other IOC programmes, especially those concerned with the ocean circulation and coastal evolution. For example, GLOSS activities are relevant to the Climate, Coastal, Operational Services and Health of the Ocean Modules of GOOS. Information on GOOS may be obtained from the GOOS Project Office at IOC.

More information on GLOSS and IOC's other sea level related activities, may be obtained from the PSMSL and IOC at the following addresses:

Permanent Service for Mean Sea Level - see below

GLOSS Technical Secretary
Intergovernmental Oceanographic Commission
1 rue Miollis
Paris 75732 Cedex 15
France
E-mail: t.aarup@unesco.org

PSMSL Permament Service for Mean Sea Level

The Permanent Service for Mean Sea Level (PSMSL) was established at Bidston Observatory in 1933 as an international data centre for mean sea level. Today their responsibilities are the collection, publication and distribution of data, and the analysis and interpretation of this data. They also give information and advice on practical aspects of sea-level measurement and data reduction.

The data bank at present holds series from over 1900 stations, and the PSMSL has a policy of actively seeking new source of data and the number of countries and stations increase annually.

Permanent Service for Mean Sea Level
Proudman Oceanographic Laboratory
Joseph Proudman Building
6 Brownlow Street
Liverpool
L3 5DA
United Kingdom
e-mail: psmsl@pol.ac.uk
Web: http://www.pol.ac.uk/psmsl/sea_level.html