Gauges in the South Atlantic

The following provides a brief overview of South Atlantic sea level recording by POL, which constitutes the major contribution by the UK to the Global Sea Level Observing System (GLOSS) of the Joint Technical Commission for Oceanography and Marine Meteorology (JCOMM) of the Intergovernmental Oceanographic Commission (IOC) and World Meteorological Organisation (WMO). At the time of writing, plans are advanced for the inclusion of gauges at Gibraltar and South Georgia into the network, and more detailed information of these developments will be included in further NTSLF reports.

Gauges in the South Atlantic

The ACCLAIM (Antarctic Circumpolar Current Levels by Altimetry and Island Measurements) programme in the South Atlantic and Southern Oceans consists of measurements from coastal tide gauges and bottom pressure stations, together with an ongoing research programme in satellite altimetry.

Phase 1 of ACCLAIM Coastal Gauges

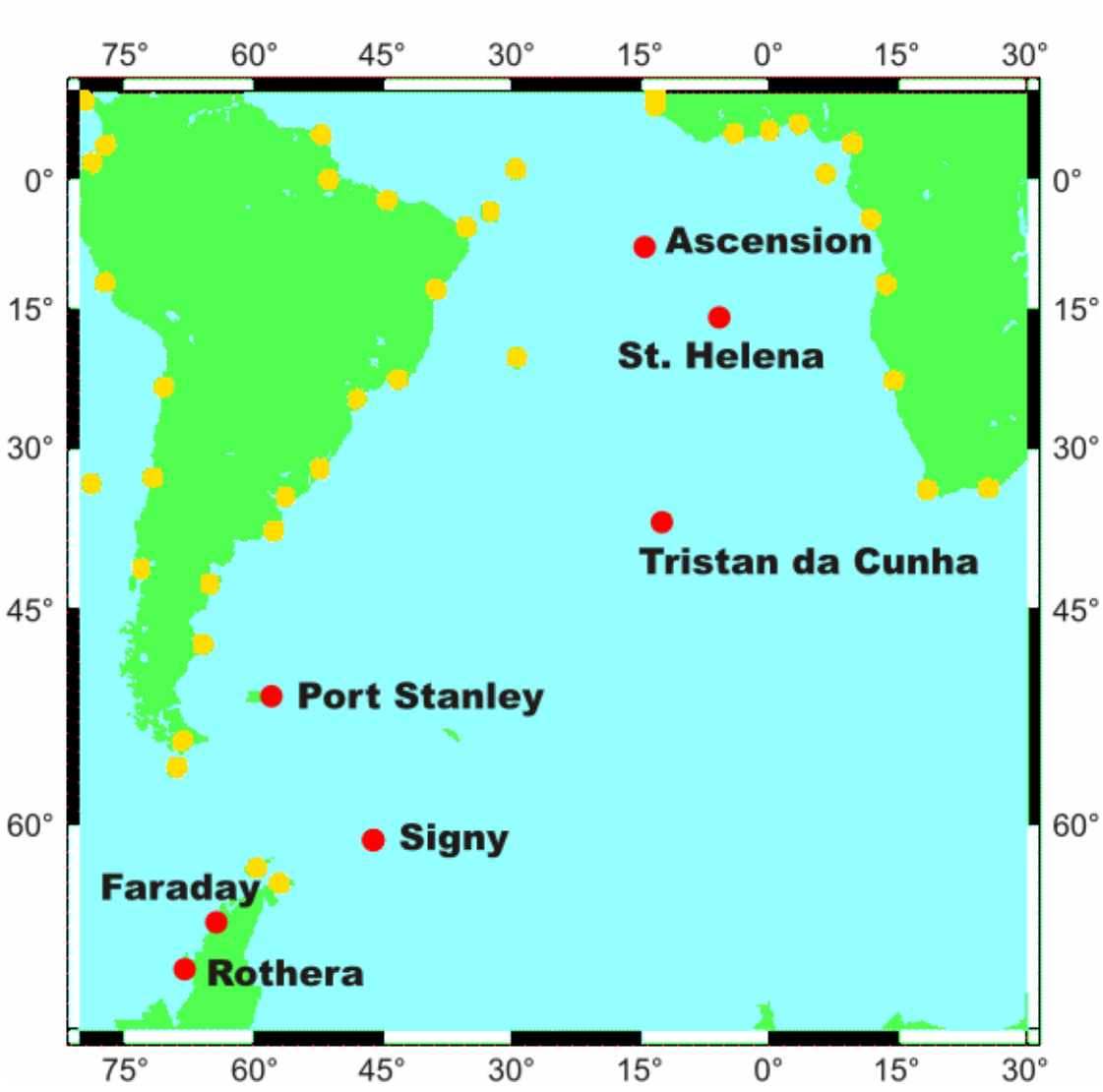
In Phase 1 of ACCLAIM from 1983, measurements at coastal tide gauge sites took the form of sub-surface pressure (SSP) measurements (units of pressure e.g. mbar) rather than sea level (units of length e.g. centimetres). SSP is here defined as the total, measured pressure recorded by a sub-surface pressure transducer, a measurement which includes the pressure load from the atmosphere as well as from the water column. It is absolutely essential that any user of ACCLAIM data realises which data type (either SSP or sea level) is being analysed.

The Phase 1 coastal SSP data were acquired in different ways (e.g. with a diver-replaced Aanderaa pressure gauge at Ascension, or with a Digiquartz in the sea sensor at St. Helena, see Spencer et al. 1993 for details) and with different pressure integration periods (e.g. quarter hour, half hour, one hour). For some data sets, the original data have been filtered to give one hour sampling. However, common to all records is an uncertainty connected with potential offset biases and drifts in the pressure sensors. At some sites (e.g. St. Helena) extensive tide pole data are also available and biases and long term drifts in the sensor data may eventually be rectified (this is under study at present). However, the drifts in general mean that in most cases the records should not be used, without further careful attention in particular studies, for the study of timescales seasonal or longer.

Phase 2 of ACCLAIM Coastal Gauges

From around early 1993, the gauges at several sites were replaced by 'B gauges' which record SSP, air pressure and sea level. These gauges have precise datum control and are used to provide long term sea level change data to the PSMSL.

Some Phase 1 and all Phase 2 coastal data will contain ancillary information on air pressures and sea temperatures from ACCLAIM sensors. Several of these records contain large gaps. However, POL has collected extensive sets of such ancillary data from meteorological agencies for its own analysis purposes, and should be able to provide further advice.



Red dots on the above map indicate sites of POL's South Atlantic coastal tide gauge network (ACCLAIM), while the yellow dots show gauges (not necessarily operational) committed to the GLOSS programme by other countries in the region.

At the present time the tide gauge sites at Ascension, St. Helena and Port Stanley can be considered to be complete 'Phase 2' sites, while Tristan, Signy and Rothera remain 'Phase 1' (i.e. simple pressure transducer sites). At Faraday (which contains the longest tide gauge record in Antarctica and which is now called Vernadsky and operated by groups from the Ukraine) there is a conventional float gauge together with a 'Phase 1' transducer.

Information on data presented below is from the latest series collected. More information on this and previous data collected can be found at the ACCLAIM website:

http://www.pol.ac.uk/psmslh

There are three directories: bprs, phase1 and phase2. Each has an inventory file, giving more information about the tide gauges.

Rothera Tide Gauge

Latitude : 67° 34.3' S Longitude : 068° 07.7' W

Instrument type : Sub-surface pressure gauge

Site of Gauge: The tide gauge is mounted in a sea water well, approximately 100 metres shorewards of the main jetty.

Data information
The series has been quality controlled and any problems have been flagged.

05/12/1998 – 02/10/1999

Other parameters:
Sea temperature, Logger temperature, Air temperature, Barometric pressure, Sub surface (total) pressure, Half tide (total) pressure

Completeness Index:
1998 98.8% * but 91 % of the total record is corrupted. Therefore, index should read 7.4%
1999 75.1%

Full tide pressure failed at : Scan 27617
Half tide pressure ended at : Scan 28894 (End of file)
Air pressure failed at : Scan 28885
Sea temp failed at : Scan 27996
Logger temp failed at : Scan 28884 (poor record after scan 28866)
Half tide temperature failed at : Scan 28890

The Logger started to fail in October 1999. Bad data points have been set to 0.000 and flagged after the full tide sensor failed. The offset between the half tide pressure and the atmospheric pressure varies between 8.4 mb at the start of the record, increasing to 10.5 mb towards the end. The offset increases steadily and may be a simple sensor drift. Comparing the half tide and full tide sensors shows a similar magnitude drift, so it looks like the problem is with the half tide sensor.

Signy (South Orkney Islands)

Latitude : 60° 42.0' S Longitude : 045° 36.0' W

Instrument type : Digiquartz pressure sensor

Site of Gauge: Data logger in nearby British Antarctic Survey building.

Data information
The series has been quality controlled and any problems have been flagged.

19/11/1999 – 30/03/2000

Tristan da Cunha

Latitude : 37° 03.0' S Longitude : 012° 18.0' W

Instrument type : Digiquartz pressure sensor

Site of Gauge: Tristan da Cunha harbour (data logger in the nearby settlement of Edinburgh).

Data information
The series has been quality controlled and any problems have been flagged.

09/01/1998 – 28/12/1998

Other parameters:
Sea temperature, Logger temperature, Air temperature, Barometric pressure, Sub surface (total) pressure, Half tide (total) pressure, Total sub-surface pressure -1000.

Completeness Index:
1998 39.7% (barometric pressure available for 96.6%)

First 1100 scans of half tide sensor do not look good
Half tide sensor fails at scan 10558 (day 119, 20.625 hours)
Full tide sensor fails at scan 13896 (day 154, 14.875 hours)

Some data in the original file had glitches in the day channel which needed correction. The early half tide data (first 1100 scans) do not look good. After scan 100, comparing the level of the half tide point with the barometer record shows the sensor to be very stable (variation <= +/- 0.5 mbar) with no apparent drift.

The full tide sensor does drift slightly, relative to the half tide (1 mbar in 7000 scans = 73 days). In general, however, the agreement between the two sensors is superb.

There are air pressure and temperature data available after the tide gauge failed.

Ascension

Latitude : 07° 54.0' S Longitude : 014° 23.0' W

Instrument type : B gauge (pressure gauge)

Site of Gauge: English Bay

Data information
The series has been quality controlled and any problems have been flagged.

14/06/2000 – 02/04/2001
Recording frequency 15 minutes

Other parameters:
Sea temperature, Air temperature, Barometric pressure, Sub surface (total) pressure, Half tide (total) pressure

Port Stanley-B

Latitude : 51° 41.0' S Longitude : 057° 49.0' W

Instrument type : B gauge (pressure gauge)

Site of Gauge: Eastern end of Port Stanley harbour by the 'floating warehouses'.

Data information
The series has been quality controlled and any problems have been flagged.

18/11/2000 – 05/05/2002
Recording frequency 15 minutes

Other parameters:
Sea temperature, Air temperature, Barometric pressure, Sub surface (total) pressure, Half tide (total) pressure
Residuals also look ok but with a lot of seiche-type HF noise.

St. Helena

Latitude : 15° 55.0' S Longitude : 005° 43.0' W

Instrument type : B gauge (pressure gauge)

Site of Gauge: Jamestown Harbour, by the landing steps.

Data information
The series has been quality controlled and any problems have been flagged.

20/06/2000 – 02/10/2001
Recording frequency 15 minutes

Other parameters:
Sea temperature, Air temperature, Barometric pressure, Sub surface (total) pressure, Half tide (total) pressure

This file goes up to October 2001, after which a rock fall destroyed power supplies to the gauge so that there will be a gap until August 2002. In addition, the gauge was taken out by the local people and reinstalled in the gap. Special attention must be paid to the reinstalled datum in the next batch of data.

Faraday / Vernadsky

Latitude : 65° 15.0' S Longitude : 064° 16.0' W

Instrument type : Float gauge

Site of Gauge: Located in tide gauge hut near to camp.

Data information
The series has been quality controlled and any problems have been flagged.

Jan 2002 - Dec 2002
Hourly values of sea level were read off the paper charts and entered into computer files.