UK Tide Gauge Status Report – National contribution to GLOSS

The UK National Tidal & Sea Level facility (NTSLF) comprises the UK National Tide Gauge Network, geodetic networks for monitoring vertical land movements, and gauges in the British Dependent Territories of the South Atlantic and Gibraltar.

The UK National Tidal Gauge Network is owned and funded by the Environment Agency. Associated scientific research is funded by the National Environment Research Council (NERC) and the Department for Environment, Food & Rural Affairs (Defra).

The NTLSF is operated by the Proudman Oceanographic Laboratory (POL) and the British Oceanographic Data Centre (BODC). Additional partners include the British Isles GPS Archive Facility (BIGF).

UK

The UK National Tide Gauge Network consists of 45 gauges around the UK coast. The majority of these are bubbler pressure gauges. Data from these gauges are made freely available to registered users of the NTSLF website (www.pol.ac.uk/ntslf), both in real time and as delayed-mode quality-controlled data. The real-time data is incorporated into models run at the UK Met Office Storm Tide Forecasting Service (STFS) and then used to issue flood warnings to the EA.

Three of the 45 sites are committed to GLOSS. At Lerwick (GLOSS No. 236) there are two full-tide and a half-tide bubbler gauge installed. In July 2007, the wind vane and anemometer were replaced, so now wind speed and direction are also being recorded. The main gauge at Newlyn (GLOSS No. 241) is a full-tide bubbler gauge, but there is also a half-tide bubbler gauge (for datum checks) and a potentiometer attached to a Munro float gauge. Charts are collected every three months and archived at BODC. At Stornoway (GLOSS No. 238), there are two full-tide and a half-tide bubbler gauge installed. All sites were visited in 2007 to carry out general maintenance and, in 2008, visits were made to Newlyn and Stornoway.

Real-time data are available on the NTSLF website for all the 45 stations. Additionally, some stations are available on the North West Shelf Operational Oceanographic System (NOOS) website and the Sea Levels along the European Atlantic Coastline (SLEAC) website. Fast delivery data for the three GLOSS stations are sent every week to the GLOSS fast centre at the University of Hawai`i Sea Level Center (UHSLC). Fully quality-controlled delayed-mode data from all the UK sites are available on the NTSLF website (registration is required). The GLOSS sites are also available from the BODC website
(http://www.bodc.ac.uk/data/online_delivery/international_sea_level/)
with no registration needed. Delayed-mode data will also be available from the European Sea Level Service (ESEAS) delayed-mode data portal.

The NTSLF also monitors sea level at strategic sites in the South Atlantic, Antarctica and Gibraltar. Even though most of these gauges are committed to GLOSS, the funding comes directly from the POL science budget and has to be competed for every few years.

Three of the UK tide gauges are set up as tsunami warning stations (Holyhead, Lerwick and Newlyn) as part of UK (Environment Agency), EU (TRANSFER) and IOC (Mediterranean and NE Atlantic) programmes. The table below shows the systems installed at each site. The analogue sensor interface generates 10 Hz data, averaging this data over a user-defined period of either one or ten seconds. The resultant high-frequency averaged data are then transferred to the data logger for processing. The data logger transmits a user selectable combination of 10 Hz, one second, ten second and integrated period data over the internet connection. Real-time data are currently displayed on the Sea Level Station Monitoring Facility website (hosted by Flanders Marine Institute – VLIZ, hereafter abbreviated as SLSMF), the Sea Levels along the European Atlantic Coastline (SLEAC) website and the POL website.

	Installed	Communications	Sensors
Holyhead	13/01/07	GPRS	2 x Underwater mounted pressure transducers 1 x Surface mounted pressure transducer connected to the bubbler gauge pressure point line. 1 x Vega radar operating since Sept 07 A Kalesto was in operation for 9 months.
Lerwick	08/10/07	GPRS Changed to ADSL broadband on 15 Aug 08	2 x Underwater mounted pressure transducers 2 x Surface mounted pressure transducers connected to the bubbler gauge pressure point lines.
Newlyn	10/07/08	GPRS	2 x Surface mounted pressure transducers connected to the bubbler gauge pressure point lines. One of the surface transducers will eventually be underwater mounted.

Equipment installed at tsunami monitoring stations

Gibraltar

Gibraltar (GLOSS No. 248) data are sent via GTS from a radar gauge, and a full-tide and mid-tide pressure transducer. Gibraltar is also set up as a tsunami monitoring station, with a different type of radar gauge and pressure transducer. Real-time data are available on the NTSLF, MedGLOSS, SLEAC and SLSMF websites; fast delivery data are sent to UHSLC.

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. Data collected at, and information on, the sites can be found at the ACCLAIM website: www.pol.ac.uk/psmslh

Ascension (GLOSS No.264)
All-in-one 'B' pressure gauge, Kalesto radar gauge with Orbcomm, temperature. Initial tests with the BGAN system were successful and a second phase of testing has begun following a visit in April 2009. Real-time data are available on the NTSLF website and plotted on the SLSMF website. Fast data are sent to UHSLC.

Port Stanley (GLOSS No.305)
"All-in-one" gauge and a radar gauge, barometric pressure and water temperature. Everything is working as expected at Port Stanley. Real-time data are available from the NTSLF website and the SLSMF. UHSLC also has fast data.

Signy (GLOSS No.306)
The subsurface pressure gauge at Signy has been in operation since 1988. There are two pressure sensors and a water temperature sensor. A visit was made in 2007 to inspect the tide gauge and install new batteries. The pressure sensors stopped working in November 2007.

South Georgia (GLOSS No.187)
A completely new installation was carried out in 2007 at King Edward Point in South Georgia. The gauge consists of two KPSI pressure sensors, a water temperature sensor and a Portux Linux system, which emails back one-minute data samples every five minutes. The system was mostly installed by local BAS personnel prior to POL arriving, but a problem with the first sensor interface board was fixed during the POL visit by replacing the module. As of May 2009, power and network problems have interrupted transmissions from KEP. We are liaising with the electrical engineer to try and resolve the issue but have so far been unsuccessful.

St. Helena (GLOSS No.264)
There is currently no functioning gauge at St. Helena, due to harbour works. Progress is being made with the plans for a new installation now that the cliff stabilisation works have been completed.

Tristan da Cunha (GLOSS No.266)
There is a long record (1984-1998) of subsurface pressure measurements from Tristan da Cunha. A new gauge is planned, but installation is complicated by limited access to the site.

Vernadsky (GLOSS No.188)
The float gauge at Vernadsky has been in operation since 1958 and is the longest record in Antarctica. Charts continue to be sent regularly to POL. There are also pressure sensors at the site and atmospheric pressure and water temperature are being recorded. Real-time data from the pressure sensors are available on the NTSLF website.

Africa and Western Indian Ocean

PSMSL and BODC work with IOC to provide access to delayed-mode quality-controlled data from gauges that form part of the ODINAFRICA and Indian Ocean Tsunami Warning System. These data are of benefit to GLOSS.

Djibouti, Djibouti
The site continues to operate smoothly. Real-time data are available from the SLSMF, and quality-controlled data can be obtained from the GLOSS website. In April 2008, two pressure sensors were added and the GPS antenna was replaced.

Inhambane, Mozambique
The tide gauge has been relocated following reconstruction work to the pier at the site. The reinstalled gauge has failed to operate properly, and a new data logger has been sent in an attempt to rectify the problem.

Lagos, Nigeria
A radar gauge was installed in August 2008. Real-time data are available from SLSMF, although transmissions often fail due to local power issues.

Nouakchott, Mauritania
The pressure sensors at the site were replaced in April 2008, as the original sensors had corroded. Real-time data are available from SLSMF. There is a noticeable lag between the radar and pressure data, perhaps as a result of a blockage in the stilling well.

Pemba, Mozambique
The site continues to be fully operational. Real-time data are available from SLSMF, and quality-controlled data from GLOSS.

Pointe Noire, Republic of Congo
Data from the fitted radar gauge have been transmitted via DCP since September 2008. A pressure sensor was added in April 2009. Real-time data are available from SLSMF.

Port Sonara, Cameroon
A radar gauge and two pressure sensors were installed in June 2008. Not long afterwards, the station ceased to transmit data due to a faulty GPS antenna. The defective item was replaced in December 2008, and data from the intervening period were recovered from the logger. Since then, transmission has continued smoothly, with real-time data available from SLSMF.

Takoradi, Ghana
The site has transmitted data since 2007, with a few breaks due to various technical issues. Transmission ceased in mid-April 2009, although should recommence once the replacement battery that has been sent to the site is installed.

UK territories gauges

South Caicos – A NOS acoustic gauge was in operation from 1991 to 1992, maintained by Florida Institute of Technology, but no information has been available since 1992.

Diego Garcia – Operated by UHSLC, real-time and fast data available from UHSLC. Real-time data are also available from the SLSMF.

Bermuda – The US National Ocean Service (NOS) have been operating an acoustic gauge since 1992. Real-time data are available from NOS and UHSLC and fast data are available from UHSLC. Real-time data are also available from the SLSMF.

Vertical land movement at tide gauges

Ten of the UK National Tide Gauge Network sites have CGPS at, or close to the tide gauge. These sites include the three GLOSS sites, Lerwick, Newlyn and Stornoway. Absolute gravity measurements are made every year at Lerwick and Newlyn, as well as at Aberdeen.

Work done by colleagues at the Institute of Engineering Surveying and Space Geodesy, University of Nottingham, presented in 2008 at the PSMSL Interdivision Session at the European Geophysical Union General Assembly (Teferle et al, 2008), showed Absolute Gravity-aligned CGPS estimates of vertical land movements in the UK with an emergence/subsidence rate of between -1.28mm/yr at Lowestoft to +0.00mm/yr at Aberdeen.

Gibraltar: GPS has been installed at the tide gauge by Richard Bingley of the University of Nottingham. Problems with the telephone line quality mean that the data transfer will need to be changed to the broadband system, which will occur in the week beginning 11 May 2009.

Ascension: DORIS beacon 6.5km away (ARIANE Tracking Station), GPS about 5 km away
St Helena: DORIS 5.9 km away (Meteorological station), no GPS
Tristan da Cunha: DORIS beacon 123 m away (Radio station), no GPS
Falklands: No DORIS, two GPS sites about 2 and 4 km away (the one, ~4 km away, is an IGS site so the data is readily available)
Rothera: DORIS beacon less than 100m away (British Antarctic Survey)

GPS data from Aberdeen, Newlyn, North Shields and Sheerness are contributed to the European Sea Level Service (ESEAS) and the International GNSS Service (IGS) Tide Gauge Pilot Project (TIGA). GPS data from Newlyn are also contributed to the EUREF Permanent Network (EPN). Data from the GPS stations at Ascension and Port Stanley are sent to the IGS.

Training

POL/PSMSL has hosted a number of visitors and provided training since June 2007, some funded by the IOC Indian Ocean Tsunami Warning System Fellowship programme. Visitors came from Aden, the Republic of the Congo, Egypt, India, Indonesia, Iran, Mozambique, Nigeria, Pakistan and Sri Lanka.

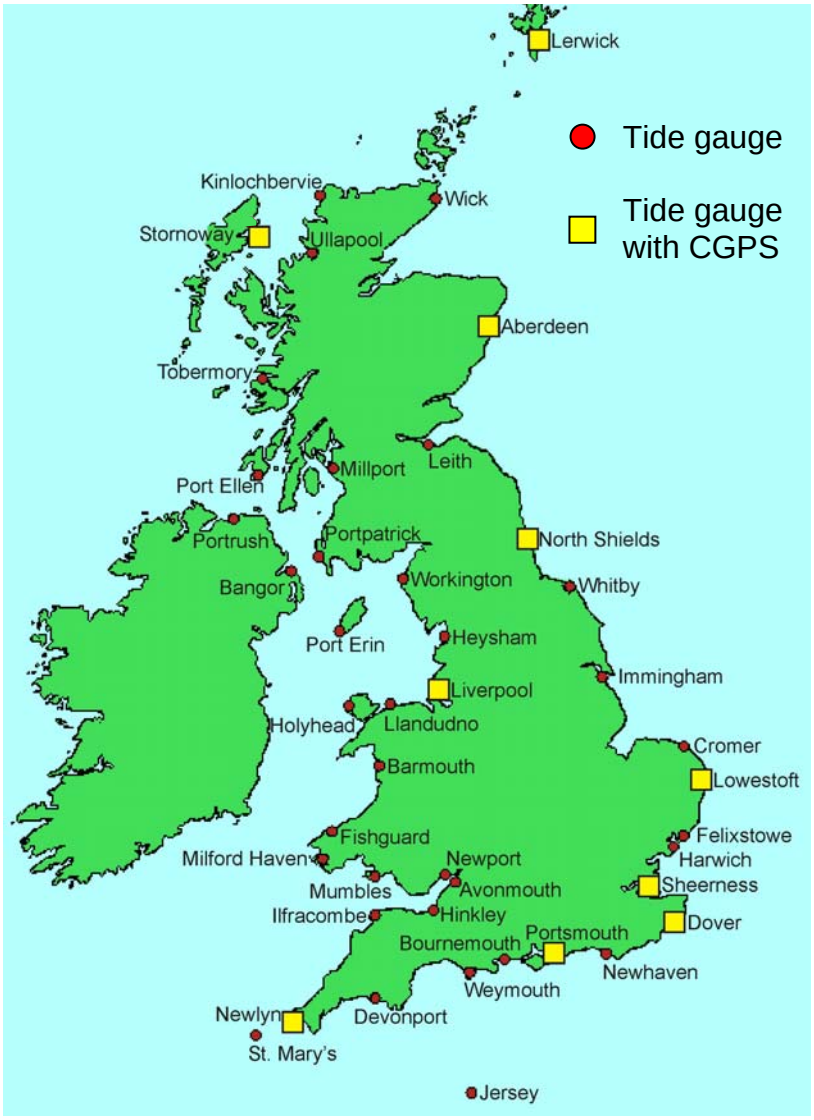
Summary

GLOSS No.	Station name	Types of Gauge(s)	VLM	Delayed mode data available	Real time data available
187	South Georgia	2 pressure sensors		N	N
188	Vernadsky	Float gauge		Y	N
		2 pressure sensors		Y	Y
236	Lerwick	2 full tide and a half tide bubbler gauge	AG, CGPS	Y	Y
238	Stornoway	2 full tide and a half tide bubbler gauge	CGPS	Y	Y
241	Newlyn	Full tide and a half tide bubbler gauge	AG, CGPS	Y	Y
		Potentiometer attached to a Munro float gauge		Y	Y
248	Gibraltar	Radar gauge	CGPS	Y	Y
		2 pressure sensors		Y	Y
263	Ascension	All-in-one pressure gauge	DORIS / GPS	Y	Y
		Radar gauge		Y	Y
264	St. Helena	Offline	DORIS	Y	N
266	Tristan da Cunha	Offline	DORIS	Y	N
305	Stanley, Falkland Is.	'B gauge'	2 GPS sites	Y	N
		All-in-one pressure gauge		Y	Y
		Radar gauge		Y	Y
306	Signy, South Orkney Ils.	Offline		Y	N

References

Teferle F N, Bingley R M, Williams S D P, Bradley S L, Milne G A, Woodworth P L, Shennan I; The Effect of Vertical Land Movement Data Sets on Estimates of Sea Level Rise around the UK; Geophysical Research Abstracts, 10, EGU2008-A-08013, European Geosciences Union General Assembly 2008 (EGU2008), Vienna, Austria, 13 – 18 April 2008. (http://www.pol.ac.uk/psmsl/egu_2008/EGU2008-A-07948.pdf)

UK tide gauge Network



UK South Atlantic Network