The Bureau of Meteorology

Australian National Report

18th Session of the Group of Experts

Global Sea Level Observing System (GLOSS)

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1. Introduction

Sea level monitoring in Australia is undertaken by a variety of federal and state government agencies and commercial port operators. Coordination on a national level is achieved through the national Tides and Sea Level Working Group under the Intergovernmental Committee for Surveying and Mapping https://www.icsm.gov.au/what-we-do/tides-and-sea-level

The Bureau of Meteorology provides the Australian national representative to the IOC as well as the national focal point for GLOSS. It undertakes the national role of curating sea level observations and providing contributions to the GLOSS Data Centres.

2. Sea level monitoring networks in the Australian region

2.1. GLOSS Core Network

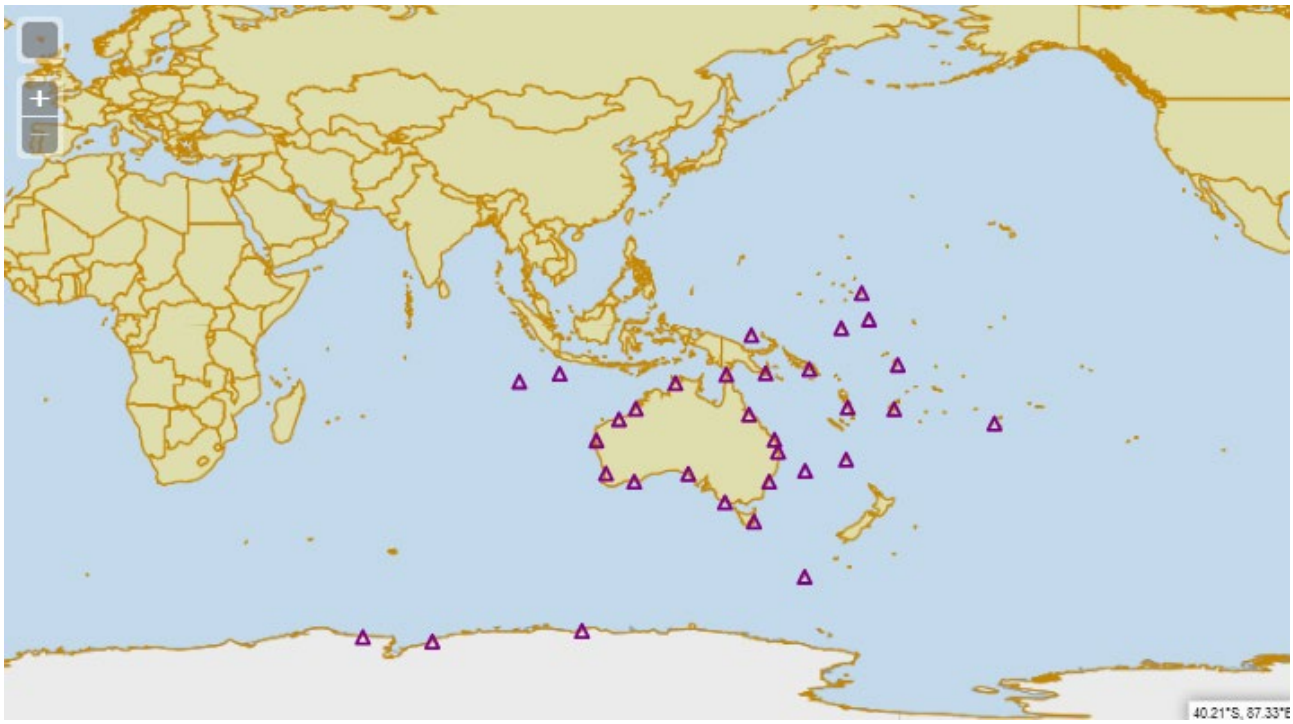

Figure 1. GLOSS Core Network stations for which Australia is the responsible country

The GLOSS Core Network includes 32 stations for which Australia is the responsible country, including;

- 16 stations operated by the Bureau of Meteorology
- 16 stations operated by other agencies

Table 1. List of GLOSS Core Network Stations for which Australia is the responsible country

Station	Country	Responsible Country	Latitude	Longitude	Gloss number	Operator
Booby Is.	Australia	Australia	-10.6	141.91666	61	AMSA
Brisbane (West Inner Bar)	Australia	Australia	-27.36666	153.16666	58	MSQ
Broome	Australia	Australia	-18	122.21666	40	BoM
Burnett Heads (Bundaberg)	Australia	Australia	-24.76666	152.38	59	MSQ
Carnarvon	Australia	Australia	-24.9	113.65	52	WA DoT
Casey	Australia	Australia	-66.28333	110.53333	278	AAD
Christmas Is.	Australia	Australia	-10.41666	105.66666	47	BoM
Cocos Is. (Keeling)	Australia	Australia	-12.7	96.9	46	BoM
Darwin	Australia	Australia	-12.46666	130.85	62	BoM
Davis	Australia	Australia	-68.45	77.96666	277	AAD
Esperance	Australia	Australia	-33.86666	121.9	54	BoM
Fremantle	Australia	Australia	-32.05	115.73333	53	FPA
Lord Howe Is.	Australia	Australia	-31.51666	159.06666	148	MHL
Macquarie Is.	Australia	Australia	-54.5	158.93333	130	AAD
Mawson	Australia	Australia	-67.6	62.86666	22	AAD
Norfolk Is.	Australia	Australia	-29.06666	167.95	124	MHL
Port Hedland	Australia	Australia	-20.31666	118.56666	51	WA DoT/PPA
Portland	Australia	Australia	-38.34333	141.61333	55	BoM
Spring Bay	Australia	Australia	-42.55	147.93333	56	BoM
Sydney, Fort Denison	Australia	Australia	-33.85	151.23333	57	PANSW
Thevenard	Australia	Australia	-32.15	133.64	308	BoM
Townsville	Australia	Australia	-19.25	146.83333	60	MSQ

Pacific stations (contributed by Australia)						
Rarotonga	Cook Islands	Australia	-21.2	-159.76666	139	BoM/COSPPac
Suva	Fiji	Australia	-18.13333	178.43333	122	BoM/COSPPac
Tarawa, Gilbert Is.	Kiribati	Australia	1.36333	172.93	113	BoM/COSPPac
Alotau	Papua New Guinea	Australia	-10.31666	150.45	63	CSIRO
Daru	Papua New Guinea	Australia	-9.05	143.2	272	Unkown
Lombrum (Manus)	Papua New Guinea	Australia	-2.03333	147.36666	331	BoM/COSPPac
Honiara	Solomon Is.	Australia	-9.43333	159.95	66	BoM/COSPPac
Port Vila	Vanuatu	Australia	-17.76666	168.3	348	BoM/COSPPac
Funafuti	Tuvalu	Australia	-8.38333	179.21666	121	BoM/COSPPac
Nauru	Nauru	Australia	-0.53333	166.9	114	BoM/COSPPac

Acronyms

AAD	Australian Antarctic Division
AMSA	Australian Maritime Safety Authority
COSPPac	Climate and Oceans Support Program for the Pacific
CSIRO	Commonwealth Scientific and Industrial Research Organisation
BoM	Bureau of Meteorology
FP	Fremantle Ports
MHL	Manly Hydraulics Laboratory, NSW
MSQ	Maritime Safety Queensland
PANSW	Port Authority of New South Wales
PPA	Pilbara Port Authority
WA DoT	Department of Transport, WA

2.2. Bureau of Meteorology Networks

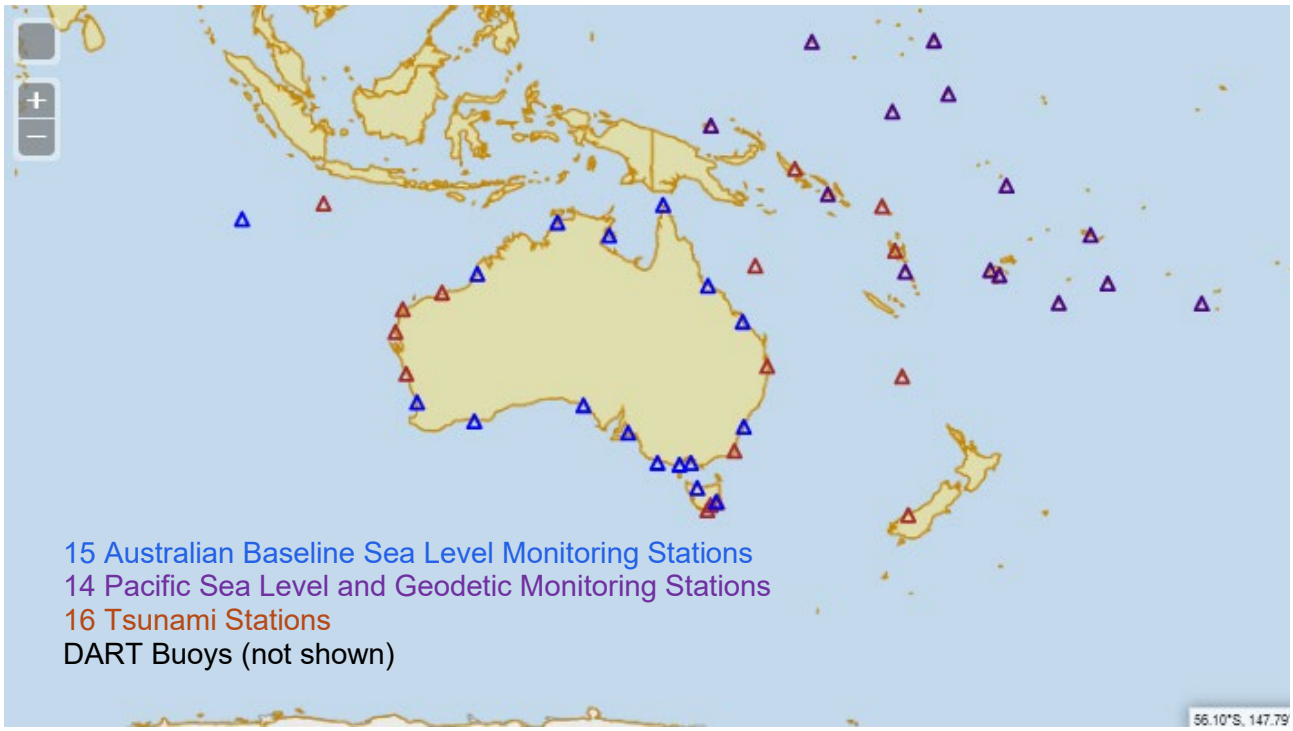

Figure 2. Permanent tide gauge network operated by the Bureau of Meteorology, including the Australian Baseline Sea Level Monitoring Array (16 sites) and Pacific Sea Level and Geodetic Monitoring Project (14 sites).

Two permanent tide gauge networks are operated in the region by the Bureau of Meteorology.

Australian Baseline Sea Level Monitoring Array

The Australian Baseline Sea Level Monitoring Array (ABSLMA) currently consists of 14 permanent gauges monitoring sea level and ancillary meteorological parameters around the Australian coastline, including one at Cocos Island. The array is supplemented with 2 privately-operated tide gauges at Lorne and Stony Point.

http://www.bom.gov.au/oceanography/projects/abslmp/abslmp.shtml

Pacific Sea Level and Geodetic Monitoring Array

The Pacific Sea Level and Geodetic Monitoring (PSLGM) component of the Climate and Oceans Support Program for the Pacific (COSPPac). currently consists of 14 permanent gauges monitoring sea level and ancillary meteorological parameters throughout the South Pacific region under the auspices

http://www.bom.gov.au/pacific/projects/pslm/index.shtml

Australian Tsunami Warning System

The Australian Tsunami Warning System (ATWS) is supported by the 30 permanent Australian and Pacific tide gauges as well as an additional network of 16 coastal tide gauges at four Pacific and 12 Australian sites as shown in Figure 2. An array of 6 deep-ocean tsunameters (DART buoys) brings the Australian tsunami-monitoring network to 52 sites in all.

The primary purpose of these additional stations is for the detection of tsunami with real time data made available to support the operations of the Pacific Tsunami Warning System. Further information about the Australian Tsunami Warning System is available at http://www.bom.gov.au/tsunami/about/atws.shtml

New equipment

Surveyable mounting of the secondary radar water level sensors and integration of mounting pillars for continuous GNSS/GPS equipment on the tide gauge infrastructure are slowly being introduced into the two networks, while acoustic water level sensors remain the primary sensor at most sites.

Problems encountered

Generally, the gauges operate autonomously in between calibration and servicing on a routine 18-month schedule, with average data return from the permanent tide gauge network exceeding 95%. The variety of day-to-day problems that do arise include power supply, data logger, data communications and sensor malfunctions, which are managed either remotely, by voluntary first in maintenance support or through contingency field trips.

Relocation or temporary removal of a tide gauge is occasionally required when the wharf is being developed or refurbished. Where possible a comparison gauge is established and run in tandem with the operational tide gauge for a period of time to help provide continuity in the record.

The following items relating to the tide gauges are worth noting at the time of writing;

- The station at Groote Eylandt has been out of service since being destroyed during Severe Tropical Cyclone Megan in March 2024.
- The station at Hillarys resumed service in April 2024, having been removed in July 2023 to accommodate wharf refurbishment.
- The station at Nauru was relocated and resumed service in May 2024, having been removed in September 2023 while the harbour was redeveloped.
- The station at Broome was relocated a short distance in February 2025 to allow for wharf refurbishment.

2.3. Australian National Network

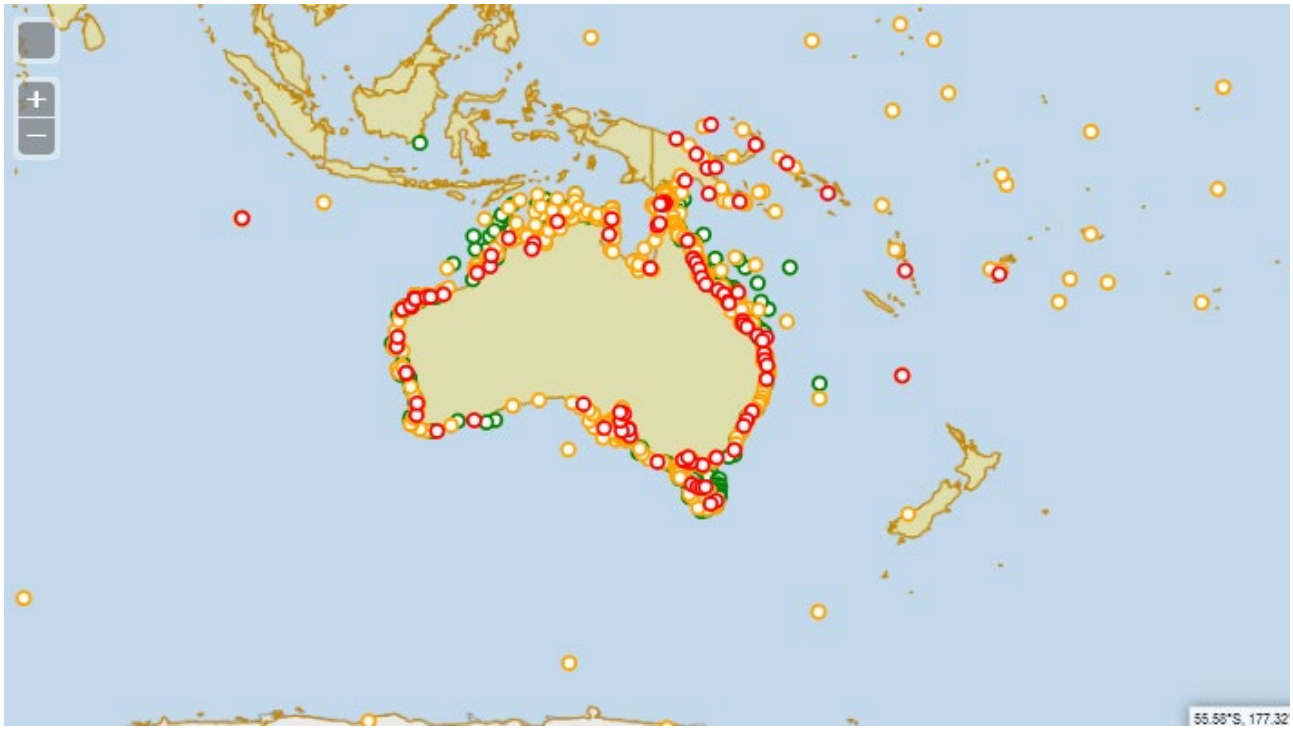

Figure 3. The Australian tide gauge network consists of around 190 operational stations and many hundreds of temporary historic stations.

The Australian national network of permanently operating sea level stations consists of numerous tide gauge operators. The Tides and Sea Level Working Group strives to maintain a list of permanently operating stations as part of the Australian Tides Manual https://www.icsm.gov.au/what-we-do/tides-and-sea-level

Monthly sea level observations collected at Australia's major ports are updated every year on the Bureau website http://www.bom.gov.au/oceanography/projects/ntc/monthly/index.shtml

Sea level observations at the many hundreds of permanent and temporary tide gauges are used as the basis of tide predictions issued by the Bureau of Meteorology http://www.bom.gov.au/australia/tides/ and the Australian Hydrographic Office https://www.hydro.gov.au/prodserv/publications/publications.htm

3. Datum Control

Operators of tide gauges in Australia are encouraged to maintain datum control (in accordance with IOC Manuals on Sea Level Measurement and Interpretation) by way of

- Regular sea level sensor calibration checks
- Regular levelling survey of tide gauges to an array of benchmarks
- Levelling connections to nearby permanent GNSS stations
- Levelling connections to national survey datum such as the Australian Height Datum and, where possible, connections to an international terrestrial reference frame (eg Ellipsoid heights).

Information is generally maintained by the tide gauge operator but shared through the use of a standard metadata sheet for the exchange of sea level observations made available by the Tides and Sea Level Working Group.

Geodetic connections for some gauges are monitored by Geoscience Australia and can be found at https://www.ga.gov.au/scientific-topics/positioning-navigation/geodesy/gnss-networks/levelling-connections-between-gnss-sites-and-tide-gauges

4. Quality Control

Many tide gauge operators apply their own quality control to the observations they collect. The Bureau of Meteorology further quality assures sea level observations submitted by agencies and prepares quality-controlled hourly and monthly datasets on a monthly and annual basis, as part of its national role and member-state obligations to GLOSS.

Additional datum homogenisation is applied by the Bureau of Meteorology for a select set of stations for an Australian National Collection of Homogenised Observations of Relative Sea Level (ANCHORS) dataset http://dx.doi.org/10.25914/6142dff37250b

5. Data delivery to GLOSS Data Centres

5.1. IOC Sea Level Facility

1-minute sea level observations collected by Bureau of Meteorology stations are transmitted in near real time every 3 minutes over the WMO GTS in CREX format in support of tsunami warning centres and subsequently ingested and displayed by the IOC Sea Level Facility.

5.2. UHSLC Fast Delivery

Quality-controlled hourly sea level observations are supplied by the Bureau of Meteorology for the UHSLC Fast Delivery dataset https://uhslc.soest.hawaii.edu/data/?fd on a monthly basis.

5.3. PSMSL

Quality-controlled monthly sea levels are published by the Bureau of Meteorology http://www.bom.gov.au/oceanography/projects/ntc/monthly/ and supplied to the PSMSL on an annual basis.

5.4. GESLA

Quality-controlled hourly sea level observations are contributed by the Bureau of Meteorology to GESLA when updates of GESLA occur https://gesla787883612.wordpress.com/

5.5. SONEL

Data from continuously-operating GNSS stations around Australia and in the south Pacific are made available by Geosciences Australia to international data centres including SONEL for the purposes of monitoring vertical land motion in the vicinity of tide gauges https://www.sonel.org/