

PCTMSL NEWS - June 2006

Australian Baseline Sea Level Monitoring Stations

Calibration and Maintenance

A scheduled calibration and maintenance (C&M) visit to Portland and Stony Point was undertaken in June 2005. Hillarys, Cocos Island and Esperance were completed in October and Groote Eylandt, Broome and Darwin in November. Port Kembla, Cape Ferguson and Rosslyn Bay were visited in early March 2006.

The implementation of Australian baseline station data transmissions via the GMS satellite message system has progressed slowly since the last report. JMA has provided the proposed station time slots and satellite address codes, however, they then requested that the applications be resubmitted, and this was done in October.

The Bureau intends to negotiate with the owners of the baseline sites to establish formal lease agreements as the first step in a major refurbishment plan for these stations. The planning for the refurbishment of the baseline stations will be done in conjunction with the Australian Tsunami Warning System project.

The NTC has been fortunate to re-employ a former NTF Technical Officer, Mr Noel Sears, to assist with baseline maintenance services.

Surveying

NTC no longer has a surveyor on staff and has ceased reporting on surveying. Datum stability survey results are available at:

<http://www.ga.gov.au/geodesy/slm/abslmp/>

Data Management and Reports

Data from the SEAFRAME gauges continues to be downloaded on a daily basis, quality controlled and archived. The level of data return for the project has excellent with 13 of the 16 stations having unbroken records. There was a gap of 10 days in the Lorne data, 3 days in the Broome data and 21 days in the Esperance data due to on-site technical problems. Monthly data reports continue to be generated, and presented on the web site. The hourly project data will soon be available from the web site, for registered users in Comma Separated Variable (.csv) format.

Key Features

The key features of the project for the twelve months to December 2005 are as follows:

- All fourteen SEAFRAME stations and associated infrastructure have continued to perform effectively. Data continues to be supplied by two privately owned gauges.
- After the tragic December 2004 tsunami, NTC set up an automated 5 minute dial-in to the Cocos Island station. This enabled more rapid response to any future Tsunami events. Subsequently a microwave radio data link between the station on Home Island and the Bureau's meteorological station on West island was set up to transmit one minute data over the Bureau's Intranet. Upgrades to the communication at all stations will gradually be implemented.
- The time-series of data on the national database for the earlier conventional stations are now on average around 40 years in length. With respect to trends in sea level, this length of record can negate much of the "instability" of transient phenomena. However, the sea level observations are "relative sea level" only (vertical movement with respect to the adjacent land mass) and the trend is not that of "absolute sea level" (related to the International Terrestrial Reference Frame) (ITRF). With that qualification, the average relative trend in sea level is +1.2 mm per year.

The global average sea level rise in the 100 years previous to this project has been of the order of +1 to +2 mm per year. At this magnitude any acceleration is imperceptible and the trend is nearly linear.

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South Pacific Sea Level and Climate Monitoring Project (SPSLCMP)

Phase III – January 2001 to December 2005

Seven Pacific stations were visited in 2005, as follows:

Cook Island, Samoa and Tonga - between 27 February and 14 March;
 Marshall Islands and the Federated States of Micronesia (FSM) - between 15 and 27 May.
 Tuvalu and Lautoka - between 29 June and 11 July.
 During the visit to FSM a protective barrier for the gauge was erected.

Remaining site visits to Pacific stations were cancelled due to funding constraints.

Phase IV – January 2006 to December 2010

In December 2005 AusAID appointed the Bureau as head contractor for a further five year phase of the project, in collaboration with Geoscience Australia and the South Pacific Applied Geoscience Commission. The aims of the project remain the same, however there is a different mix of communication products and training, and future integration with tsunami networks is under consideration.

A calibration and maintenance site visit to Vanuatu, Solomon Islands and the PNG were undertaken in early March 2006.

New problems with phone communication are coming to light, with some countries introducing VoIP communications protocol. This service does not allow for the facility of dial-in-service to download or conduct diagnostic checks on instruments. This will lead to the possibility of future loss of data through inability to recover missing satellite packets, or worse, the inability to reboot the instrument program.

Data Management and Reports

The data from the SEAFRAME gauges continues to be quality controlled and archived on a monthly basis. A monthly data report is compiled, and made available on the web site and on a quarterly CDROM. All of the project data is distributed to the Pacific forum countries by CDROM on a quarterly basis. The hourly project data is now available via the project pages within the Bureau web site in Comma Separated Variable (CSV) format. These files contain hourly sea level and meteorological data in one annual file. Tide Calendars for 2006 were made available from the NTC website and hard copies distributed to forum countries.

Key Findings

The key findings up to December 2005 include:

- Sea level trends continue to show regional coherence, supporting the utility of these high-quality observations for regional sea level analysis and determining sea level response to climate variations and climate change.

- A cooling trend was observed across the equatorial Pacific bringing an end to weak warm-episode conditions and reducing the likelihood of an El Niño developing.
- Ocean temperatures and atmospheric conditions across the equatorial Pacific became characteristic of neutral climate conditions.
- Data obtained from SEAFRAME stations were consistent with the regional climatological trend and near-normal sea level, water temperature and air temperatures developed.
- It is still too early to draw conclusions on any long-term trend in rising sea level as a result of climate change, due to the relatively short duration of the data record from the SEAFRAME stations. The observations continue to be more indicative of decadal trends related to climate variability. However, the sea level records for all stations, when corrected for local land movement and the inverted barometer effect, are beginning to demonstrate coherence in sea level trends. These trends are in line with predicted sea level rise estimated by the latest computer models of the climate system and observed by satellite altimeters.
- The value of the SPSLCMP's high-quality sea level observations as verification of other spatial technologies, particularly satellite altimeters, continues to prove its worth.

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AAPMA/NTFA Tidal Contract

The production of tidal information under the previous contract between the former NTFA and Association of Australian Port and Marine Authorities (AAPMA) is being continued by the NTC, whilst the contract is being renegotiated.

The 2007 tide product packages for 79 Standard Ports have been supplied to the relevant Port Authorities. The tide package includes centimeter predictions at one-hour intervals, a resolution that requires annual refinement. During the 12-month cycle leading up to the computation of the predictions, the port operators provide tidal observations, which are analysed by NTC for correction of the tidal constituents.

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Regional News

Queensland

The usual activities of tidal observation, validation and storage in the Queensland tidal data base continue.

The tropical cyclone season was very quite until cyclone until severe tropical cyclone "Larry" struck north Queensland with devastating fury. The region around Innisfail was severely damaged. "Larry" whipped up waves with Hmax in the 5 to 6 metre range and a storm tide of 4.3m recorded at Clump Point by the Environment Protection Agency. This storm tide at 0.71m above Highest Astronomical Tide was one of the largest recorded excursions outside the normal tidal envelope. A copy of the fact sheet prepared by the Environment Protection Agency concerning "Larry" may be found at URL http://www.epa.qld.gov.au/about_the_epa/current_issues/cyclone_larry/

This year the "King Tides" occurred on 30 January at Gold Coast Seaway, Brisbane Bar, Mooloolaba, Noosa Head, Fraser Island, Shute Harbour, Karumba, and Mornington Island. They occurred on 27 February at Abbot Point, Townsville, Lucinda, Mourilyan, Cairns, Port Douglas and Twin Island on the following day at Bundaberg, Urangan, Gladstone, Port Alma, Hay Point, and Mackay. These higher than average spring tides occurred very much as predicted everywhere except in the Torres Strait where they were reported to be exceptionally high at the end of January.

As reported in the previous newsletter, vessel traffic services have become a significant activity in Queensland with the first of the real time display system installed at Brisbane. Work is in hand to establish a second system for the port of Hay Point.

The Port of Brisbane Corporation have installed a permanent gauge at Tangalooma to support their hydrographic surveying and shipping operations. The corporation is preparing to revise the tidal datum for the Brisbane River. They are also considering a number of sites to locate a base station for a GPS real time kinematic system. The RTK system will be used, in conjunction with the tide gauges, for surveying and dredging in the North West Channel approach across Moreton Bay to the Port of Brisbane.

The Karumba tide gauge was struck by lightning. It has been reinstated with the loss of only a few days of readings. Otherwise all permanent stations continue to return data.

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Western Australia

Department for Planning and Infrastructure Tides and Waves Section

Further to the routine functions of the Tides and Waves Section of the Department for Planning and Infrastructure (DPI) WA, we have been involved with the following activities.

Data Collection / Instrumentation

The State tide and wave monitoring activities continue and all stations have been operating satisfactorily. The 2005 annual data recovery rate from our 28 tide gauges was 98.98% and from our wave buoys was 96.88%.

As part of DPI's coastal management program, a wave buoy has been deployed at Esperance and another one is planned for installation at Exmouth (North West Cape) in September. These will be permanent recording stations providing real time information for and extend DPI's existing wave buoy network located at, Albany, Cape Naturaliste, Rottneest, Cottesloe and Jurien.

The Valeport 740, pressure transducer tide recorder continues to be a valuable instrument used as a temporary fill-in tide gauge. It provides accurate tide information in remote areas in support of our Hydrographic surveys.

The Broome wave and current monitoring program has been completed. The records are currently being analysed as part of the investigation for a proposed boat harbour. This project was done using the Acoustic Wave and Current (AWAC) instruments which were tested under some severe working conditions.

Given the increasing demand for tide data and information we are slowly investigating new tide gauges for continuous real time information.

Data Analysis / Management

The call for tide data and information continues to increase. As such, maintaining our data management systems and processes is an ongoing

task. The annual analysis of the 2005 tide data is complete. Our analysis indicates that the state Mean Sea Level for 2005 is on average approximately 0.009 metres higher than the long-term mean, which seems consistent with the recent El Nino weather phenomenon. The tide gauge datums at Esperance and at Albany have been changed to LAT. An adjustment 0.13m and 0.11m respectively has been made to correspond with the new 2006 prediction datum and LAT datum now used on RAN charts.

Apart from the routine daily data collection and processing tasks, we are slowly progressing with following projects:

- Further database development to improve the ability to locate specific information within the large volumes of data stored.
- The WA Tidal Information booklet project which contains information on datum descriptions, tidal bench marks, tidal statistics, datum relationships, field books, period of available records, historical notes on datums, history of instrumentation and other general tidal information pertaining to specific past and present tide monitoring locations.

Our Coastal Data website

(<http://www.dpi.wa.gov.au/coastaldata>) continues to grow in popularity - currently receiving approximately 55,000 unique visitors hits per month.

Staff

Following recent changes with our technical field staff, we are now proceeding with the recruitment for a new position of Senior Technical Officer. The main function of this position will be as follows;

- Manages the service and maintenance program of the Tides and Waves Section providing specialist electronics and operational support to the Department's state wide tide and wave monitoring network and associated oceanographic instrumentation and equipment.

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South Australia

Flinders Ports Pty Ltd

The status of the Flinders Ports managed tide recording sites are as follows:

- Tide, barometric pressure and wind data (speed, direction and gust) continue to be recorded at

Port Adelaide (Outer Harbor), Wallaroo, Port Pirie, Port Lincoln and Port Giles.

- A local real time display on PC is established at all of the above sites as well as Thevenard from the NTC Seaframe tide gauge.
- An intranet based tides Real Time Display program is established for Port Adelaide, Port Lincoln, Port Pirie and Thevenard.
- Tide, barometric pressure and wind data (speed, direction and gust) recorded at Whyalla (on behalf of OneSteel)
- Tide recorded at Victor Harbor and Cape Jervis (on behalf of Dept. of Transport, Energy and Infrastructure DTEI).

Flinders Ports utilise three Ceetide portable acoustic tide gauges with CDMA modems for hydrographic survey work and an interim Inner Harbor tide gauge. Flinders Ports also have a Yeokal Model 610 portable tide gauge, two Mindata portable tide gauges and a Workhorse Sentinel ADCP Profiler (currents and waves) that are used for survey work, data verification and contract work for other clients.

Dredging to deepen the entire Outer Harbor channel by 2 metres (to 14.2 metres) is almost complete. Since the commencement of the program, two of the portable Ceetide gauges have been established at the Outer Harbor Tide Hut and the Entrance Beacon and used for survey purposes. The dredging contractor (Dredco) operated their own real time tide gauge at the Outer Harbor Tide Hut to give a real time feed of tide data for accurate setting of the dredge head. The Outer Harbor tide gauge wind sensor was relocated from No. 6 beacon to No. 9 temporarily. When all the beacons are in position the existing wind sensor will be relocated to the Outer Harbor swinging basin and a new wind sensor will be located at the new Entrance beacon.

Flinders Ports have taken delivery of a new acoustic tide gauge from General Acoustics in Germany to be installed at Outer Harbor No.1 beacon as well. The attractive component of this particular system is that it has the capacity to measure waves as well due to a 5 hz measurement speed. And it is relatively inexpensive. Testing of this system for waves and tides against our existing system at Outer Harbor is currently being carried out.

A new tide gauge has been installed on behalf of Santos at the Port Bonython tanker facility in Spencer Gulf. The Whyalla chart datum has been transferred across and the tides will be based on this datum (as have all the hydrographic surveys to this date). This is based around a new logger system; the Vaisala QML201 logger from the Vaisala automatic weather stations. This has been brought about by the fact the Handar 555 logger platform is now obsolete world wide and a new logger system had to be found. The sensors consist of a Siemens acoustic water level sensor, Vaisala ultrasonic wind sensor and a Vaisala barometric sensor.

This logger system is also being used as the platform for converting the temporary installation at Cape Jervis (the mainland port for Kangaroo Island ferry) into a permanent tide gauge. The sensors for this gauge are the same wind and barometric sensors as for Port Bonython but the water level sensor will be bubbler. This will be installed in the next month or so (on behalf of DTEI). In conjunction with this project datums will be re-established and tide boards checked at the Kangaroo Island ports of Penneshaw, American River and Kingscote.

ABB Grain have agreed to have Flinders Ports install a complete tide and wind gauge system at the port of Ardrossan. It is aimed to have a gauge in place by the end of September 2006.

Flinders Ports has purchased the HydroTel software package to become the new tide management system. This package is able to automate the data acquisition process, verify and test the data, store in a database and report possible problems and suspect data in a timely manner. It will also enable data to be written to file in a user defined format and will be a useful tool for exporting data to external clients or other software applications. This is due to be installed in August 2006 and all of our existing data will then be migrated across to the new system.

From May to July last year, three Navy S4 Tide Gauges were deployed at key sites in Spencer Gulf as part of a major hydrographic survey conducted on identified zones in the preferred shipping route to Whyalla. These gauges recorded the water level every ten minutes and were reduced to LAT by the Australian Hydrographic Office. GPS observations were then carried out at the end of 2005 at the three sites with reference to the nearest ports to check the determination of LAT and the correlation of the two methods was very close. The survey has now been processed using the reduced tidal data.

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Southern Ocean Sea Level Network

Macquarie Island Tide Gauge System

The Macquarie Island Tide Gauge was first commissioned in December 1993. Since then attempts have been made every year to improve the performance of the system.

In the past data has been retrieved at approximately

30 day intervals from the Garden cove gauges by using a portable computer to download the data loggers. This has been upgraded so that data can be downloaded via the internet at Kingston. Data logging rates can also be adjusted and diagnostic queries to determine the functioning or malfunction of the tide gauges.

The tide gauge calibrations were completed in March 2005 using the "Floating GPS" method developed by the University of Tasmania. Levelling to ARGN GPS base station was also completed. Another calibration and leveling exercise was carried out in April 2006.

Mawson Tide Gauges

With the reduction in shipping to Mawson station it is now difficult for surveyors to get to the station and as a result tide gauge calibration and levelling has not been possible in the last three years. The bottom mounted tide gauge in Horseshoe Harbour continues to be downloaded on a regular basis by station personnel. The shore mounted tide gauge can be accessed via the internet from Kingston. Data logging rates can be adjusted and diagnostic made to determine the functioning or malfunction of the tide gauges.

Davis Submerged Tide Gauge

The topography of the sea bed at Davis is such that an onshore gauge cannot be installed there. The AAD will continue in its efforts to develop a radio connection to the bottom mounted gauge so that communications from Kingston are possible.

The gauge was calibrated using the "Floating GPS" technique in December 2003. Due to the unavailability of berths in the 2005/06 summer no leveling or calibration took place. Station personnel continue to download the tide gauge on a regular basis from the sea ice.

Casey – Wharf tide gauge and Submerged tide gauge

A new tide gauge was installed in the Casey wharf in the 2004/05 summer. Due to the movement of ice and periodic open water in winter the Casey submerged tide gauge is quite difficult to locate and download. It has been fortunate that divers operate at Casey and we have used their services to download the gauge for the last five years. The submerged tide gauge will be allowed to run until the batteries run out and then removed. The gauge was successfully downloaded by divers in February 2006.

Due to construction activities at the wharf new tide gauge bench marks were placed and levelled to in the summer of 2004/05 and 2005/06.

Geoscience Australia website – GPS base stations

Level connections between tide gauge bench marks and the GPS base station for all Antarctic stations and Macquarie Island can be found on the web at: <http://www.ga.gov.au/geodesy/antarc/antgauge.jsp>

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Australian Hydrographic Service (AHS)

Survey operations, and associated tidal data collection as required, has been carried out in Melville Island, Cairns, and the majority of the work has been carried out in the Torres Strait.

Production of the Australian National Tide Tables (ANTT) 2007 is near completion, with the expectation that the ANTT will be available early October. There are about 650 ports in section 4 Harmonic constituents, consisting of 85 Standard ports and about 560 secondary ports (of which 18 are 'quasi-standard' Ports). The Georgetown gauge has been removed and replaced by Low Head.

The Australian National Tide Tables – Electronic Version 2007 should also be available by October.

The Digital Hydrographic Data Base (DHDB) continues to be populated and has been the major time consuming project for the Tidal and Geodetic Section over the past few months. Tidal data loaded into the Data base must be deconflicted prior to loading, so when anomalies are found in tidal records, the AHO needs to investigate and resolve the anomaly in order to determine the correct datums.

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3rd Australasian Tides Workshop

The Third Australasian Tides Workshop will be held at the National Tidal Centre (NTC) of the Bureau of Meteorology, at the South Australian Regional Office, Kent Town, Adelaide. It will comprise presentation of lectures combined with hands-on

processing sessions. It is scheduled to be held on 25-27 September 2006 and to be followed by a field trip on the 28 September.

Topics to be covered will include:

- tidal theory
- storm surges and extreme events
- mean sea level and climate variability
- instrumentation
- realtime systems with meteorological sensors
- benchmark levelling and datums
- data analysis and quality control
- archiving and quality assurance

During the workshop there will be hands-on sessions on analysis and quality control of sea level data with examples of some of the problems that typically arise. There will also be attention given to the need for standard formats and data archiving processes.

The cost of attending will be \$1000 p.p. (incl. GST) which will cover all lectures and practical sessions, notes, copies of selected software and access to PCs.

Workshop attendance will be set at a minimum of 8 and a maximum of 12 attendees.

Point of contact for all enquiries is Bill Mitchell at NTC, telephone (08) 8366 2710, or email: b.mitchell@bom.gov.au

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Conferences & Symposia

2006

18-22 August. 'MSIA Conference 400 Years of Mapping Australia'
www.mappingsciences.org.au

18-22 September. 'OCEANS 2006': Boston, Massachusetts, USA..
www.oceans2006.org

19-23 September. 'Combined 5th Trans Tasman Survey Conference and 2nd Queensland Spatial Industry Conference 2006'. Cairns Convention Centre, Cairns, Australia.
www.icms.com.au/cairnsspatial2006

8-13 October. 'FIG XXIII Congress': Munich, Germany .
www.fig2006.de

20-25 November. 'OMG Multibeam Course': Singapore.
www.omg.unb.ca/mbc/

2007

27-29 March. 'Ocean Business 2007':
Southampton, England.
www.oceanbusiness2007.com

14-18 May. 'SSI Biennial International Conference':
Hobart, Australia.
www.spatialsciences.org.au/events/
