

Appendix C

Queensland EPA Information Sheets: March 2004

Information sheet

Environmental Sciences Division – Coastal Services

Coastal Services monitor storm event – March 2004

Summary

On Thursday 4 March 2004, the Bureau of Meteorology issued Top Priority Severe Weather and Storm Tide Warnings for coastal communities between the Town of 1770 and Coolangatta.

- Very large waves along south-east Queensland coastline.
- 992 hp tropical low crosses coast near Wide Bay (Figure 1).
- Highest maximum wave (14.3m) recorded at Brisbane.
- Second-highest significant wave heights recorded at a number of SEQ locations (Table 1) – highest on record 7.4 during cyclone Roger in 1993.
- 0.7m storm surge recorded in Moreton Bay.

EPA storm tide advisors reported to the State Counter Disaster Organisation's Disaster Coordination Centre to provide information on wave and tide conditions. This information is critical for deciding if a coastal community should be evacuated due to a storm tide threat.

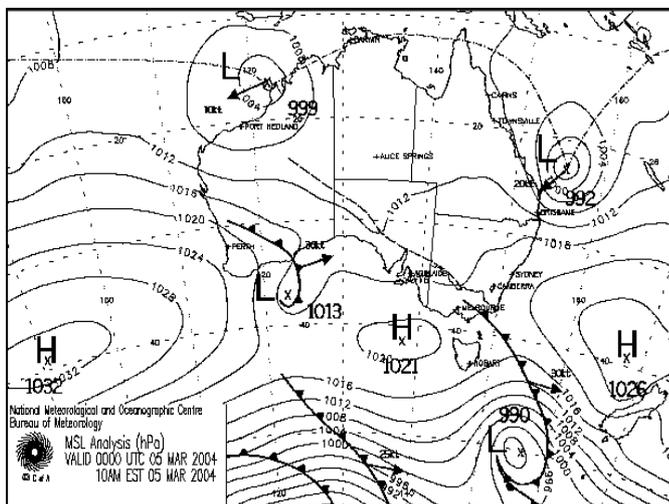


Figure 1 - SEQ Tropical Low (5 March 2004) courtesy of BoM

Wave records

The EPA operates a network of wave monitoring stations along the Queensland coastline. Southern Queensland stations include Tweed Heads, Gold Coast, Brisbane, Moreton Bay and Mooloolaba (Figure 2).

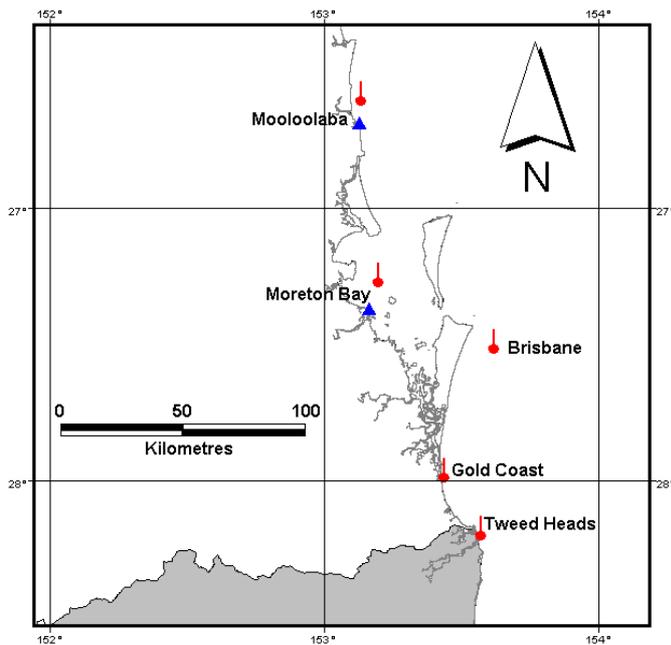


Figure 2 - SEQ wave recording stations

Peak wave conditions recorded at these stations during the severe weather conditions resulted in several record significant wave heights (Hsig). (See Table 1)

Table 1 - Recorded significant wave heights*

Site	Hsig (m)	Time / Date	Rank
Tweed Heads	6.1	01:00 6/03/2004	2
Gold Coast	5.9	21:30 5/03/2004	2
Brisbane	7.0	17:30 5/03/2004	2
Moreton Bay	1.8	00:30 6/03/2004	1
Mooloolaba	5.9	16:00 5/03/2004	1

*The significant wave height is the average of the one-third highest waves in a 26.6 minute record.

Table 2 shows the maximum individual wave heights (Hmax) recorded at these stations during the severe weather conditions.

Table 2 - Maximum recorded wave heights*

Site	Hmax	Time / Date	Rank
Tweed Heads	10.7	02:30 6/03/2004	2
Gold Coast	11.8	21:30 5/03/2004	2
Brisbane	14.3	17:30 5/03/2004	1
Moreton Bay	3.6	00:30 6/03/2004	1
Mooloolaba	12.1	15:30 5/03/2004	1

* The maximum wave height is the largest wave to occur in a 26.6 minute record.

A plot from the Brisbane wave station, showing wave heights and periods recorded is shown in Figure 3. The peak maximum individual wave height (14.3m Hmax) during this event was the largest recorded by the Environmental Protection Agency at the Brisbane station since recordings commenced there in October 1976. The previous highest wave at the Brisbane wave station was 13.1 metres, during Tropical Cyclone Roger in March 1993.

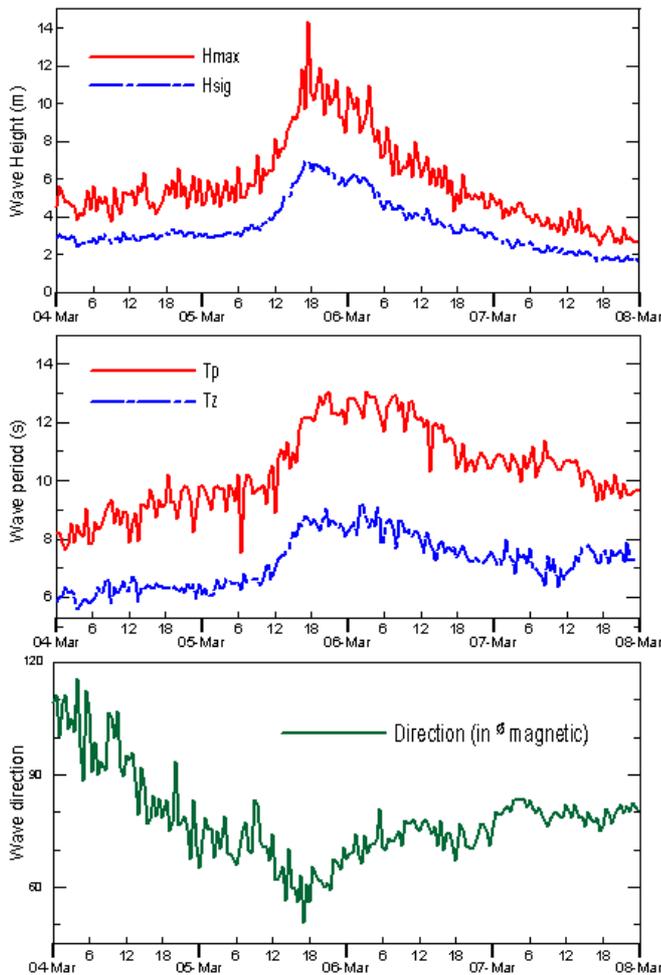


Figure 3 - Brisbane wave data 4-7 March 2004

Storm tide recording

The EPA storm tide system (comprising 21 storm tide gauges along the Queensland coastline) allows real-time access to storm tide data via the public telephone network during cyclone events. Water level data were obtained from the EPA storm tide gauge at Mooloolaba and the Maritime Safety Queensland tide gauge in Moreton Bay at Whyte Island at the mouth of the Brisbane River. A plot of the record from Whyte Island is shown in Figure 4.

At Whyte Island, a positive storm surge of 0.73 metres was recorded at 0210 on 6/03/2004. The storm tide did not exceed Highest Astronomical Tide (HAT) because the peak surge occurred while the tide was at low water. Had the peak surge occurred seven hours later, the storm tide would have been 0.44 metres above HAT.

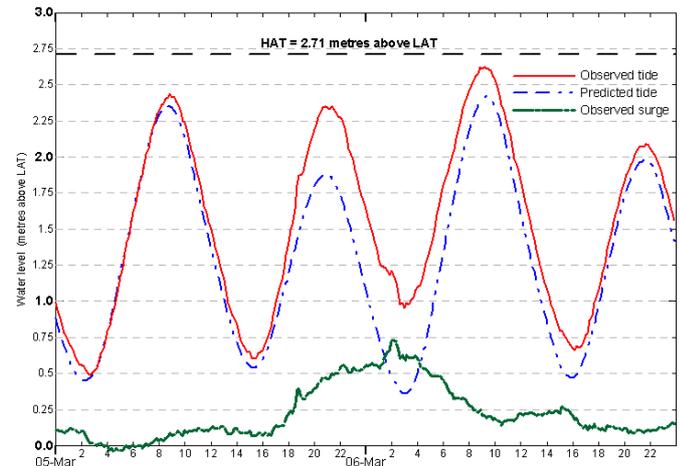


Figure 4 Whyte Island observed water level 5-6 March 2004

At Mooloolaba, a positive storm surge of 0.39 metres was recorded at 0020 on 6/03/2004. The storm tide did not exceed (HAT) as the peak surge occurred while the tide was at low water. Had the peak surge occurred seven hours later, the storm tide would have been 0.16 metres above HAT.

Glossary

Hsig

The significant wave height (in metres), defined as the average of the highest one third of the zero up-crossing wave heights in a 26.6 minute wave record. This wave height closely approximates the value a person would observe by eye.

Hsig is frequently used by meteorologists, oceanographers and coastal engineers. It is based on the concept that smaller (and least significant) waves should be ignored from the observations as they have little influence on wave processes generally.

Hmax

The maximum zero up-crossing wave height (in metres) in a 26.6 minute record.

Tz

The average of the zero up-crossing wave periods (in seconds) in a wave record.

Tp

Wave period at the peak spectral energy (in seconds). This is an indication of the wave period of those waves that are producing the most energy in a wave record. Depending on the value of Tp, waves could either be caused by local wind fields (sea) or have come from distant storms and have moved away from their source of generation (swell).

Direction

The direction that peak wave period (Tp) waves are coming from (in degrees Magnetic). In other words, where the waves with the most wave energy in a wave record are coming from.

EPA Web Sites

1. www.epa.qld.gov.au/waves
2. www.epa.qld.gov.au/tides

Information sheet

Environmental Sciences Division – Coastal Services

Coastal Services monitor tropical cyclone Grace – March 2004

Summary

On Thursday 18 March 2004, the Bureau of Meteorology issued Gale and Strong Wind Warnings for coastal communities between Cape Melville and St Lawrence. Although this was the start of heavy rain and flooding in north-Queensland (already reeling after Natural Disaster Relief Arrangements were activated there earlier in the month), the real action occurred in the south during 23–25 March.

- Extension of previously approved NDRA event approved by Minister for Emergency Services.
- Tropical cyclone Grace develops but moves south-east away from coast.
- Intense pressure gradient between ex-tropical cyclone Grace and large high in Tasman Sea (Figure 1).
- Very large waves along south-east Queensland coastline.
- Third-highest significant wave height (4.1m) recorded at Mooloolaba.
- Third-highest maximum wave heights (8.5m) recorded at Tweed Heads.
- No significant storm surge recorded in south-east Queensland.

EPA storm tide advisors provided information on wave and tide conditions to the State Counter Disaster Organisation's Disaster Coordination Centre. This information is critical for deciding if a coastal community should be evacuated due to a storm tide threat.

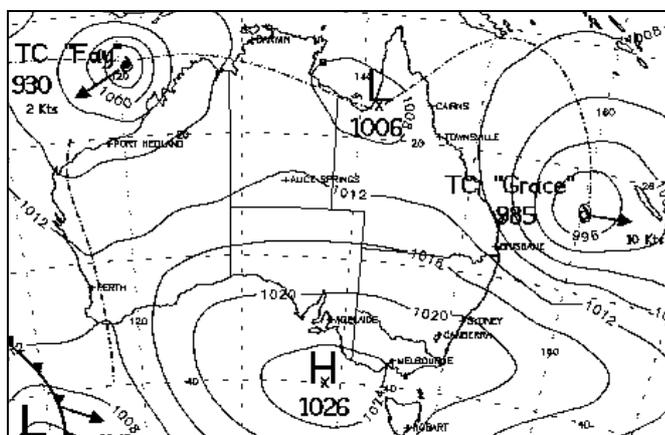


Figure 1 – Synoptic situation 23 March 2004 (courtesy of BoM)

Wave recording

The EPA operates a network of wave monitoring stations along the Queensland coastline. Southern Queensland stations providing information during this event include Tweed Heads, Gold Coast, Brisbane, Caloundra and Mooloolaba (Figure 2).

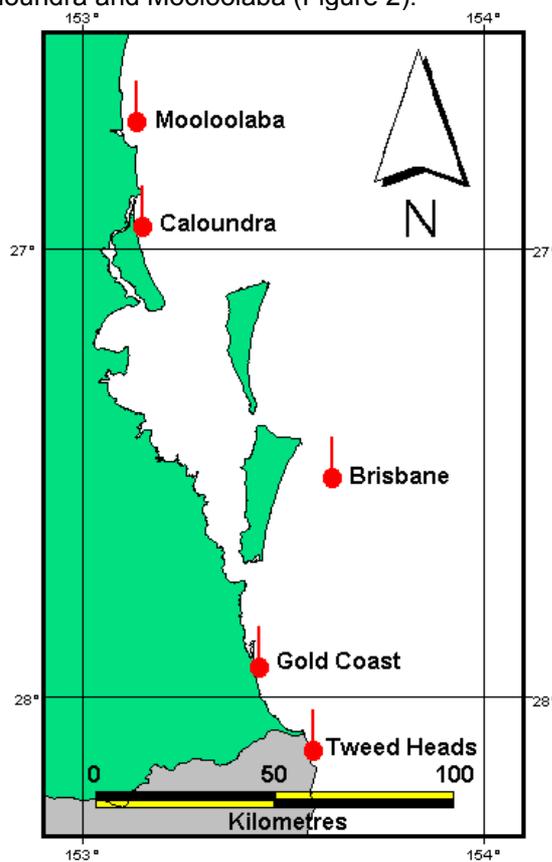


Figure 2 - SEQ wave recording stations

The recorded peak significant wave heights are listed in Table 1.

Table 1 - Recorded significant wave heights

Site	Hsig (m)	Time / Date	Rank
Tweed Heads	4.8	06:00 24/03/2004	5
Gold Coast	4.1	22:00 24/03/2004	10
Brisbane	4.8	08:00 24/03/2004	25
Caloundra	2.0	11:00 24/03/2004	1
Mooloolaba	4.1	05:30 24/03/2004	3



Figure 3 – Typical beach condition 23–25 March 2004

Table 2 shows the maximum individual wave heights (Hmax) recorded at these stations during the severe weather conditions.

Table 2 - Maximum recorded wave heights

Site	Hmax	Time / Date	Rank
Tweed Heads	8.5	04:00 24/03/2004	3
Gold Coast	7.7	12:30 24/03/2004	8
Brisbane	9.2	17:00 23/03/2004	11
Caloundra	3.8	11:00 24/03/2004	1
Mooloolaba	6.4	05:30 24/03/2004	4

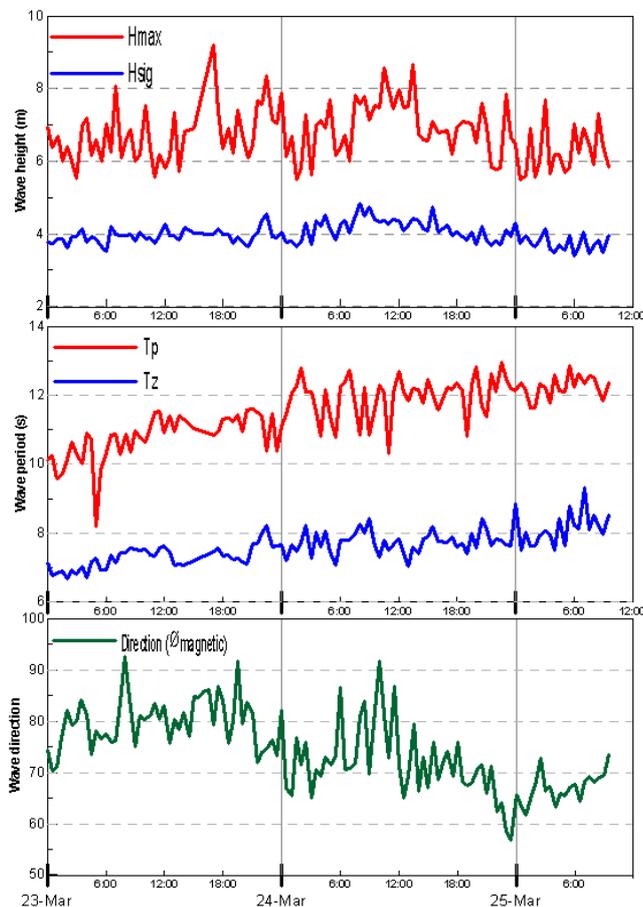


Figure 4 - Brisbane wave data 23–25 March 2004

Wave heights and periods recorded during the event at the Brisbane wave station are shown in Figure 4. The peak maximum individual wave height (9.2m Hmax) was the eleventh-highest recorded by the EPA at the Brisbane station since recordings commenced there in October 1976. The all-time highest wave recorded at Brisbane was 14.3 metres, during the recent east-coast low on 5 March, 2004. Although this was the highest event recorded at Caloundra, this

must be treated with caution as the site has only been operating since September 2003.

Storm tide recording

The EPA storm tide system (comprising 21 EPA storm tide gauges and other organisations' tide gauges along the Queensland coast) allows real-time access to storm tide data during cyclone events. Water level data were obtained from the EPA storm tide gauge at Mooloolaba; the EPA tide recorder at Caloundra; the Maritime Safety Queensland tide gauges in Moreton Bay at Whyte Island at the mouth of the Brisbane River, and at the Marine Operations Base in the Broadwater at the Gold Coast.

No significant storm surges were recorded at any of the above gauges. Also, tides at these sites did not reach the level of Highest Astronomical Tide (as the spring tides had occurred on 19–20 March).

Coastal Erosion

An inspection of Gold Coast beaches by engineers from Coastal Services identified no significant erosion. Generally beach conditions are good (considering the recent storms) as shown in Figure 3.

Glossary

Hsig The significant wave height (in metres), defined as the average of the highest one third of the zero up-crossing wave heights in a 26.6 minute wave record.

Hsig is frequently used by meteorologists, oceanographers and coastal engineers. It is based on the concept that smaller (least significant) waves should be ignored from the observations as they have little influence on wave processes generally.

Hmax The maximum zero up-crossing wave height (in metres) in a 26.6 minute record.

Tz The average of the zero up-crossing wave periods (in seconds) in a wave record.

Tp Wave period at the peak spectral energy (in seconds). This indicates the wave period of those waves producing the most energy in a wave record.

Direction The direction that peak wave period (Tp) waves are coming from (in ° Magnetic). In other words, where waves with the most wave energy are coming from.