

Meteotsunami in Queensland

Coastal Impacts Unit

A unique and uncommon wave that is very similar to a Tsunami wave hit Queensland coastal regions on 3 and 4 December 2016. The wave occurred during a storm event and passed without being noticed in the stealth of darkness. A Tsunami-like wave train was recorded in many of the Queensland Storm Tide gauges over a 10 hour period.

What is a Meteotsunami?

The wave is called a Meteotsunami, which are atmospheric gravity waves that occur when air parcels are lifted by buoyancy and pulled back down by gravity in oscillatory fashion. These energy and pressure fluctuations translate to the water surface and the response of the surface generates the Meteotsunami. The gravity waves generally have periods of 10 to 50 minutes and particularly affect bays and inlets.

The development of a Meteotsunami is dependent on several factors such as the intensity, direction, and speed of the atmospheric disturbance as it travels over a water body with an appropriate depth that enhances wave magnification.

Most Meteotsunamis are too small to be noticed however large Meteotsunamis can have devastating impacts on coastal regions. Damaging waves, strong currents and flooding can last from several hours up to a day, and can cause significant damage to people and property. For example a series of waves up to 4 metres high at Boothbay Harbour Maine USA emptied and flooded the harbour at least three times over 15 minutes.

The Queensland Meteotsunami

DSITI operates a network of 36 storm tide gauges along the Queensland coastline capable of recording real time water levels as well as atmospheric pressure. The Meteotsunami was recorded by this network at around 0.4 m in height (magnitude), and passed during low tide levels. If it had occurred at high water then there would have been potential for damage to property through inundation. The passage of the Meteotsunami was in the south east region.

Atmospheric Pressure fluctuations

The driving force responsible for the Meteotsunami was a series of sudden falls followed by a consequent rise in atmospheric pressure during the passage of a low pressure trough across the south east coast. The pressure changes were recorded by two pressure sensors at Southport beach (6.1 hPa) and within the Gold Coast Seaway (6.4 hPa).

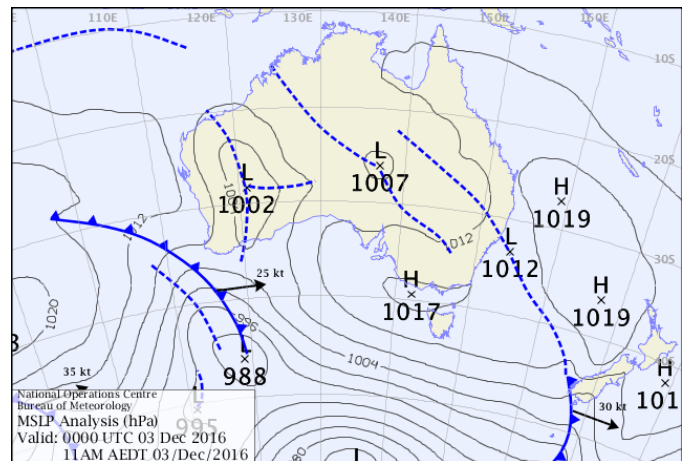


Figure 1 Synoptic chart of MSLP several hours before passage of the Meteotsunami, showing a low pressure ridge across Queensland and NSW. From “December 2016 monthly weather summary”, Bureau of Meteorology.

Wave characteristics

The wave height of the Meteotsunami was recorded at several locations in the south east Queensland coastal region. There was a particularly strong signal in the Gold Coast Broadwater and on the ocean facing Southport beach. The Meteotsunami wave consisted of a train of 10 to 15 waves with one wave twice the height of the others in the wave train.

Table 1 Largest change in atmospheric pressure and maximum Meteotsunami wave height at the Gold Coast.

Site	Pressure change (hPa)	Wave height (m)
Wavebreak Island South Channel	6.4	0.27
Wavebreak Island North Channel	na	0.27
Sand Pumping Jetty Southport beach	6.1	0.36
Gold Coast marine operations base	na	0.35
West Crab Island North Channel	na	0.41

How extensive was the Meteotsunami?

The Meteotsunami signal was recorded by the DSITI Storm Tide gauges from the state border with NSW to the Gold Coast beaches and waterways, within Moreton Bay, and as far north as Burnett Heads near Bundaberg. Interestingly the Meteotsunami travelled at least 50 km up the Brisbane River and was detected in the Brisbane City Council Alert gauges (not presented here).

Further information

Additional information about DSITI's storm tide and wave monitoring networks can be found on the Queensland Government webpages:

www.qld.gov.au/tides and www.qld.gov.au/waves

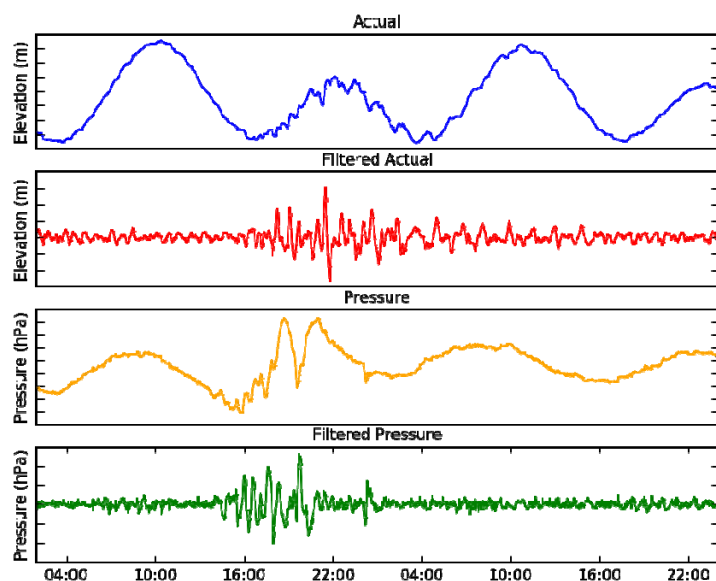


Figure 2 Water level and atmospheric pressure at Southport Beach. Non-filtered (top) and high-pass filtered.