

Expedition Log for IODP Expedition 325
Week 3
Great Barrier Reef Environmental Changes

2nd March 2010

A Science Aside by Carol Cotterill

On February 27th at 16:34 Brisbane time (+10 hours GMT), there was a devastating earthquake in Chile, Magnitude 8.8. This was followed by multiple aftershocks, some of which were larger in themselves than the Haiti quake. An unusual start to a logbook entry from the Great Barrier Reef you may think – how can those events on the other side of the Pacific relate to our activity?

Initially our interest was piqued, as family and friends began to log onto facebook and other such networking sites discussing the impact of the earthquake. This soon turned into monitoring of the effects, as both NOAA and the Joint Australian Tsunami Warning Centre issued Pacific wide tsunami alerts – would it reach us here? Would we feel the effects or would the wave be dissipated? If it did reach here, how large would it be and when would it arrive?

TSUNAMI BULLETIN NUMBER 005
PACIFIC TSUNAMI WARNING CENTER/NOAA/NWS
ISSUED AT 1045Z 27 FEB 2010

THIS BULLETIN APPLIES TO AREAS WITHIN AND BORDERING THE PACIFIC
OCEAN AND ADJACENT SEAS...EXCEPT ALASKA...BRITISH
COLUMBIA...WASHINGTON...OREGON AND CALIFORNIA.

... A WIDESPREAD TSUNAMI WARNING IS IN EFFECT ...

A TSUNAMI WARNING IS IN EFFECT FOR

CHILE / PERU / ECUADOR / COLOMBIA / ANTARCTICA / PANAMA / COSTA
RICA / NICARAGUA / PITCAIRN / HONDURAS / EL SALVADOR / GUATEMALA /
FR. POLYNESIA / MEXICO / COOK ISLANDS / KIRIBATI /
KERMADEC IS / NIUE / NEW ZEALAND / TONGA / AMERICAN SAMOA / SAMOA /
JARVIS IS. / WALLIS-FUTUNA / TOKELAU / FIJI / AUSTRALIA / HAWAII /
PALMYRA IS. / TUVALU / VANUATU / HOWLAND-BAKER / NEW CALEDONIA /
JOHNSTON IS. / SOLOMON IS. / NAURU / MARSHALL IS. / MIDWAY IS. /
KOSRAE / PAPUA NEW GUINEA /
POHNPEI / WAKE IS. / CHUUK / RUSSIA / MARCUS IS. / INDONESIA / N.
MARIANAS / GUAM / YAP / BELAU / JAPAN / PHILIPPINES / CHINESE TAIPEI

THIS BULLETIN IS ISSUED AS ADVICE TO GOVERNMENT AGENCIES. ONLY
NATIONAL AND LOCAL GOVERNMENT AGENCIES HAVE THE AUTHORITY TO

MAKE DECISIONS REGARDING THE OFFICIAL STATE OF ALERT IN THEIR
AREA AND ANY ACTIONS TO BE TAKEN IN RESPONSE.

AN EARTHQUAKE HAS OCCURRED WITH THESE PRELIMINARY
PARAMETERS

ORIGIN TIME - 0634Z 27 FEB 2010
COORDINATES - 36.1 SOUTH 72.6 WEST
DEPTH - 55 KM
LOCATION - NEAR COAST OF CENTRAL CHILE
MAGNITUDE - 8.8

MEASUREMENTS OR REPORTS OF TSUNAMI WAVE ACTIVITY

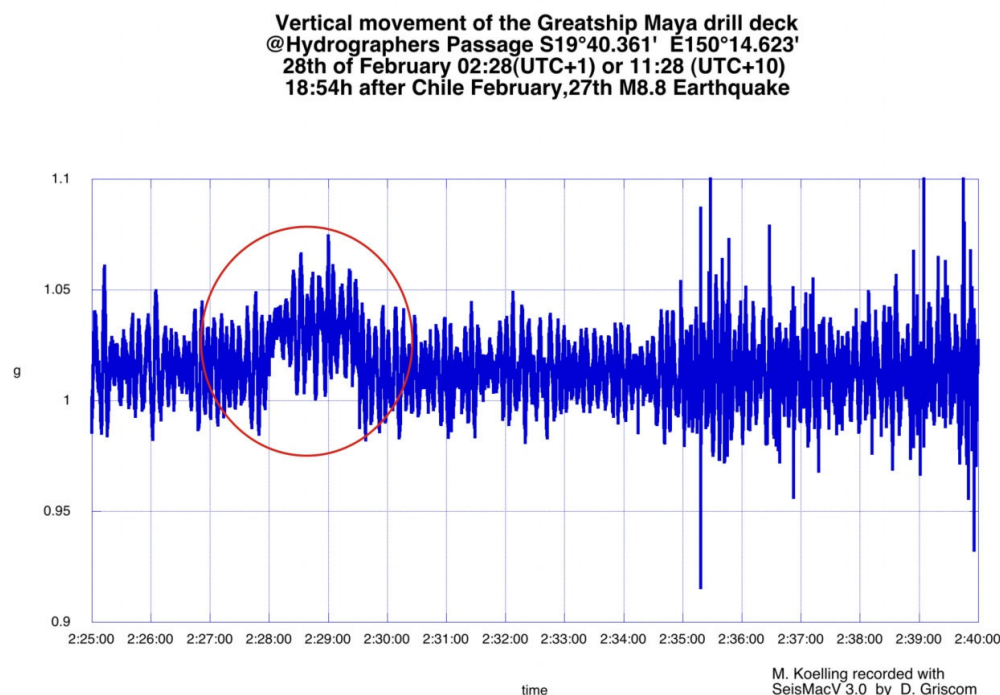
GAUGE LOCATION	LAT	Lon	TIME	AMPL	PER
IQUIQUE CL	20.2S	70.1W	0906Z	0.27M / 0.9FT	72MIN
ANTOFAGASTA CL	23.2S	70.4W	0941Z	0.49M / 1.6FT	52MIN
ARICA CL	18.5S	70.3W	1007Z	0.94M / 3.1FT	44MIN
DART LIMA 32412	18.0S	86.4W	0941Z	0.24M / 0.8FT	36MIN
CALDERA CL	27.1S	70.8W	0843Z	0.45M / 1.5FT	20MIN
TALCAHUANO CL	36.7S	73.4W	0653Z	2.34M / 7.7FT	88MIN
COQUIMBO CL	30.0S	71.3W	0852Z	1.32M / 4.3FT	30MIN
CORRAL CL	39.9S	73.4W	0739Z	0.90M / 2.9FT	16MIN
SAN FELIX CL	26.3S	80.1W	0815Z	0.53M / 1.7FT	08MIN
VALPARAISO CL	33.0S	71.6W	0708Z	1.29M / 4.2FT	20MIN

It is known that tsunamis generated from earthquakes or submarine slides can travel at the speed of passenger jets, at up to 950km per hour, with wavelengths up to hundreds of kilometres in length. However, despite these statistics, in the open ocean the wave is often only around 1m in height and so it can be easily missed in the background sea swell!

Initially the maps showed that we were working in an area that would be effect free, with the main marine warning limited to coastline from Sydney to Brisbane. But by 7am on the 28th, this marine warning area had crept slowly northward, until it was not far away from our coring location. So now the discussions began as to the best tactics.....should we continue coring or pull the pipe in case of a wave that took us beyond our 2.5m heave capacity? Would its arrival coincide with a high tide, which due to being on Springs, would compound the height and heave problem caused by the sea swell? Would the main effect actually be felt not from the incoming wave, but from any return waves / currents channelling back out through the reef passages afterwards? Should we contemplate doing our usual CTD dips to measure the physical structure of the water column if tides and currents were going to be unusual and increased in strength?

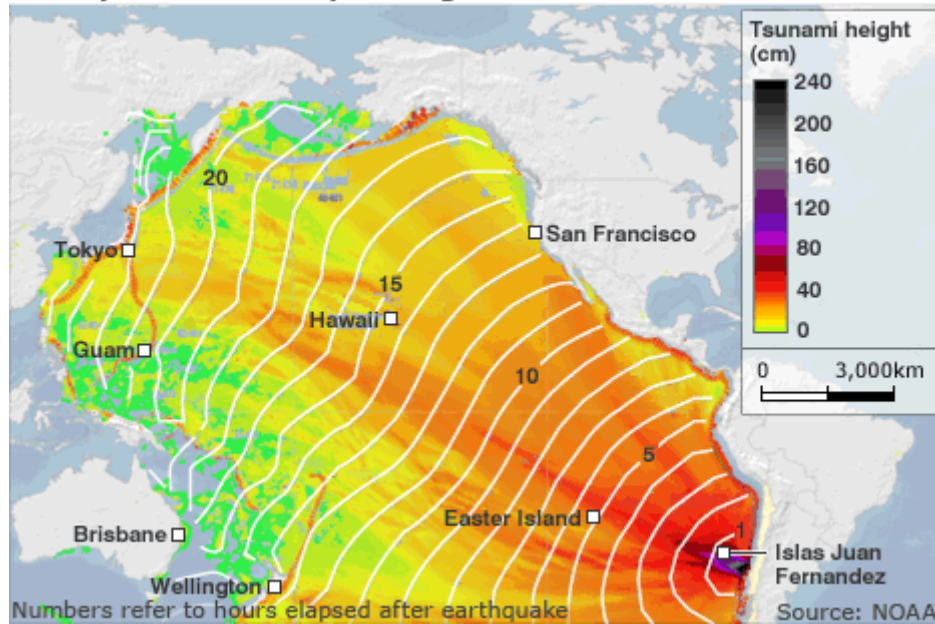
By 08.15 am, any tsunami effects were due to have reached the area around Brisbane. Logging on to the regular updates, we could see that the waves reaching the coast were minimal – in the order of 10-15cm above the usual tidal heights. And so the next question.....would we even notice it at all?! NOAA had its arrival at Mackay down for 12:51 local time.....and so we waited!

The sun beat down on the boat deck as we all assembled for a fire drill at 12:50.....and then all left at 13:00 with not so much as a ripple over the usual sea swell. But yesterday (March 1st) Martin Kölling, one of the geochemists onboard, came and showed me an interesting plot.



On his laptop he has a piece of software installed called “SeisMac”. This monitors the movement of the laptop in the x, y and z orientation. He printed out a plot for a 15 minute period which appears to show an increase in the average sea swell induced fluctuations of the drill floor of approximately 0.5g for a period of 1.5 minutes, occurring between 18 and 19 hours after the initiation of the tsunami in Chile. When we checked against the predicted arrival time plot generated by NOAA, it matched this time window.

Chile quake tsunami spreading across the Pacific



So, as an aside to coring for past records of sea level change on the Great Barrier Reef had we actually managed to record a present day sea level change event? The jury is still open....but I'm pretty convinced!