



**Sea conditions off Foxton, 16-17
March, 2009**

**NIWA Client Report: HAM2009-047
April 2009**

NIWA Project: THP09201

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Reviewed by:



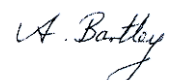
Mark Pritchard

Approved for release by:



Rob Bell

Formatting checked



1. Introduction

This report on sea conditions was requested by Maritime New Zealand to assist investigations into an incident occurring in the South Taranaki Bight some 5-6 km off Foxton, where a vessel capsized some time on the evening of 16-17 March, 2009.

2. NIWA wave forecasts

NIWA runs an operational forecast system for sea conditions, using the Wavewatch III wave model (Tolman, 2002) to predict the generation of wave conditions, taking input wind fields from NIWA's regional weather prediction models.

As part of an operational forecasting system for the New Zealand region, the Wavewatch III has been implemented on two nested grids: globalwave_120 and nzwave_12. The outermost domain is a global grid with spatial resolution of order 120 km. A daily 144-hour forecast is run, starting at 00UTC, taking inputs of wind velocity and sea-ice concentration from the UM global weather model run by the UK MetOffice.

This nzwave_12 model covers the New Zealand region at a spatial resolution of approximately 12 km. Inputs of wind velocity are taken from NIWA's 12 km resolution New Zealand Limited Area Model (nzlam_12) weather forecasts, while boundary conditions are provided by the latest forecast of globalwave_120.

Two 48-hour forecasts are run daily, from 06UTC and 18UTC, along with other models predicting tides and storm surge.

3. Forecasts and observations on 16-17 March 2009

Figure 1 shows the wave conditions predicted by the nzwave_12 forecast started at 07:00NZDT on 16 March 2009 for two output times straddling the likely time of the vessel incident. The overall pattern early in the evening of 16 March (19:00 NZDT) shows waves were from the SW in the Tasman Sea, with significant wave heights¹ over 1.5 m in open waters, but decreasing eastward to be less than 0.5 m in the

¹ Defined as the mean of the highest 33% of individual wave heights

sheltered waters of the South Taranaki Bight. By 01:00 NZDT on the following morning (17 March), a region of slightly elevated wave heights (over 0.5 m) with average direction from the east, developed in the mid South Taranaki Bight. We see from the corresponding forecast winds (Figure 2) that this corresponds to the development of easterly winds of 20-25 km/h (11-14 knots) in this region, which earlier in the day had been light and variable.

Table 1 gives hourly forecast wave and sea-level statistics at a point off Wanganui, the closest location to Foxton for which model outputs are regularly archived. Throughout the evening of 16 March, and into the morning of 17 March, significant wave height was predicted to be below 0.3 m, with peak and mean wave periods both around 13 seconds, travelling towards 60-65° T (i.e., from the ESE) indicating that the sea state was predominantly a small long-period swell entering from the Tasman Sea. This output location is too close to shore to show the development of a notable wind-sea from the easterlies late at night, as was predicted to occur further offshore. The same would apply to the incident location off Foxton.

Sea-surface temperatures, which may be of relevance to maritime safety, are available from satellite observations. Figure 3 shows sea-surface temperature in the region for 16-17 March 2009. Sea surface temperatures off Wanganui were in the range 18.5-19.0°C.

4. Reference

Tolman, (2002). User manual and system documentation of WAVEWATCH-III version 2.22. NOAA/NWS/NCEP/MMAB Technical Note 222, 133 pp.

Table 1: Hourly sea conditions at (40.0000°S, 174.8333°E), off Wanganui, and air temperature and wind speed at Wanganui (Spriggens Park), as forecast by NIWA tide, storm surge, wave and weather model forecasts commencing at 07:00 NZDT on 16 March 2009. Tidal and storm surge levels are both given relative to the Mean Level of the Sea. Mean and peak wave directions denote the direction (in degrees clockwise from True North) toward which waves travel. Wind directions denote the direction (in degrees clockwise from True North) from which winds blow.

Time (NZDT)	Tidal sea level relative to MLOS (m)	Storm surge height (m)	Mean wave period (sec)	Mean wave direction (°T)	Wave directional spread (°T)	Peak wave period (sec)	Peak wave direction (degrees)	Significant wave height (m)	Air temperature (°C)	Wind speed (knots)	Wind direction (°T)
16/03/2009 07:00	-0.820	-0.131	8.8	25.2	39.7	14.8	63.2	0.32	10.27	3.42	62.0
16/03/2009 08:00	-0.943	-0.122	10.2	38.4	36.0	14.7	63.8	0.29	10.57	3.12	62.8
16/03/2009 09:00	-0.820	-0.117	11.4	47.4	31.1	14.6	63.2	0.27	12.00	2.80	67.9
16/03/2009 10:00	-0.487	-0.129	12.2	53.6	26.1	14.5	63.7	0.26	13.56	2.86	70.3
16/03/2009 11:00	-0.030	-0.144	12.6	55.7	23.3	14.4	63.1	0.26	14.10	2.94	65.5
16/03/2009 12:00	0.432	-0.159	12.7	57.5	21.5	14.1	63.8	0.26	14.86	1.81	63.2
16/03/2009 13:00	0.782	-0.159	12.6	56.8	22.8	13.9	63.6	0.26	18.92	1.38	71.2
16/03/2009 14:00	0.933	-0.159	12.5	56.4	23.9	13.8	63.9	0.27	20.40	1.52	171.2

Time (NZDT)	Tidal sea level relative to MLOS (m)	Storm surge height (m)	Mean wave period (sec)	Mean wave direction (°T)	Wave directional spread (°T)	Peak wave period (sec)	Peak wave direction (degrees)	Significant wave height (m)	Air temperature (°C)	Wind speed (knots)	Wind direction (°T)
16/03/2009 15:00	0.848	-0.133	12.4	55.8	24.4	13.7	63.6	0.26	21.00	2.95	170.2
16/03/2009 16:00	0.553	-0.122	12.4	56.8	23.3	13.6	63.9	0.26	20.90	3.60	168.8
16/03/2009 17:00	0.125	-0.120	12.3	56.7	23.3	13.5	63.6	0.26	20.06	4.72	178.7
16/03/2009 18:00	-0.325	-0.126	12.5	58.5	20.7	13.5	63.9	0.26	19.24	5.40	181.2
16/03/2009 19:00	-0.685	-0.124	12.6	58.9	19.9	13.4	63.6	0.25	17.44	5.00	193.6
16/03/2009 20:00	-0.866	-0.110	12.4	58.5	21.3	13.4	63.9	0.26	15.68	4.88	196.6
16/03/2009 21:00	-0.827	-0.101	12.0	56.9	24.3	13.4	63.6	0.26	14.41	3.21	180.2
16/03/2009 22:00	-0.583	-0.107	11.7	55.5	26.2	13.3	63.9	0.26	13.03	1.75	82.4
16/03/2009 23:00	-0.201	-0.118	11.5	54.3	28.7	13.3	63.6	0.26	12.64	3.52	75.6
17/03/2009 00:00	0.219	-0.128	11.5	54.6	28.9	13.2	63.9	0.26	12.17	4.26	79.3
17/03/2009 01:00	0.569	-0.135	11.6	55.6	28.2	13.1	63.5	0.25	11.29	4.05	75.5
17/03/2009 02:00	0.762	-0.141	11.7	56.3	26.0	13.0	63.8	0.25	10.50	3.46	64.3

Time (NZDT)	Tidal sea level relative to MLOS (m)	Storm surge height (m)	Mean wave period (sec)	Mean wave direction (°T)	Wave directional spread (°T)	Peak wave period (sec)	Peak wave direction (degrees)	Significant wave height (m)	Air temperature (°C)	Wind speed (knots)	Wind direction (°T)
17/03/2009 03:00	0.754	-0.130	10.4	48.2	32.0	12.9	63.5	0.27	10.11	3.18	61.2
17/03/2009 04:00	0.550	-0.112	9.7	42.7	33.9	12.8	64.3	0.29	10.39	3.36	73.5
17/03/2009 05:00	0.209	-0.096	9.8	43.7	33.5	12.7	65.0	0.28	9.77	3.59	54.6
17/03/2009 6:00	-0.179	-0.090	10.6	49.7	30.1	12.6	64.3	0.27	9.36	3.77	52.4
17/03/2009 7:00	-0.514	-0.091	11.5	55.7	25.9	12.5	65.0	0.25	9.26	3.88	51.9
17/03/2009 8:00	-0.709	-0.090	12.2	59.7	20.4	12.4	64.3	0.24	10.12	3.85	52.8
17/03/2009 9:00	-0.718	-0.090	12.5	62.1	17.3	12.4	65.0	0.23	13.14	2.81	53.8
17/03/2009 10:00	-0.541	-0.094	12.6	62.4	16.4	12.3	64.4	0.24	16.02	2.41	57.6
17/03/2009 11:00	-0.226	-0.097	12.7	63.2	15.4	12.3	65.0	0.23	18.81	1.50	80.7
17/03/2009 12:00	0.145	-0.090	12.8	63.1	14.9	12.3	64.4	0.24	21.19	1.67	90.8
17/03/2009 13:00	0.477	-0.081	12.8	63.2	16.4	12.3	65.0	0.24	22.27	1.95	124.2
17/03/2009 14:00	0.686	-0.076	12.8	62.9	16.8	12.2	64.3	0.24	22.86	2.48	159.6

Time (NZDT)	Tidal sea level relative to MLOS (m)	Storm surge height (m)	Mean wave period (sec)	Mean wave direction (°T)	Wave directional spread (°T)	Peak wave period (sec)	Peak wave direction (degrees)	Significant wave height (m)	Air temperature (°C)	Wind speed (knots)	Wind direction (°T)
17/03/2009 15:00	0.722	-0.070	12.9	63.7	16.2	12.2	65.0	0.24	23.15	3.11	176.9
17/03/2009 16:00	0.580	-0.060	13.0	64.1	14.3	12.2	64.3	0.25	22.90	1.83	180.0
17/03/2009 17:00	0.298	-0.046	13.1	65.0	13.4	12.2	65.0	0.25	22.03	0.86	251.8
17/03/2009 18:00	-0.051	-0.039	13.1	65.2	12.3	12.2	64.3	0.25	20.79	2.99	309.2
17/03/2009 19:00	-0.378	-0.039	13.1	65.9	12.3	15.1	64.3	0.25	19.67	2.82	316.1
17/03/2009 20:00	-0.604	-0.028	13.1	65.8	11.8	15.0	64.8	0.26	17.70	2.77	291.9
17/03/2009 21:00	-0.675	-0.028	13.1	66.4	12.2	14.9	64.3	0.26	16.03	2.75	290.6
17/03/2009 22:00	-0.579	-0.033	13.0	66.5	11.9	14.9	64.8	0.27	15.67	2.37	320.0
17/03/2009 23:00	-0.345	-0.036	13.0	67.0	12.4	14.9	64.2	0.26	15.20	3.11	353.2
18/03/2009 0:00	-0.037	-0.047	12.9	67.0	12.0	14.8	64.8	0.27	15.13	3.91	3.7

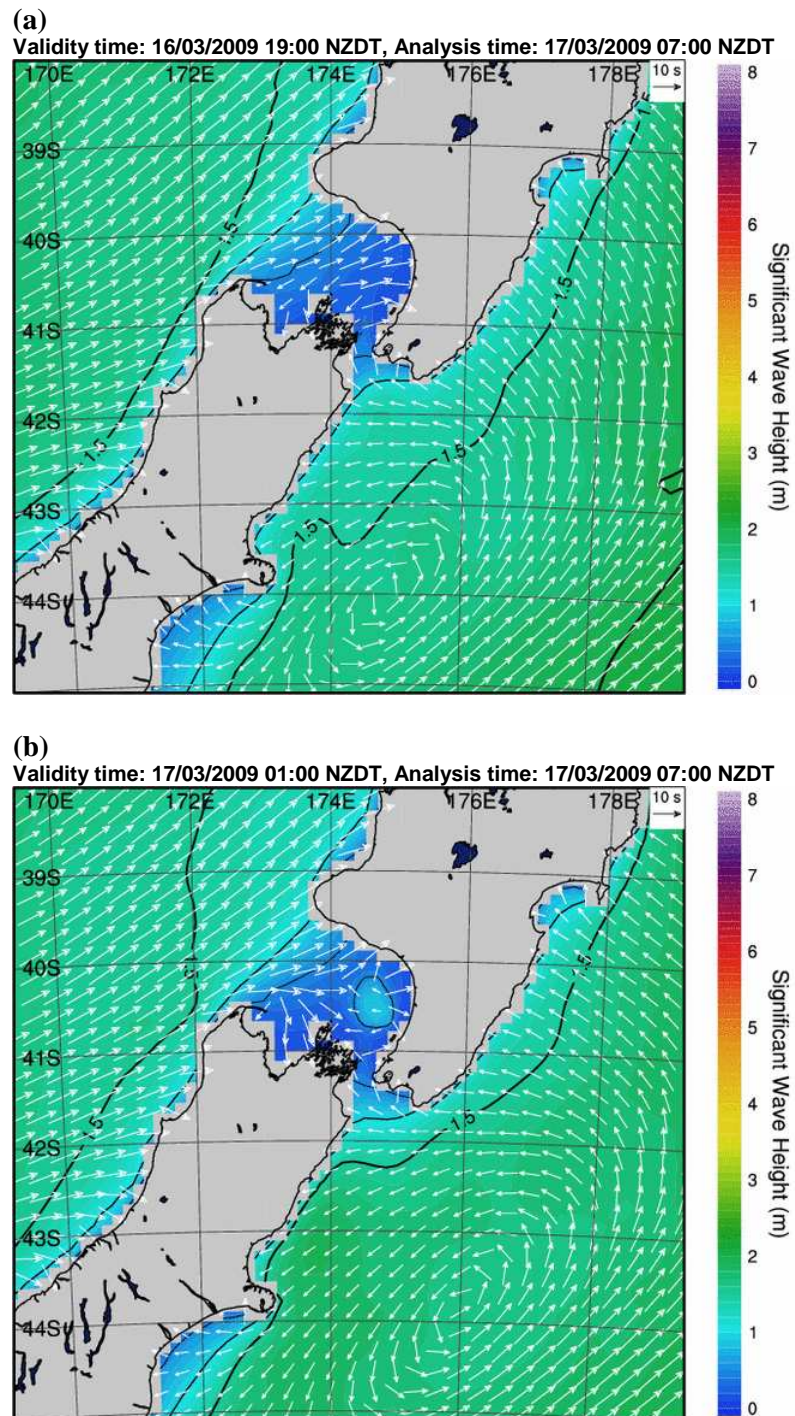


Figure 1: Wave conditions predicted for Central New Zealand at (a) 19:00 NZDT on 16 March, 2009, and (b) at 01:00 NZDT on 17 March, 2009, by the nzwave_12 forecast commencing at 07:00 NZDT on 16 March 2009.

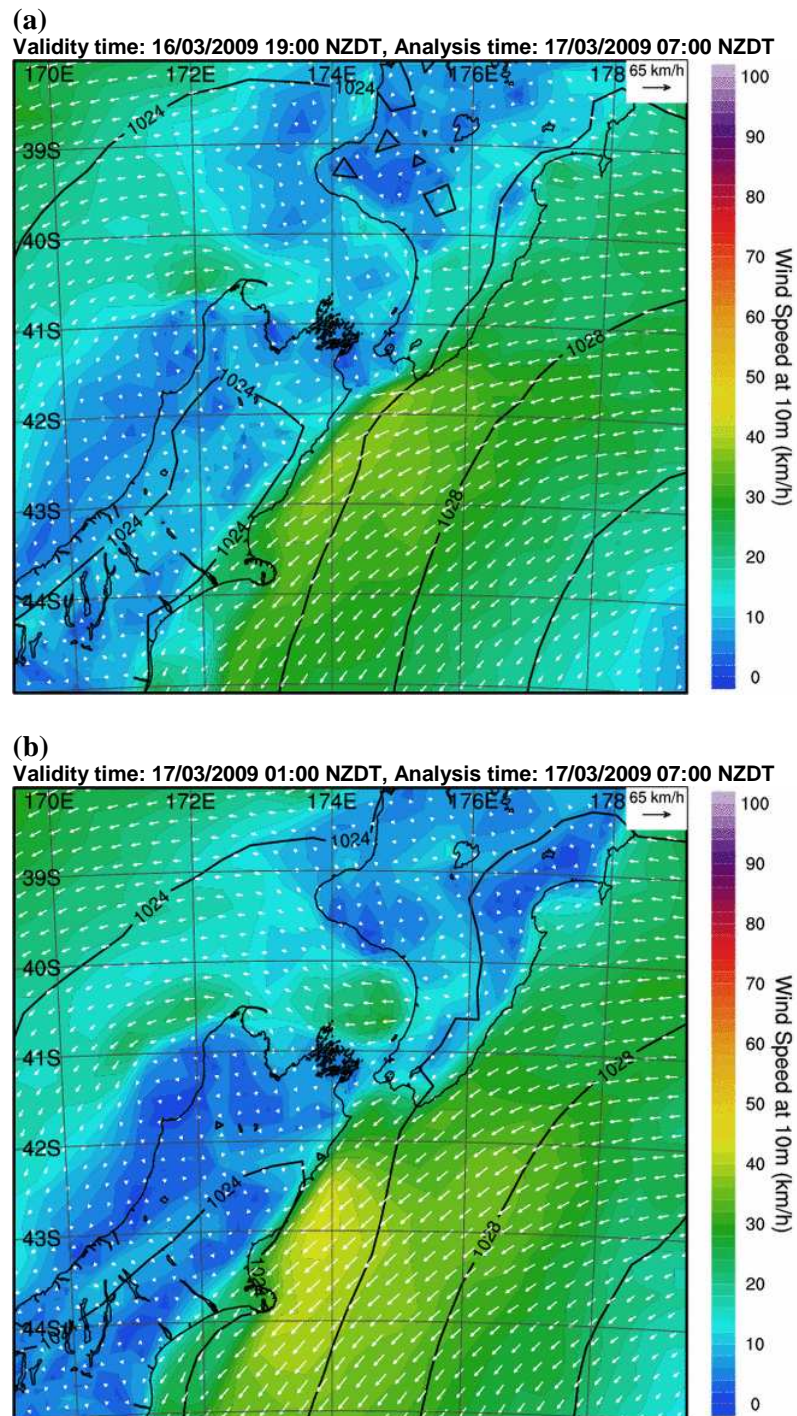


Figure 2: Wind and mean sea level pressure predicted for Central New Zealand at (a) 19:00 NZDT on 16 March, 2009, and (b) at 01:00 NZDT on 17 March, 2009, by the nzlam_12 forecast commencing at 07:00 NZDT on 16 March 2009.

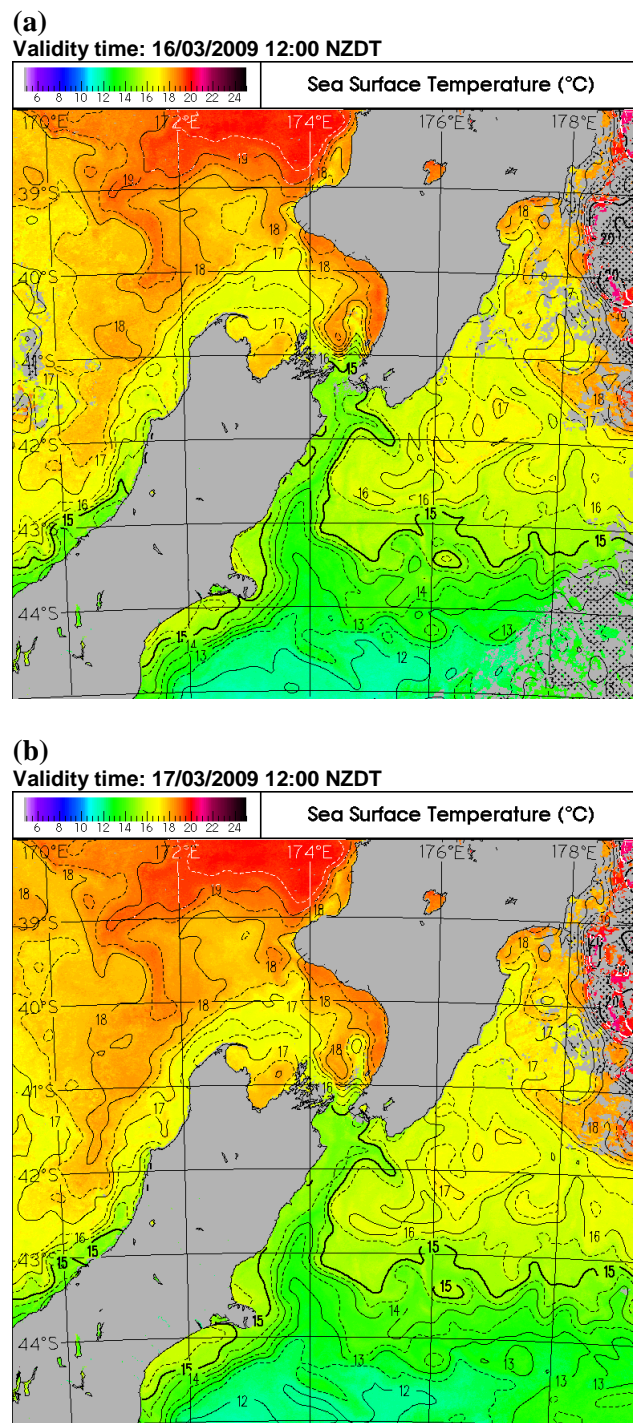


Figure 3: Sea surface temperature in the Central New Zealand region at (a) 12:00 NZDT on 16 March, 2009, and (b) 12:00 NZDT on 17 March, 2009, from satellite data.