

7<sup>th</sup> September 2018

Hon. David Parker  
Air Quality NES Exceptional Circumstances  
Ministry for the Environment  
PO Box 10362  
Wellington 6143

Dear Minister,

**APPLICATION UNDER NATIONAL STANDARDS FOR AIR QUALITY – REGULATION 16A  
EXCEPTIONAL CIRCUMSTANCES**

The Hawke's Bay Regional Council is seeking a determination that an exceedance of the National Air Quality Standards for PM<sub>10</sub> in the Awatoto Airshed on 12<sup>th</sup> June 2018 was an exceptional circumstance. A completed application form and additional supporting information accompany this letter and support the five criteria that define exceedances caused by exceptional or natural events:

1. the exceedance was caused by the events assessed,
2. the circumstances were beyond the reasonable control of the Council,
3. the circumstances could not be planned for,
4. the event was unusual,
5. determining that the circumstances were exceptional is consistent with the purpose of the RMA.

If you require any further information or have any questions, please do not hesitate to contact me.

Thank you for your consideration in this matter.

Yours sincerely



Dr Kathleen Kozyniak  
Principal Scientist Climate and Air

P 06 833 8055 | F 06 835 3601  
[kathleen@hbrc.govt.nz](mailto:kathleen@hbrc.govt.nz) | [www.hbrc.govt.nz](http://www.hbrc.govt.nz)



## Resource Management (National Environmental Standards for Air Quality) Regulations 2004 – Regulation 16A Exceptional Circumstances

### APPLICATION FORM

**Before completing this form** please read section 3.8 of the [2011 User's Guide to the revised National Environmental Standards for Air Quality](#).

**Need more help?** If you have any questions email [air@mfe.govt.nz](mailto:air@mfe.govt.nz).

**Please send your completed application form and all attachments** to [air@mfe.govt.nz](mailto:air@mfe.govt.nz).

Alternatively, if attachments are too large to email, please post hard copies of the application form and all attachments, along with a CD containing all files, to:

Air Quality NES Exceptional Circumstances  
Ministry for the Environment  
PO Box 10362  
Wellington 6143

1. Applicant details	
Name of regional council	Hawke's Bay Regional Council
Contact person	Kathleen Kozyniak
Position	Principal Scientist - Air
Email address	kathleen@hbrc.govt.nz
Telephone number	06 833 8055
Mobile number	0272252871
Postal address	Private Bag 6006, Napier 4142
2. Details of exceedance event	
Contaminant	PM <sub>10</sub>
Date of exceedance ( <i>must not be &gt;3 months from date this application is received</i> )	12 <sup>th</sup> June 2018
Relevant airshed	Awatoto
Monitoring station and technical specifications of monitor	Awatoto Air Quality Site, 80 Waitangi Road. Site details are provided in Appendix I. Beta Attenuation Monitor (BAM) housed in an air conditioned hut. BAM make and model: Thermo FH62C14.

Summary of monitoring reading showing exceedance event	The 24 hour average PM <sub>10</sub> on the 12 <sup>th</sup> June 2018 was 56.6 µg/m <sup>3</sup> . Further information is provided in Appendix 2 and an excel file of measurements is attached. The source of the particulate is believed to be sea salt.			
Analysis of baseline data	Please refer to Appendix 3.			
Source speciation or other analysis	<p>Samples of particulate were collected on BAM tape only. Some New Zealand universities offer analysis of BAM tapes using SEM microscopy, however the relevant portion of the tape was accidentally torn, then taped together by a technician on removal from the instrument and rendered unsuitable for analysis.</p> <p>PM<sub>2.5</sub> concentrations at the site measured 11.7 µg/m<sup>3</sup>, indicating that the majority of particulate was in the coarse PM<sub>10</sub>-PM<sub>2.5</sub> fraction. A source apportionment study undertaken between May 2016 and April 2017 found that marine aerosol accounts for 64% on average of coarse particles and 80% on days when PM<sub>10</sub> concentrations are high (see Appendix 3).</p>			
Explanation of any previous exceedance event/s from this monitoring station in the past 5 years	<p>59 µg/m<sup>3</sup> on 11<sup>th</sup> June 2013 – likely source was sea salt.</p> <p>55 µg/m<sup>3</sup> on 11<sup>th</sup> June 2014 – attributed to sea salt and deemed an exceptional event.</p> <p>64 µg/m<sup>3</sup> on 1<sup>st</sup> October 2014 – attributed to sea salt and deemed an exceptional event.</p> <p>53 µg/m<sup>3</sup> on 28<sup>th</sup> January 2015 – likely sources were sea salt and earthworks.</p> <p>52 µg/m<sup>3</sup> on the 28<sup>th</sup> March 2015 – unknown local source</p> <p>80 µg/m<sup>3</sup> on the 29<sup>th</sup> March 2015 – unknown local source.</p> <p>75 µg/m<sup>3</sup> on the 29<sup>th</sup> April 2017 – attributed to sea salt and deemed an exceptional event.</p> <p>66 µg/m<sup>3</sup> on 22<sup>nd</sup> February 2018 – likely source was a delivery of reactive phosphate rock to the local fertiliser works.</p> <p>59 µg/m<sup>3</sup> on 4<sup>th</sup> March 2018 – results from SEM microscopy with energy dispersive spectroscopy suggest mineral, biological, calcium carbonate and calcium sulphate contributions.</p>			
Monitoring readings covering exceedance event	<input checked="" type="checkbox"/> Attached		<input type="checkbox"/> Not attached	
<b>3. Details of exceptional circumstances</b>				
Exceptional circumstances leading to exceedance	<input type="checkbox"/> Localised impact on a monitor	<input type="checkbox"/> Anthropogenic extreme event	<input checked="" type="checkbox"/> Natural disaster or natural extreme event	<input type="checkbox"/> Other
Explanation of circumstances leading to exceedance event	<p>A slow moving low pressure system centred in the Bay of Plenty, together with a high pressure system over the South Island, created a 'squash zone' of strong easterly winds over Hawke's Bay. The weather on the day was stormy with 30 mm of rain recorded on the Heretaunga Plains, onshore wind gusts reaching gale force and wave heights exceeding 5 metres (<a href="https://www.nzherald.co.nz/hawkes-bay-today/video/news/video.cfm?c_id=1503454&amp;gal_cid=1503454&amp;gallery_id=194355">https://www.nzherald.co.nz/hawkes-bay-today/video/news/video.cfm?c_id=1503454&amp;gal_cid=1503454&amp;gallery_id=194355</a>). Sea spray associated with the high seas is believed to have raised particulate levels in the Awatoto airshed above normal background levels. Please see Appendix 4 for further detail.</p>			
Reasons why these circumstances were beyond the reasonable control of the regional council	<p>Natural events are beyond the reasonable control of the Council and it is believed the exceedance was the result of an exceptional amount of sea salt in onshore winds during a period of high seas. The high seas are attributed to an intense, slow moving pressure system located near the Bay of Plenty, which brought onshore winds and stormy weather to Hawke's Bay.</p>			

Supporting evidence (eg, meteorological report)	<input checked="" type="checkbox"/> Attached	<input type="checkbox"/> Not attached
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7/9/2018  
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Dated

*K. M. [Signature]*  
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Signed

## **APPENDIX 1 – SITE INFORMATION**

**Site Name** – Awatoto AQ

**Site Location** – 80 Waitangi Road, Awatoto

**Map Reference** NZMG 2846750E 6176930N, NZTM 1936791E 5615302N

**Region and Monitoring zone** – Hawke's Bay, Awatoto Airshed

**Airshed Type** – Industrial

**Owner (Operator)** – Hawke's Bay Regional Council (HBRC)

**Parameters monitored** –

- PM<sub>10</sub> (Thermo FH62C14 Beta Attenuation Monitor, <2 years old)
- PM<sub>2.5</sub> (5014i Beta Attenuation Monitor, <1 year old)
- Wind direction and speed
- Temperature
- Humidity

**Monitoring period** –

- PM<sub>10</sub>, wind speed, humidity and temperature -15<sup>th</sup> February 2012 to present
- Wind direction – 10<sup>th</sup> May 2012 to present
- PM<sub>2.5</sub> – 8<sup>th</sup> September 2016 to present

**Height above ground** – PM<sub>10</sub> and PM<sub>2.5</sub> approximately 4 m, climate parameters 6 m (see Figure 1.1 for the site configuration)

**Nearest SH and Local Road with Direction** – SH2 75 m E, Waitangi Road 23 m W.

**Nearest tree** – 20 m



**Figure 1.1:** HBRC’s air quality and climate site at Waitangi Road, Awatoto. The hut on the left houses a Thermo FH62C14 BAM measuring PM<sub>10</sub> and the hut on the right houses a Thermo FH62C14 BAM measuring PM<sub>2.5</sub>. The mast with climate instruments is adjacent to the hut on the right.

### **Location Map and Additional Notes**

The Awatoto airshed lies near the coast south of Napier and comprises industrial and rural land. It is approximately 3 km long and, for the most part, lies within 800 m of the shoreline but extends to 1km from the coast at its widest point. The rural land lies on the western side of the airshed and industry is concentrated on its eastern border in a strip less than 300 m wide.

HBRC’s monitoring site is located approximately 200 metres west of the shoreline and 1 km from its northern border (Figure 1.2). Ravensdown Limited, a fertiliser manufacturer, dominates the area immediately to the south of the monitoring site. Ravensdown monitors PM<sub>10</sub> on the eastern boundary of the airshed as a requirement of its air discharge consent.

HBRC chose the site for the following reasons:

- it is situated amongst the exposed population,
- the property is otherwise unused,
- it is relatively free of obstacles,
- easily accessible and has a power supply,



- fairly centrally located within the narrow strip of industrial activity,
- able to capture at least some industrial sources of PM<sub>10</sub> in most wind directions and particularly the prevailing wind which has a westerly component.

Consideration has been given to moving the site beyond 500 m from the coast to place it beyond the “sea spray zone” but this would limit the effectiveness of sampling. It would place the monitor out of the industrial zone, meaning emissions from industry would be captured only in easterly conditions and in an area where human exposure is negligible.



**Figure 1.2** An aerial photo of the Awatoto airshed showing the locations of the HBRC and Ravensdown’s air quality sites.

## APPENDIX 2 – MONITORING SHOWING THE EXCEEDANCE EVENT

On Tuesday 12<sup>th</sup> June 2018, hourly PM<sub>10</sub> concentrations at Awatoto AQ ranged from 37 to 93 µg/m<sup>3</sup> and averaged 56.6 µg/m<sup>3</sup> over 24 hours. The following day's concentrations were also relatively high, averaging 46.4 µg/m<sup>3</sup>. Average PM<sub>10</sub> concentrations recorded at the Ravensdown site measured 86 and 58 µg/m<sup>3</sup> on the 12<sup>th</sup> and 13<sup>th</sup> June respectively.

At Marewa Park in Napier, which lies 2 km from the coast, the PM<sub>10</sub> concentration on 12<sup>th</sup> June was 29.3 µg/m<sup>3</sup> and in Hastings, approximately 9 km inland, it was 14.5 µg/m<sup>3</sup>. Further north, in the Whirinaki airshed, the PM<sub>10</sub> concentration measured by Pan Pac Forest Products Limited was 63 µg/m<sup>3</sup>. The monitor in Whirinaki is located 200 m from the coast and has a shelterbelt of large pine trees between it and the sea. Figure 2.1 shows the locations of the monitoring sites and the recorded concentrations.

Figure 2.2 shows the profile of hourly PM<sub>10</sub> and PM<sub>2.5</sub> concentrations through 12<sup>th</sup> June 2018, along with the wind direction, wind speed and humidity measured at the Awatoto site. Hourly wind speeds reached a maximum of 28 km/h and averaged 19 km/h for the day. The wind direction remained east to southeast.

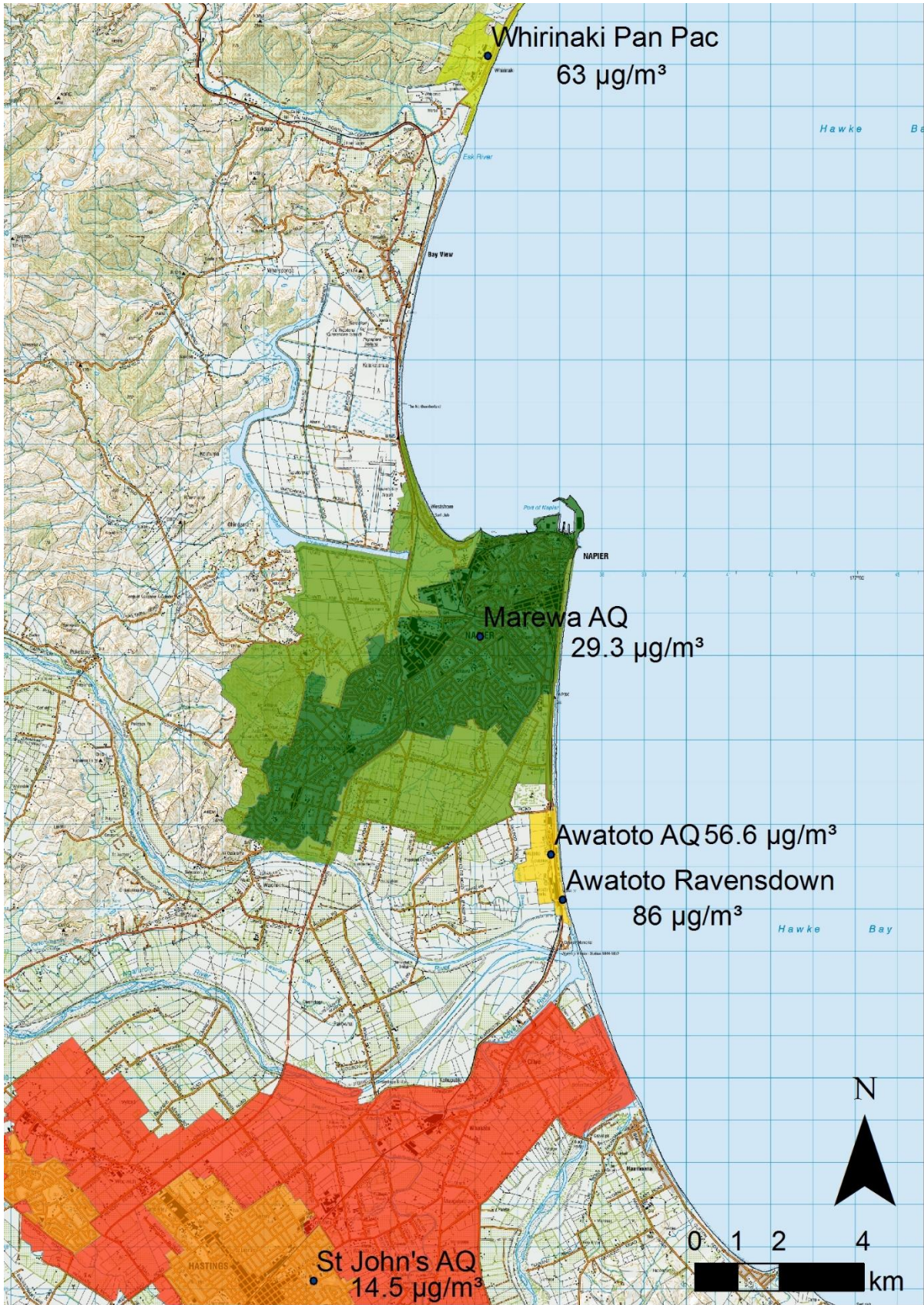
PM<sub>2.5</sub> concentrations did not exceed the World Health Organisation guideline for the 24 hour average (i.e. 25 µg/m<sup>3</sup>) and measured 12 µg/m<sup>3</sup>. The highest hourly maximum was 17 µg/m<sup>3</sup>. Relative humidity was high throughout the day and had a mean value of 87% and the mean temperature was 14°C, with a narrow range of 13-15°C. It rained from midnight to 1pm then showers followed in the afternoon and evening. Rainfall totals reached more than 30 mm in Napier and Hastings, which is 40-50% of the average June rainfall.

The concentration rose for 12<sup>th</sup> June 2018 in Figure 2.3 shows the dominance of onshore winds from the northeast to southeast.

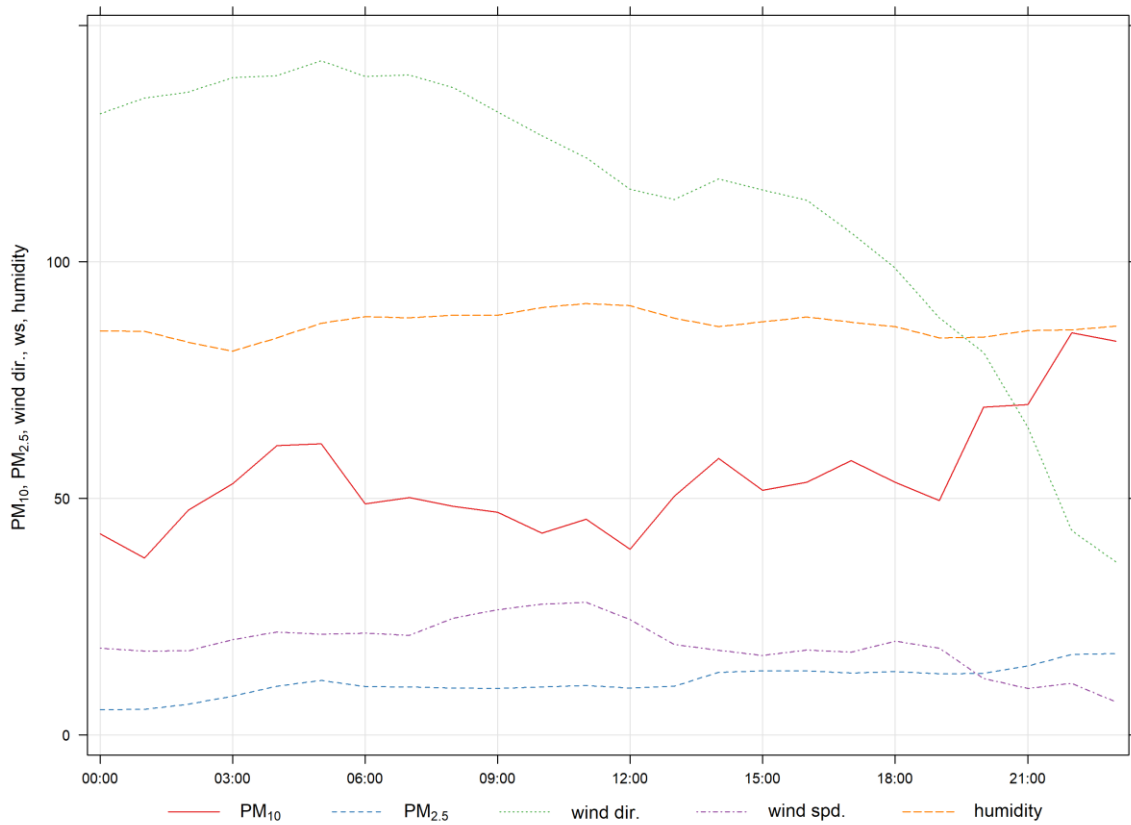
Seas were high on the 12<sup>th</sup> June and wave heights peaked with the strongest winds (Figure 2.4). Significant wave heights, measured at the Port of Napier buoy, reached a maximum of 5.3 m (20 min reading) at approximately 11 am and the maximum wave height recorded at that time exceeded 8 m. Significant wave heights in excess of 5 m lie at the extreme tail of wave height distributions at the Port of Napier (Figure 2.5). The modern Beaufort Scale (<https://blog.metservice.com/sea-state-and-swell>) describes wave heights of 5-8 m as capable of generating moderate to large amounts of airborne spray that can reduce visibility. The wave period was approximately 10 seconds throughout the day.

The source of particulates is most likely sea salt given the onshore winds, the high seas and the prevalence of high concentrations at sites near the coast and their progressive decrease inland.

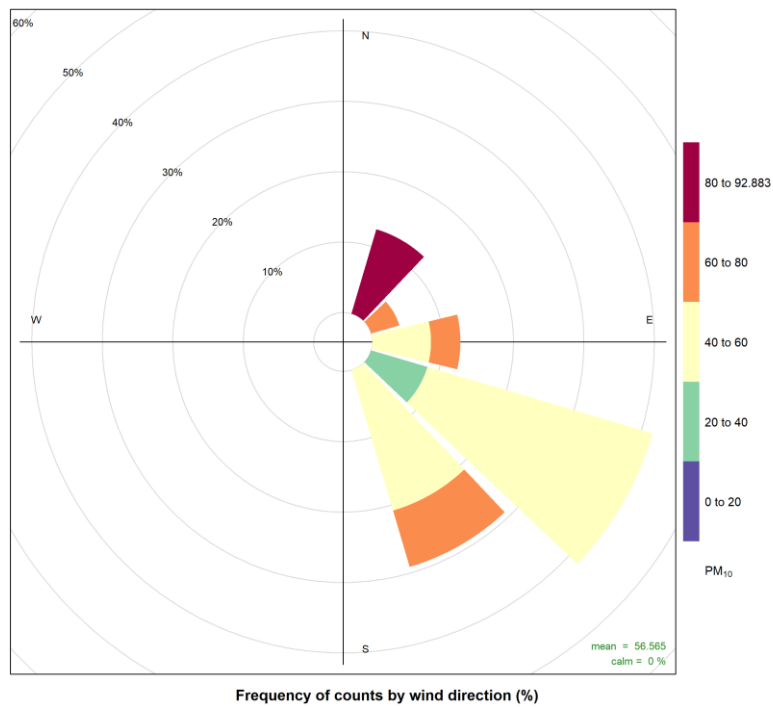




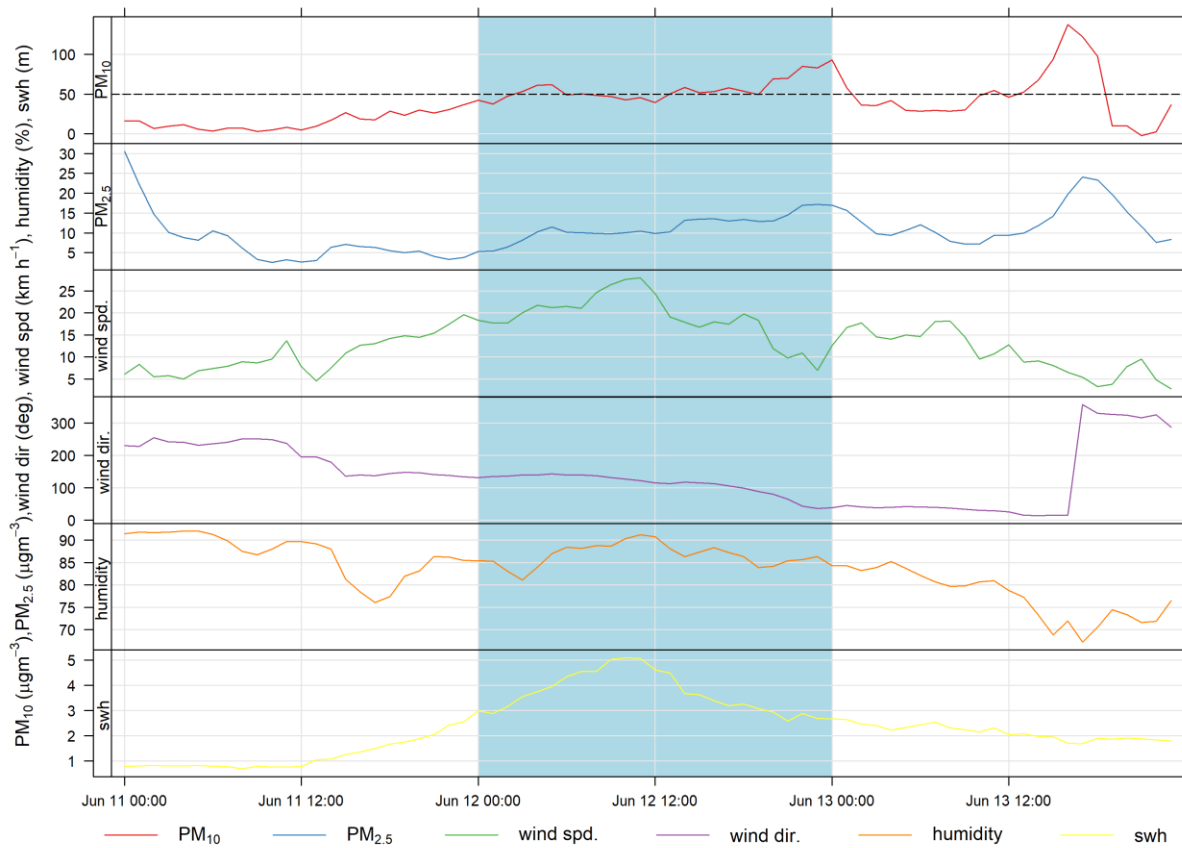
**Figure 2.1:** 24 hour average PM<sub>10</sub> concentrations on 12<sup>th</sup> June 2018 at monitoring sites in Hawke's Bay. All sites monitor PM<sub>10</sub> using a Thermo FH62C14 BAM.



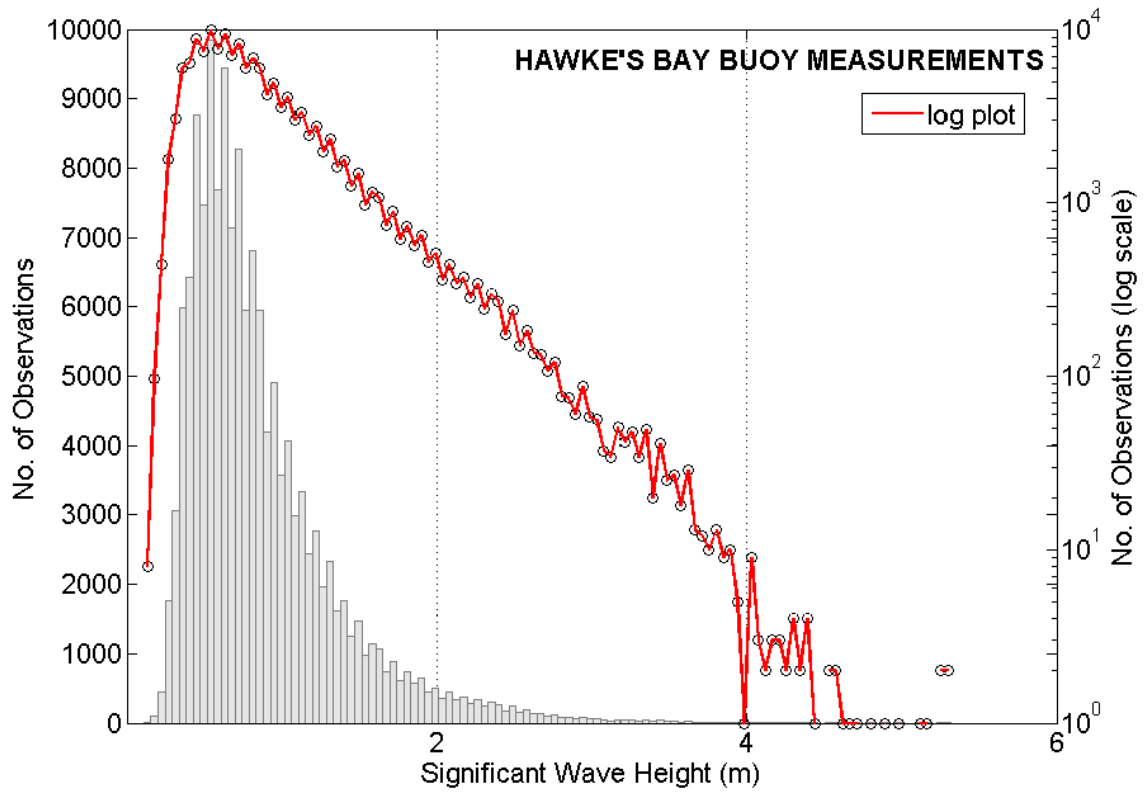
**Figure 2.2:** Hourly PM<sub>10</sub> and PM<sub>2.5</sub> concentrations, wind direction, wind speed and humidity during 12<sup>th</sup> June 2018.



**Figure 2.3:** Concentration rose of hourly PM<sub>10</sub> concentrations ( $\mu\text{g}/\text{m}^3$ ) by wind direction for 12<sup>th</sup> June 2018.



**Figure 2.4:** Hourly averages of PM<sub>10</sub> (top), PM<sub>2.5</sub> (second from top), wind speed (third from top), wind direction (third from bottom), humidity (second from bottom) and significant wave height (swh) (bottom) from 11<sup>th</sup> to 13<sup>th</sup> June 2018. PM<sub>10</sub>, PM<sub>2.5</sub> wind speed, wind direction and humidity are measured at the Awatoto monitoring site and wave heights at Port of Napier. The day the PM<sub>10</sub> standard was exceeded, 12<sup>th</sup> June, is shaded in blue. The NES for PM<sub>10</sub> is indicated by a black dashed line.

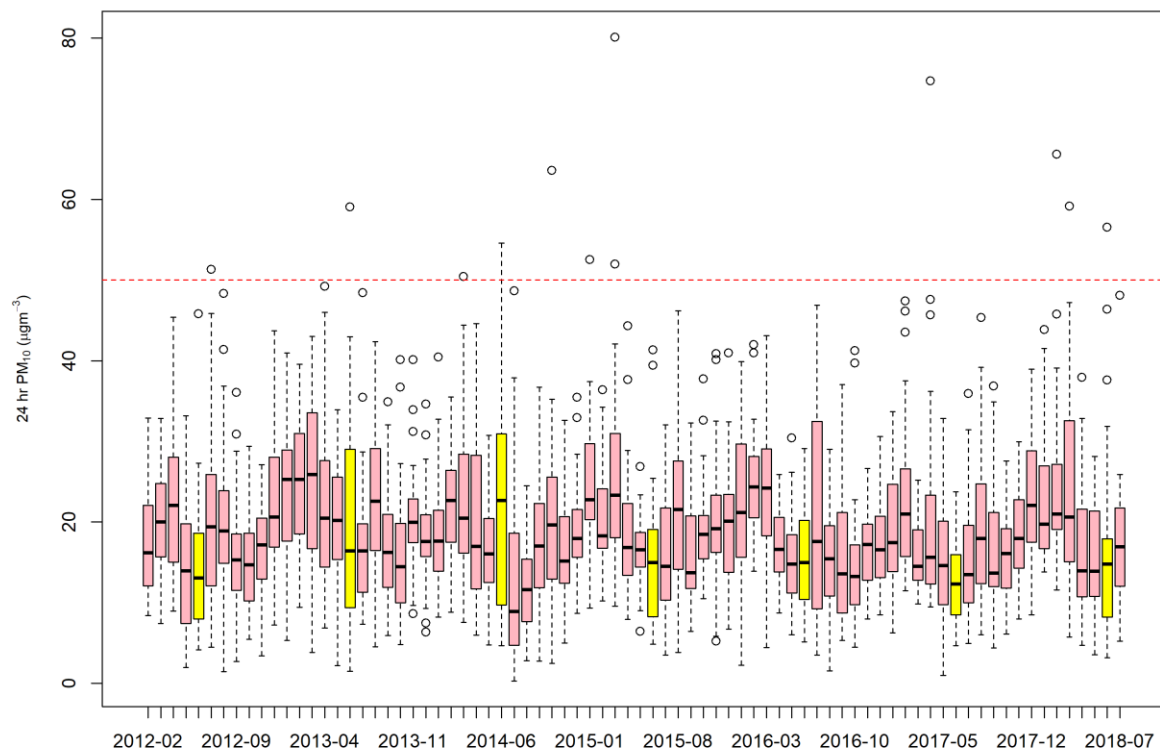


**Figure 2.5:** Histogram of significant wave heights measured by the Port of Napier buoy from 2000 to 2010 (Komar and Harris, 2014<sup>1</sup>)

## APPENDIX 3 – BASELINE DATA

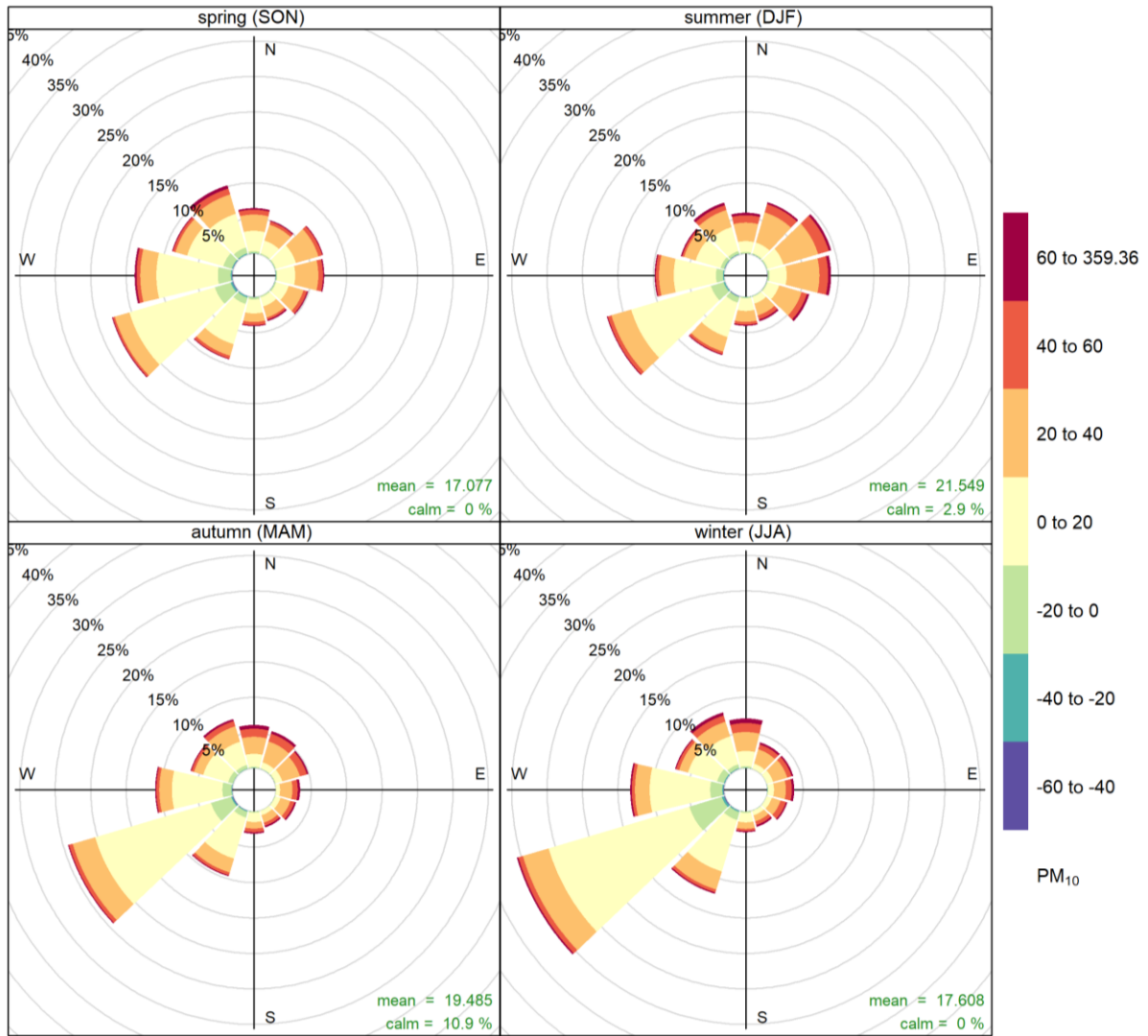
### Average daily PM<sub>10</sub> concentrations

PM<sub>10</sub> has been monitored at the site since 2012. Figure 3.1 shows a boxplot of daily PM<sub>10</sub> concentrations for each month since May 2012. Higher monthly concentrations tend to occur during late summer. This is mostly likely due to sea breezes occurring more often, bringing with them sea salt (Figure 3.2). Exceedances exhibit no distinct seasonality, with all seasons having at least one and autumn having the most, followed by winter.



**Figure 3.1:** Box and whisker plot of 24 hour average PM<sub>10</sub> concentrations, on a monthly basis, from May 2012 to July 2018. June months are coloured yellow. Median values are shown by thick black lines, the top and bottom sides of the box represent the upper and lower quartiles, dashed black lines extend to 1.5 times the inter-quartile range and outliers are indicated by black circles. The red dashed line represents the NES for PM<sub>10</sub>.

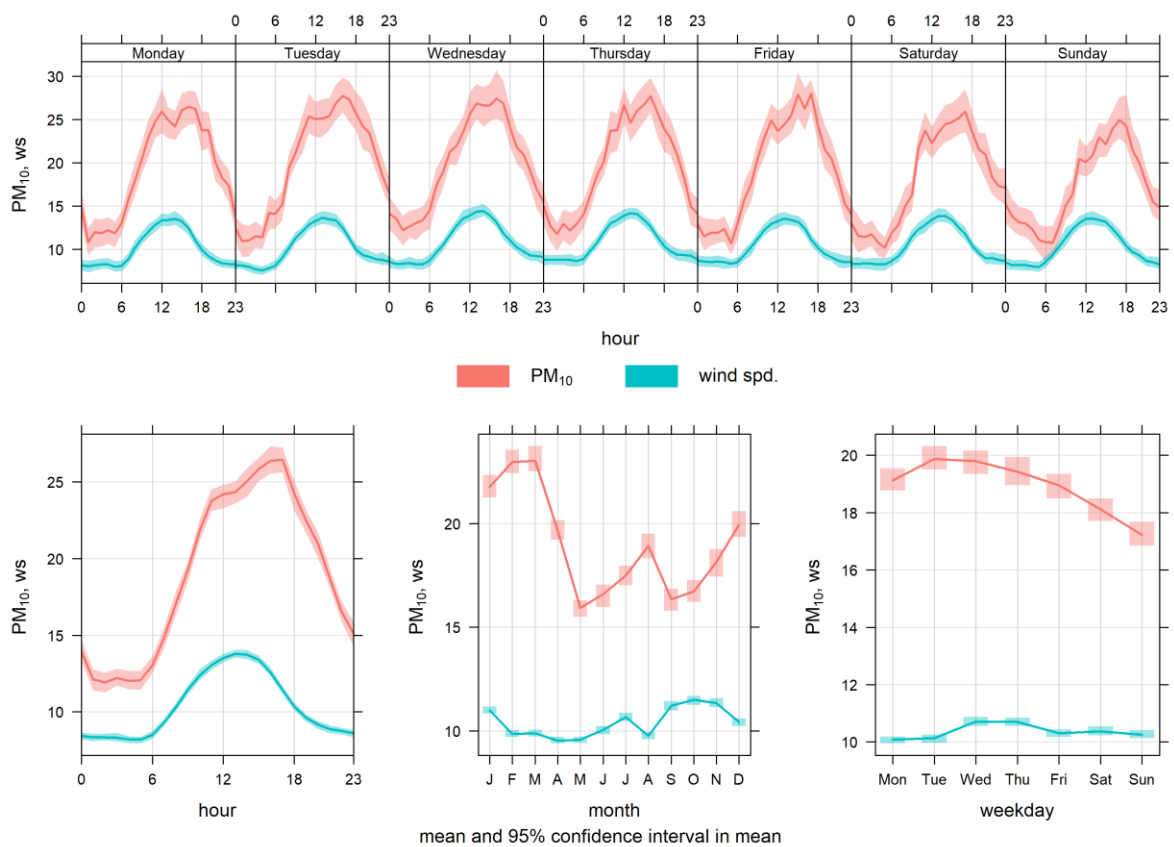




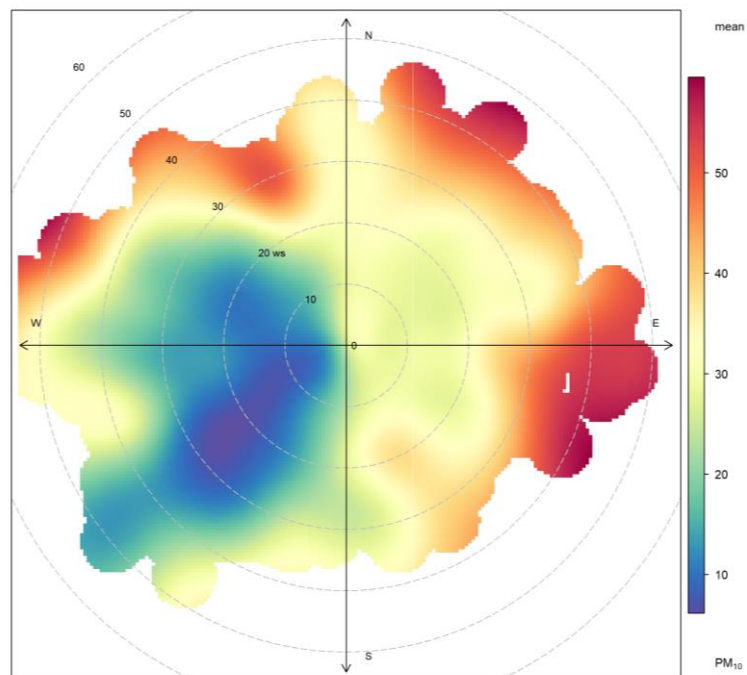
Frequency of counts by wind direction (%)

**Figure 3.2:** Concentration rose of hourly PM<sub>10</sub> concentrations by season at Awatoto AQ, based on data from 2012 to 2018.

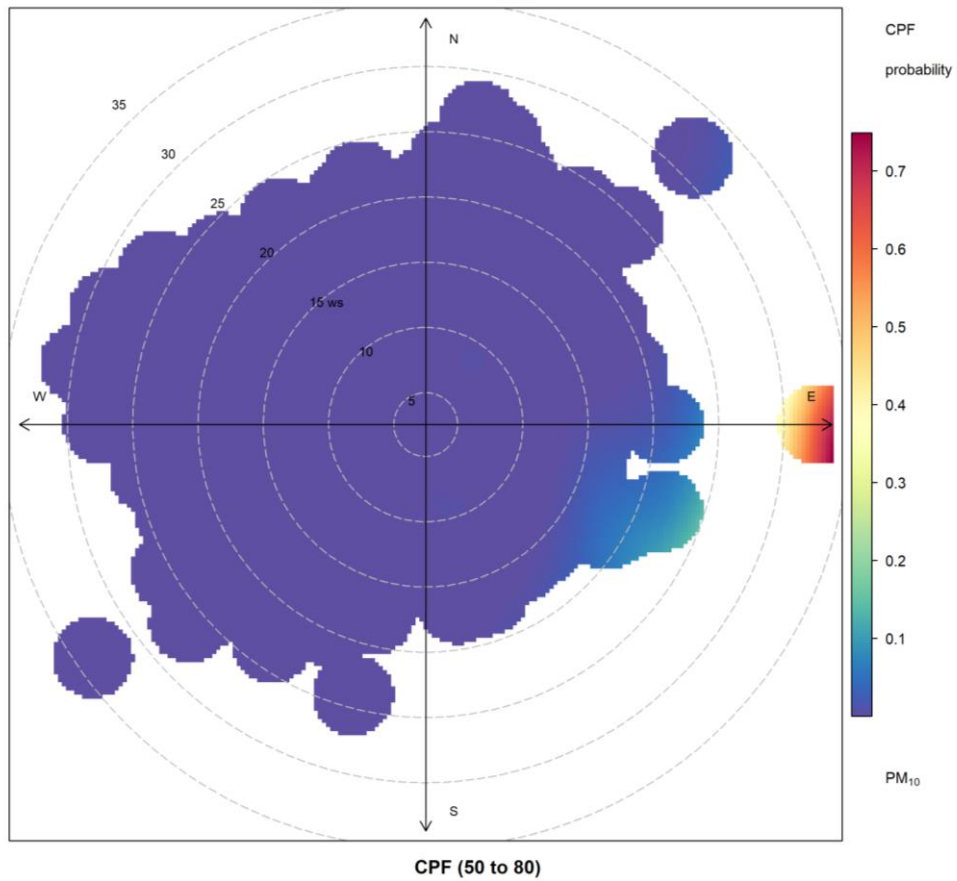
Measurements collected to date indicate that hourly PM<sub>10</sub> concentrations tend to peak between midday and 6 pm, when wind speed also peaks (Figure 3.3). This pattern is evident on all days of the week, though concentrations during weekends tend to be marginally lower than during weekdays. The pattern is consistent with a polar plot (Figure 3.4), which shows the highest hourly concentrations tend to occur in higher wind speeds and mainly in directions from northwest through northeast to southeast. Exceedances days are most likely to occur in winds from an easterly direction (Figure 3.5). The predominant wind direction at the site is however southwest (Figure 3.6).



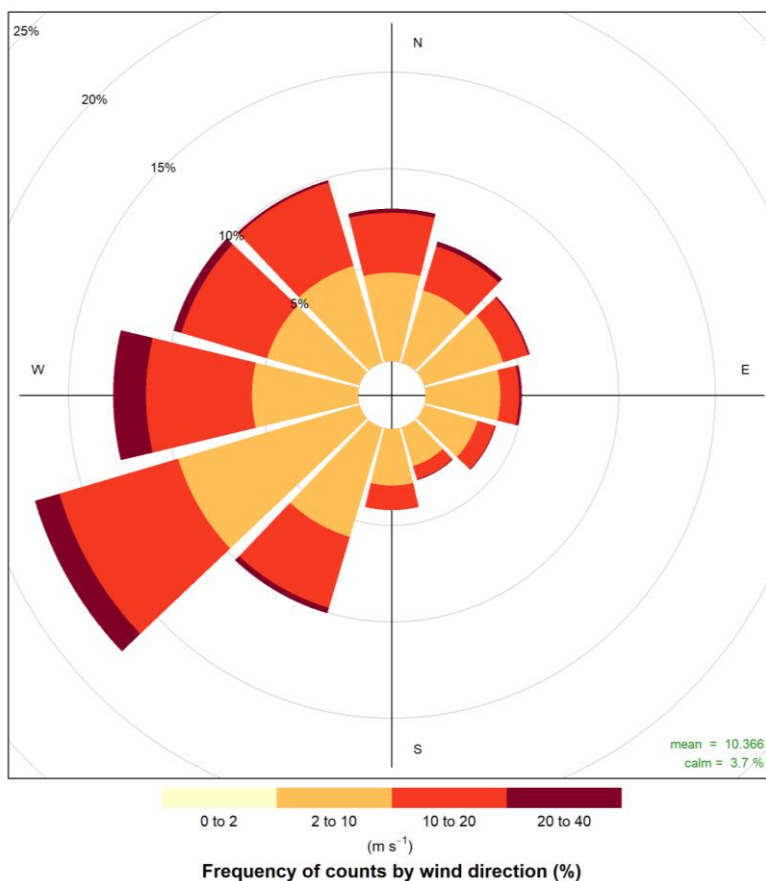
**Figure 3.3:** The variation of PM<sub>10</sub> concentrations ( $\mu\text{g m}^{-3}$ ) and wind speed ( $\text{km h}^{-1}$ ) at the Awatoto site by hour, day and month based on data collected since the site was established in 2012.



**Figure 3.4:** Hourly PM<sub>10</sub> ( $\mu\text{g m}^{-3}$ ) by wind direction and wind speed ( $\text{km h}^{-1}$ ) at Awatoto, 2012 to 2018.

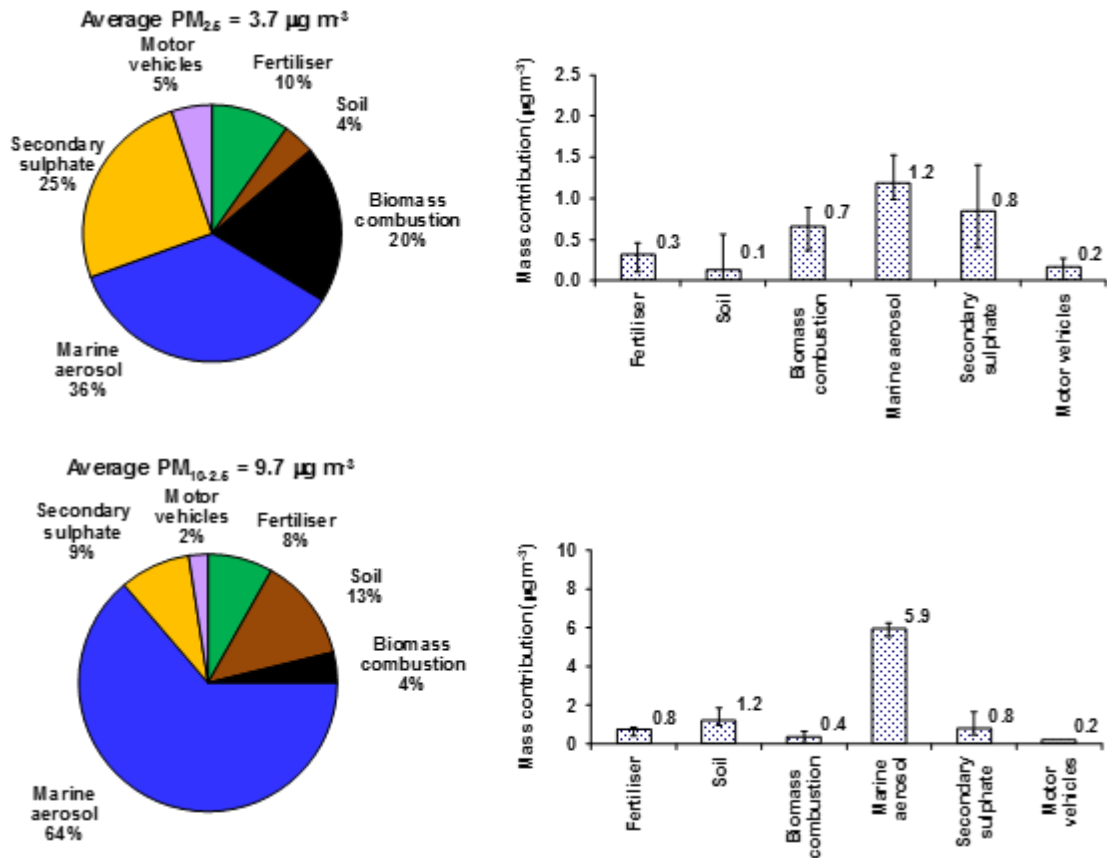


**Figure 3.5:** The probability of daily mean PM<sub>10</sub> concentrations being greater than 50 µg/m<sup>3</sup> at Awatoto AQ. The probabilities are conditional upon wind direction and wind speed (km h<sup>-1</sup>). Concentric lines are wind speed intervals in km h<sup>-1</sup> and wind direction is indicated by the compass points.



**Figure 3.6:** Wind rose for Awatoto AQ, based on data since monitoring began in 2012.

Particulate samples were collected at the Awatoto site from May 2016 to April 2017 on a one in every three day basis. GNS Science used X-ray fluorescence spectroscopy and receptor modelling to analyse the samples and apportion sources (Davy and Trompetter, 2017). Marine aerosol was the primary source of both fine (36%) and coarse particulate matter (64%), with lesser contributions from soil, secondary sulphate, biomass combustion, fertiliser and motor vehicles (Figure 3.7). During days of high PM<sub>10</sub> concentrations (>33 µg m<sup>-3</sup>), marine aerosols accounted for 80% of PM<sub>10</sub> mass on average (Davy and Trompetter, 2017).



**Figure 3.7:** Average source contributions to PM<sub>2.5</sub> and PM<sub>2.5-10</sub> in Awatoto over the monitoring period May 2016 – April 2017 (Davy and Trompetter, 2017).

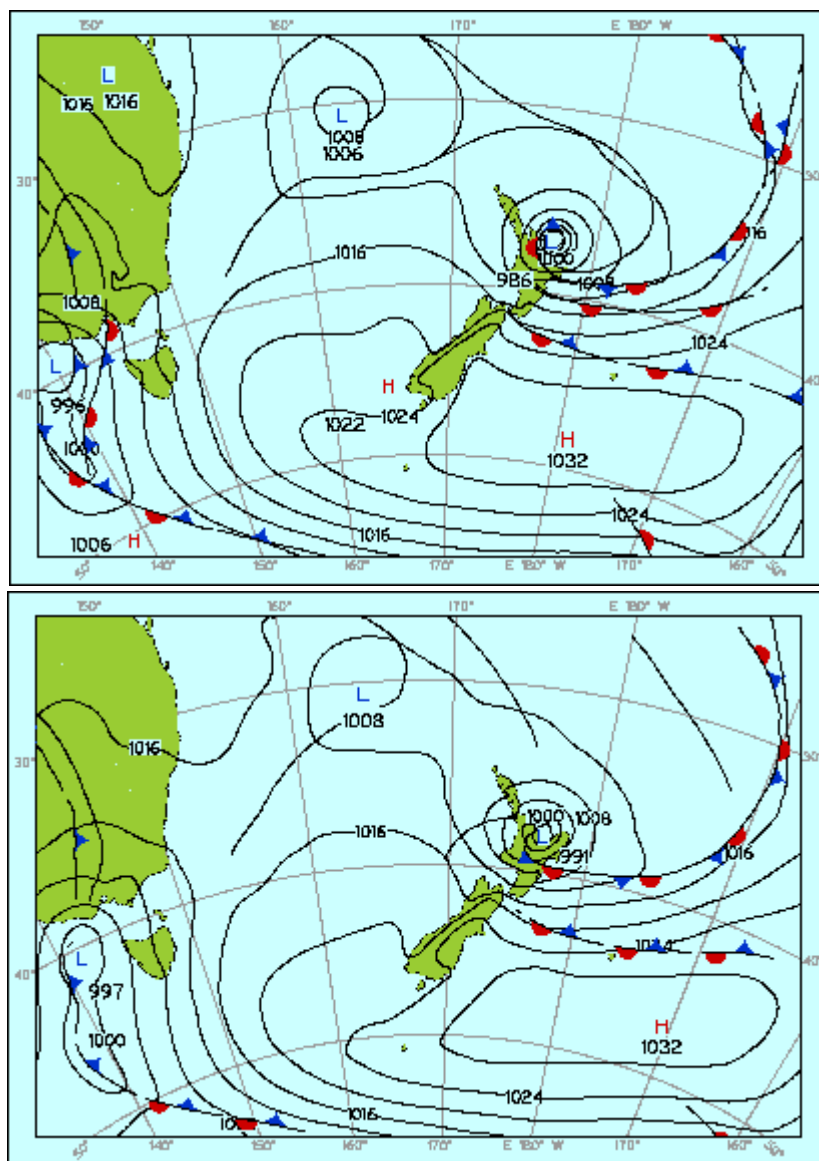
References

Davy, P.K. and Trompetter, W.J, 2017. Analysis and of PM10 composition and sources at Awatoto Hawke’s Bay Region. HBRC Report No. RM18-06-4986 prepared by GNS Science.



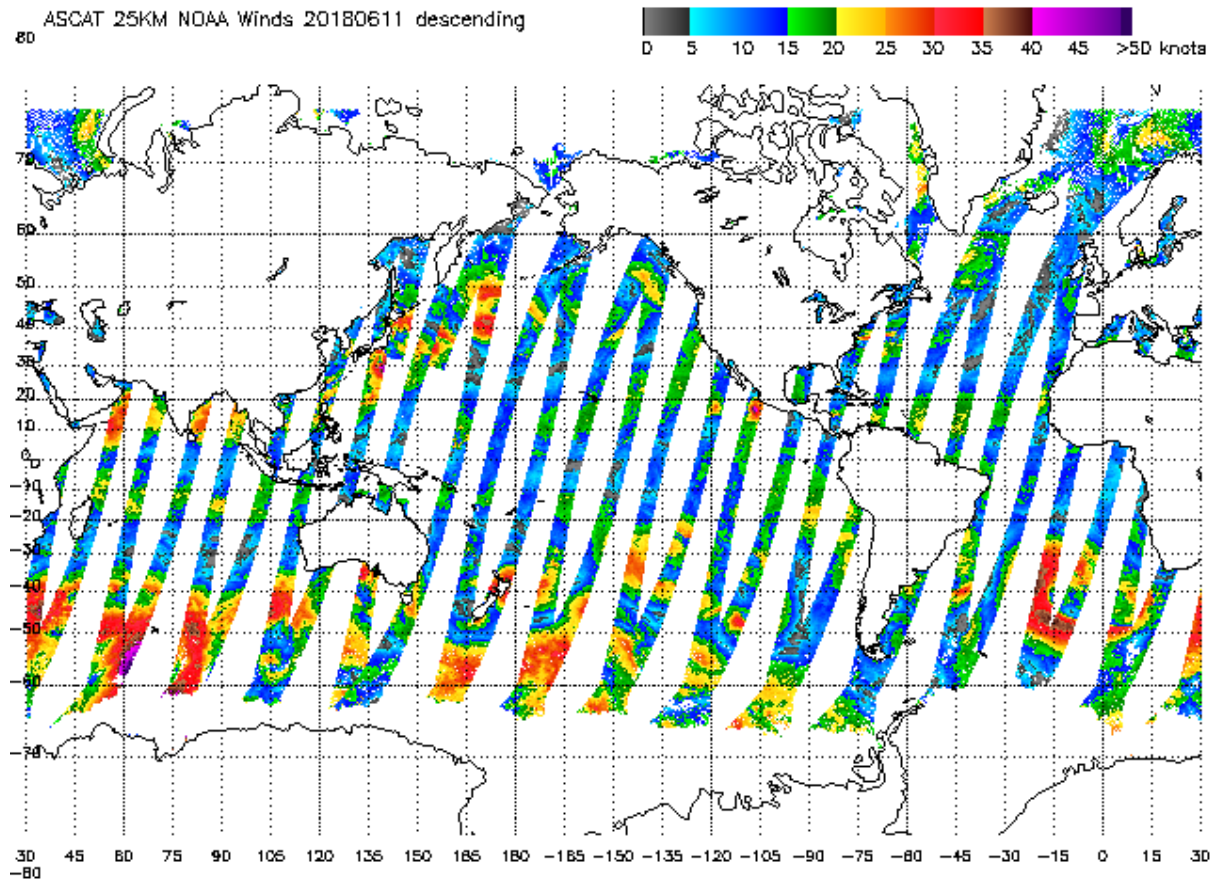
#### APPENDIX 4 – METEOROLOGICAL CONDITIONS LEADING TO THE EXCEEDANCE

An intense low was centred near the Bay of Plenty on the 12<sup>th</sup> June 2018 while a ridge of high pressure extended over the South Island. Together the two systems formed a ‘squash zone’ of strong easterly winds over Hawke’s Bay that directed an easterly swell onto the North Island’s east coast. The region experienced periods of rain during the day associated with a slow moving occluded front (Figure 4.1). A video showing the stormy conditions on the day was posted on the news media website Hawke’s Bay Today ([https://www.nzherald.co.nz/hawkes-bay-today/video/news/video.cfm?c\\_id=1503454&gal\\_cid=1503454&gallery\\_id=194355](https://www.nzherald.co.nz/hawkes-bay-today/video/news/video.cfm?c_id=1503454&gal_cid=1503454&gallery_id=194355)).



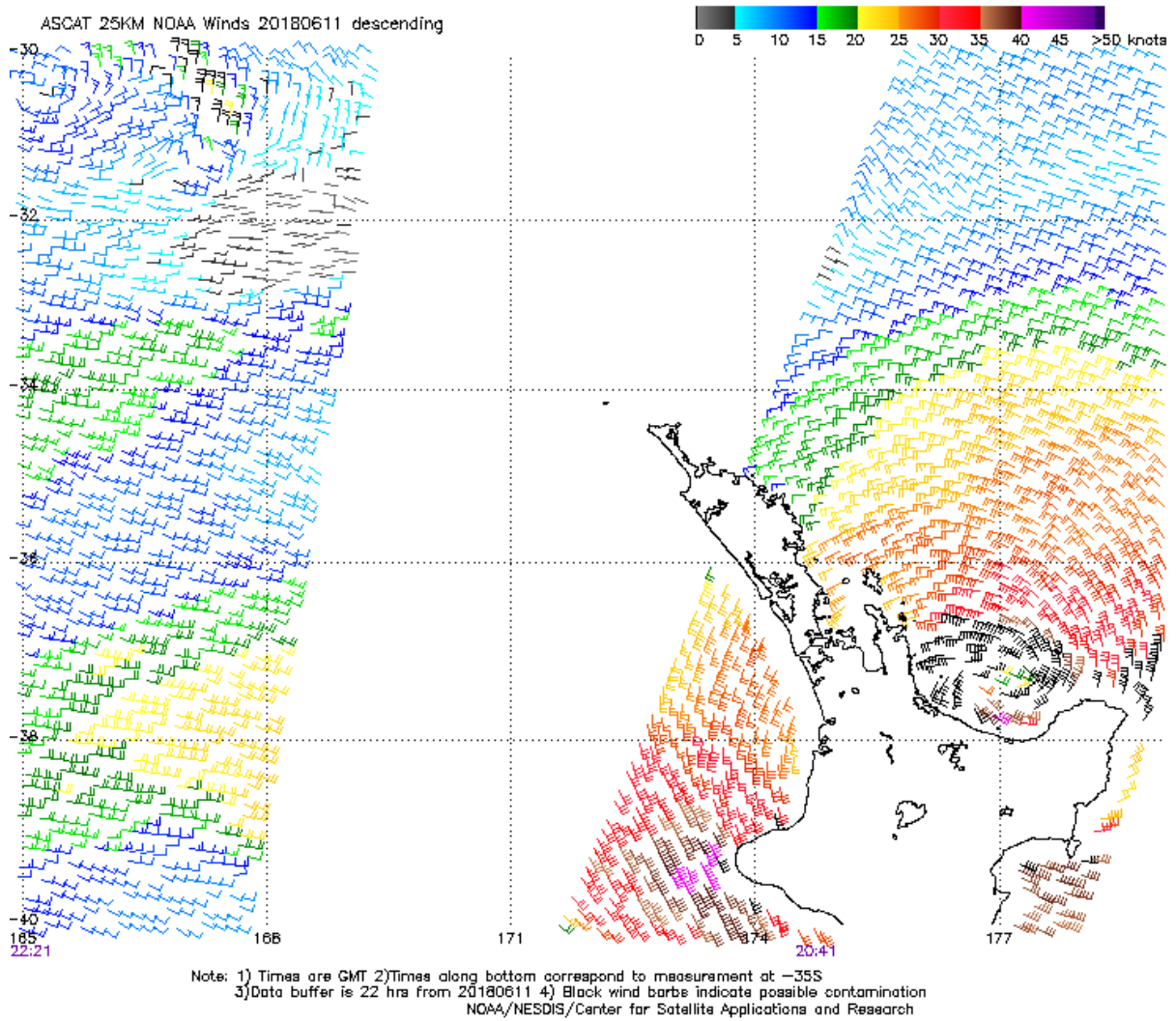
**Figure 4.1:** New Zealand Metservice mean sea level analysis chart for 6am 12<sup>th</sup> June 2018 (top) and midday 12<sup>th</sup> June 2018 (bottom).

Wind speeds near the low and in Hawke Bay reached gale force (Figure 4.2 and Figure 4.3) which contributed to the high seas. Satellite altimeter data (which reaches in excess of 16 feet) supports the buoy measurements of approximately 5 m swells in the vicinity of Hawke’s Bay (Figure 4.4).

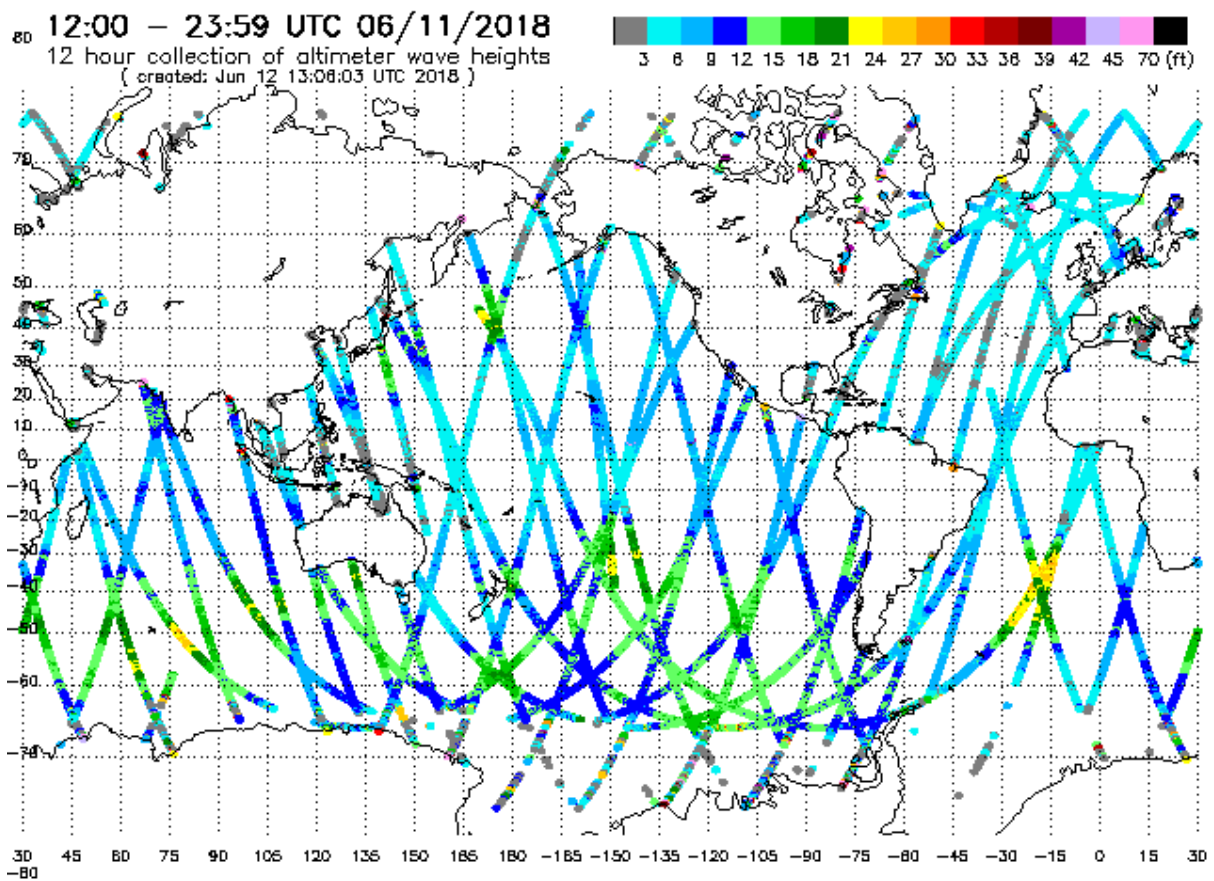


**Figure 4.2:** Ascet sea winds on 12<sup>th</sup> June 2018. An area of strong winds is evident around the seas surrounding the North Island, associated with the low pressure system near the Bay of Plenty.

The trajectory of air for the 24 hours prior to midday on the 12<sup>th</sup> June 2018 is shown in Figure 4.5. The trajectory was generated using the HYSPLIT model and reanalysis data. It suggests that the air on the day of the exceedance was of oceanic origin.



**Figure 4.3:** Ascet sea winds on the morning of the 12<sup>th</sup> June 2018 (note the image shows time in GMT) around the low pressure system featured in Figure 5.2. An area of gale force southeast winds are evident in Hawke Bay.



**Figure 4.4:** Satellite altimeter data showing mean wave heights for the period from midnight to midday 12<sup>th</sup> June 2018 (<https://manati.star.nesdis.noaa.gov/datasets/SGWHData.php>)

NOAA HYSPLIT MODEL  
 Backward trajectories ending at 0000 UTC 12 Jun 18  
 CDC1 Meteorological Data

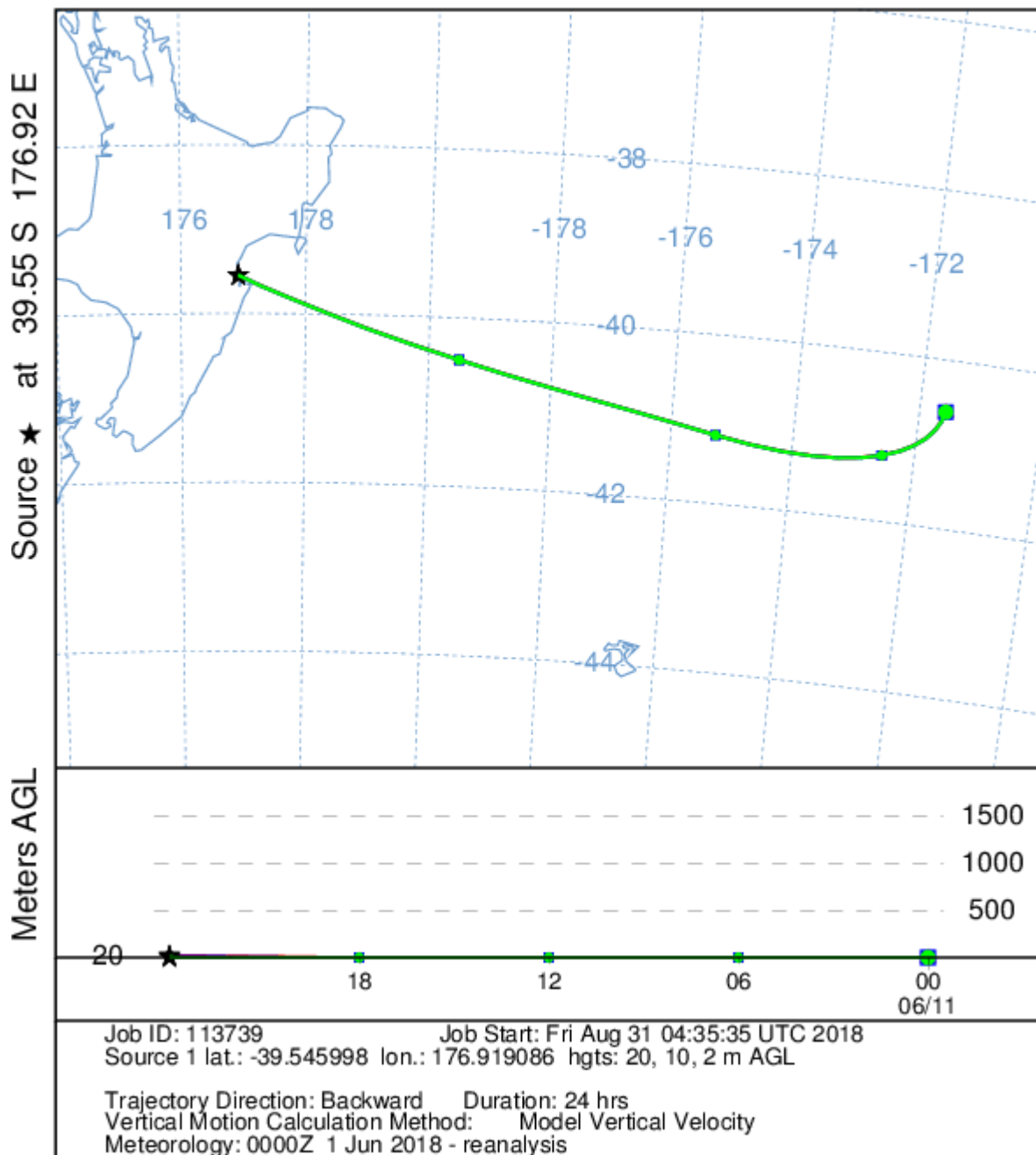


Figure 4.5: HYSPLIT air trajectory for the 24 hours prior to midday on the 12<sup>th</sup> June 2018.