

Air quality in the Upper Hunter: Autumn 2017

Upper Hunter air quality for 1 March to 31 May 2017 was generally good.

- Levels of nitrogen dioxide (NO₂) and sulfur dioxide (SO₂) were below benchmark concentrations.
- Levels of particulate matter were below benchmarks, except for regional events on one day for PM_{2.5} and one day for PM₁₀ (particles less than or equal to 2.5 and 10 microns diameter, respectively).
- Daily average levels of fine particulate matter PM_{2.5} were above the 25 µg/m³ (micrograms per cubic metre of air) benchmark on 12 May at Muswellbrook and Singleton. The PM_{2.5} maximum daily average was 29.6 µg/m³. Camberwell recorded a PM_{2.5} level of 23.3 µg/m³ which is just below the benchmark. This was an exceptional event resulting from smoke from large hazard reduction burns¹.
- Daily average levels of PM₁₀ were above the 50 µg/m³ benchmark on 10 April at Singleton and closer to mining activity at Camberwell, Mount Thorley, and Singleton NW.
 - This was a widespread exceptional event, impacted by a dust storm originating from the Victorian Mallee and southern NSW regions on 9 April². All sites in the region recorded elevated PM₁₀ levels on this day, with daily averages ranging from 40.4 to 56.8 µg/m³.
 - This event preceded the passage of a frontal system through NSW, with elevated levels occurring from around midnight, under west to north-westerly winds. PM₁₀ at the Merriwa background site was 47.9 µg/m³, supporting particle transport from west of the valley.
 - The number of days over the PM₁₀ benchmark in autumn 2017 (one day) was lower than in the previous five years. There were three days when PM₁₀ was over the benchmark at one or more sites in autumns 2013 to 2016 and eight days in autumn 2012.

Annual air quality trends in the Upper Hunter

A comparison of the annual average levels of PM₁₀ and PM_{2.5} shows the long term trends. Benchmarks for annual average level are 25 µg/m³ for PM₁₀ and 8 µg/m³ for PM_{2.5}, based on a calendar year. Figure 1 shows the PM₁₀ and PM_{2.5} *rolling* annual averages, based on the 12-month periods, from autumn to autumn for 2013 to 2017. The comparison shows that particle levels generally were lower to the end of autumn in 2015, 2016 and 2017 than in the earlier years 2013 and 2014.

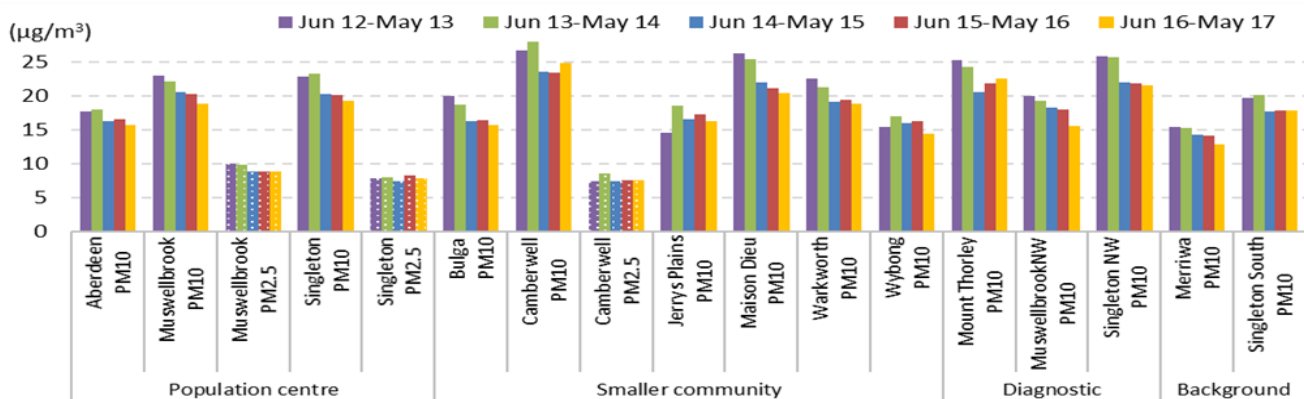


Figure 1: PM₁₀ and PM_{2.5} rolling annual averages to the end of autumn: 2013 to 2017

¹ Rural Fire Service (RFS) ICON database: 2066 ha 'NPWS Widden HR' fire from 11–15 May approximately 40 km west of Jerrys Plains and 1159 ha 'NPWS HR Old Bulga' fire from 11–21 May (with 748 ha burnt by 12 May) approximately 15 km southwest of Bulga

² [DustWatch April 2017 report](#)

At the larger population sites, the PM₁₀ and PM_{2.5} *rolling* averages to the end of autumn 2017 remained similar or lower to the previous two year periods. At Camberwell and Mt Thorley, sites closer to mines, the PM₁₀ annual *rolling* averages increased compared to the two previous years, with levels elevated during summer, but remaining below level in the earlier years 2013 and 2014.

Rolling annual averages are not intended to be compared to the annual benchmarks. The rolling annual averages provide a guide to long term trends, using the most up to date monitoring data.

Days above benchmark concentrations

There was one day over the PM₁₀ benchmark and one day over the PM_{2.5} benchmark during autumn 2017.

Table 1: Number of days above the relevant benchmarks – autumn 2017

Station type*	Station	PM ₁₀ daily [50 µg/m ³ benchmark]	PM _{2.5} daily [25 µg/m ³ benchmark]	SO ₂ hourly [20 pphm benchmark]	SO ₂ daily [8 pphm benchmark]	NO ₂ hourly [12 pphm benchmark]
Population centre	Aberdeen	0	-	-	-	-
Population centre	Muswellbrook	0	1	0	0	0
Population centre	Singleton	1	1	0	0	0
Smaller community	Bulga	0	-	-	-	-
Smaller community	Camberwell	1	0	-	-	-
Smaller community	Jerrys Plains	0	-	-	-	-
Smaller community	Maison Dieu	0	-	-	-	-
Smaller community	Warkworth	0	-	-	-	-
Smaller community	Wybong	0	-	-	-	-
Diagnostic	Mount Thorley	1	-	-	-	-
Diagnostic	Muswellbrook NW	0	-	-	-	-
Diagnostic	Singleton NW	1	-	-	-	-
Background	Merriwa	0	-	-	-	-
Background	Singleton South	0	-	-	-	-

µg/m³ = microgram per cubic metre and pphm = parts per hundred million by volume (i.e. parts of pollutant per hundred million parts of air)

- = not monitored * For explanation, refer to the end of the report Definitions: Upper Hunter monitoring station types

Daily time series plots

Daily average time series plots for PM₁₀ and PM_{2.5} and daily one hour maximum plots for NO₂ and SO₂ show the daily concentrations throughout the autumn season.

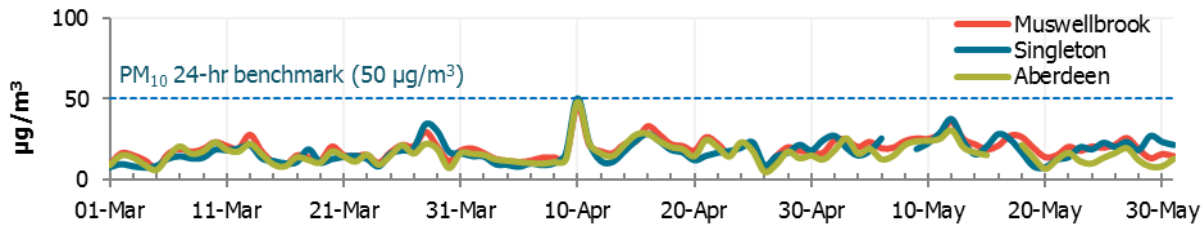


Figure 2: Population centre sites: daily average PM₁₀ – autumn 2017

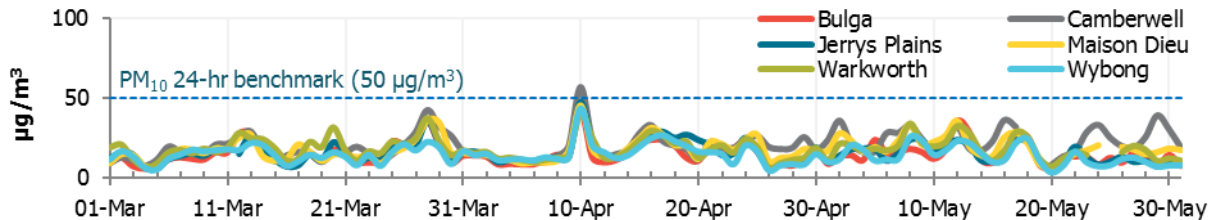


Figure 3: Smaller community sites: daily average PM₁₀ – autumn 2017

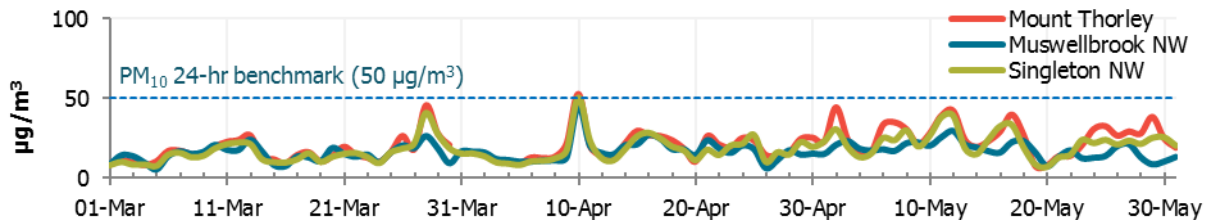


Figure 4: Diagnostic sites: daily average PM₁₀ – autumn 2017

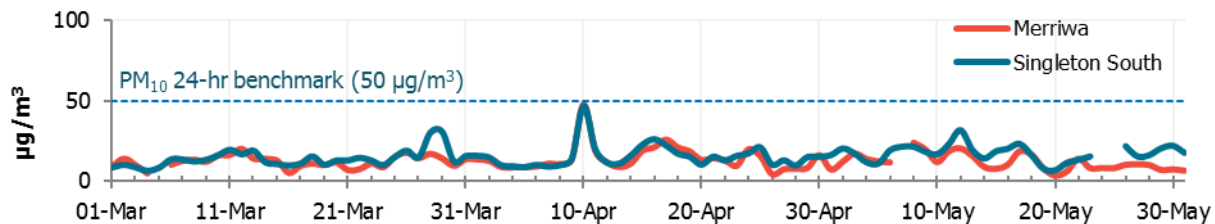


Figure 5: Background sites: daily average PM₁₀ – autumn 2017

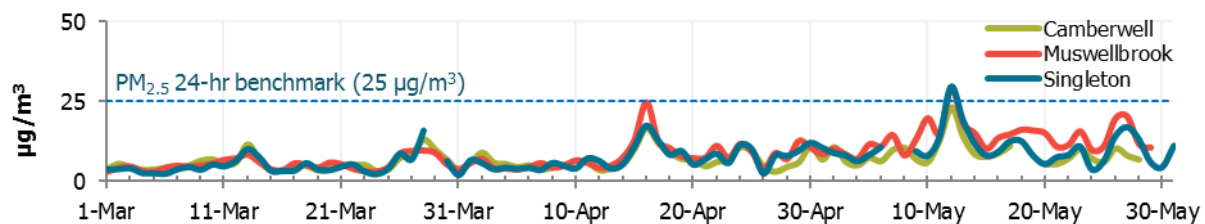


Figure 6: Daily average PM_{2.5} – autumn 2017

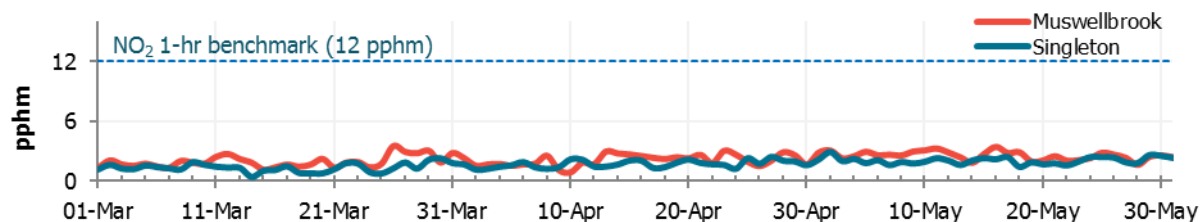


Figure 7: Daily 1-hr maximum NO₂ – autumn 2017

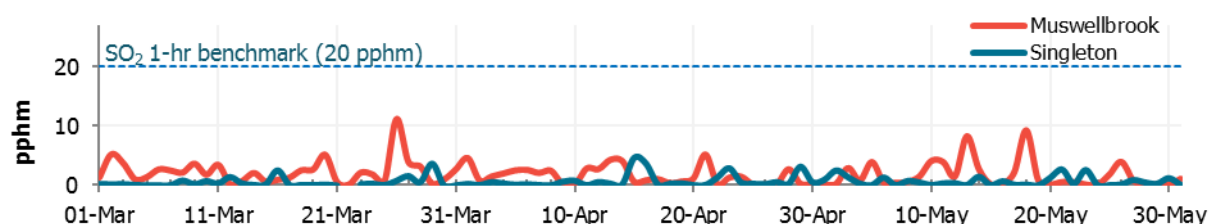


Figure 8: Daily 1-hr maximum SO₂ – autumn 2017

Pollution roses

The seasonal PM₁₀ pollution rose map³ shows that hourly PM₁₀ levels were generally low during autumn.

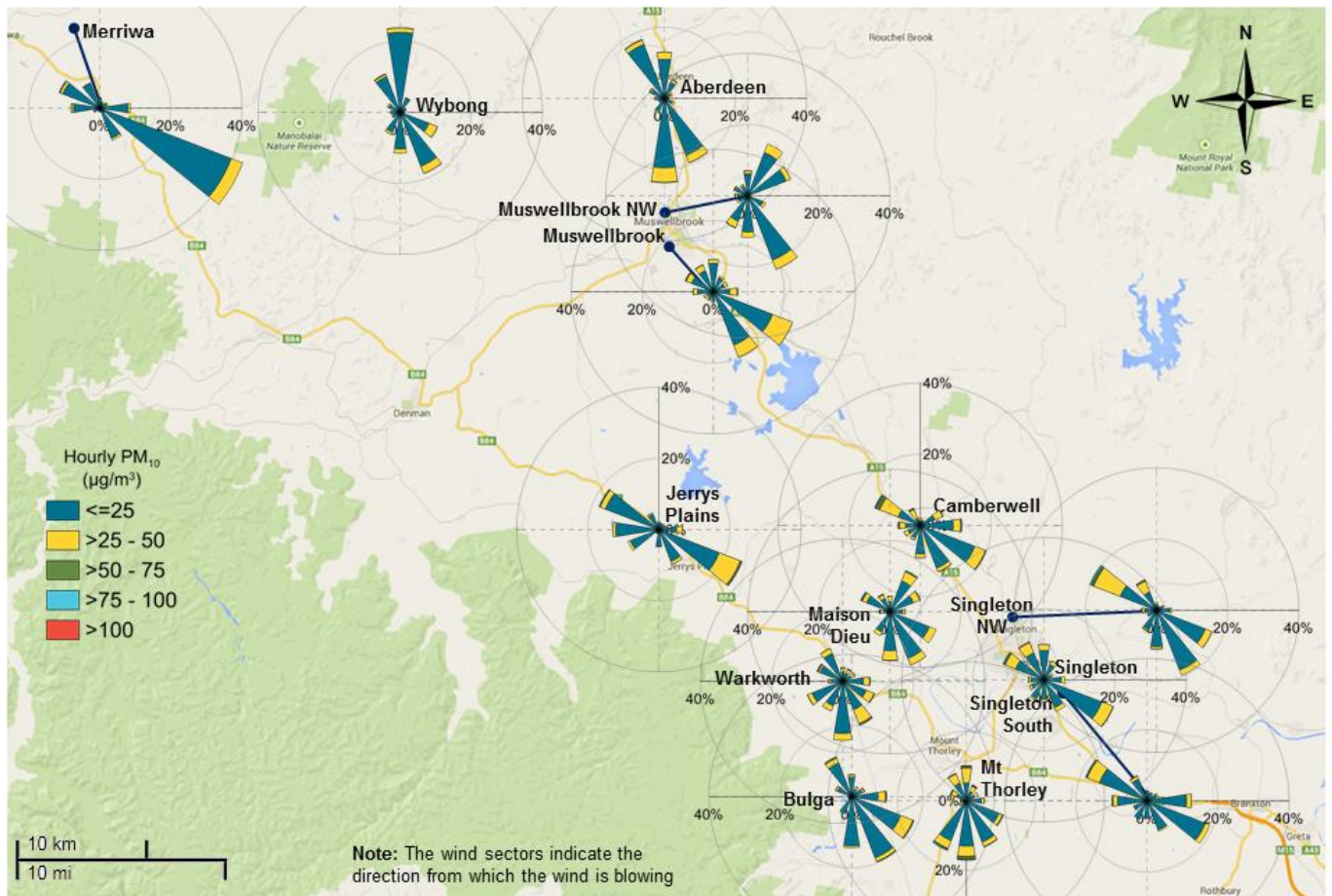


Figure 9: Hourly PM₁₀ pollution rose map for the Upper Hunter region for autumn 2017

³ Pollution roses show the wind direction and particle levels at a location. The length of each bar around the circle shows the percentage of time that the wind blows from a particular direction. The colours along the bars indicate categories of particle levels (as outlined in the key).

Seasonal comparisons

This section compares air quality levels in autumn 2017 with previous autumn seasons.

All days were below the benchmark concentrations for NO₂ and SO₂ in autumn in the past five years.

The daily average PM_{2.5} concentrations were above the benchmark on one day during autumn 2017 at Singleton and Muswellbrook. Prior to this, two days were over the PM_{2.5} benchmark in autumn 2016.

The daily average PM₁₀ concentrations were above the benchmark on one day during autumn 2017. This was lower compared to autumn in the previous five years. There were three days when PM₁₀ was over the benchmark at one or more sites in autumns 2013 to 2016 and eight days in autumn 2012.

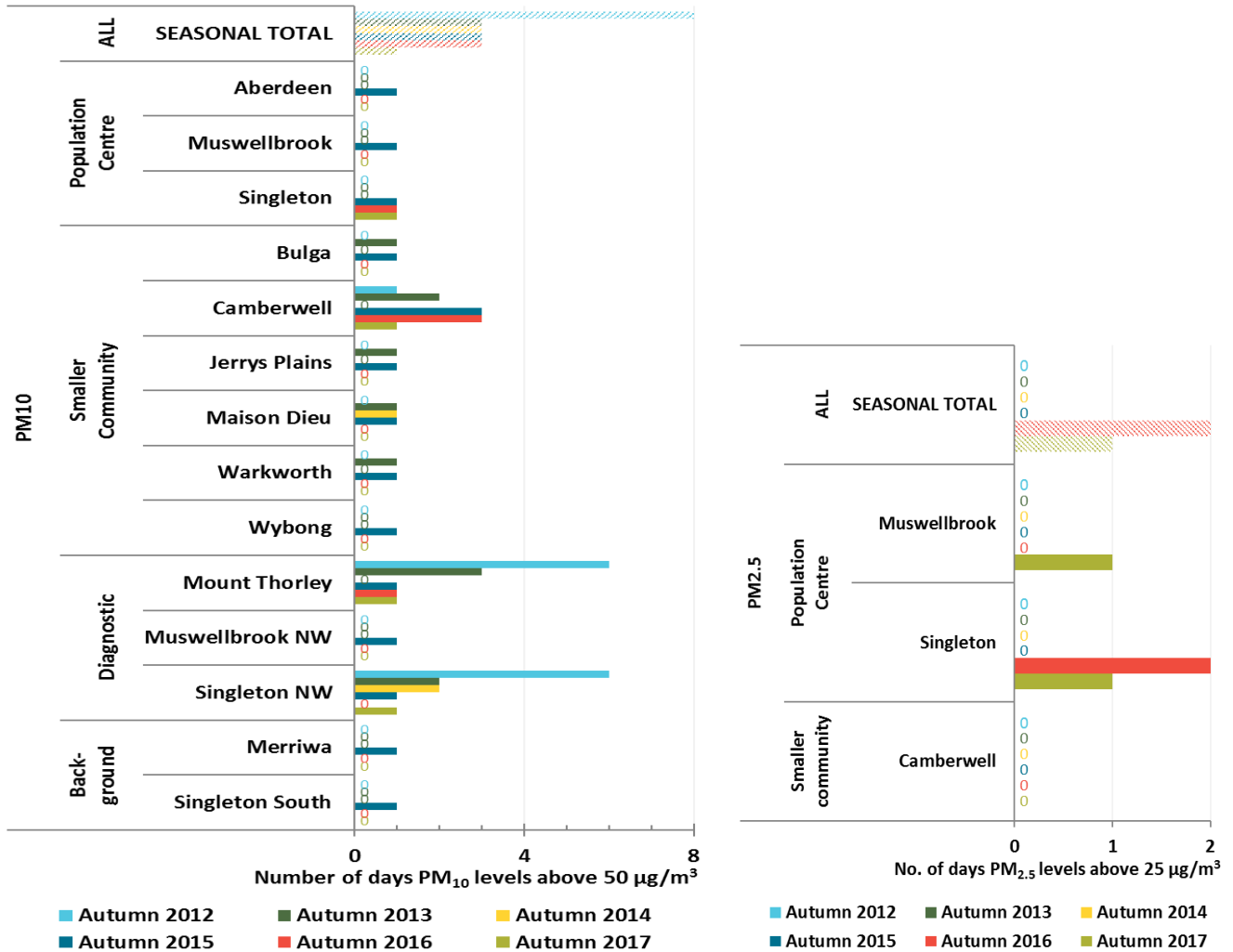


Figure 10: Number of days above the PM₁₀ and PM_{2.5} benchmarks during the 2012 to 2017 autumn seasons

Autumn particle air quality trends in the Upper Hunter

Figure 11 and Figure 12 show daily average levels of PM₁₀ during autumn 2017, compared to the daily maximum and minimum (i.e. range) of PM₁₀ levels for the autumn periods from 2011 to 2016, at Singleton and Muswellbrook. Daily PM₁₀ levels generally were lower in autumn 2017 than in earlier years, especially during March. Rainfall in the region was well above average in March and average in April and May.

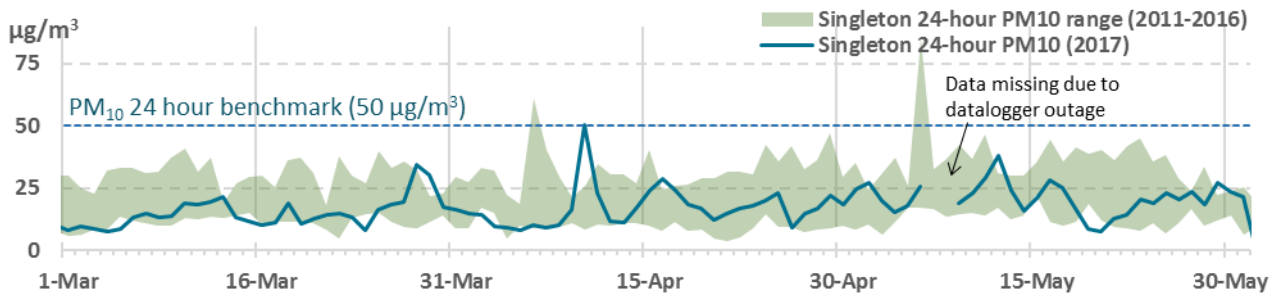


Figure 11: Singleton daily average PM₁₀ during autumn 2017 plotted against the daily maximum and minimum PM₁₀ levels recorded from autumn 2011 to 2016

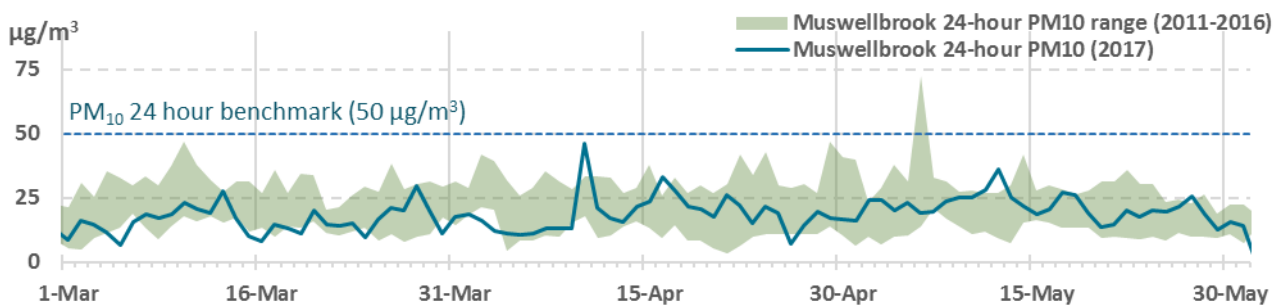


Figure 12: Muswellbrook daily average PM₁₀ during autumn 2017 plotted against the daily maximum and minimum PM₁₀ levels recorded from autumn 2011 to 2016

Figure 13 and Figure 14 show daily average levels of PM_{2.5} during autumn 2017, compared to the daily maximum and minimum levels from autumn 2011 to 2016, at Singleton and Muswellbrook. Daily PM_{2.5} levels generally were lower in the first half of autumn 2017 compared to earlier years, although some elevated levels were seen in the latter half.

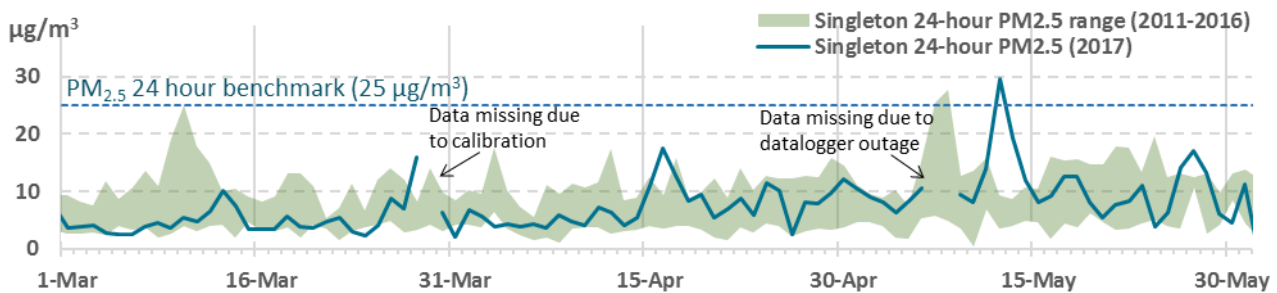


Figure 13: Singleton daily average PM_{2.5} during autumn 2017 plotted against the daily maximum and minimum PM_{2.5} levels recorded from autumn 2011 to 2016

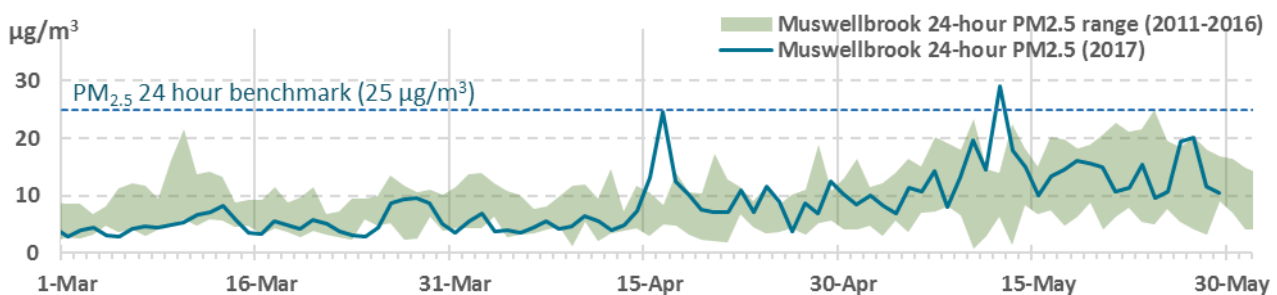


Figure 14: Muswellbrook daily average PM_{2.5} during autumn 2017 plotted against the daily maximum and minimum PM_{2.5} levels recorded from autumn 2011 to 2016

Meteorological summary

Rainfall and temperature⁴

The Upper Hunter experienced above average rainfall overall during autumn 2017, with very much above average rainfall recorded during March and average rainfall during April and May. Autumn 2017 was wetter than autumn 2016 with 100 to 200 millimetres more rain, while drier than autumn 2015 with up to 200 millimetres less rain.

Maximum temperatures were average, while minimum temperatures were above average during the season.

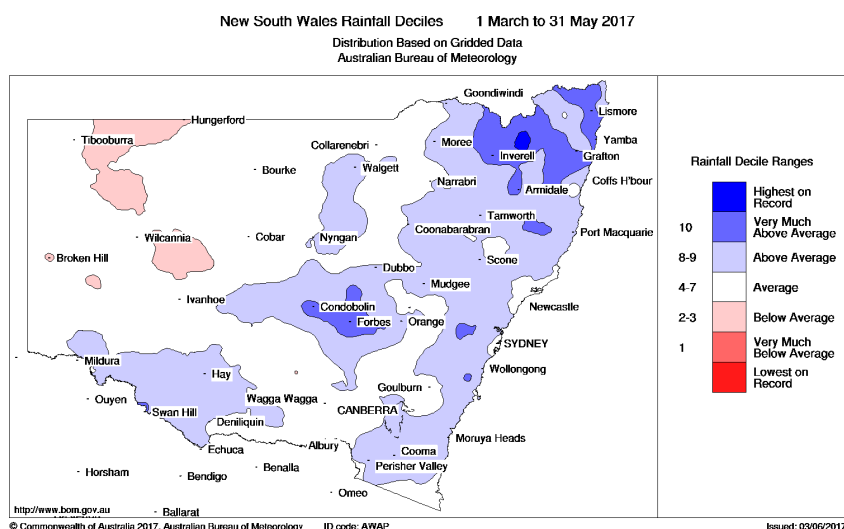


Figure 15: NSW rainfall deciles – autumn 2017

Wind

The winds were variable throughout the region during autumn 2017, which is typical for this time of the year. Winds typically change from south-easterly during the warmer months to north-westerly as conditions cool. Wind speeds in autumn 2017 generally were lower than the previous two autumn seasons 2015 and 2016, while similar to autumn 2012, 2013 and 2014.

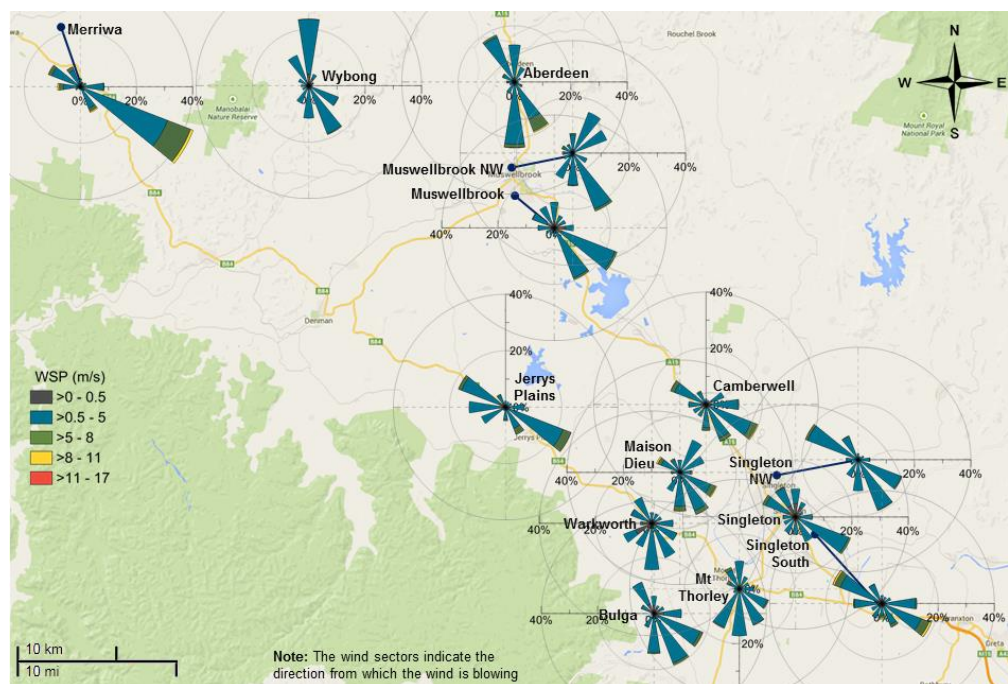


Figure 16: Wind rose map⁵ for the Upper Hunter region for autumn 2017

⁴ Rainfall and temperature information are from the Bureau of Meteorology [New South Wales autumn 2017 climate statement](#) and [climate maps](#) (accessed June 2017)

⁵ Wind roses show the wind direction and speed at a location. The length of each bar around the circle in these wind roses show the percentage of time that the wind blows from a particular direction. The colours along the bars indicate the wind speed categories.

Network performance

The target network performance is at least 95% available data for all parameters. The maximum online time that can be attained for NO₂ and SO₂ is 96%, due to daily calibrations.

Table 2: Online performance (%) during autumn 2017

Station	Particles PM ₁₀ daily	Particles PM _{2.5} daily	Gases SO ₂ hourly	Gases NO ₂ hourly	Meteorology Wind hourly
Aberdeen	98	-	-	-	99
Bulga	100	-	-	-	100
Camberwell	98	96	-	-	99
Jerrys Plains	99	-	-	-	98
Maison Dieu	99	-	-	-	98
Merriwa	98	-	-	-	97
Mount Thorley	99	-	-	-	99
Muswellbrook	100	98	96	96	100
Muswellbrook NW	100	-	-	-	98
Singleton	98	97	91	94	98
Singleton NW	100	-	-	-	100
Singleton South	98	-	-	-	99
Warkworth	98	-	-	-	100
Wybong	100	-	-	-	100

- = not monitored

The overall reduced online times were mainly due to:

- Singleton SO₂ – instrument problems (two days) and data logger problem (one day)

Definitions: Upper Hunter monitoring station types

The 14 monitoring stations in the Upper Hunter serve different purposes:

Larger population: stations near the larger population centres monitor the air quality in these centres.

Smaller communities: stations in smaller communities monitor the air quality at those locations.

Diagnostic: provide data that can help to diagnose the likely sources and movement of particles across the region as a whole; they do not provide information about air quality at population centres.

Background: the stations near Merriwa and Singleton South are at both ends of the valley and provide background data, measuring the quality of air entering and leaving the Upper Hunter Valley under predominant winds (south-easterlies and north-westerlies).

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