

Air quality monitoring in the Namoi/North-West Slopes Region

Synopsis

Air quality at regional population centres in the Namoi/North-West Slopes region from 1 June to 31 August 2018 met national benchmarks¹ 92% of the time. This means air quality was good (55% of the time) to fair (37% of the time) in terms of the NSW Air Quality Index² (Figure 1).

Winter air quality was affected by local and regional sources of airborne particle pollution, including local and regional dust storms³ and domestic woodsmoke⁴.

Seven air quality monitoring stations operate in the region (Figure 1).

The NSW Office of Environment and Heritage (OEH) operates the monitoring stations at Tamworth (since October 2000), Gunnedah and Narrabri (since December 2017). Data are reported in near-real time on the [NSW air quality web site](https://www.environment.nsw.gov.au/aqms/hourlydata.htm)⁵.

Industries operate the monitoring stations at Maules Creek, Wil-gai, Breeza and Werris Creek. Data (from July 2015) are reported weekly on the [NSW Environment Protection Authority Namoi project website](https://www.epa.nsw.gov.au/your-environment/air/regional-air-quality/namoi-air-quality-monitoring-project)⁶.

All stations continuously monitor airborne particle matter, measured as PM₁₀ and PM_{2.5} (particles with sizes less than or equal to 10 and 2.5 micrometres, respectively). The Gunnedah station continuously monitors gaseous air pollutants, nitrogen dioxide (NO₂) and ozone (O₃).

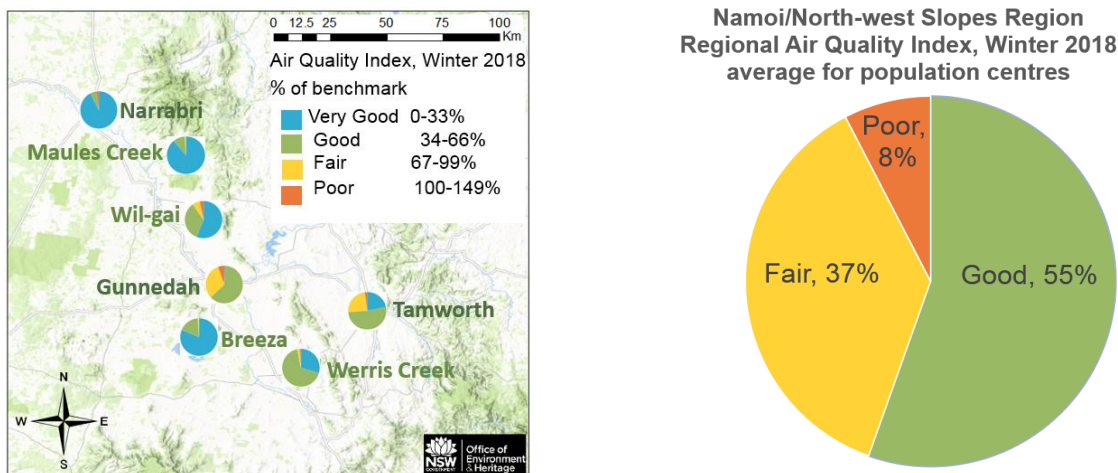


Figure 1 Winter air quality at monitoring stations (left) and Regional Air Quality Index (right), showing air quality in population centres met national standards 92% of the time in winter 2018

¹ The [National Environment Protection \(Ambient Air Quality\) Measure \(Air NEPM\)](https://www.environment.nsw.gov.au/air-quality/air-quality-measure) sets national standards for urban air pollutants. The NSW Government reports annually to the Australian Government on compliance with national standards at 22 air quality monitoring stations. The Narrabri and Gunnedah air quality monitoring sites currently are not designated as Air NEPM compliance monitoring sites. Therefore, this report uses the national standards as 'benchmarks' for reporting air quality.

² The [NSW Air Quality Index](https://www.environment.nsw.gov.au/air-quality/air-quality-index) uses colour coding to compare air pollution levels to national benchmark concentrations.

³ The [Air Quality Monitoring Network Namoi/North-West Slopes, May 2017 to July 2018 newsletter](https://www.environment.nsw.gov.au/air-quality/air-quality-monitoring-network-namoi-north-west-slopes) included an analysis of PM_{2.5} levels in the region for 14 to 21 July 2018. Peaks in PM_{2.5} levels on cold, calm nights, with minimum temperatures below 0°C, suggested the influence of domestic woodsmoke.

⁴ For further detail on local and regional dust levels, see [DustWatch report June 2018](https://www.environment.nsw.gov.au/air-quality/dustwatch-report-june-2018), [DustWatch report July 2018](https://www.environment.nsw.gov.au/air-quality/dustwatch-report-july-2018), [DustWatch report August 2018](https://www.environment.nsw.gov.au/air-quality/dustwatch-report-august-2018)

⁵ [OEH web site \(https://www.environment.nsw.gov.au/aqms/hourlydata.htm\)](https://www.environment.nsw.gov.au/aqms/hourlydata.htm)

⁶ [NSW EPA website \(https://www.epa.nsw.gov.au/your-environment/air/regional-air-quality/namoi-air-quality-monitoring-project\)](https://www.epa.nsw.gov.au/your-environment/air/regional-air-quality/namoi-air-quality-monitoring-project)

Days above benchmark concentrations¹, winter 2018

The region experienced four days over the PM₁₀ benchmark and four days over the PM_{2.5} benchmark. Table 1 shows the number of days each site recorded levels above the relevant benchmarks.

Table 1 Number of days above the relevant benchmarks, by station, winter 2018

Station type	Station	PM ₁₀ daily benchmark [50 µg/m ³]	PM _{2.5} daily benchmark [25 µg/m ³]	NO ₂ hourly benchmark [12 pphm]	O ₃ hourly benchmark [10 pphm]
OEH	Narrabri	2	0	-	-
OEH	Gunnedah	1	4	0	0
OEH	Tamworth	3	0	-	-
Industry	Maules Creek	1	0	-	-
Industry	Wil-gai	3	0	-	-
Industry	Breeza	0	0	-	-
Industry	Werris Creek	1	0	-	-

- = not monitored; µg/m³ = microgram per cubic metre;

pphm = parts per hundred million by volume (i.e. parts of pollutant per hundred million parts of air)

Air quality trends - Particle matter, winter 2018

Figure 2 shows daily average levels of PM₁₀ during winter 2018.

- Daily average PM₁₀ levels were above the benchmark concentration of 50 µg/m³ on four days. Regional maximum daily PM₁₀ levels on these days ranged from 56 to 89 µg/m³. On these days, the NSW Rural Air Quality Monitoring Network showed elevated levels of suspended particles at monitoring stations in central and north-west NSW⁷. This suggests long range transport of dust.
 - On 25 June 2018, Wil-gai recorded a daily average PM₁₀ concentration of 63 µg/m³
 - On 20 July 2018, Tamworth recorded a daily average PM₁₀ concentration of 59 µg/m³
 - On 4 August 2018, six sites recorded daily average PM₁₀ concentrations above the benchmark, with 89 µg/m³ at Maules Creek; 73 µg/m³ at Gunnedah, Tamworth; and Werris Creek; 65 µg/m³ at Will-gai; and 61 µg/m³ at Narrabri. Breeza recorded 49.673 µg/m³, just below the benchmark concentration of 50 µg/m³.
 - On 31 August 2018, Narrabri recorded a daily average PM₁₀ concentration of 56 µg/m³.

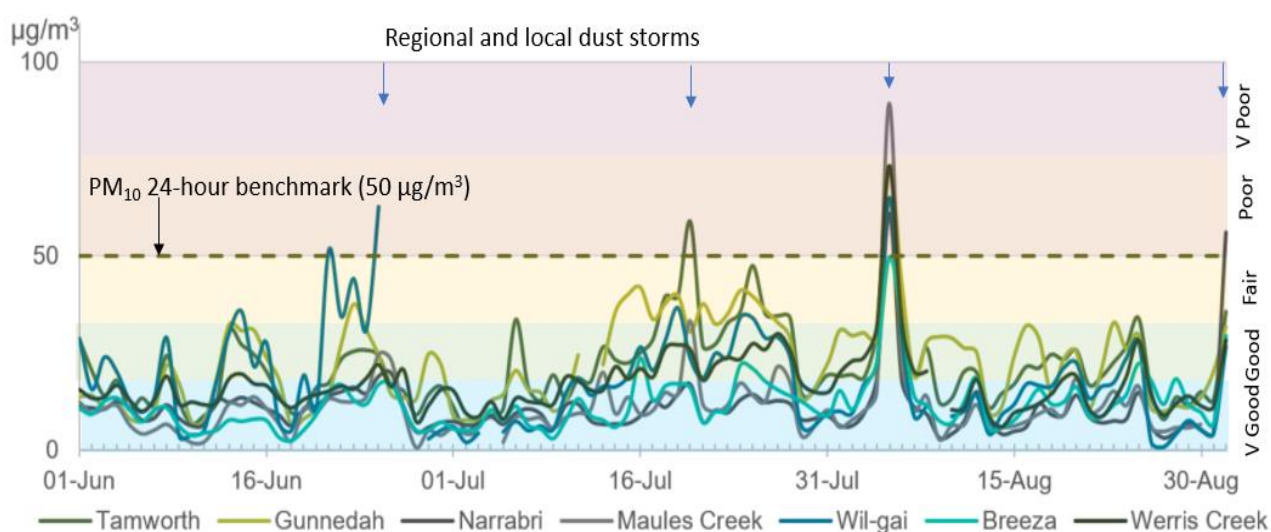


Figure 2 Daily average PM₁₀, during winter 2018, showing levels generally below the national benchmark, except during local and regional dust storms

⁷ For further detail, see the total suspended particles on the OEH web site [NSW Rural Air Quality Monitoring Network](#)

Figure 3 shows daily average of PM_{2.5} during winter 2018.

- Daily average PM_{2.5} levels were above the benchmark concentration of 25 µg/m³ on four days, at Gunnedah on 14-16 and 21 July 2018. Daily average PM_{2.5} levels ranged from 26 to 32 µg/m³.
- The peaks in hourly PM_{2.5} levels occurred on cold, calm nights, indicating the potential contribution of domestic woodsmoke³.

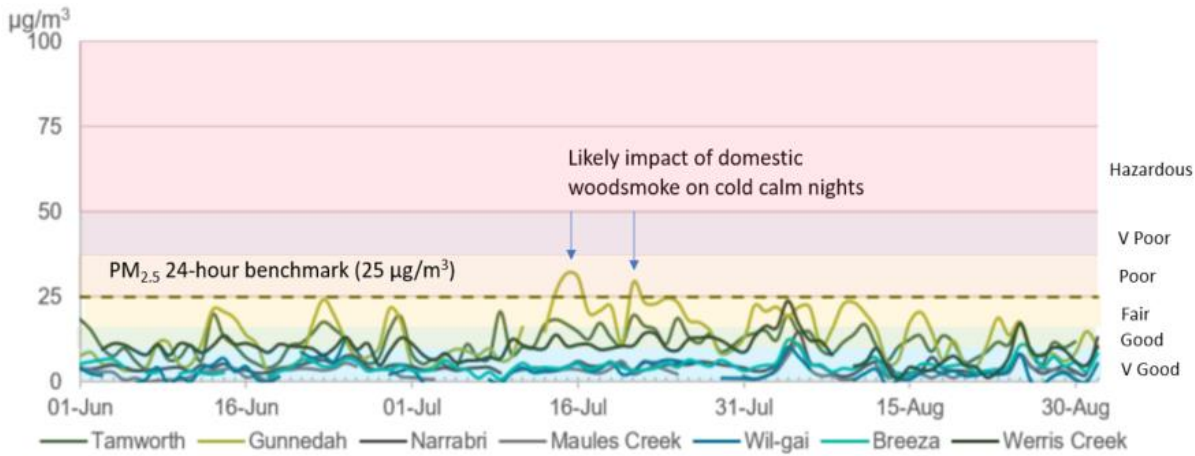


Figure 3 Daily average PM_{2.5}, during winter 2018, showing levels below the national benchmark, except at Gunnedah in mid to late July 2018, due to the likely impact of domestic woodsmoke

Air quality trends: Gaseous pollutants, Gunnedah, winter 2018

Figure 4 and Figure 5 show daily maximum 1-hour average concentrations of NO₂ and O₃ respectively. Levels were below national benchmark concentrations during winter 2018.

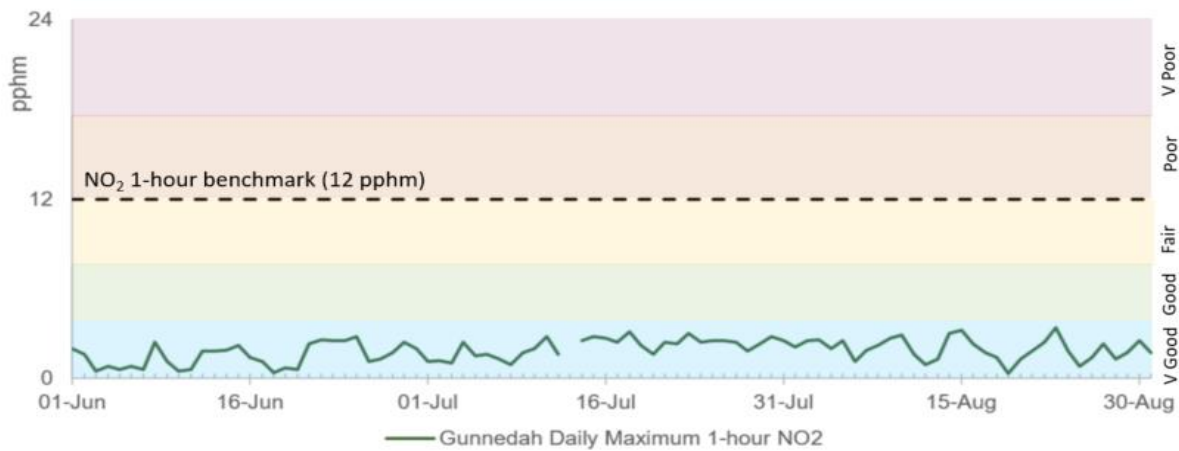


Figure 4 Daily Maximum 1-hour Nitrogen Dioxide, at Gunnedah during winter 2018, showing levels below the national benchmark concentration

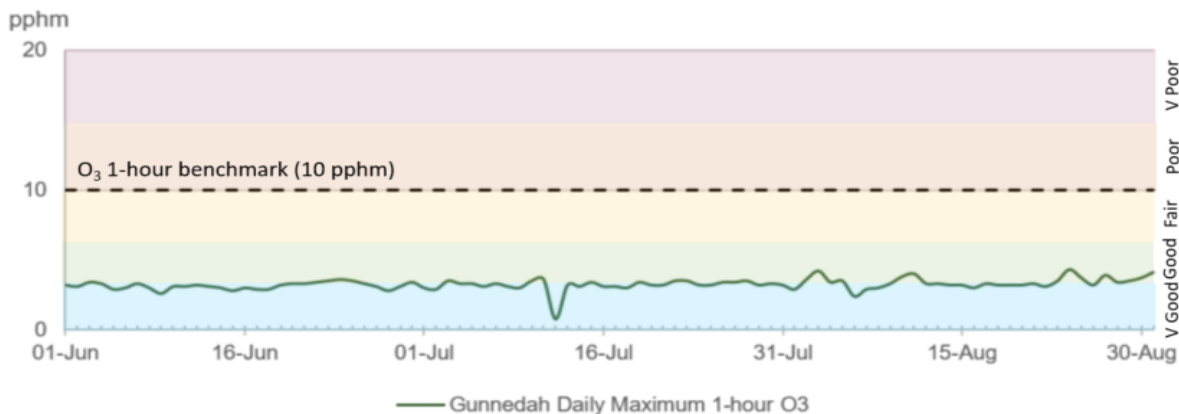


Figure 5 Daily Maximum 1-hour Ozone, at Gunnedah during winter 2018, showing levels below the national benchmark concentration

Meteorological summary

Rainfall and temperature⁸

The Namoi/North-west Slopes received rainfall at levels 'very much below average' during winter 2018. Rainfall totals were 50 to 100 millimetres (mm) across the region, which was similar to winter 2017. Winter rainfall in 2018 and 2017 was lower than the previous three seasons. The region received 150 to 300 mm less rainfall in winter 2018 than winter 2016.

Winter daytime temperatures were 'very much above average', while night-time temperatures were 'below average'. Temperature were similar to winter 2017, with cooler night time temperatures than winters in 2014 to 2016.

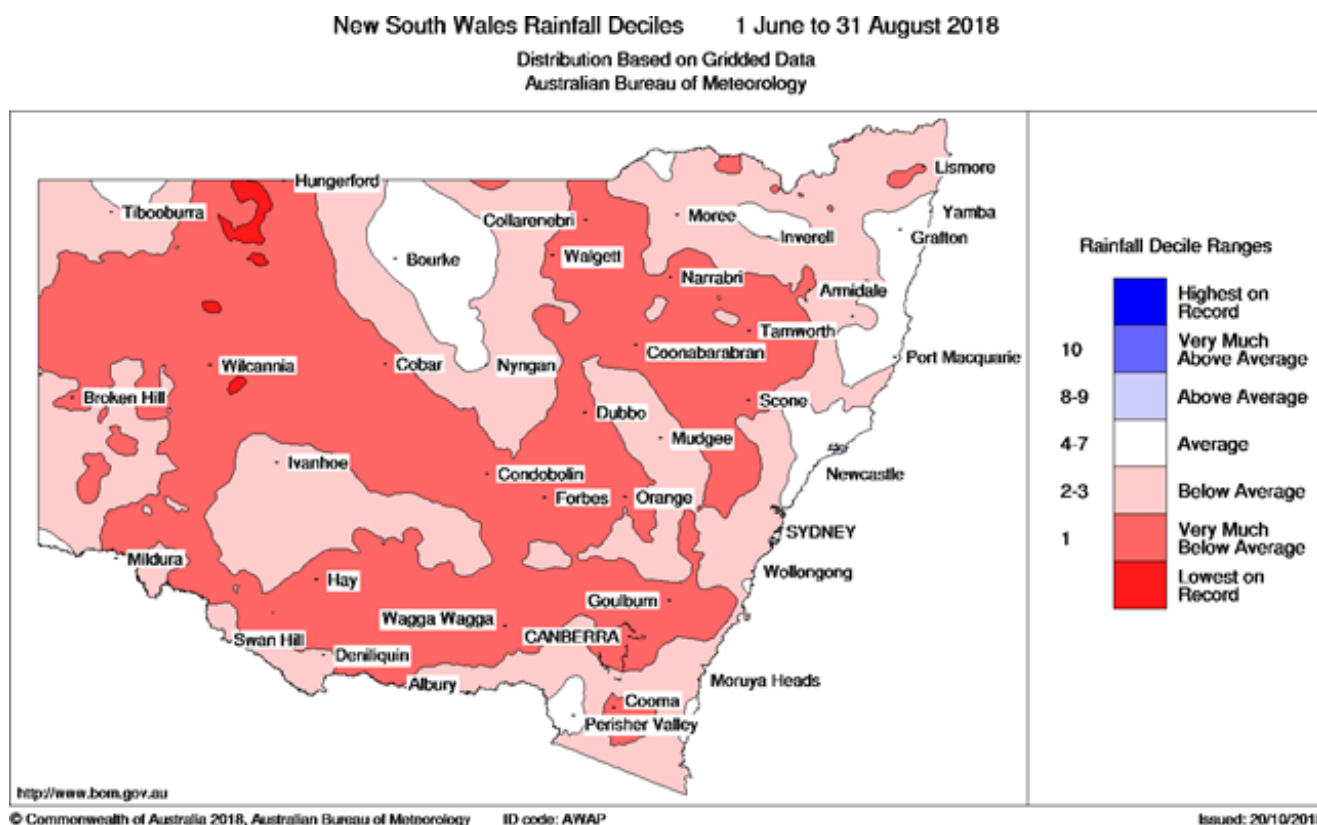


Figure 6 NSW rainfall deciles - winter 2018, showing rainfall very much below average in the Namoi/North-west Slopes region

⁸ Rainfall and temperature information is from the Bureau of Meteorology [New South Wales winter 2018 climate statement](#) and [climate maps](#) (accessed November 2018)

Drought conditions

The Namoi/ North-west Slopes experienced low rainfall and intense drought in the 12 months to August 2018 (Figure 7). Long-range dust from drought-affected areas in NSW contributed to the increase in the particle levels observed in the region during winter 2018 (see below, page 8).

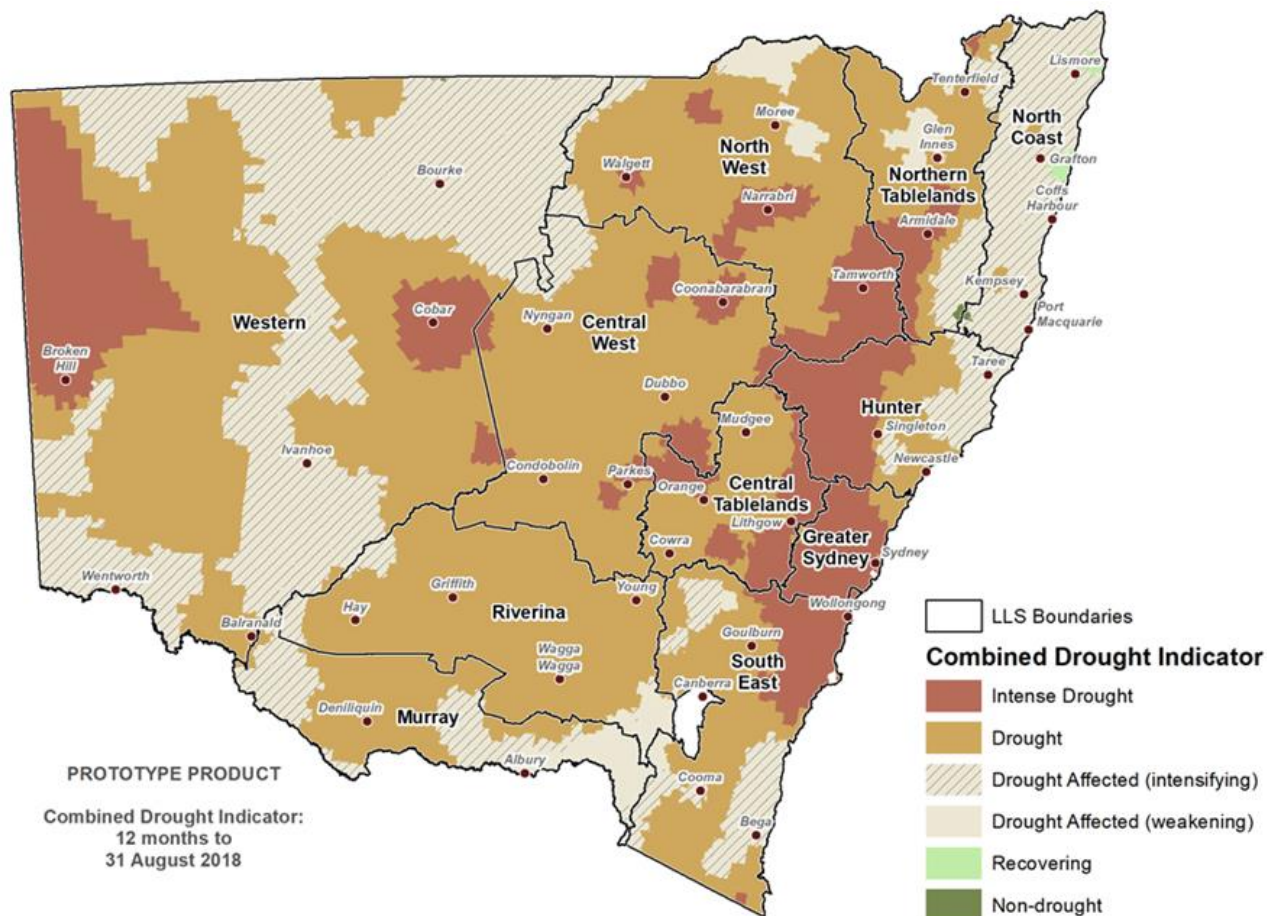


Figure 7 Department of Primary Industries NSW Combined Drought Indicator to 31 August 2018⁹, showing intense drought in the Namoi/North-west Slopes region

⁹ Sourced from Department of Primary Industries [NSW State seasonal update - August 2018](#) (accessed November 2018).

Wind

The winds were predominantly from the south-east during winter 2018 (Figure 8). Wind direction was more variable at Narrabri and Gunnedah than at Tamworth. Wind speeds were generally higher at Narrabri than at Gunnedah and Tamworth.

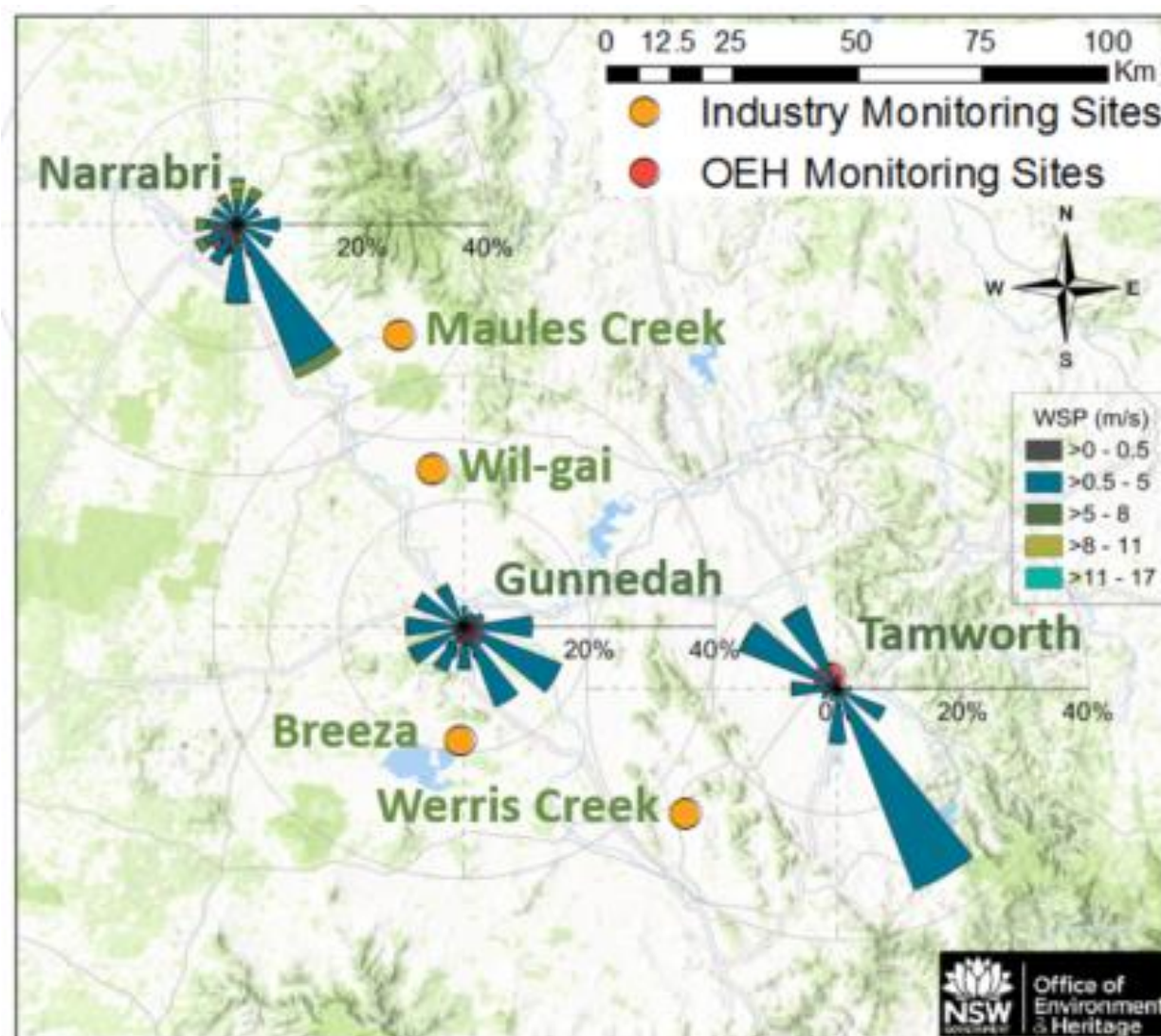


Figure 8 Wind rose map¹⁰ for the North-west Slopes for 1 June to 31 August 2018, showing winds were predominantly from the south-east

¹⁰ 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.

Pollution roses

The pollution rose maps¹¹ show that hourly PM₁₀ and PM_{2.5} levels were generally low during winter 2018. Higher hourly PM₁₀ levels (greater than 75 µg/m³)¹² at Tamworth coincided with south-east winds. Higher hourly PM₁₀ and PM_{2.5} levels at Narrabri and Gunnedah were associated with more variable wind directions, than at Tamworth. (For detail on PM₁₀ levels during a regional dust storm, see below, page 8.)

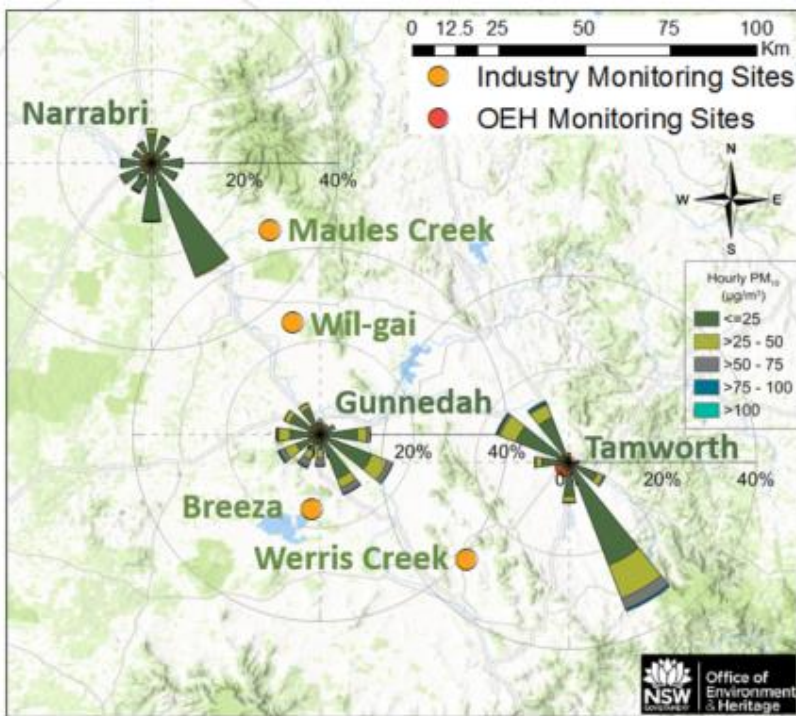


Figure 9 Hourly PM₁₀ pollution roses for winter 2018, showing higher PM₁₀ levels associated with more variable wind directions at Narrabri and Gunnedah than at Tamworth.

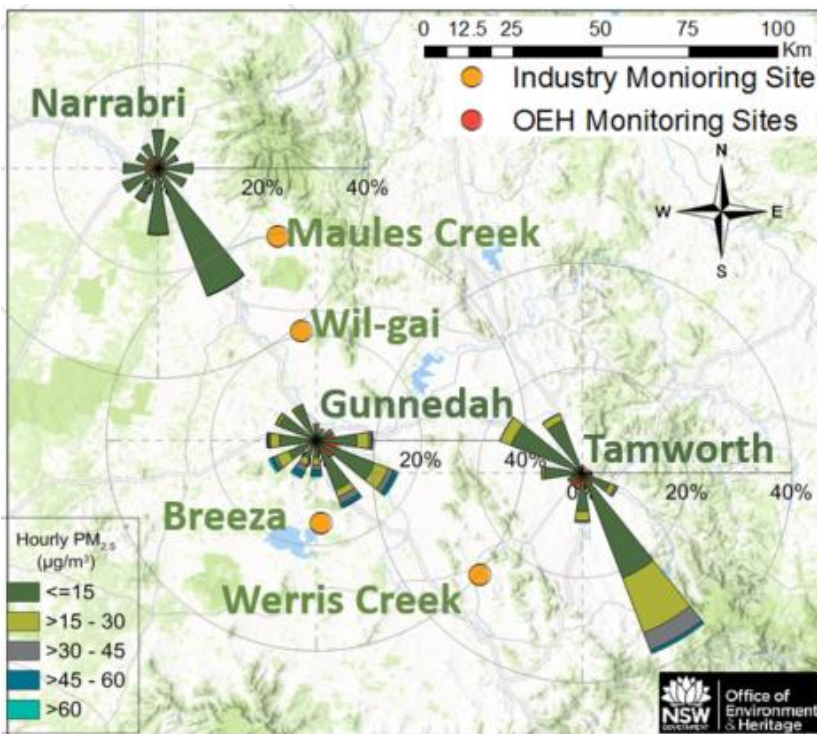


Figure 10 Hourly PM_{2.5} pollution roses for winter 2018, showing higher PM_{2.5} levels associated with variable wind directions at Narrabri and Gunnedah

¹¹ 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 the wind blows from that direction. The colours along the bars indicate the concentration of particle levels.

¹² There are no standards for hourly PM₁₀ or PM_{2.5} in the National Environment Protection (Ambient Air Quality) Measure (Air NEPM).

Incident analysis: Dust storm, 4 August 2018

Extreme events, such as dust storms, bushfires and hazard reduction burns, affect air quality levels.

Synopsis

On 4 August 2018, the Namoi/North-west Slopes experienced poor to very poor air quality, in terms of the NSW Air Quality Index² (Figure 11).

Air quality across the region on 4 August 2018 was affected by long-range transport of dust particles, from South Australia, southern Queensland and drought-affected northern NSW (Figure 16). The event was associated with the passage of a low-pressure system across eastern Australia, during 3-5 August 2018 (Figure 14).

Particle levels exceeded the PM₁₀ daily benchmark of 50 µg/m³ at Narrabri, Gunnedah, Tamworth, Maules Creek, Wil-gai and Werris Creek. Daily PM₁₀ levels at these monitoring sites ranged from 61 to 89 µg/m³ (Figure 11). The maximum hourly PM₁₀ level reached 473 µg/m³ at Gunnedah, at 2:00 pm on 4 August (Figure 12).

Regional air quality in the Namoi/North-West Slopes on 4 August 2018

Figure 11 shows PM₁₀ daily levels above the national benchmark across the region on 4 August 2018.



Figure 11 Daily PM₁₀ levels, by station, 4 August 2018

Hourly PM₁₀ levels across the Namoi/North-West Slopes peaked on 4 August 2018, generally associated with moderate to fresh westerly winds (Figure 12 and Figure 13).

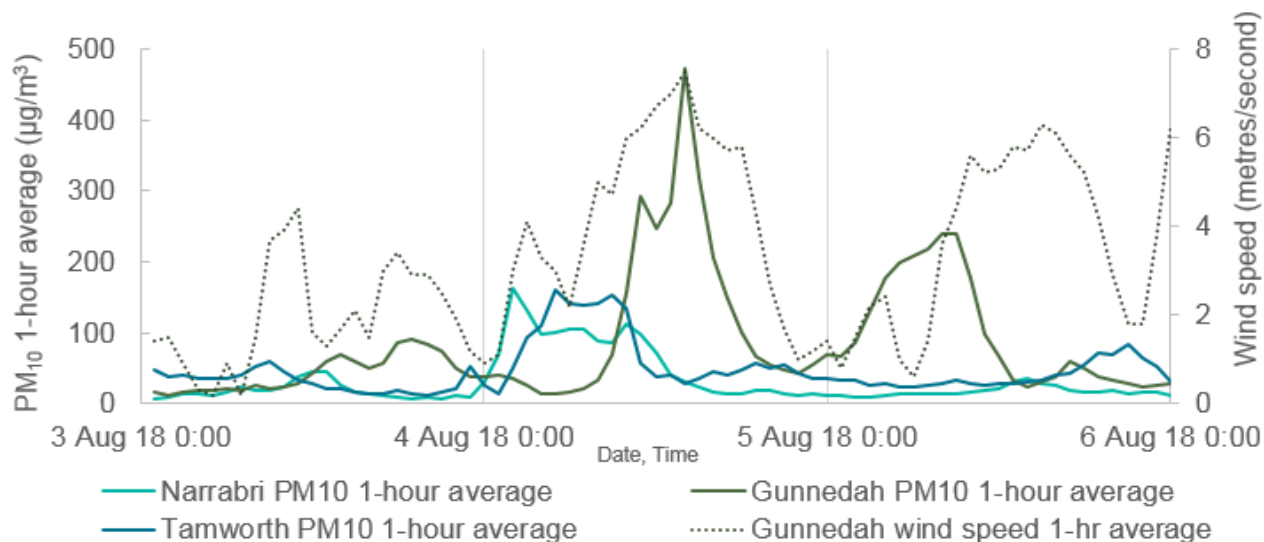


Figure 12 PM₁₀ 1-hourly average concentrations, North-west Slopes during 3-5 August 2018, showing a peak at Gunnedah on 4 August 2018, associated with high wind speed.

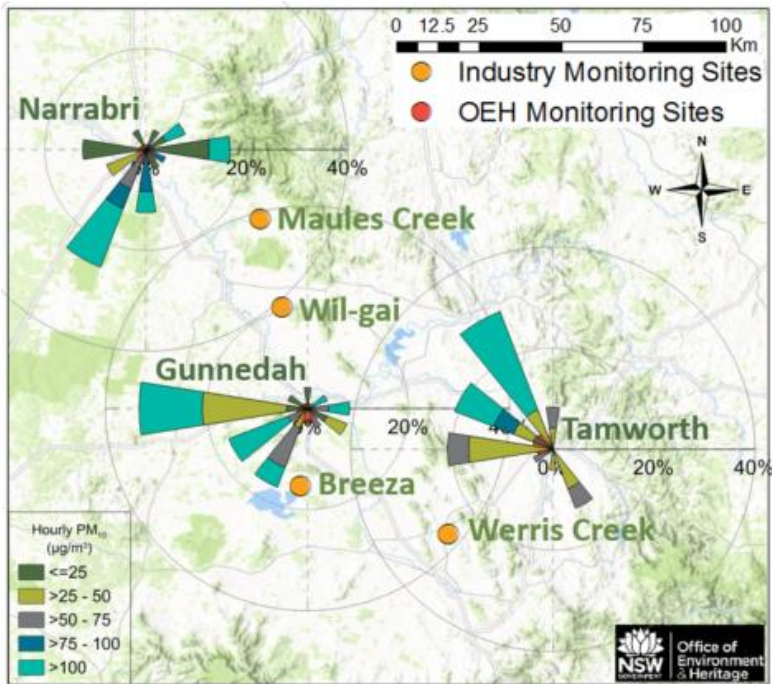
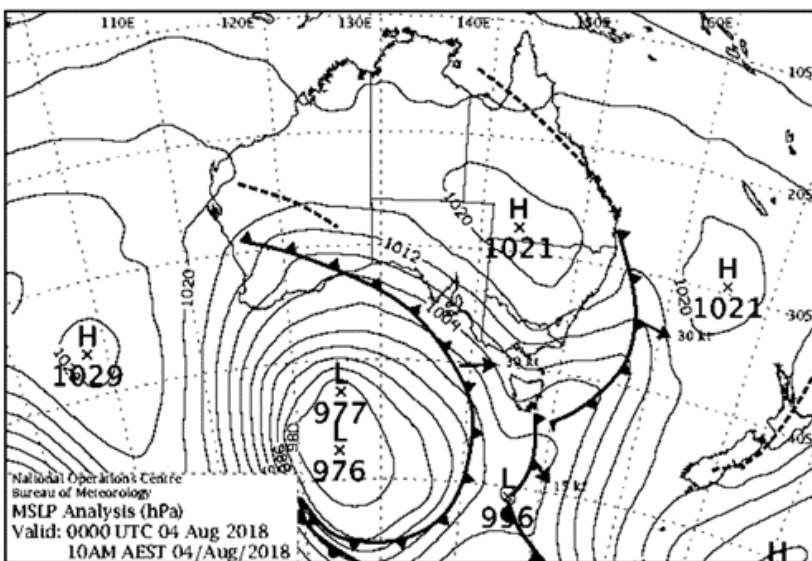


Figure 13 Hourly PM₁₀ pollution rose map for 4 August 2018, showing high particle levels generally coinciding with westerly winds

Seasonal weather conditions and dust activity during 3-5 August 2018

Dust activity in NSW increased throughout 2018. DustWatch¹³ reported the increasing frequency of dust storms, loss of groundcover and ongoing dry conditions. Most of NSW recorded rainfall levels very much below average and intensified drought conditions (as noted above in Figure 6 and Figure 7). The NSW Rural Air Quality Monitoring Network¹⁴ reported high levels of suspended dust particles across central and western NSW and the North-west Slopes, during 3-4 August 2018.

On 3-4 August 2018, a cold front and low-pressure system moved across eastern Australia (Figure 14). Moderate to fresh breezes lifted soil dust and transported suspended particles across the region. Figure 15 shows a satellite image of dust transported by winds associated with the frontal system.



¹³ DustWatch reports January to August 2018

¹⁴ NSW Rural Air Quality Monitoring Network reports hourly updated levels of PM_{2.5}, PM₁₀ and Total Suspended Particles

Figure 14 Synoptic weather chart for 10:00 am 4 August 2018¹⁵, showing a low-pressure system and two cold fronts with associated westerly winds

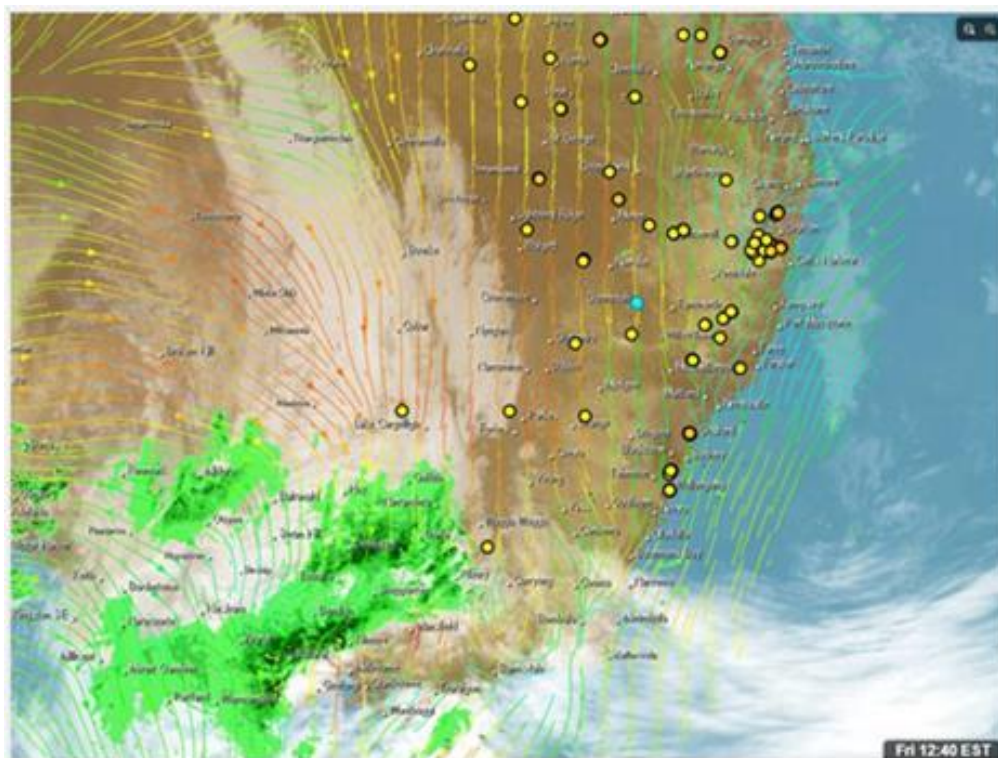


Figure 15 Satellite image of south-eastern Australia for 3 August 2018¹⁶, showing elevated dust transported by winds associated with the frontal system. Gunnedah is shown as a blue dot.

Tracking dust particles across NSW on 4 August 2018

The OEH used the computer model [HYSPLIT in NSW](#) and synoptic data from the Bureau of Meteorology, to determine the source of the high particle levels in the Namoi/North-west Slopes on 4 August 2018.

Error! Reference source not found. shows the modelled 24-hour pathway of air parcels, travelling from South Australia and southern Queensland, across northern and western NSW, before arriving in the Namoi/North-west Slopes. These long-range air flows transported suspended dust particles, elevating PM₁₀ levels across the region.

¹⁵ Sourced from the [Bureau of Meteorology Analysis Chart Archive](#) website (accessed in November 2018)

¹⁶ Sourced from [windy.com](#) accessed August 2018

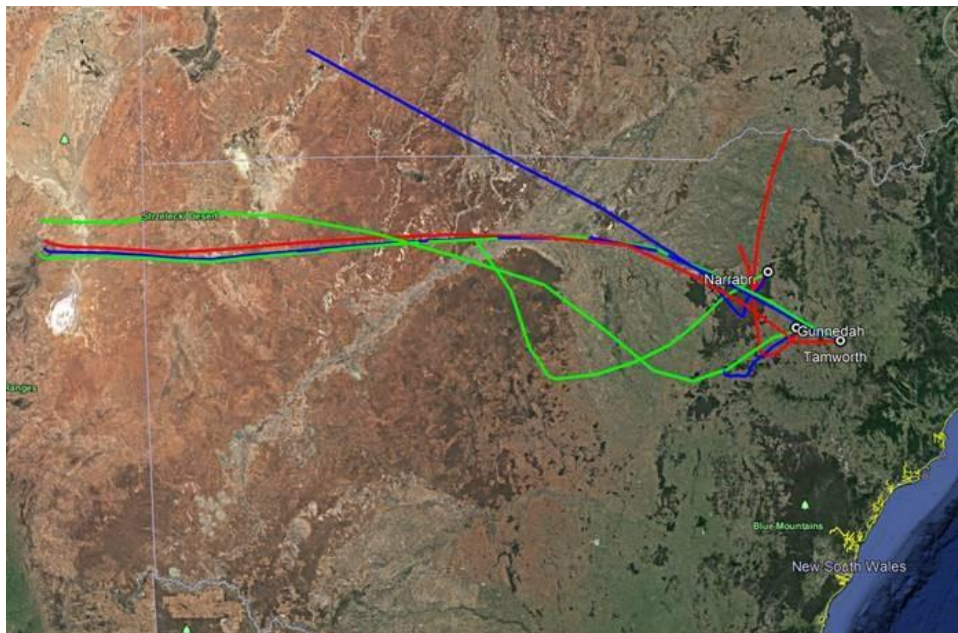


Figure 16 Modelled path of air particles, travelling at 50 mAGL (red), 500 mAGL (green) and 1000 mAGL (blue), before arriving in the Namoi/North-west Slopes region on 4 August 2018.

Online performance of monitoring stations

The target performance for air quality monitoring is at least 95% available data for all parameters. The maximum online time attainable for gases, NO₂, and O₃, is 96%, due to daily calibrations.

Gunnedah, Narrabri and Tamworth monitoring sites met online targets for monitoring of PM₁₀ and meteorology, for 1 June to 31 August 2018.

Instrument faults and associated calibrations reduced the online time at Tamworth, for PM_{2.5} (12 days) and at Gunnedah, for monitoring NO₂ (7 days) and O₃ (5 days).

Table 2 Online performance (%) during January to July 2018

Station	Particles PM ₁₀ daily	Particles PM _{2.5} daily	Gases NO ₂ hourly	Gases O ₃ hourly	Meteorology Wind hourly
Gunnedah	99	99	92	94	100
Narrabri	99	98	-	-	100
Tamworth	100	87	-	-	100

- = not monitored

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