

Air Quality Monitoring Network

Namoi/North West Slopes Region – Winter 2023

Air quality in the Namoi/North West Slopes region was mostly good throughout winter 2023. Daily particle levels met national benchmarks¹ on 96% of days (Figure 1). Good air quality was sustained across most of the network. Air quality in Gunnedah was good 78% of the time. Fair to poor days were likely due to smoke from wood heaters. Winter 2023 was very dry with below-average rainfall and above-average temperatures throughout the season. Previous high rainfall maintained substantial ground cover during winter 2023, which contributed to reduced dust activity.

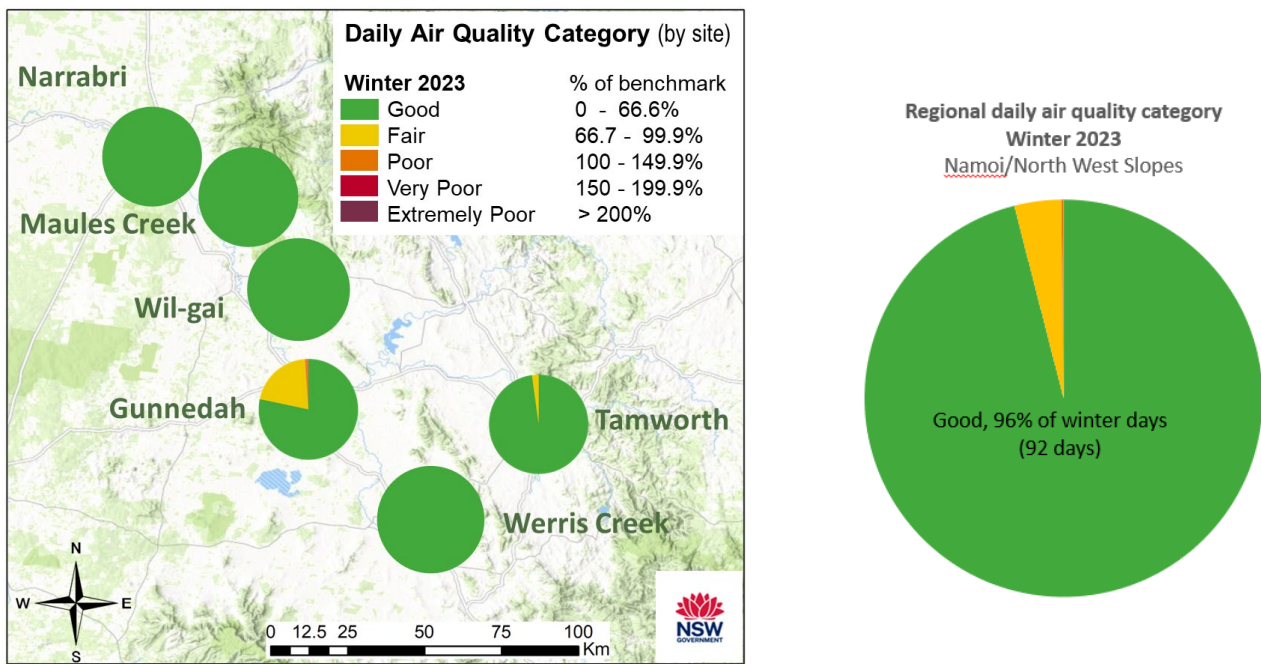


Figure 1 Daily air quality categories at individual monitoring stations (left) and regional air quality in the Namoi/North West Slopes region (right).

Air quality: summary statistics, winter 2023

Gunnedah and Tamworth both recorded days above the national benchmarks during winter 2023 (Table 1). These high values are likely due to woodfire smoke.

Table 1 Number of days above each benchmark, by station, 1 June to 31 August 2023.

Station	PM10 daily benchmark [50 µg/m ³]	PM2.5 daily benchmark [25 µg/m ³]	NO ₂ hourly benchmark ^{1a} [8 pphm]	O ₃ 8-hourly benchmark ^{1a} [6.5 pphm]
Gunnedah	0	1	0	0
Narrabri	0	0	-	-
Tamworth	0	0	0	0
Maules Creek	0	0	-	-

Station	PM10 daily benchmark [50 µg/m ³]	PM2.5 daily benchmark [25 µg/m ³]	NO ₂ hourly benchmark ^{1a} [8 pphm]	O ₃ 8-hourly benchmark ^{1a} [6.5 pphm]
Werris Creek	0	0	-	-
Wil-gai	0	0	-	-

Air quality: particle pollution winter 2023

The time series of daily average particle concentrations shows PM10 levels below the benchmark. No stations recorded PM10 concentrations above the benchmark during winter 2023 (Figure 2).

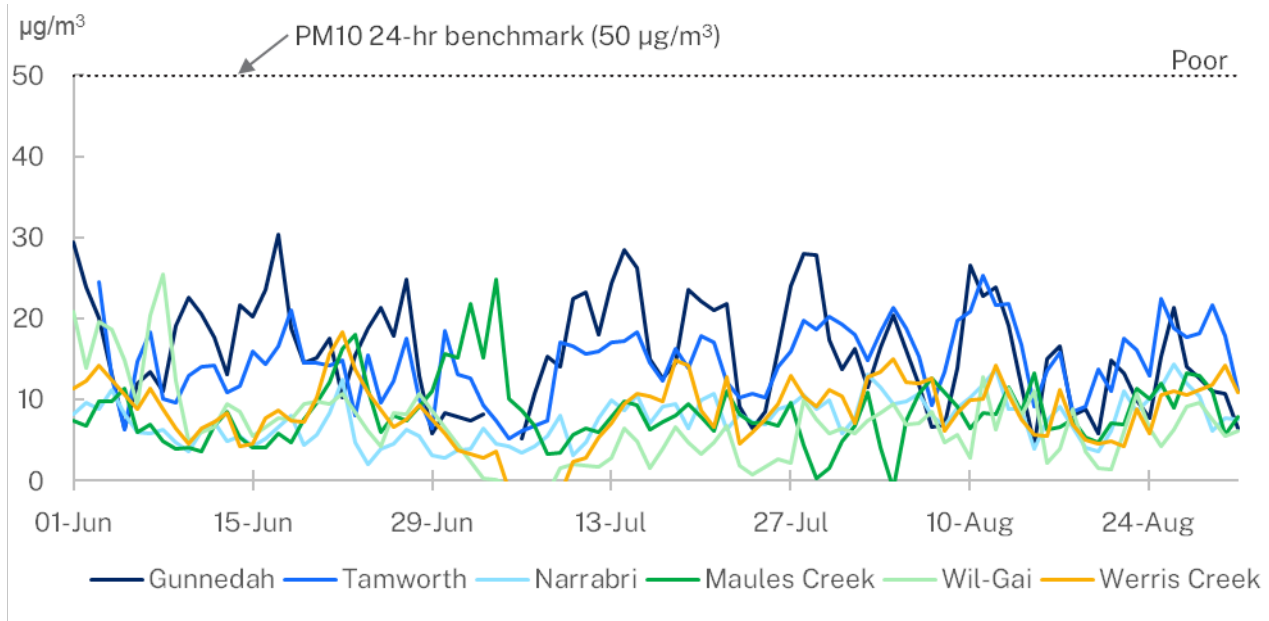


Figure 2 Daily average PM10 in winter 2023, showing concentrations below the benchmark.

Gunnedah and Tamworth recorded daily average PM2.5 levels above the national benchmark during winter 2023 (Figure 3). This is likely due to woodfire smoke.

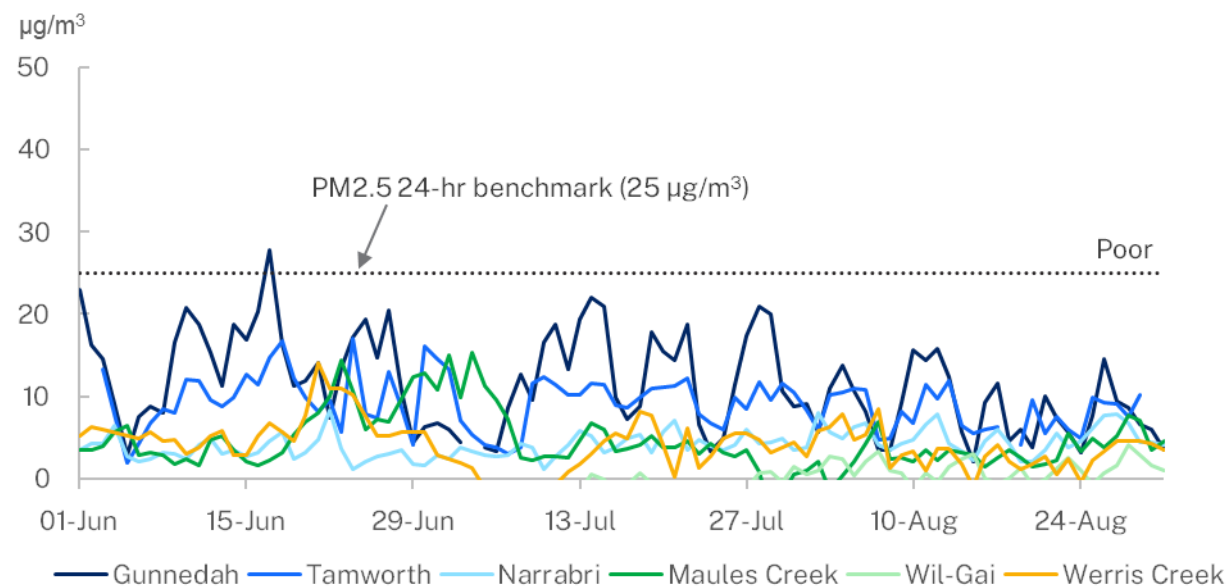


Figure 3 Daily average PM2.5 in winter 2023, showing concentrations below the benchmark.

Air quality: gaseous pollution winter 2023

Figure 4 and Figure 5 show winter 2023 trends at both Gunnedah and Tamworth stations were characterised by broadly stable ozone and nitrogen dioxide concentrations, well below the stricter O₃ and NO₂ standards².

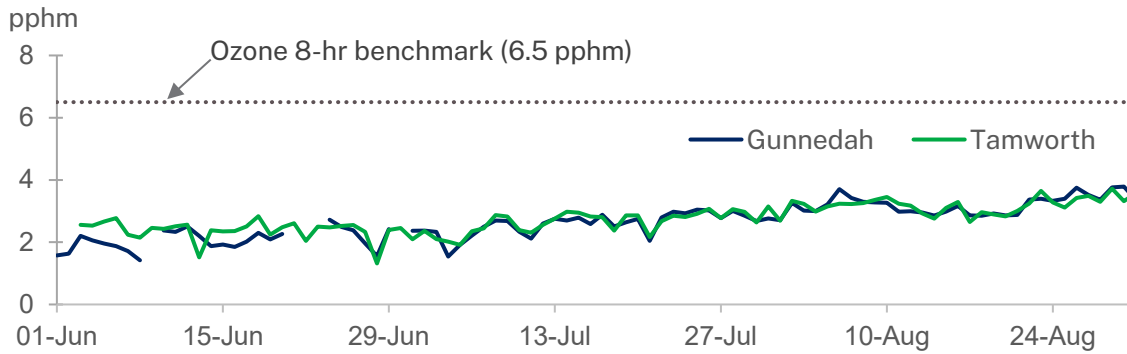


Figure 4 Ozone daily maximum 8-hour average concentrations at Gunnedah and Tamworth, during winter 2023, showing levels below the benchmark.

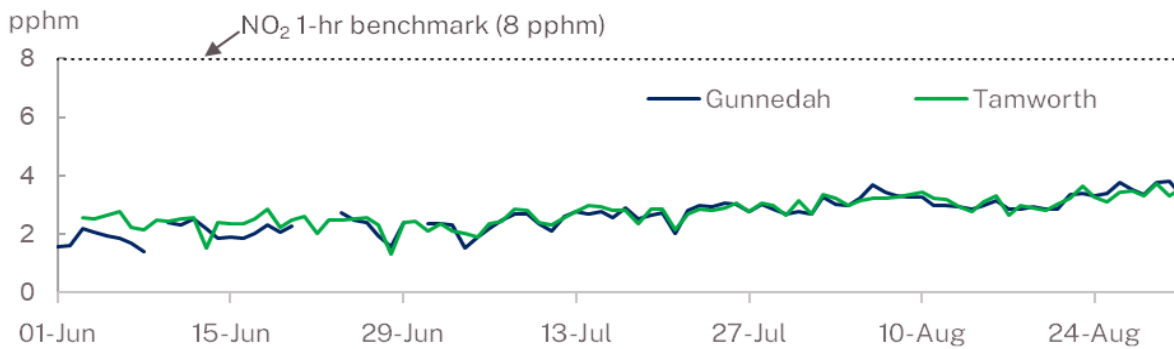


Figure 5 Nitrogen dioxide daily maximum 1-hour average concentrations at Gunnedah and Tamworth, during winter 2023, showing levels below the benchmark.

Seasonal weather and climate

Dry conditions continued to expand into parts of New South Wales during winter 2023 with 8% of the state now declared drought-affected or in drought. According to the Bureau of Meteorology (BOM), rainfall was above average over the far west of the state, below average over the western slopes of the Great Dividing Range, and very much below average along the coast. Temperatures were very much above average across the state with the winter 2023 area-averaged maximum temperature the warmest on record. Furthermore, Global Temperatures, Carbon Brief State of the Climate³ reported that the first 3 quarters of 2023 have seen exceptional heat globally, putting 2023 on track to be the warmest year since records began. June, July and August shattered prior records by at least 0.3 °C.

The climatic drivers El Niño forming in the Pacific Ocean and the positive Indian Ocean Dipole combined during winter 2023 for a very dry year across most of Australia⁴, including eastern New South Wales. This led to the increased drought-affected areas.

Drought conditions and dust activity

Below-average rainfall and above-average temperatures throughout winter 2023 led to increased drought conditions east of the Great Dividing Range. The NSW DPI Combined Drought Indicator (CDI) shows that 91% of New South Wales was in the non-drought category at the end of August

2023⁵ (Figure 6). Dust levels remained low due to the abundance of ground cover remaining from previous wet seasons.

DustWatch⁶ reported increased levels of dust activity in the Northwest NSW region during winter 2023, even though the hours of strong winds were very few.

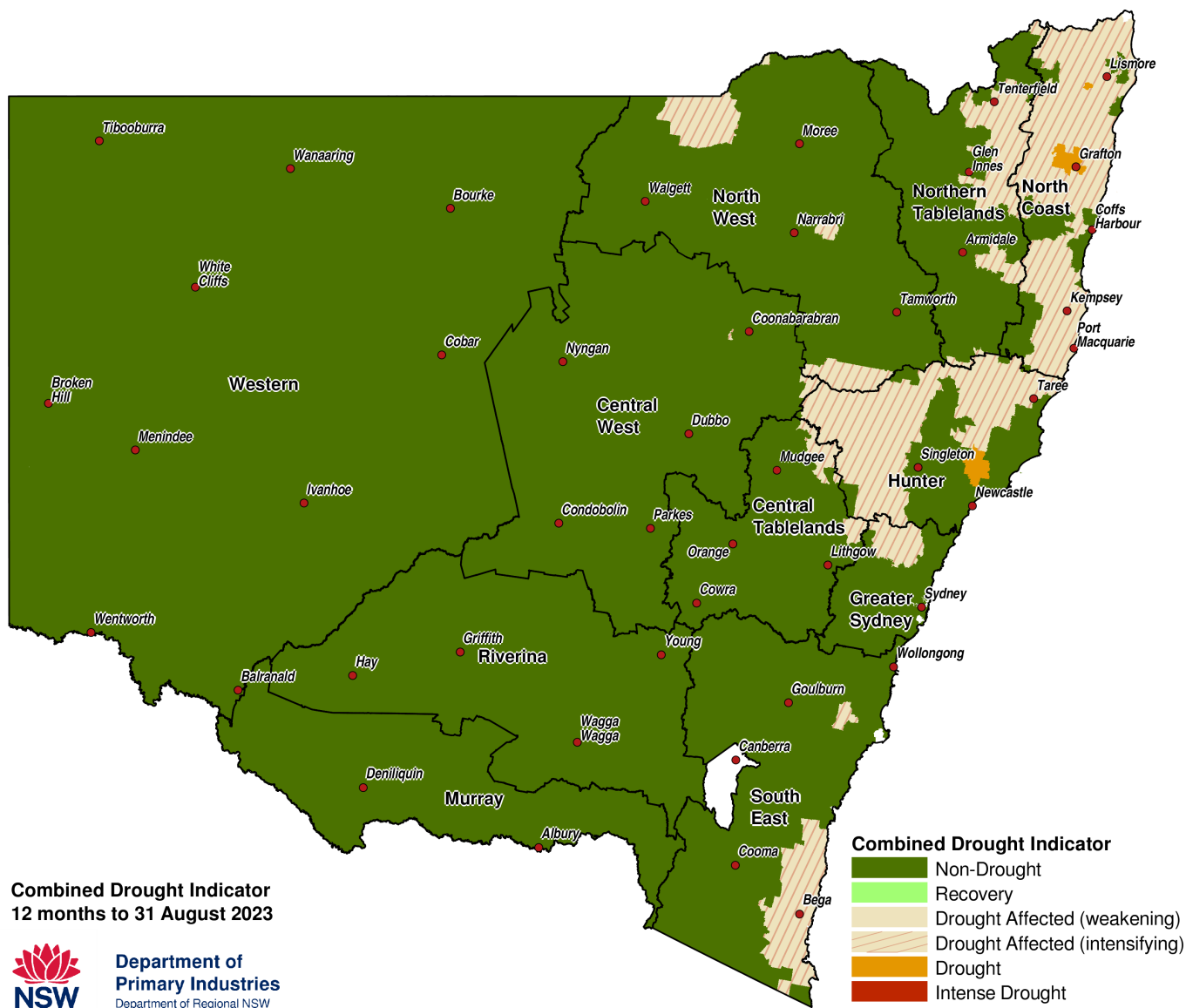


Figure 6 NSW Combined Drought Indicator – 12 months to 31 August 2023, showing drought-affected conditions across the Namoi/North West Slopes region and generally across the state.

Rainfall

The BOM seasonal rainfall summary, Figure 7⁷, shows that rainfall during winter 2023 was ‘very much below average’ for most of the Namoi/North West Slopes region. According to the Bureau, the regional rainfall total was 28.2% below the 1961 to 1991 average, in contrast to the rainfall totals during 2022. These totals ranged between 300–400 millimetres (mm)⁸.

Seasonal rainfall totals for winter 2023 at individual BOM stations Tamworth AWS (91 mm)⁹ and Gunnedah AWS (91.6 mm)¹⁰, were well below their respective long-term winter totals (187 mm and 170 mm)^{11,12}. The department’s Gunnedah air quality monitoring station (Gunnedah AQM) recorded 53.6 mm of rainfall (Figure 8)¹³ during winter 2023.

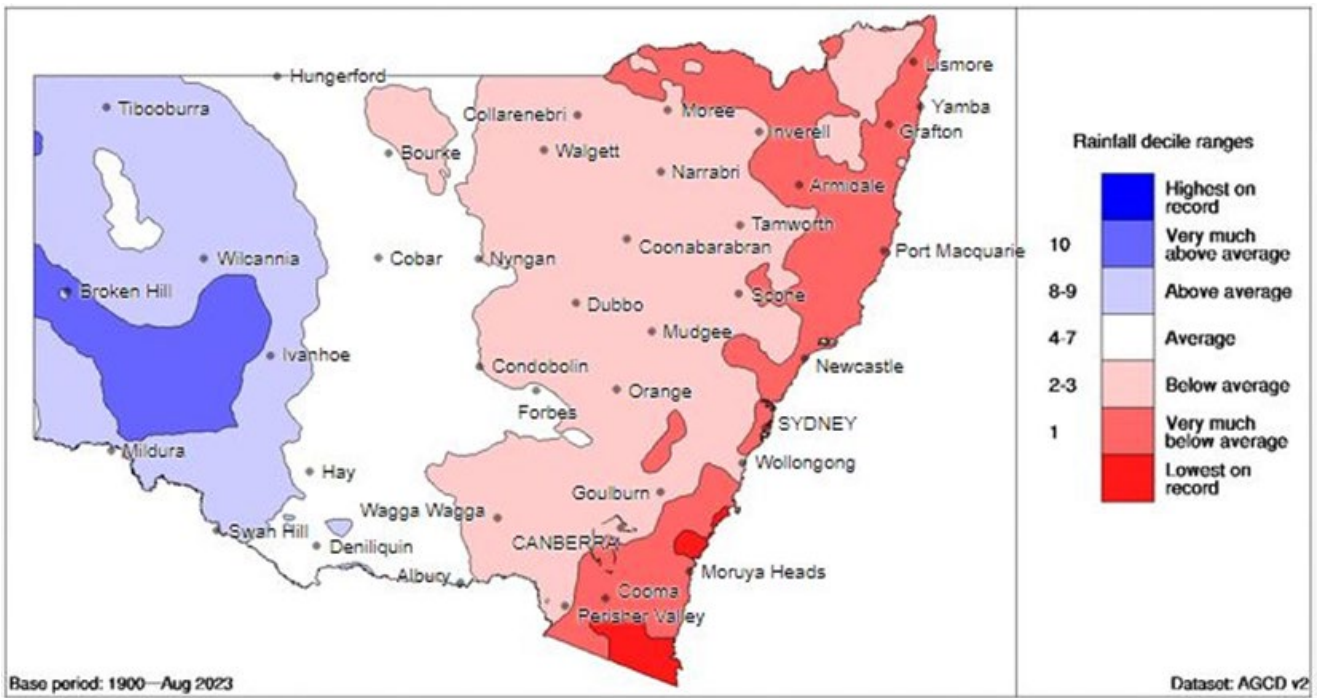


Figure 7 NSW rainfall deciles for spring, 1 June to 31 August 2023, showing very much below-average rainfall in the Namoi/North West Slopes region (Commonwealth of Australia 2023, Bureau of Meteorology).

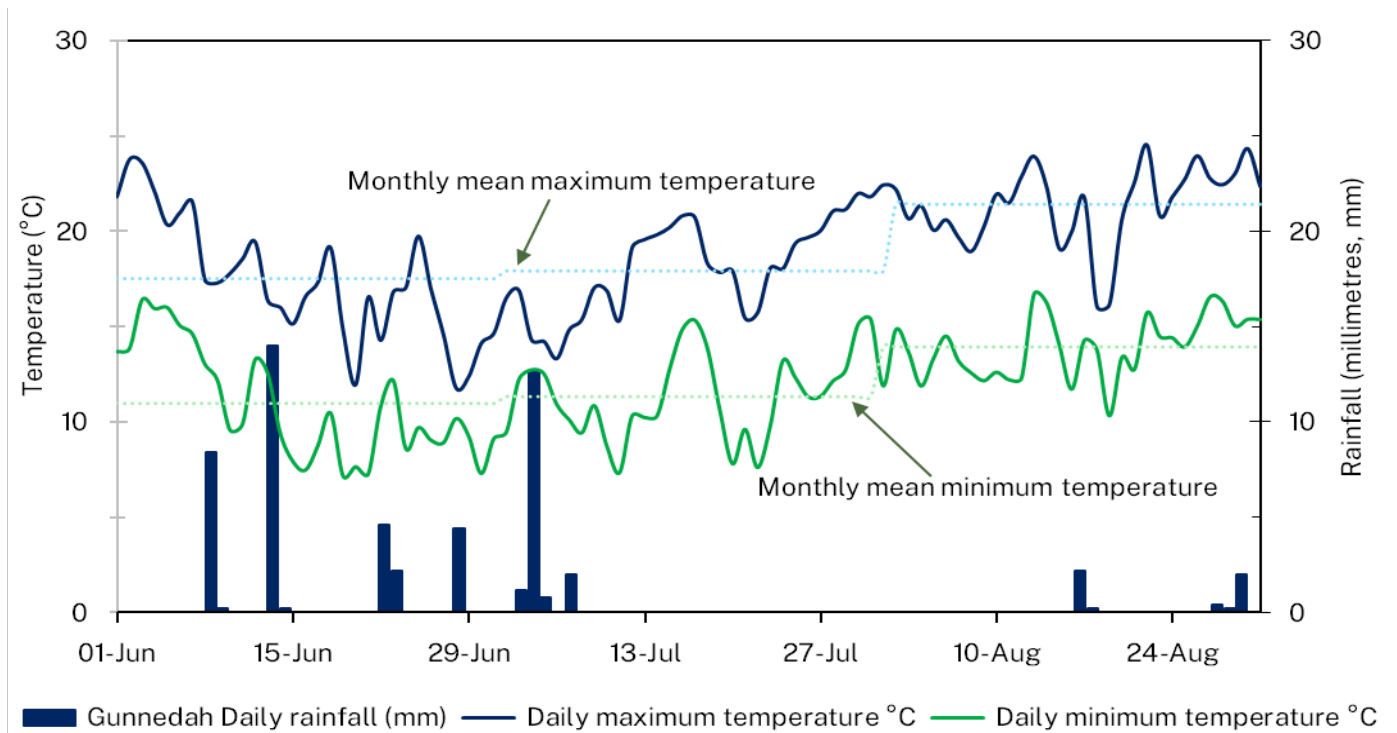


Figure 8 Gunnedah AQM station meteorology conditions, showing rainfall days and seasonal maximum and minimum temperatures during winter, 1 June to 31 August 2023.

Temperature

Maximum daytime temperatures across the Namoi/North West Slopes region were the highest on record according to the Bureau's winter 2023 seasonal summary (Figure 9)¹⁴.

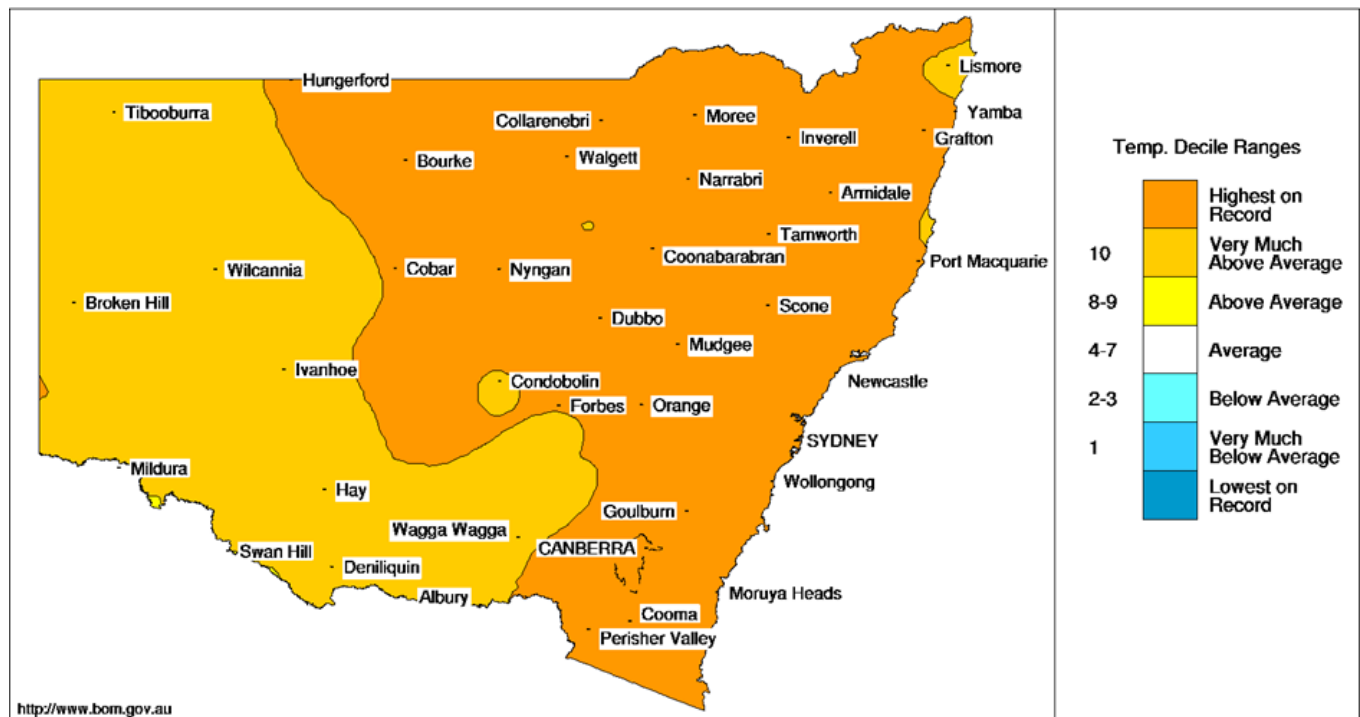


Figure 9 NSW maximum temperature deciles, showing average maximum temperatures throughout the North West Slopes region during winter, 1 June to 31 August 2023. (Commonwealth of Australia 2023, Bureau of Meteorology).

The department's Gunnedah AQM station recorded above-average days (maximum temperatures) compared to the long-term winter maximum at Gunnedah AWS. Winter maximum temperatures at Gunnedah AQM station ranged from 12 to 24.5°C (blue line at Figure 8), with an average of 19°C. According to the Bureau's winter 2023 seasonal summary, a new maximum mean temperature record was set at Gunnedah AWS (27.2°C)¹² since national observations began in 1910.

Meanwhile, overnight (minimum) temperatures at Gunnedah AQM station were also above average. Minimum temperatures ranged from 7.2 to 16.6°C (blue line at Figure 8), with an average of 12°C, about 7°C higher than the Gunnedah AWS¹² long-term average winter minimum (10°C). The Bureau's winter 2023 seasonal summary¹⁵ shows 'average' to 'above-average' minimum temperatures in the region, as cloud cover kept nights relatively warm.

Wind

The topography of the North West Slopes region is characterised by highlands in the east and south, and to the west lies a broad floodplain, with Namoi River flowing north-west through Gunnedah and Narrabri, and Peel River flowing north-west through Tamworth. Prevailing winds across the region generally align with the direction of the Namoi and Peel River valleys, that is, along the south-east to north-west sector.

The wind rose map at Figure 9 shows wind direction and speed through the region, with the length of the bars showing the percentage of time the wind blows in each direction. The colours along the bars indicate wind speed categories.

As is typical for the Namoi region during winter months, prevailing winds in winter 2023 were light to moderate south-easterlies. At Tamworth and Gunnedah some influence from other sectors was observed, while at Narrabri the south-easterlies dominated, and winds were stronger at this station than at other locations.

Gunnedah AQM station¹⁶ is located within the region’s population centre, as is Tamworth AQM station¹⁷ and both stations are surrounded by high population densities. Narrabri AQM station¹⁸ is located at Narrabri Airport, outside of the regional population centre which is located to the west.

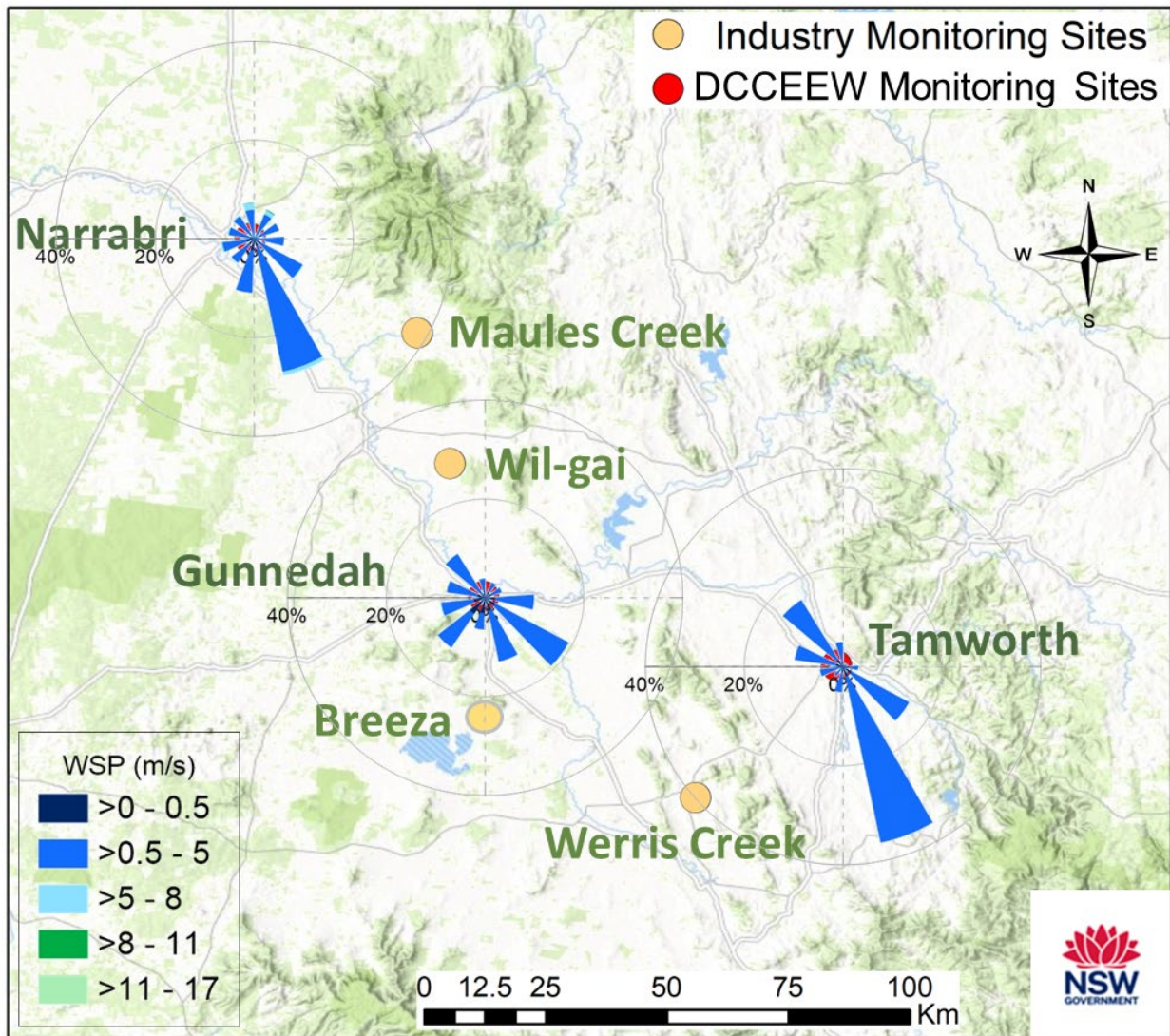
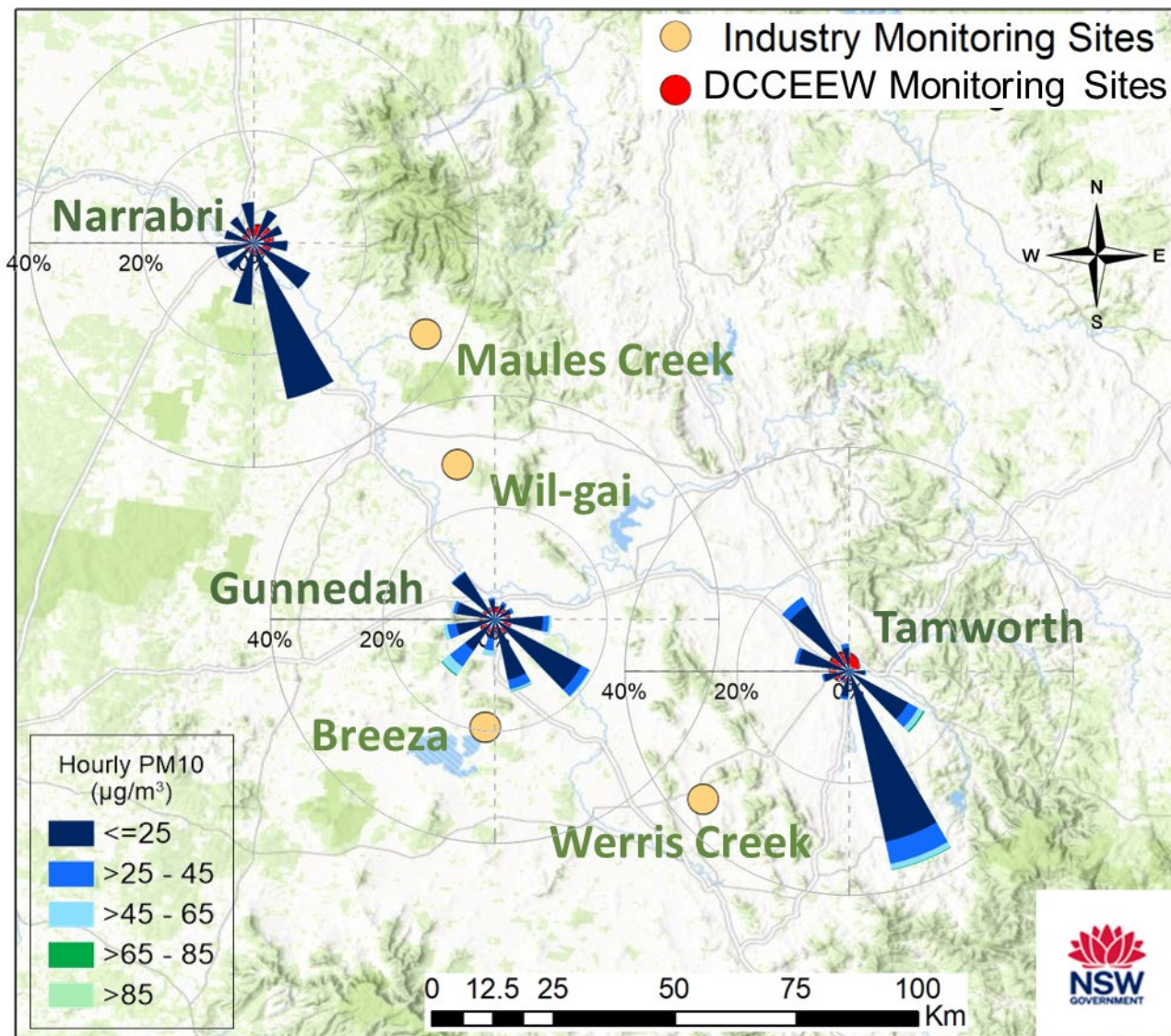


Figure 9 Wind rose map for the Namoi/North West Slopes during winter 2023.

Pollution roses from hourly particle data

Pollution roses show the wind direction and particle levels at a location, with the length of each bar around the circle showing the percentage of time the wind blows from each direction. The colours along the bars indicate the concentration of particle levels. Figure 10 shows winter 2023 pollution roses for the 3 regional centres (Narrabri, Gunnedah and Tamworth).

High levels of hourly PM10 and PM2.5 were predominantly associated with south-easterly winds at all stations with some distinctions. At Gunnedah elevated particle levels were also associated with southwesterlies and occasionally north-westerlies. At Tamworth, elevated particle levels were also observed under north-westerlies. At Narrabri, higher levels were associated with north-easterlies.



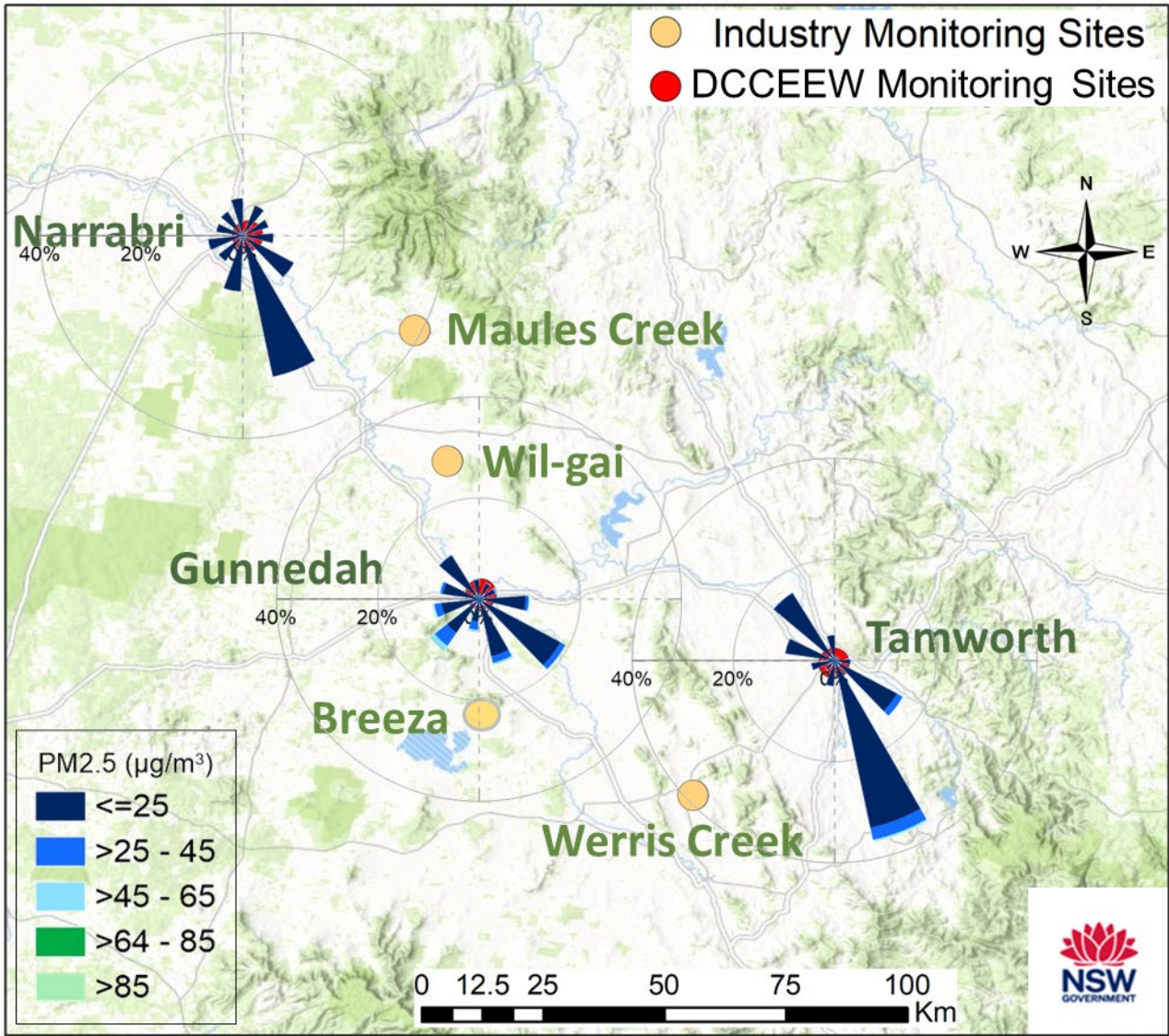


Figure 10 Pollution roses for hourly PM10 (top) and PM2.5 (bottom) in winter 2023.

Online performance of monitoring stations

The target performance for air quality monitoring at the department's stations is at least 95% data availability for all criteria pollutants and meteorological parameters. The maximum online time attainable for gases, NO₂ and O₃, is 96% due to daily calibrations.

Table 2 presents the online performance of monitoring stations at Gunnedah, Narrabri, and Tamworth during winter 2023:

- All stations met online targets for monitoring of meteorology.
- Gunnedah, Narrabri and Tamworth met online targets for monitoring of PM10 and PM2.5.
- Gunnedah and Tamworth did not meet online targets for NO₂ or O₃.

Table 2 Online performance (%) from 1 June to 31 August 2023

Station	Particles PM10 daily	Particles PM2.5 daily	Gases NO ₂ hourly	Gases O ₃ hourly	Meteorology wind hourly
Gunnedah	97.8	98.9	94.5	93.6	99.9
Narrabri	100	100	-	-	99.9
Tamworth	97.8	95.7	94.3	94.3	98.6

'-' not monitored.

Reduced online times were due to:

- Gunnedah and Tamworth NO₂ and O₃: monitors did not meet online targets due to intermittent instrumentation problems.

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This report was prepared by Jo Heidenreich and Toan Trieu; reviewed by Emily Goodale and David Salter.

Published by: Department of Climate Change, Energy, the Environment and Water, Locked Bag 5022, Parramatta NSW 2124. Ph: 131 555 Email: info@environment.nsw.gov.au;

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- ¹ The [National Environment Protection \(Ambient Air Quality\) Measure \(Air NEPM\)](#) sets national standards for common urban air pollutants, which in this report are referred to as air quality ‘benchmarks’. 1a: the 2021 amended NEPM strengthened the 1-hour NO₂ standard (from 12 pphm) and replaced the previous O₃ standards with the 8-hour rolling average standard.
- ² Air quality categories based on the updated national gaseous standards (or benchmarks) are not yet established. Hence these plots do not show any other air quality category other than ‘poor’ which are defined by benchmarks.
- ³ [Global Temperatures, Carbon Brief State of the Climate](#), accessed December 2023.
- ⁴ [Climate update - tracking Australia’s climate and water resources through 2023](#), Bureau of Meteorology, accessed December 2023.
- ⁵ [Combined Drought Indicator for 12 months to 30 August 2023](#), Department of Primary Industries, accessed June 2023.
- ⁶ [DustWatch Reports: June 2023, July 2023 and August 2023](#), Department of Planning and Environment, accessed November 2023.
- ⁷ [Rainfall decile map for 3 months to 31 August 2023](#) for NSW, Bureau of Meteorology, accessed November 2023.
- ⁸ [Winter 2023 rainfall totals](#) and 1-year to 3-year differences, Bureau of Meteorology, accessed December 2023.
- ⁹ [Daily Weather Observations - Tamworth Airport Automatic Weather Station \(AWS\)](#), accessed November 2023.
- ¹⁰ [Daily Weather Observations - Gunnedah Airport Automatic Weather Station \(AWS\)](#), accessed November 2023.
- ¹¹ [Summary climate statistics - Gunnedah Airport AWS](#), Bureau of Meteorology, accessed December 2023.
- ¹² [Summary climate statistics - Tamworth Airport AWS](#), Bureau of Meteorology, accessed December 2023.
- ¹³ DPE observations at Gunnedah air quality monitoring (AQM) station. This data is not NATA accredited.
- ¹⁴ [Temperature \(maximum\) decile map for 3 months to 31 August 2023](#), Bureau of Meteorology, accessed December 2023.
- ¹⁵ [Temperature \(minimum\) decile map for three months to 31 August 2023](#), Bureau of Meteorology, accessed December 2023.
- ¹⁶ [About the DPE Gunnedah Air Quality Monitoring station](#).
- ¹⁷ [About the DPE Tamworth Air Quality Monitoring station](#).
- ¹⁸ [About the DPE Narrabri Air Quality Monitoring station](#).