BLANkET[1] Technical Report 5
A large dust storm seen in data from BLANkET and other Tasmanian Air Quality Stations, September 2009-10-23

November 2009

Air Section, Environment Division, DPIPWE, supporting the EPA

BLANkET is the Base-Line Air Network of EPA Tasmania

Summary: Three distinct dust events occurred over Tasmania on successive days in September 2009. The dust originated in the Simpson Desert area of northern South Australia, and was carried over Tasmania and Bass Strait by strong upper level winds. Dust was deposited over a large area of Tasmania, particularly during the third event late on the 12th of September just prior to the passage of a cold front. This dust storm preceded the more widely reported 'Red Dawn' dust storm which impacted on New South Wales and Queensland about 10 days later.

Five new BLANkET (Base-Line Air Network of EPA Tasmania) air stations in north-east Tasmania were operating during this event, in addition to the major stations located in George Town, Rowella (lower Tamar Valley), Launceston, and Hobart. All recorded elevated levels of PM_{10} (particulate matter up to 10 millionths of a metre in aerodynamic diameter), with little or no corresponding increase in $PM_{2.5}$ (particles up to 2.5 millionths of a metre in aerodynamic diameter). This is a well-known signature of dust, which has relatively few fine particles.

Reference air quality instruments were in operation at George Town, Launceston and Hobart during the event. A breach of the 24-hour PM_{10} National Environmental Protection (Ambient Air Quality) Measure of 50 µg m^{-3} was recorded at George Town for the 12th of September, where the measured 24-hour PM_{10} reading was 50.9 µg m^{-3}. Air quality standards were not exceeded at Launceston or Hobart.

This report presents a short account of the event and discusses the data from the above mentioned air stations.

[1] Base-Line Air Network of EPA Tasmania

The dust events seen by the BLANkET network:

The BLANkET stations are equipped with optical particle counters called Dustraks. A particle *mass concentration* is inferred from a calibration of Dustrak particle counts against a gravimetric (mass-measuring) instrument. The BLANkET dustraks have been calibrated for the usual types of particles found in the Tasmanian airshed, which are particles from smoke, sea-salt aerosols, and some types of dust. Because the Dustraks have not been calibrated specifically to measure dust from the Simpson Desert the derived mass concentrations presented here should be taken as indicative only.

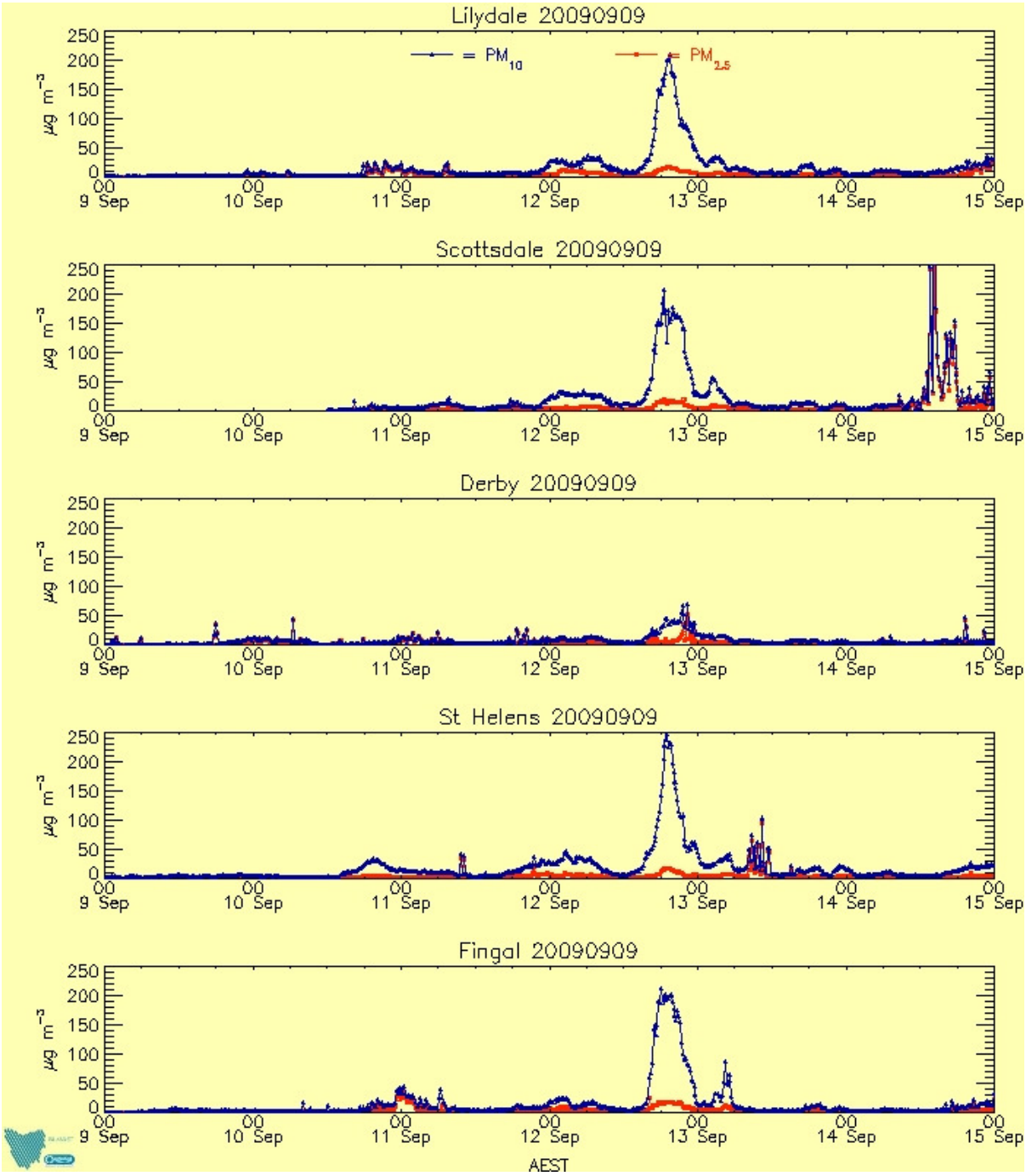

Figure 1 - BLANkET air quality data for the north-east of Tasmania 9th to 14th September 2009. The large peak late on the 12th of September is the signature of a significant dust event.

Figure 1 presents PM_{10} and $PM_{2.5}$ data (particles less than 10 and 2.5 millionths of a metre in effective diameter respectively) from the five BLANkET stations in the north-east of Tasmania. The most obvious feature of this figure is the large peak in PM10 (blue line) late on the 12th of September. This is the signature of a significant dust impact. Note that the fine particle component (as measured by the $PM_{2.5}$ data, shown in red) shows only a very small increase relative to the PM_{10}. Figure 2 shows the difference $PM_{10} - PM_{2.5}$. That is, this plot shows the inferred concentration of particles with sizes between 2.5 and 10 millionths of a metre. Doing this emphasises the dust component of the air quality data.

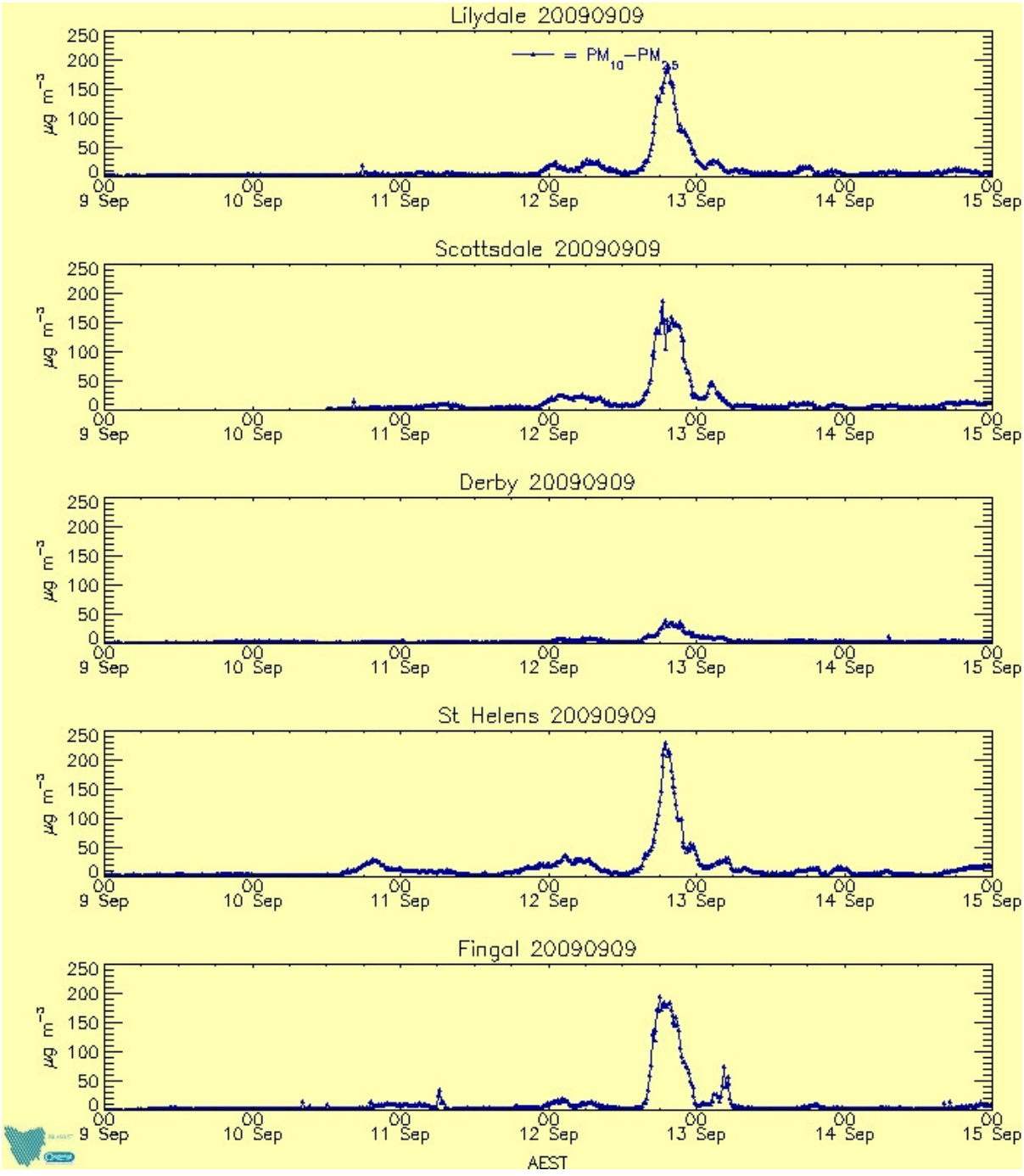

Figure 2 - As for Figure 1, but here we plot the difference PM_{10} - $PM_{2.5}$ to emphasis the dust component of the data.

At least two smaller dust events preceded the 12th September event. This is more readily seen in Figure 3, which shows the detail of the PM_{10} – $PM_{2.5}$ data. For example, at St Helens there were dust events late on the 10th and early on the 12th.

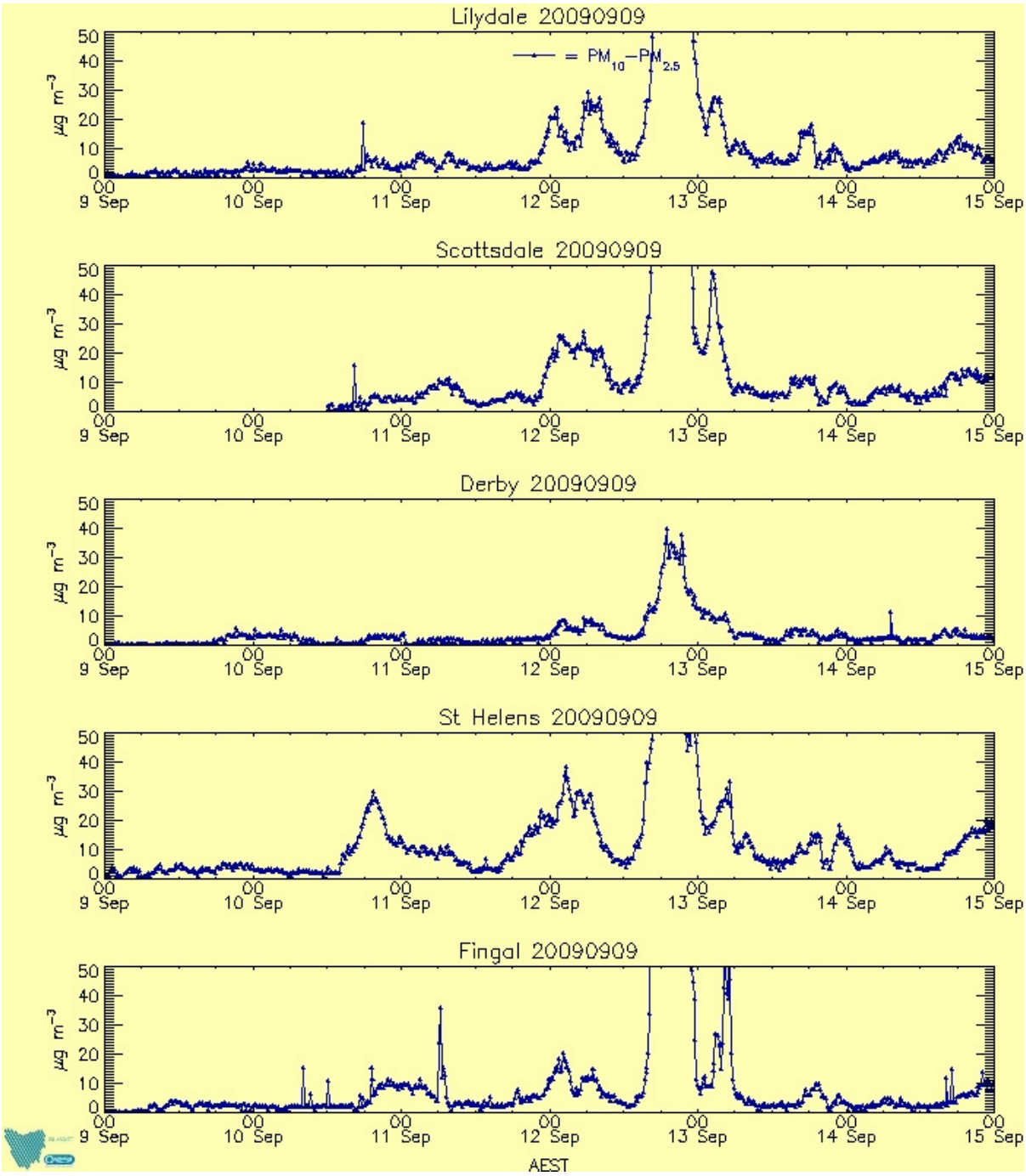

Figure 3 - Detail of the dust component of the signal, measured at the BLANkET stations.

Meteorology on the 12th of September:

The Bureau of Meteorology surface pressure chart for 10 pm on the 12th of September shows a cold front just approaching the west coast of Tasmania (Figure 5). The peak dust impact preceded passage of the frontal system over Tasmania. The Hobart office of the Bureau of Meteorology reported very strong upper level north-westerly winds over Hobart, reaching a peak of more than 160 kilometres an hour at 9pm on Saturday evening.

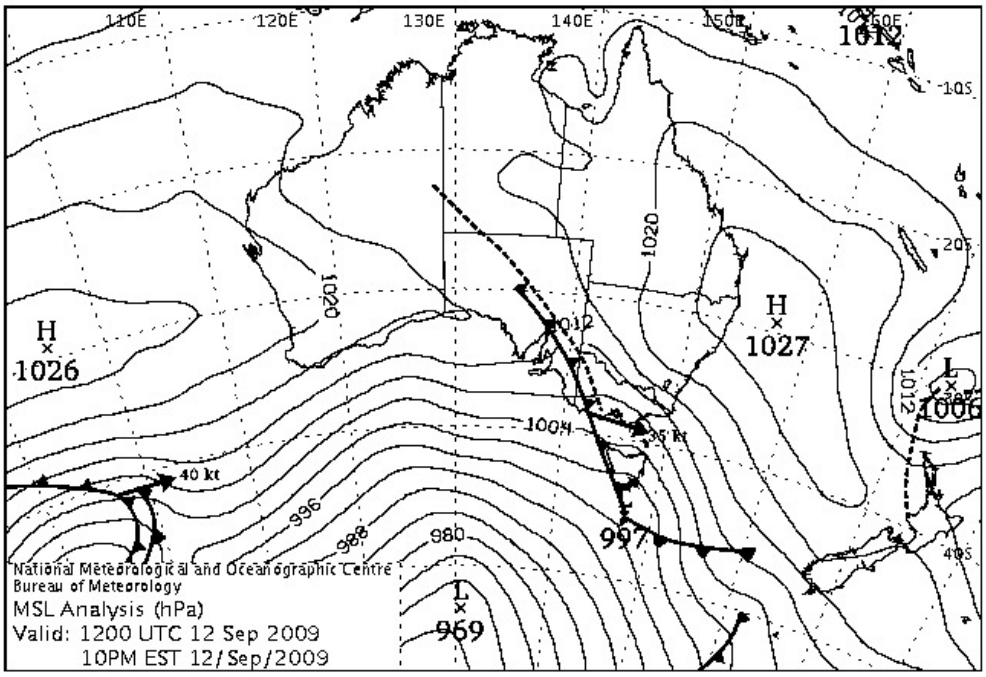

Figure 5 - Bureau of Meteorology chart for 10 pm on the 12th of September.

Satellite view of the 12th September dust event:

In New South Wales the Dustwatch programme, operated by a consortium of regional councils, Griffith University, and the NSW Department of Environment, Climate Change and Water, monitors the development and impacts of large-scale dust storms. A composite MODIS satellite image for the afternoon of the 12th of September, supplied by the Dustwatch programme, is shown in Figure 6. Dust can be seen streaming from the source in northern South Australia, down to the coast, and through Bass Strait into the Tasman Sea.

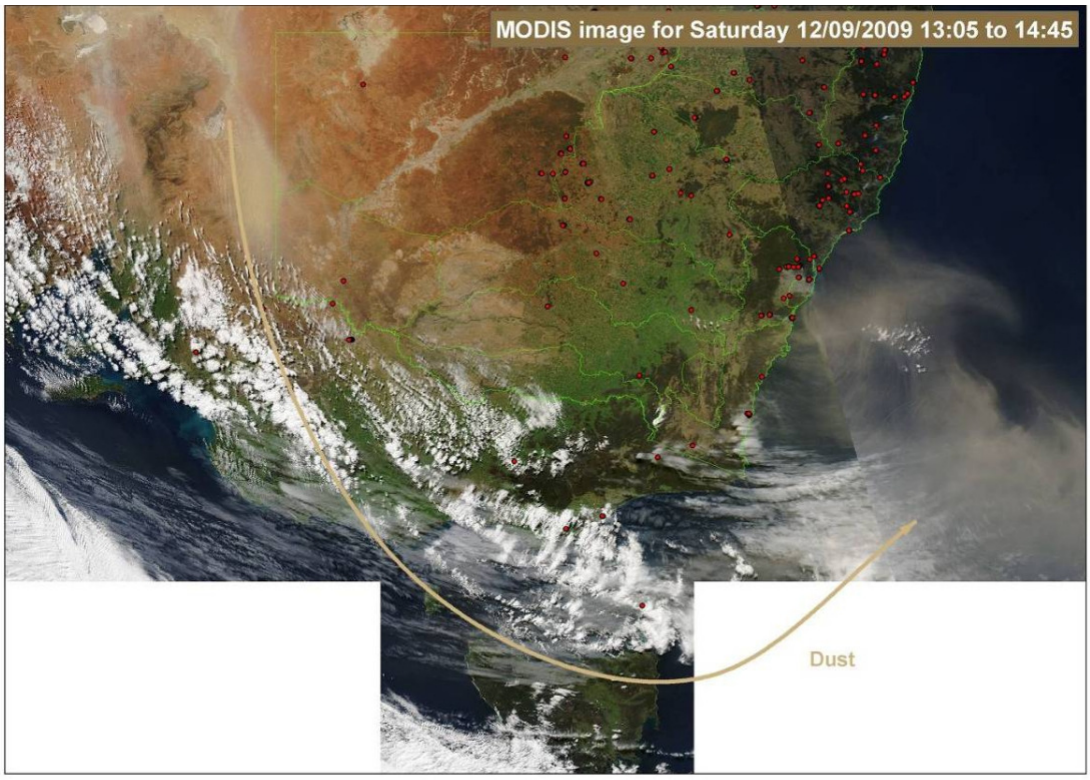

Figure 4. MODIS satellite image fires and dust plumes the Lake Eyre Basin to The Tasman Sea.

DustWatch is funded by the Lower Murray Darling, Lachlan, and Murray CMAs, the Department of Environment, Climate Change and Water NSW and Griffith University.

Figure 6 - Composite MODIS image of south-eastern Australia for 12th September 2009, courtesy of the NSW DustWatch programme.

In the media:

A significant deposition of dust occurred in northern and eastern Tasmania overnight on the 12th, and was reported in various media outlet, including the Launceston Examiner (Figure 6). The source of the dust included material from the Simpson Desert that travelled to and through the Victorian Mallee.

Mallee dust a big blow outdoors

Report, picture:
PETER SANDERS

IT WASN'T a terrorist chemical attack or even a youthful prank.

The mystery reddish-brown substance covering cars and outdoor furniture around Launceston yesterday was dust from the Mallee region of north-western Victoria.

Mowbray Heights Neighbourhood Watch treasurer Ann Bevan contacted The Examiner about the coating after several of her members phoned her about it.

Weather bureau information officer Bruce Copplestone said that the phenomenon was a combination of extremely strong winds on the mainland and rain across Tasmania.

When prevailing wind conditions are right, dust picked up by the wind can be blown south and rain simply washes it out of the sky, he said.

"Conditions were right from Saturday to Sunday with Swan Hill and Mildura reporting raised dust levels and strong winds aloft in the right direction,'' Mr Copplestone said.

"The rain finished the job."

Mowbray Heights Neighbourhood Watch treasurer Ann Bevan cleans away the dust that collected on her outdoor table on Saturday night.

Figure 7 - Report from the Launceston Examiner, 14th September 2009

Air Quality impacts:

Breaches of the National Environmental Protection (Ambient Air) Measure (known as the Air NEPM) air quality standards can only be determined by the use of reference (gravimetric) instrumentation. The BLANkET instruments are not reference instruments but provide indicative data only, and hence cannot be used to determine if air quality standards have been exceeded.

The day-average of the continuous PM_{10} data for George Town, Rowella, Launceston and Hobart for the 12th of September 2009 are given in the Table 1. Reference (gravimetric) data are available for George Town, Launceston, and Hobart, and are also given in the table. The data show that a breach of the 24-hour Air NEPM standard for PM10 occurred at George Town on the 12th of September due to the dust storm. The gravimetric data provided by the Rowella TEOM suggest that a breach of the Air NEPM PM_{10} standard may have occurred at this site as well. Moving to the south, neither Launceston nor Hobart recorded air quality breaches.

Station	Reference PM_{10} ($\mu g\ m^{-3}$)	Day-averaged continuous PM_{10} data ($\mu g\ m^{-3}$)	Method for Continuous data
George Town	50.9	54	Optical
Rowella	N/A	51	TEOM
Launceston	42.3	41	TEOM
Hobart	23.2	21	TEOM

Table 1 – Day averaged PM_{10} data for the major Tasmanian Air stations.

For completeness only, day-averaged PM_{10} values for the 12th of September derived from the BLANkET data are also given in Table 2. Because of the uncertainty in the calibration of the Dustrak signals from optical scatter to mass concentration for dust these values must be regarded as approximate, and provide only an indication of the actual day-averaged PM10 levels that were present at the BLANkET sites on this day.

Four north-east Tasmanian stations (Lilydale, Scottsdale, St Helens and Fingal) have day-averaged PM_{10} values just over 50 µg m-3. Some measure of the accuracy of the day-averaged BLANkET PM_{10} data is available however from a comparison of the Hobart TEOM and gravimetric PM_{10} data and day-averaged data from a Dustrak co-located with these instruments at the Hobart (New Town) air station. The day-averaged PM_{10} from the Hobart Dustrak for the 12th of September was 29 $\mu g\ m^{-3}$, which is comparable to but greater than the values of 23.2 $\mu g\ m^{-3}$ and 21 $\mu g\ m^{-3}$ recorded by the gravimetric and TEOM instruments respectively. If this comparison is applicable to data from the other BLANkET stations, indicating the BLANkET stations have overestimated actual concentrations, it would appear that there were no breaches of the Air NEPM 24-hour PM_{10} standard at any of the five BLANkET stations operating at this time.

BLANkET station	12 Sept 2009, Day-averaged optical PM10 (indicative, nominal µg m^{-3})
Lilydale	51
Scottsdale	54
Derby	17
St Helens	54
Fingal	52
Hobart	29

Table 2 – Day-averaged indicative PM_{10} for 12 September 2009 for the five north-east Tasmanian BLANkET stations and Hobart.

Implications:

Dust storms are a common occurrence in mainland Australia, but are less common in Tasmania. The combination of strong winds in the desert areas of Australia that will raise dust to sufficient altitude together with strong high-altitude winds in the correct orientation to bring mainland dust to Tasmania that happened on the 10^{th} to 12^{th} of September 2009 appears relatively rare. However, long-distance transport of dust is known to occur, and as the instance reported here shows, mainland Australian dust can reach Tasmania in sufficient concentrations to cause exceedences of national air quality standards. Around 10 days after the events described here a major dust storm impacted on NSW and Queensland. In Sydney at the peak of that storm PM_{10} levels up to 15,000 µg m^{-3} were recorded. Public health notices were issued warning against extreme physical activity and cautioning people with respiratory and related conditions to be vigilant if medical difficulties arose. Large dust storms are more prevalent in times of drought. There is concern that a consequence of a warmer and drier climate may be more frequent and more severe dust storms in Australia. Such storms cannot be prevented, but the availability of on-line air quality data in Tasmania at least ensures that the community and relevant authorities can access information concerning these events as they occur.

Report compiled by John Innis.