Analysis of the Destructive Winds in the Tallong/South Marulan region on December 1, 2020

Destructive winds occurred over the Tallong/South Marulan regions on December 1, 2020 which caused considerable damage and loss of power. In this report there will be an analysis of the observed meteorology, photographic evidence of the damage and a preliminary interpretation of the possible causes.

The prevailing weather data on December 1, 2020

On December 1, 2020 at around 1600 AEST, the Tallong/South Marulan region was hit by extreme wind conditions. There was only anecdotal evidence that the maximum wind speeds during this event were in the vicinity of 160 km/hr. So far this observation cannot be supported by the weather measurements at several stations in the region. In Figure 1 there are wind speed data taken from the weather stations (Gunlake and Peppertree Quarries [10 m] and 467 Mulwaree Dr., Tallong [2 m]) which show much lower speeds. At the Boral South Marulan weather station the maximum wind speed was 17.3 ms^{-1} (62.25 km/hr) in the hour prior to 1600 AEST. A stronger maximum wind speed of 108 km/hr (30 ms^{-1}) was observed at about 1.8 m, 546 Caoura Rd, Tallong (Figure 2). In general the higher altitude above the ground the higher wind speed, with the standard height for Bureau of Meteorology station wind measurements being 10 m. Even so the wind damage evidence to be discussed, together with overseas studies suggests that the wind speeds on this occasion were indeed closer to the anecdotal observations.

Other data are available from the Bureau of Meteorology weather radar observations. In Figure 3 the rain radar image at 1704 AEDT (1604 AEST) shows a patch of intense precipitation over the Tallong/Marulan area. In fact during this event the rain was of short duration with typical 10-15 minute amounts of only 0.8-8.5 mm. The Doppler wind radar image taken at 1704 AEDT is seen in Figure 4. In this case there is a line of intense wind speeds near the extreme scale of 90 km/hr towards the radar (dark blue shading) following the line of the rain patterns in Figure 3. An animated sequence of both the rainfall and Doppler radar images during this event (from Weatherzone) will be available on the TCFG website under the Weather Menu.

Evidence of the Destruction

There was extensive damage across the Tallong/Marulan region in the form of thousands of large trees (mainly eucalypts) being uprooted, snapped off and twisted and power lines brought down with significant electricity outages. Great swathes of trees were knocked down at the end of Longpoint Road, Tallong and into the entrance of Morton National Park (MNP) there. Some of the tree damage on the farm at 432 Longpoint Road can be seen in Figure 5. These images were taken of about a 100m wide path of tree destruction through a forest on the farm bordering the MNP. Not only were trees snapped but huge gum trees uprooted. Elsewhere on the farm and across Longpoint Road there were other significant tree uprootings (Figure 6). Inside the MNP to the left of the entrance can also be seen trees snapped half way up and a tree trunk twisted and bent (Figure 7). Further SW on Greenhills Road, Marulan there was also evidence of trees being snapped and forest destruction (Figure 8). The overall impression is of small areas of intense destruction.

Drone photos on the Longpoint Rd farm taken some 13 months after this destructive event show consistent directions of the tree downfalls. These can be seen in Figures 9-11. A drone flyover of the affected area near the end of the bitumen section of Longpoint Road can be seen at https://youtu.be/QuGkKW9sISY

Overseas and other studies of forest destruction due to extreme winds

The destruction observed in Tallong/Marulan on December 1, 2020 seems to be a result of a series of concentrated downbursts from a thunderstorm moving across the region. " Microbursts are small — less than 4 km across — and short-lived, lasting only five to 10 minutes, with maximum wind speeds sometimes

exceeding 100 mph." (NSSL 2021). In Figure 12 from this report there is an overseas example of forest destruction due to a microburst. It is suggested that the tree destructions in Figure 5 and Figures 9-11 are similar to that in Figure 12. Johnson (2018) reported " Microbursts are often mistaken for tornadoes as both can have damaging winds, a loud "roaring sound" from high winds, and "twisted" off tree damage."If it's a tornado, that damage is going to be in different directions. For a microburst wind, chances are everything is going to be in the same direction, so trees are going to be laying down in the same direction," said Chief Meteorologist Chris Bailey." The observation of possible "twisting" associated with a microburst is consistent with the observations in Figure 7 and trees lying in the same direction consistent again with Figure 5 and Figures 9-11. Other reports on microbursts can be seen at Pedersen (2016) and Caracena (1994). Geerts (2000) studied a climatology of strong short-lived wind gusts (microbursts) in NSW and found that above 21 ms^{-1} the frequency of occurrence fell by 50% in each 3 ms^{-1} increment.

Conclusions:

While the maximum measured wind speed associated with the tree damage on December 1, 2020 was 108 km/hr the photographic evidence suggests that in those areas of maximum damage the wind speeds were much higher, possibly even up to the anecdotal value of 160 km/hr; the relatively narrow swathes of destruction meant the extreme winds may have missed the recording station locations. The tree damage is also consistent with being the result of a series of microbursts or extreme downdrafts associated with the thunderstorm which crossed the region.

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References:

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Geerts, B. 2000: Estimating downburst-related maximum surface wind speeds by means of proximity soundings in New South Wales, Australia. July In press?

Johnson, C. 2018: WKYT - What are microbursts and why can they cause so much damage? https://www.wkyt.com/content/news/What-are-microbursts-and-why-can-they-cause-so-much-damage-487526741.html

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Pedersen, T. 2016: Facts About Microbursts https://www.livescience.com/55912-microbursts.html

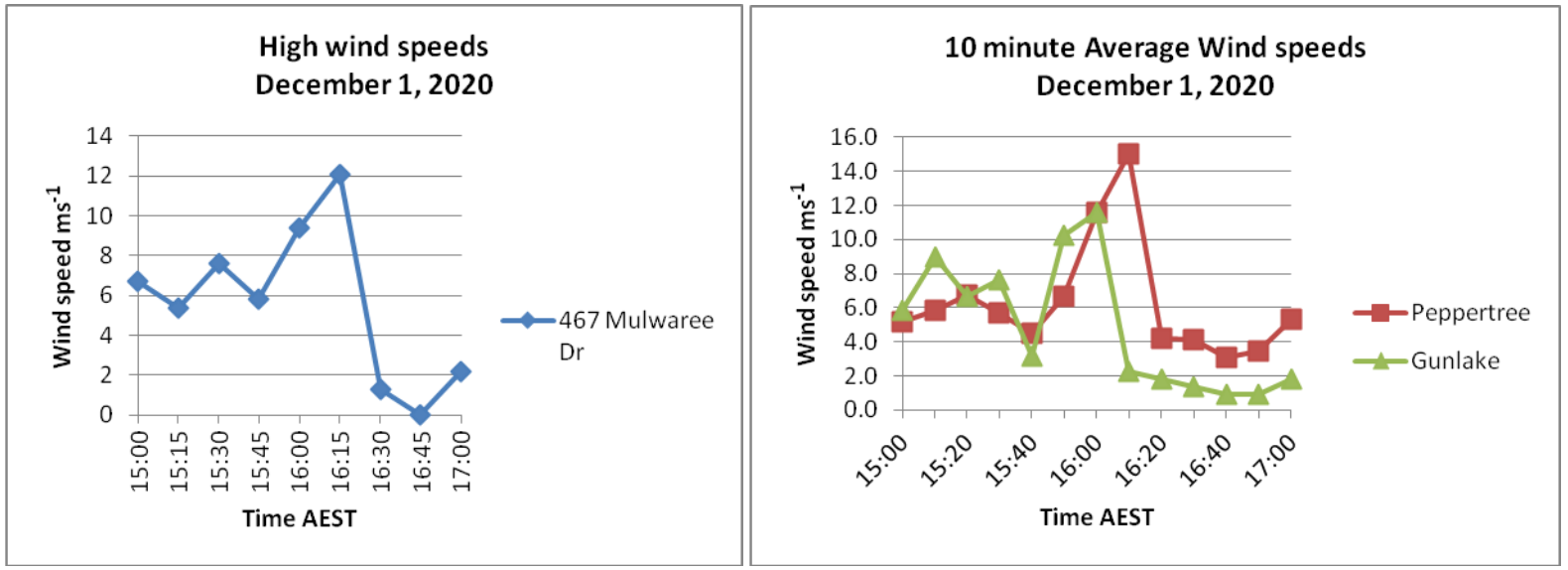
High wind speeds
December 1, 2020
Wind speed ms-1
14
12
10
8
6
4
2
0
15:00
15:15
15:30
15:45
16:00
16:15
16:30
16:45
17:00
Time AEST
467 Mulwaree Dr
10 minute Average Wind speeds
December 1, 2020
Wind speed ms-1
16.0
14.0
12.0
10.0
8.0
6.0
4.0
2.0
0.0
15:00
15:20
15:40
16:00
16:20
16:40
17:00
Time AEST
Peppertree
Gunlake

Figure 1

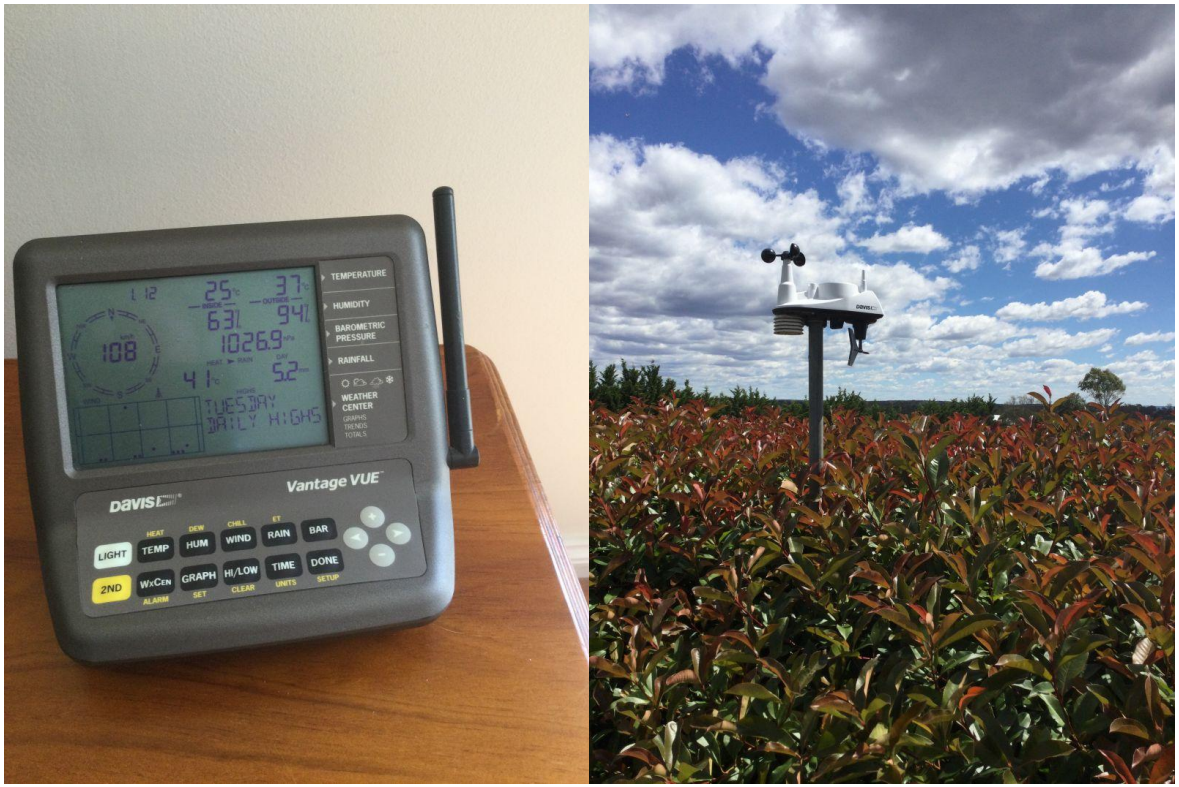
TEMPERATURE
HUMIDITY
BAROMETRIC PRESSURE
RAINFALL
WEATHER CENTER
GRAPHS
TRENDS
TOTALS
TUESDAY
DAILY HIGHS
DAVIS
Vantage VUE
LIGHT
TEMP
HUM
WIND
RAIN
BAR
2ND
GRAPH
HI/LOW
TIME
DONE

Figure 2


Wollongong Radar - Rain Rate
05:00 01/12/2020 UTC to 07:00 01/12/2020 UTC
1hr
2hrs
4hrs
8hrs
12hrs
18hrs
24hrs
36hrs
48hrs
64km
128km
256km
512km
128km
HD
This page is for personal and academic use only. Upgrade
Help / More Information
Top activity days
Intensity Timeseries
Intensity Histogram
Custom Timeframe :
2020-12-01
4pm
to
2020-12-01
6pm
Timezone : Australia/Sydney (Radar Local)
Update
Export
Visualisation (GIF)
Create
Data Pack
Request
Data packs are available that can contain a variety of processed radar data including animated GIF, mp4 video, individual composite images, rainfall estimations, custom GIS overlays and a KMZ files.
Portland
Colo Heights
Bathurst
Lithgow
Bilpin
Gosford
Terrigal
Richmond Ap
Glenorie
Avalon
Blackheath
Oberon
Hornsby
Katoomba
Penrith
Jenolan
Parramatta
Warragamba Dam
Camden
Oakdale
Campbelltown
Picton
Stanwell Park
Bellambi
Wollongong
Bowral
Dapto
Robertson
Kiama
Goulburn
Berry
Nowra
Bungonia
Huskisson
Nerriga
Point Perpendicular
50 km
05:04pm 01 Dec 2020 AEDT +11:00
06:04 01 Dec 2020 UTC +00:00

Figure 3

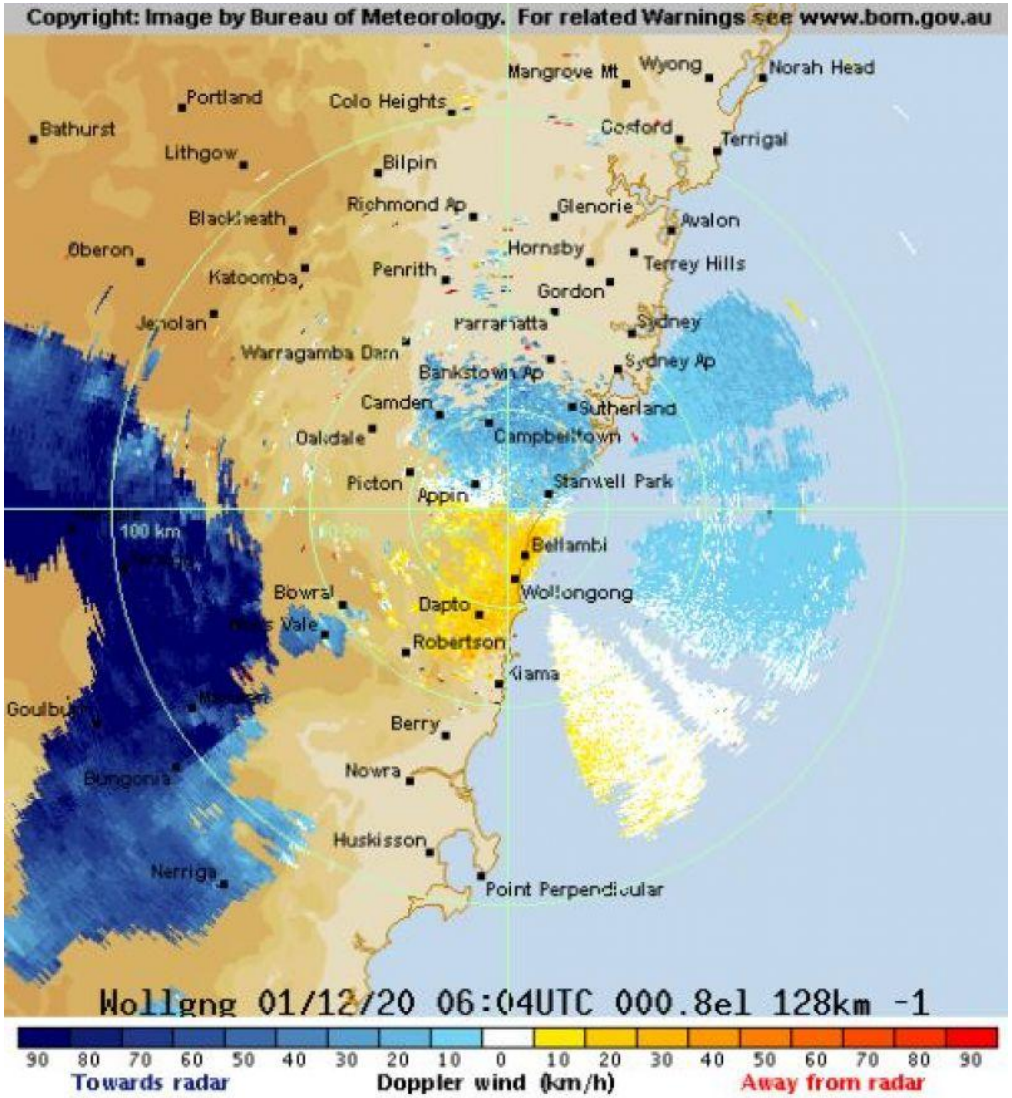
Copyright: Image by Bureau of Meteorology. For related Warnings see www.bom.gov.au
Mangrove Mt
Wyong
Norah Head
Portland
Colo Heights
Bathurst
Gosford
Terrigal
Lithgow
Bilpin
Richmond Ap
Glenorie
Avalon
Blackheath
Oberon
Hornsby
Terrey Hills
Katoomba
Penrith
Gordon
Jenolan
Parramatta
Sydney
Warragamba Dam
Sydney Ap
Bankstown Ap
Camden
Sutherland
Oakdale
Campbelltown
Picton
Appin
Stanwell Park
100 km
Bellambi
Bowral
Wollongong
Dapto
Robertson
Kiama
Berry
Nowra
Bungonia
Huskisson
Nerriga
Point Perpendicular
Wollgng 01/12/20 06:04UTC 000.8el 128km -1
90 80 70 60 50 40 30 20 10 0 10 20 30 40 50 60 70 80 90
Towards radar
Doppler wind (km/h)
Away from radar

Figure 4

Figure 5

Figure 6

Figure 7

Figure 8

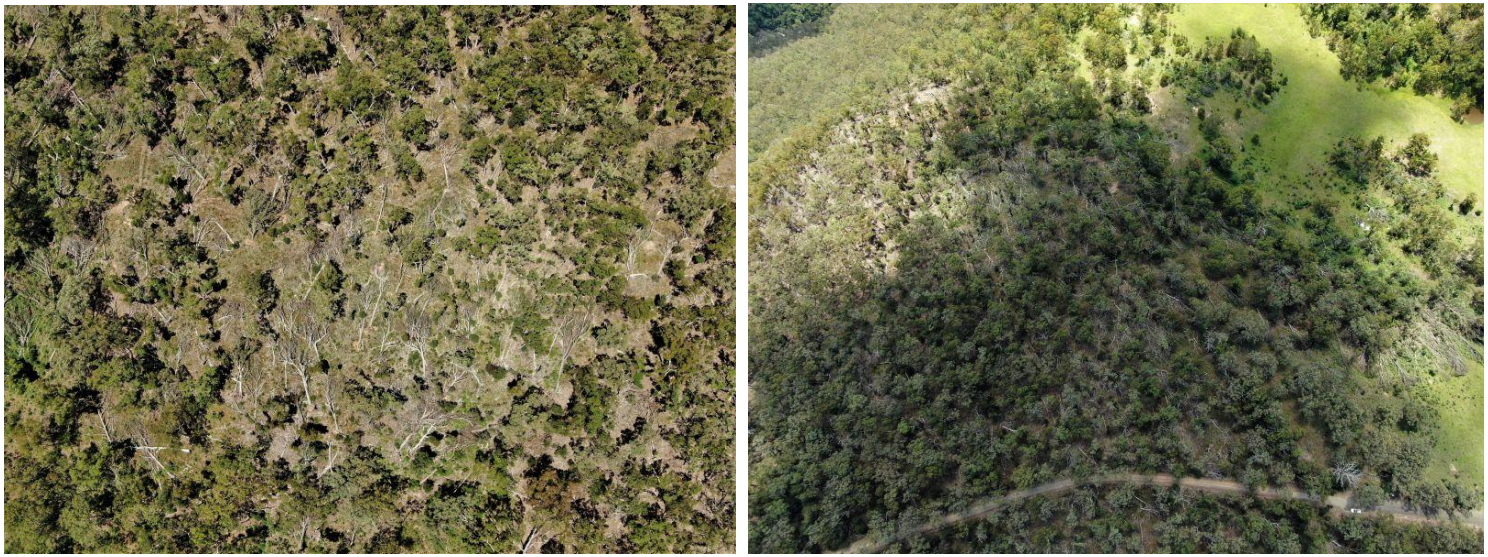

Figure 9

Figure 10

Figure 11

Figure 12 (from NSSL 2021)