Draft - A Summary of the Weather in the Tallong Region - 2022

Rainfall and significant storm events observed during 2022 will be discussed together with temperatures later in the report. Details of the weather data available from the Tallong Region are noted in Table 1; there is also an image of the region from Google Earth seen in Figure 1.

The Bureau of Meteorology indicated that the main climate influences during 2022 were La Nina which persisted through the 2021-2022 summer, dissipated in autumn but redeveloped in September and continued until the end of 2022. There was also a negative Indian Ocean dipole in winter and spring and a persistently positive phase of the Southern Annular Index from mid-autumn onwards. These influences on rainfall patterns caused rainfall to be well above average on the east coast of Australia with major flooding across eastern Australia multiple times during the year. These factors will be discussed in terms of the local observations in our region.

Rainfall

In Table 2 the 2022 monthly and annual rainfall totals together with the long term median values from all stations in the observer network through the Tallong region indicate the following:

1. Record annual rainfalls were observed at all stations in the network; certain months were exceptional.
2. Rainfall totals in January were 2-3 times the Median values
3. The rainfall totals in March were exceptionally high and 5-10 times higher than the Median values and in July about 7 times the Median values.
4. By contrast June was a very dry month with several stations 2.5-6 times below the Median values and Woods only recording 3 mm by comparison with a Median of 49 mm.

The reasons for the exceptional monthly figures will now be discussed in terms of the significant rainfall events.

Significant Weather Events in 2022

The significant rainfall events during 2022 are shown in Table 3. Some of the days with very significant rain will be discussed in relation to the surface synoptic scale weather/pressure maps and the rainfall radar data over the region.

January 2022

In the period January 6 to 8 there was an inland trough with onshore flow associated with a High pressure system in the Tasman Sea (Figure 2). The weather radar images in Figure 3 indicate a broad area of rainfall moving down from the NW trough towards the SE in the early morning (0559 AEDT) followed later in the day at 1809 AEDT by a thunderstorm over the Tallong region and more later in the evening (2014 AEDT), all associated with convergence in the trough zone as the system moved to the SE.

March 2022

There was very significant rainfall in the first nine days of March with the most intense days March 2-3 when 24 hour totals of 80- 120 mm were recorded in the Tallong region and March 7-8 when 42-70 mm were observed. In Figure 4 the surface pressure maps showed a complex system of troughs inland and a low pressure system in the NE of NSW feeding a large amount of moisture inland. The weather radar images indicated on March 2 that rain was being swept inland from the NE over Tallong (Figure 5 A) but by the evening of March 5 a series of thunderstorms developed along an inland trough line and travelled from the west towards the coast (Figure 5B). Several days later more rain was observed moving in from the NE under the influence of the coastal trough and Low pressure system in NE NSW (Figure 4B and Figure 5C).

April

Between April 6 and 9 there was significant rain with the largest totals observed at the E and SE stations in the Tallong observing network (Table 3). An onshore wind associated with a High pressure system in the SW Tasman sea combined with an inland trough moving towards the coast (Figure 6) lead to the heavy rainfall totals. The rain was most intense along the coast but moved down from the ENE over Tallong (Figure 7A). However rain observed on April 8 had circulated inland from NE of Sydney and was transported from the NNW over Tallong (Figure 7B).

July

A complex system of inland and coastal troughs and a Low pressure system developed between July 1 and 4 (Figure 8). This lead to widespread rainfall across a region from south of Sydney to the Illawarra and moving inland to the northwest (Figure 9). 24 hour totals up to 93 mm were observed across the Tallong region on July 3 (Table 3).

October

There was a general onshore flow associated with a High pressure system centred south of Tasmania (Figure 10) which lead to the rain totals up to 42 mm observed over Tallong on October 6. The weather radar indicated the rain bands moving from the W and NW over our region (Figure 11 A). A few days later there was passage of a cold front (Figure 11 B) which brought the 40+mm 24 hour rain totals observed at 0900 AEDT on October 9.

November

All the action associated with the rainfall event recorded on November 1 occurred during the previous evening. There was an interesting evolution of the synoptic patterns onwards from 1700 AEDT on October 31 (Figure 12 A) with an inland trough ahead of an approaching cold front associated with a low pressure system south of Tasmania. By 2300 AEDT the front had moved slightly east (Figure 12 B) and the following morning had crossed the coast leaving another trough behind (Figure 12 C). This triggered a narrow line of thunderstorms moving from west to east which brought the heaviest rain between 1900 and 2000 AEDT on October 31 over Tallong (Figure 13).

On the evening of November 13 a trough extending to the NW of Australia and over central NSW merged with a cold front from the SW (Figure 14) to generate a line of thunderstorms travelling to

the east (Figures 15 and 16). They resulted in a reasonably uniform rainfall distribution of 32-40 mm across our region (Table 3).

December

A significant rainfall event occurred between December 30 and 31 resulting in 24 hour totals between 14.5 (Peppertree Quarry) and 45 mm (Botticchio) being observed over the Tallong/South Marulan region (Table 3). The synoptic pattern driving this event only showed an onshore flow associated with a High pressure system in the south Tasman Sea and an inland trough over western NSW (Figure 17). However, the weather radar images indicated a small low pressure circulation pattern centred near Nowra on the morning of December 30 which brought rain in from the SE over Tallong (Figure 18).

Rainfall Summary

Analysis of the annual variations and significant rainfall events from the Tallong observation network during 2022 suggest that rain events which originate inland associated with low pressure troughs will lead to widespread, more uniform rain across the network. Rain originating with air movement from the coast will cause higher readings in stations closer to the coast. Thunderstorms can be spawned along trough lines and be limited in geographic size. These can cause local heavy rain events only affecting some stations and thus distorting the annual averages and larger geographic influences.

Temperatures

The 2022 monthly temperature statistics from the weather station operating at 467 Mulwaree Drive, Tallong are shown In Table 4 with the long statistics (11 years from 2012 to 2022) in Table 5. The Annual and Winter averages are shown in Table 6. The following observations can be made:

1. The summer months of 2022 were generally cooler than the long term averages with extreme maximums only in the low 30°'s by comparison with over 40° long term.
2. In autumn, winter and spring the average minimum temperatures were slightly warmer than the long term averages but the average maximum temperatures were cooler.
3. Overall, winter temperatures were normal (Table 6).
4. When averaging temperatures across all times and seasons, 2022 was equal lowest with 2021 at 12°C.

Geoffrey Clark

September 23, 2023

Acknowledgements

Through the continued dedication of the network of rainfall and weather observers in the Tallong region, this report has been able to describe the unique geographic features and variations of Tallong's weather. Long time observer David Woods left our network this year due to ill health and I thank him for his many years of service. I would also like to again acknowledge Chris Brown from Boral, Peppertree Quarry for allowing access to the detailed weather station data at the Peppertree quarry and the South Marulan sites. Many thanks to all concerned.

Station Name	Rain gauge					Observation	Data Type
	Geographic co-ordinates °		Altitude m	UTM Co-ordinates m		Duration	
Black	150.14907	-34.79092	627	239150.2	6146438.5	2004 to 2020	Daily rainfall
Darda	150.11468	-34.76478	627	235919.5	6149247.9	1999 to 2020	Daily rainfall
Clark	150.09201	-34.69578	634	233622.1	6156843.5	2006 to 2020	T,RH,Dew,u,θ,Rain, Daily rain
Botticchio	150.10297	-34.71486	629	234686.9	6154755.4	1998 to 2020	Daily rainfall
Leese	150.10872	-34.72306	685	235239.9	6153861.1	2001 to 2020	Daily rainfall
Woods	150.12735	-34.72105	676	236940.3	6154133.2	2002 to 2020	Daily rainfall
Montgomery	150.05625	-34.75513	614	230538.3	6150163.1	1966 to 2020	Daily rainfall
Boral Peppertree	150.02472	-34.74641	607	227623.0	6151046.0	2019 to 2020	T,RH,u,θ,σ_θ,Rain,Radiation
Boral South Marulan	150.01190	-34.76770	618	226518.9	6148648.8	2008 to 2020	T,RH,u,θ,σ_θ,Rain

Where

T	RH	u	θ	Rain	σ_θ	Radiation	Dew
Temperature	Relative Humidity	Wind Speed	Wind Direction	Rain	Wind direction Standard Deviation	Solar Radiation	Dew Point Temperature

Table 1

Observer	Location	Observations (years)	Jan	Feb	Mar	Apr	May	June	July	August	Sept	Oct	Nov	Dec	Total
Dugald Black	1095 Caoura Rd	19	158.5	97.3	353.8	150.9	71.9	11.3	222.8	58.0	57.4	158.7	85.6	57.3	1483.5
	Median		81.6	93.5	59.1	40.5	28.3	49.5	28.6	38.9	40.1	59.3	63.2	65.0	849.1
Freda Darda	593 Caoura Rd	24	144.30	89.80	302.30	140.20	63.70	7.00	206.50	47.50	56.00	137.50	84.00	57.25	1336.05
	Median		59.00	98.13	59.38	34.83	25.30	47.15	27.78	38.48	37.48	46.63	69.13	61.70	745.00
David Woods	1183 Highland Way	22	142.0	89.0	339.0	141.0	73.0	3.0	234.0	46.0	67.0				
	Median		58.8	100.8	74.0	42.5	26.3	49.0	31.5	36.5	33.3				
Christina Leese	957 Highland Way	24	170.5	73.0	347.0	130.0	73.5	8.0	236.0	50.5	83.0	134.5	85.0	54.0	1445.0
	Median		62.3	95.3	67.3	32.3	30.8	50.3	30.0	34.3	36.5	51.3	74.5	57.8	721.8
Margaret Botticchio	66 Railway Pde	25	187.5	74.0	386.0	138.5	77.0	12.5	272.0	53.5	80.5	155.5	104.0	60.0	1601.5
	Median		97.5	63.3	37.5	23.3	51.8	31.0	41.0	42.0	46.3	71.5	62.5	761.3	761.3
Geoff Clark	467 Mulwaree Dr	17	163.9	59.5	292.4	113.3	64.3	7.8	225.5	46.6	59.9	117.2	91.0	48.5	1289.9
	Median		55.8	96.9	53.9	36.6	31.9	49.8	30.8	46.6	34.2	46.5	65.0	67.5	793.9

Table 2

Date	Dugald Black	Freda Darda	David Woods	Christina Leese	Margaret Botticchio	Geoff Clark	Peppertree Quarry	Boral South Marulan
January								
7	33.6	39.0	12.0?	34.0	34.0	28.8	19.0	21.0
8	48.2	41.0	52.0	47.5	53.0	48.0	31.5	28.5
30	24.3	14.5	20.0	20.0	31.0	42.5	16.5	
March								
1	4.4	25.0?	11.0	10.5	7.0	2,5	4.0	13.0
2	23.7	17.5	22.0	17.5	16.0	14.0	17.5	15.0
3	120.2	94.5	100.0		110.0	91.5	79.5	86.0
4				128.0	22.0	16.0	14.5	10.5
6	26.2	38.0	55.0	29.5	38.0	27.5	37.0	30.5
7	13.8		0.0	27.0	33.0	21.8	9.5	5.5
8	65.0	60.5	70.0	53.0	62.0	47.6	42.5	49.5
9	15.4	-	10.0	16.0	19.0	14.0	10.5	11.0
29	19.8	14.0	22.0	10.0	12.0	11.9	8.0	14.5
Total								
April								
7	38.0	37.0	54.0	22.0	31.0	26.2	27.5	31.0
8	36.4	34.0	30.0		32.0	27.5	22.5	21.0
9	26.6			49.0	15.0	9.7	7.0	11.0
Total								
July								
2	66.8	57.0	80.0	61.5	72.0	51.7	48.5	48.5
3	76.6	67.0	78.0	77.0	93.0	84.5	40.0	34.5
4	33.4	19.0	35.0	44.5	47.0	39.5	20.0	19.0
September								
28	17.0	20.0	25.0	28.0	30.0	25.2	23.5	26.5
October								
6	42.2	32.0		26.0	30.0	25.0	20.0	28.0
9		40.0		42.0	47.0	39.0	39.0	43.0
23		16.5		20.0	22.0	21.0	40.5	43.5
November								
1	29.6	29.5		30.0	37.0	28.7	28.0	34.0
14	34.4	37.0		40.0	40.0	38.8	32.5	33.5
December								
31	21.6	21.0		26.5	45.0	27.4	14.5	15.0

Table 3 Significant rain events in 2022

Tallong at 1.2m Dates: 010122 to 311222
Dry Bulb Temperature (deg.c)
Time (EST.)

Month	0000-0300	0300-0600	0600-0900	0900-1200	1200-1500	1500-1800	1800-2100	2100-2400	Average		Extreme	
									Minimum	Maximum	Minimum	Maximum
January	16.1	15.7	17.4	21.2	22.9	21.6	18.5	16.9	15	24.3	9.3	33.3
	2.1	2	2.2	3.3	4	3.7	2.7	2	standard	deviations		
	372	372	372	372	372	372	372	372	number	of	observations	
February	14.5	13.9	15.3	20.1	21.8	20.4	16.9	15.4	12.9	23.3	6.9	30.5
	2.4	2.6	2.8	3.9	4.4	4.5	3.1	2.5	standard	deviations		
	336	336	336	336	336	336	336	336	number	of	observations	
March	14.2	13.7	14.3	17.6	19.2	17.7	15.4	14.5	12.7	20.1	6.5	28.2
	2.1	2.5	2.4	2.5	3.1	2.7	1.9	1.9	standard	deviations		
	372	372	372	372	372	372	372	372	number	of	observations	
April	10.9	10.3	11.1	15.4	17.4	15.8	12.9	11.5	9.1	18.2	4.7	24.7
	2	2.1	2.1	2.7	3.2	2.8	1.8	2.1	standard	deviations		
	360	360	360	360	360	360	360	360	number	of	observations	
May	7.9	7.2	7.6	11.9	14.1	12.3	9.3	8.3	5.7	15	-0.9	22.3
	3.6	3.7	3.6	3.2	3.5	3.6	3	3.3	standard	deviations		
	372	372	372	372	371	372	372	372	number	of	observations	
June	4.2	3.6	3.7	8	10.3	8.6	5.7	4.6	1.8	11.1	-4.3	13.9
	3.2	3.1	3.1	2.4	1.9	2.3	2.3	2.9	standard	deviations		
	360	360	360	360	360	360	360	360	number	of	observations	
July	4.4	3.9	4	7.6	10	8.8	6.2	5.2	2.5	10.8	-5.5	16.4
	3.2	3.7	3.7	2.3	2.2	2.3	2.2	2.8	standard	deviations		
	372	372	372	372	372	372	372	372	number	of	observations	
August	5.7	5.4	6.1	10.3	12.3	10.7	7.7	6.3	3.4	13.5	-2.5	19
	3.4	3.7	3.7	2.5	2.5	2.9	2.7	2.8	standard	deviations		
	372	372	372	370	369	372	372	372	number	of	observations	
September	7	6.4	7.6	12	13.9	12.1	9	7.8	5.1	15	-2.3	19.8
	3.2	3.4	3.2	2.2	2.5	2.5	2.2	2.8	standard	deviations		
	360	360	360	360	360	360	360	360	number	of	observations	
October	10	9.3	11.3	15.2	15.9	14.5	12	11	8.3	17.2	2.5	22.3
	3	3.2	3.5	3.4	2.8	2.8	2.6	3	standard	deviations		
	372	372	372	372	372	372	372	372	number	of	observations	
November	9.6	8.6	12.1	17	18.5	16.7	12.6	10.6	7.4	19.8	1.6	26.9

	2.9	2.8	3.3	3.8	3.9	3.9	3.4	2.9	standard	deviations		
	360	360	360	360	356	360	360	360	number	of	observations	
December	11.2	10.3	13.9	19	21.1	19.7	15.3	12.7	9.1	22.5	3.6	33.1
	3.3	3.3	3.9	5.3	5.6	5.4	4.5	3.4	standard	deviations		
	372	372	372	372	372	372	372	372	number	of	observations	

Table 4 Temperature analyses at 467 Mulwaree Dr, Tallong - 2022

Tallong at 1.2m Dates: 010112 to 311222
Dry Bulb Temperature (deg.c)
Time (EST.)

Month	0000-0300	0300-0600	0600-0900	0900-1200	1200-1500	1500-1800	1800-2100	2100-2400	Average		Extreme	
									Minimum	Maximum	Minimum	Maximum
January	15.8	15	18.1	23.9	26.2	24.3	19.7	17	13.9	27.9	2.5	42
	3.3	3.5	4.4	6.1	6.6	6.4	4.8	3.6	standard	deviations		
	4092	4092	4090	4092	4092	4092	4092	4092	number	of	observations	
February	14.9	14.1	16.2	21.5	23.9	22.3	18.1	15.9	13.1	25.5	3.4	41.9
	2.9	3	3.6	5	5.6	5.5	4	2.9	standard	deviations		
	3732	3732	3732	3728	3732	3732	3732	3732	number	of	observations	
March	13.5	12.8	14.2	19.3	21.5	19.9	16	14.3	11.5	22.9	1.2	35.4
	3	3.3	3.5	4.2	4.7	4.6	3.2	2.9	standard	deviations		
	4092	4092	4092	4092	4092	4092	4092	4092	number	of	observations	
April	10.2	9.4	10.4	16.4	19	17.1	13	11.2	8	20.2	-0.6	32.5
	3.4	3.7	3.7	3.8	4.2	4.1	3.1	3.1	standard	deviations		
	3960	3960	3960	3959	3960	3960	3960	3960	number	of	observations	
May	6.4	5.8	6.5	12.3	15.1	13	8.9	7.3	4	16	-4.2	24.2
	3.8	4	4	3.6	3.5	3.7	3.1	3.4	standard	deviations		
	3804	3811	3803	3783	3779	3780	3780	3793	number	of	observations	
June	4.6	4.1	4.3	8.8	11.5	9.7	6.4	5.1	2.3	12.4	-5.5	18.7
	3.6	3.8	3.8	2.7	2.3	2.6	2.6	3.1	standard	deviations		
	3948	3948	3948	3948	3947	3948	3948	3948	number	of	observations	
July	3.9	3.4	3.7	8.8	11.5	9.7	6.1	4.8	1.6	12.4	-7.1	20.4
	3.7	3.9	4	3	2.6	3	2.7	3.3	standard	deviations		
	4092	4092	4092	4088	4091	4092	4092	4092	number	of	observations	
August	4.1	3.4	4.4	10.1	12.5	10.8	6.9	5.1	1.6	13.5	-6.2	22.4
	3.7	3.9	4	3.1	3.1	3.3	2.8	3.2	standard	deviations		

	4080	4080	4080	4078	4077	4080	4080	4080	number	of	observations	
September	6.7	5.7	7.9	14	16.3	14.5	10.1	8	4	17.5	-4.7	31.4
	3.8	4.1	4.3	3.9	4.3	4.3	3.3	3.5	standard	deviations		
	3960	3960	3960	3960	3960	3960	3960	3960	number	of	observations	
October	9.4	8.4	11.9	17.6	19.6	17.8	13.1	10.8	6.9	20.9	-2.6	32.1
	3.7	4	4.4	5	5.3	5.3	4	3.6	standard	deviations		
	4092	4092	4092	4089	4092	4092	4091	4092	number	of	observations	
November	11.4	10.6	14.5	19.9	21.9	19.7	15	12.6	9.3	23.3	0.6	39.4
	3.5	3.8	4.4	5.2	5.6	5.7	4.3	3.4	standard	deviations		
	3960	3960	3958	3960	3956	3960	3960	3960	number	of	observations	
December	13.6	12.9	16.7	22.4	24.3	22.2	17.7	15	11.7	26	1.6	41.9
	3.5	3.6	4.5	5.8	6.2	6.2	4.8	3.7	standard	deviations		
	4092	4092	4092	4090	4090	4092	4092	4092	number	of	observations	

Table 5 Temperature analyses at 467 Mulwaree Dr, Tallong - 2012 to 2022

Annual	average	temperatures
	Average	No.
2012	12.3	35135
2013	13.5	33252
2014	13.3	35040
2015	12.8	34942
2016	13.5	35131
2017	13.2	35037
2018	13.3	35040
2019	13.7	34379
2020	13.0	35126
2021	12.1	34989
2022	12.1	35030
Winter	average	temperatures
Average	No.	
2012	6.5	8831
2013	7.5	8736
2014	7.0	8832
2015	6.0	8736
2016	7.5	8828
2017	6.6	8832
2018	6.6	8832
2019	6.8	8831
2020	7.0	8832
2021	6.9	8832
2022	6.8	8827

Table 6: Annual and Winter Average Temperatures at

467 Mulwaree Dr., Tallong - 2012 to 2022

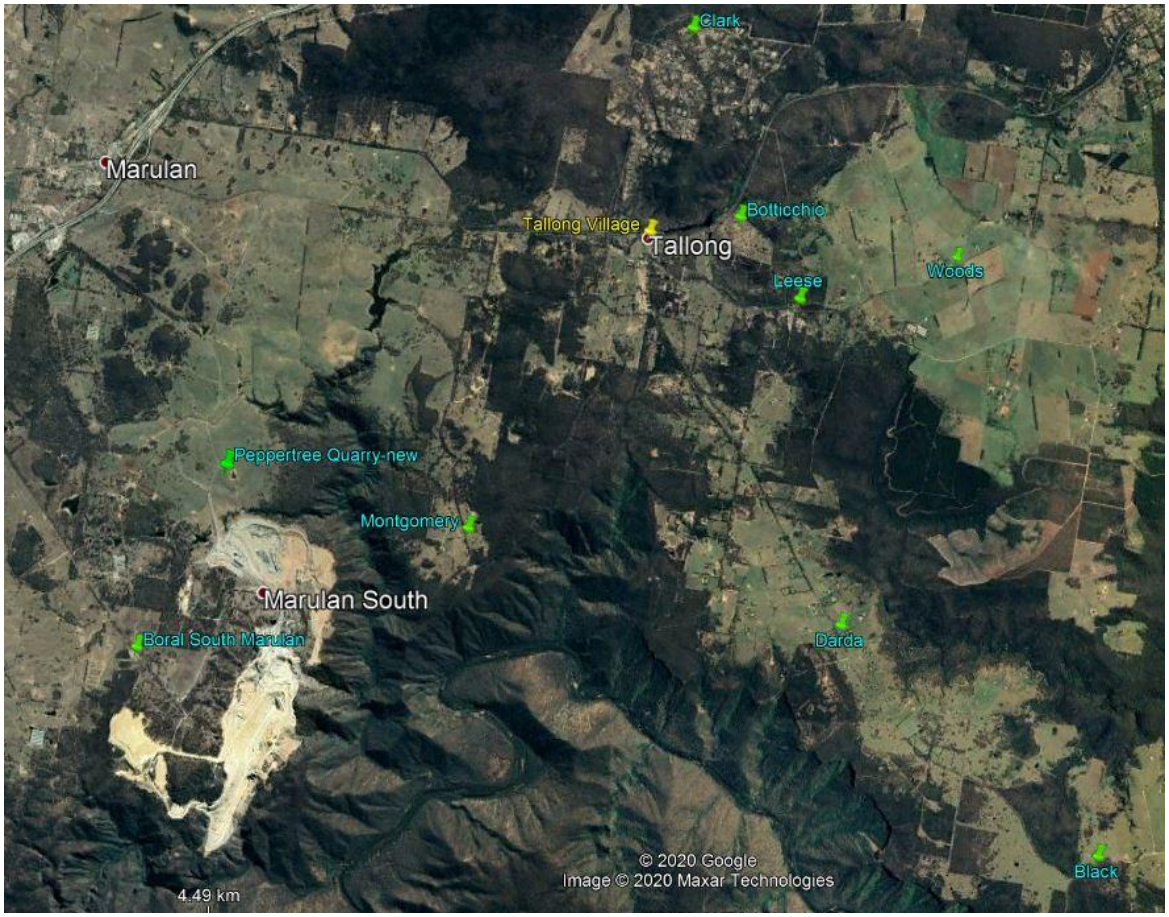
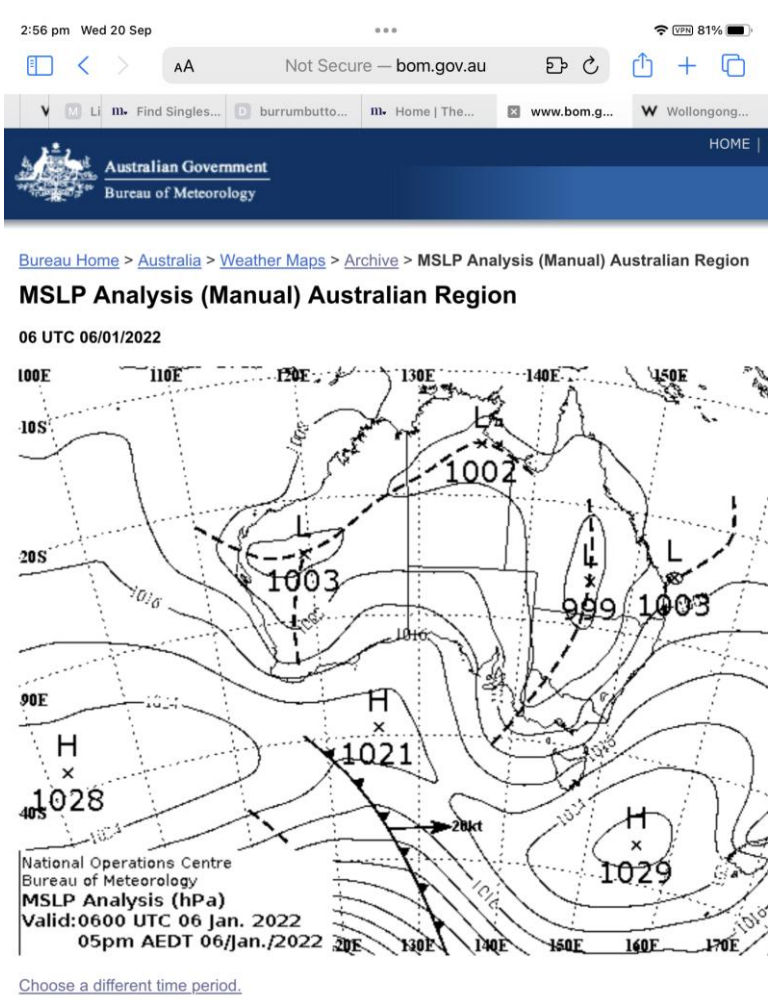


Figure 1: Google Earth image of the Tallong region



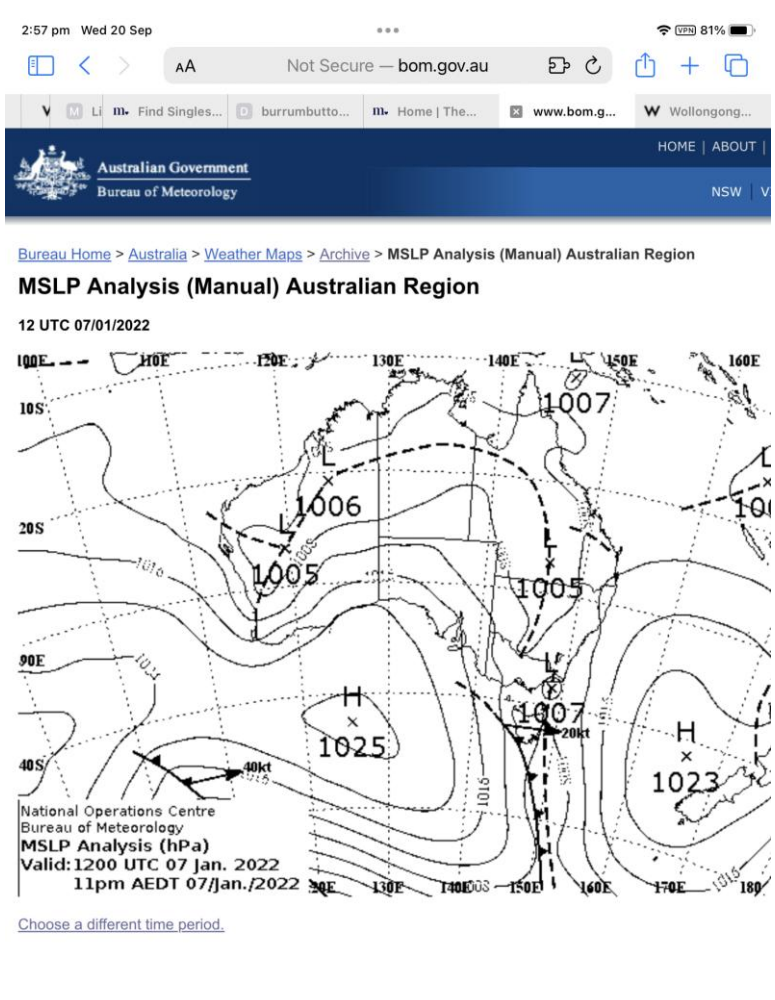
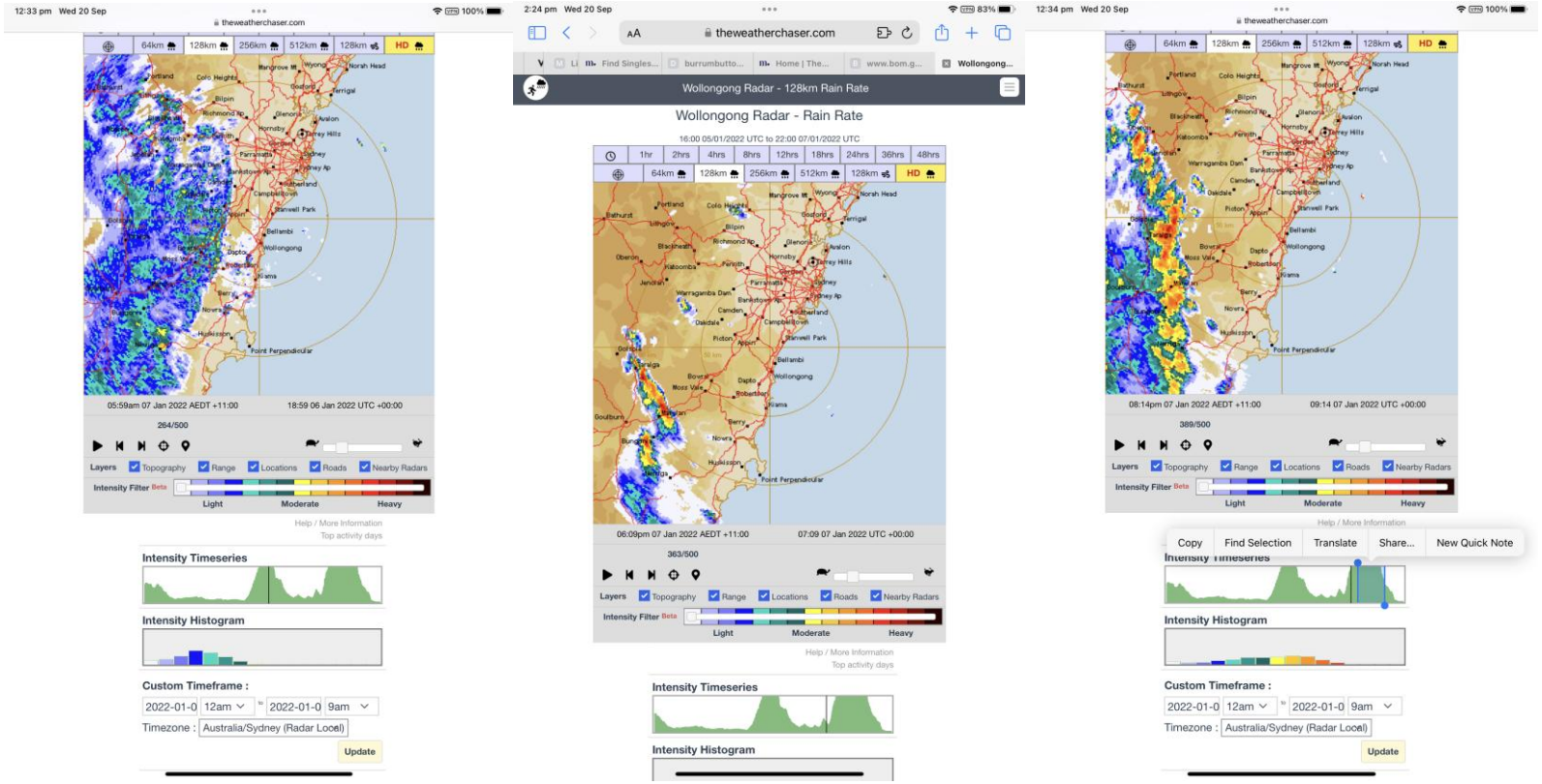
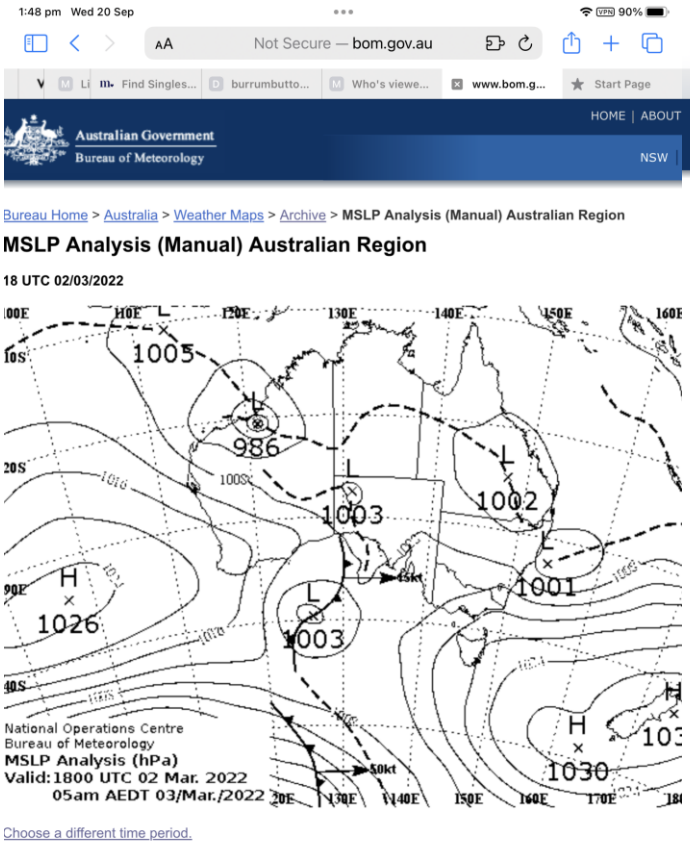


Figure 2: Synoptic weather/surface pressure maps for January 6 and 7, 2022

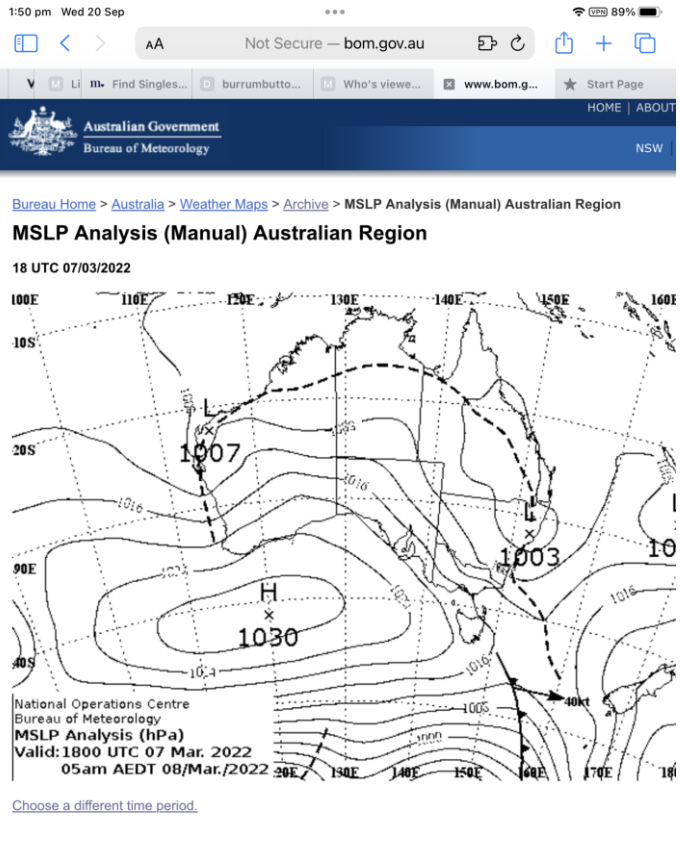


A. B. C.

Figure 3: Weather radar images on January 7, 2022: A. 0559 AEDT; B. 1809 AEDT; C 2014 AEDT

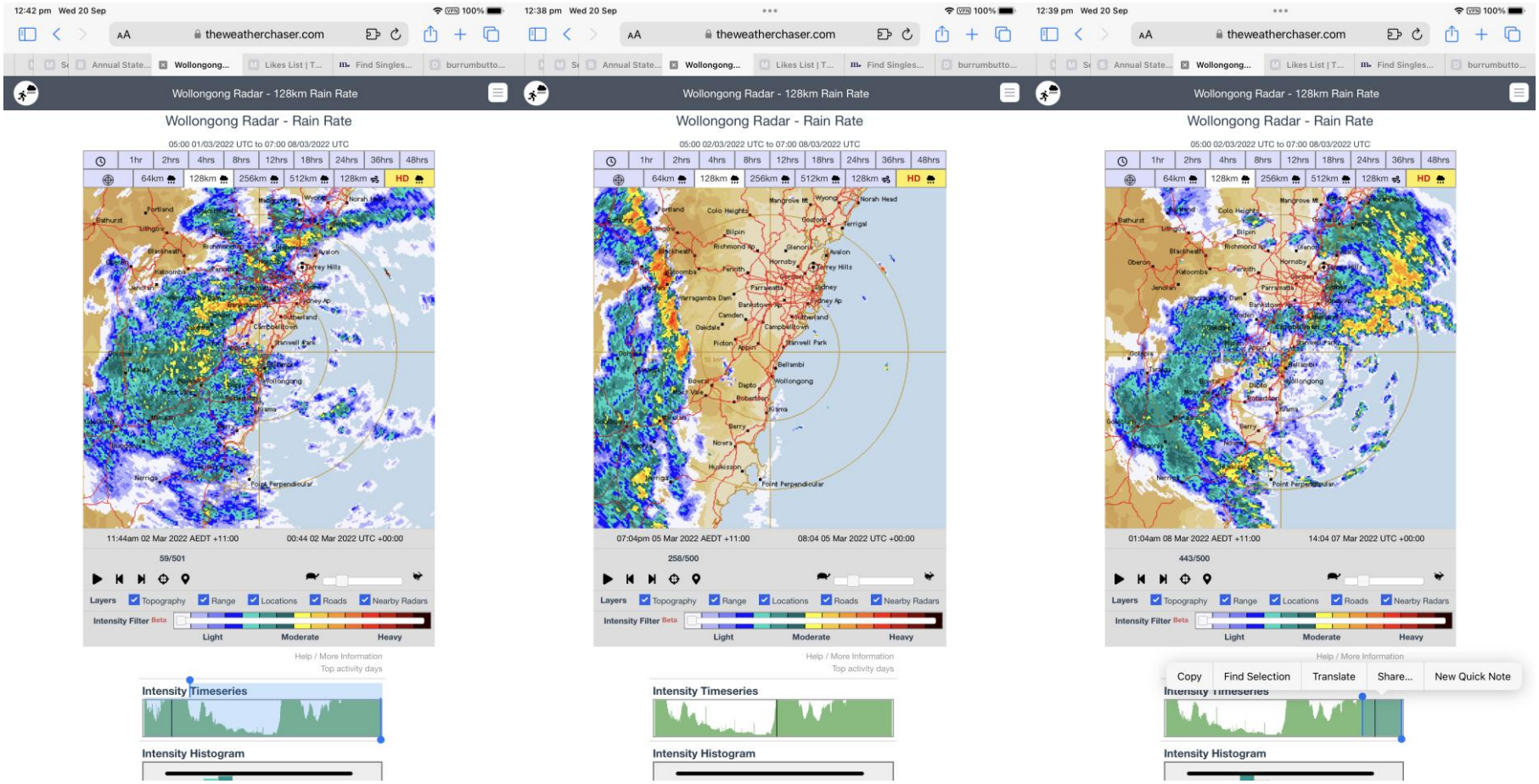


A.



B.

Figure 4: Synoptic weather/surface pressure maps for March 3 (A) and March 8 (B)



A. B C

Figure 5: Weather radar images on March 2 (A), March 5 (B), March 8 (C)

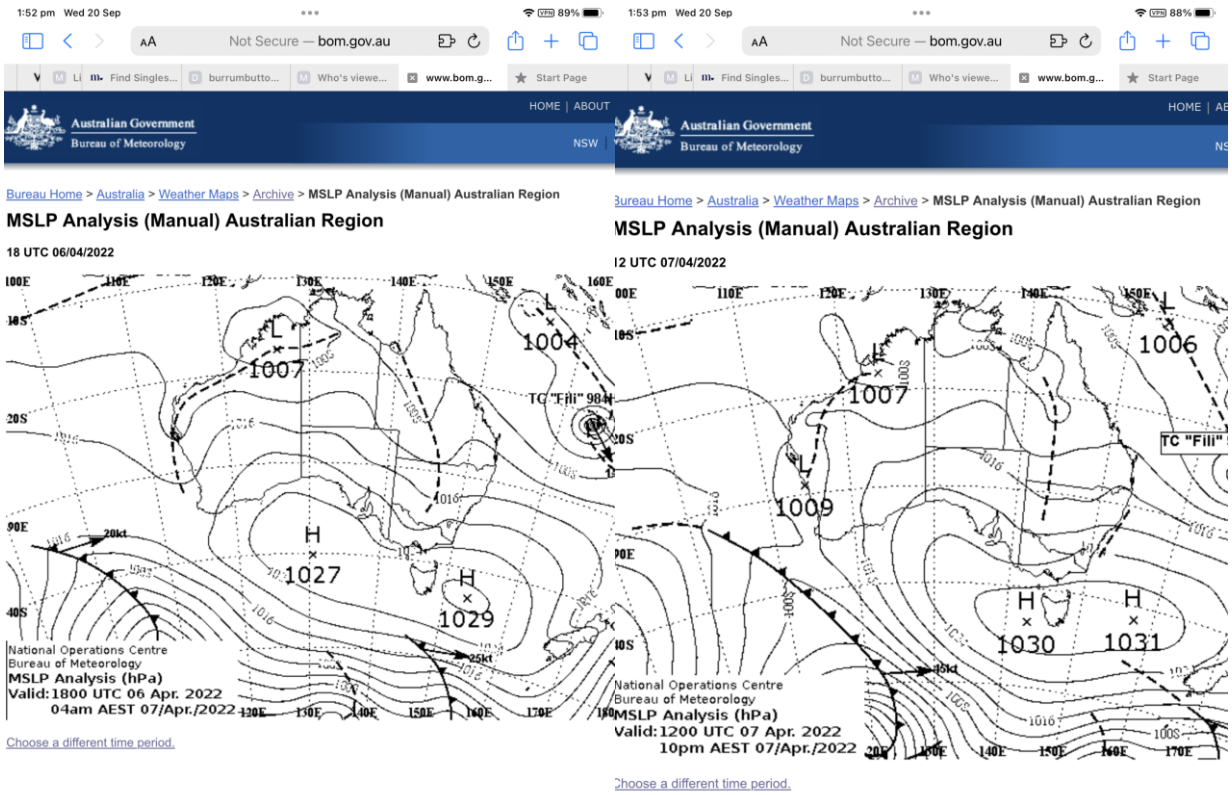
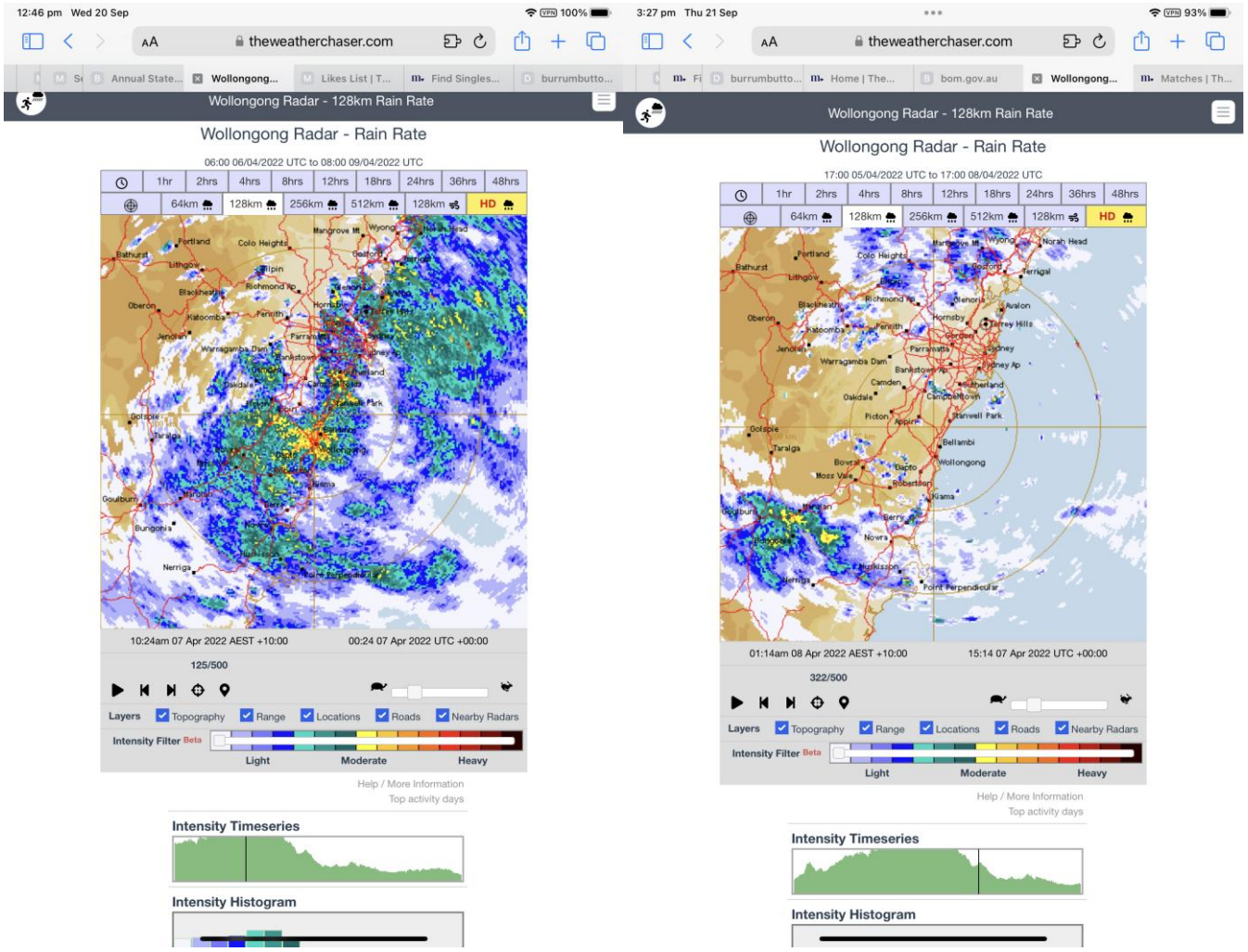
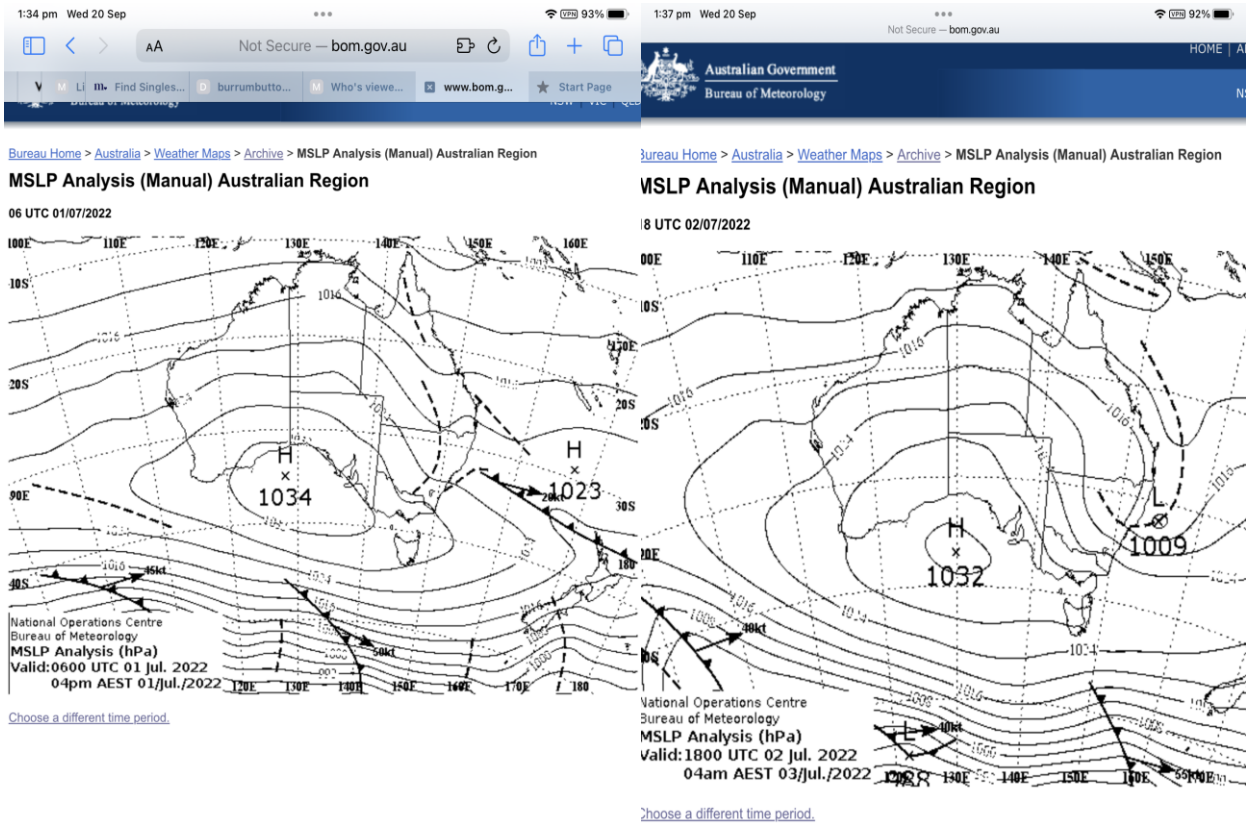


Figure 6: Synoptic weather/surface pressure maps for April 7, 2022



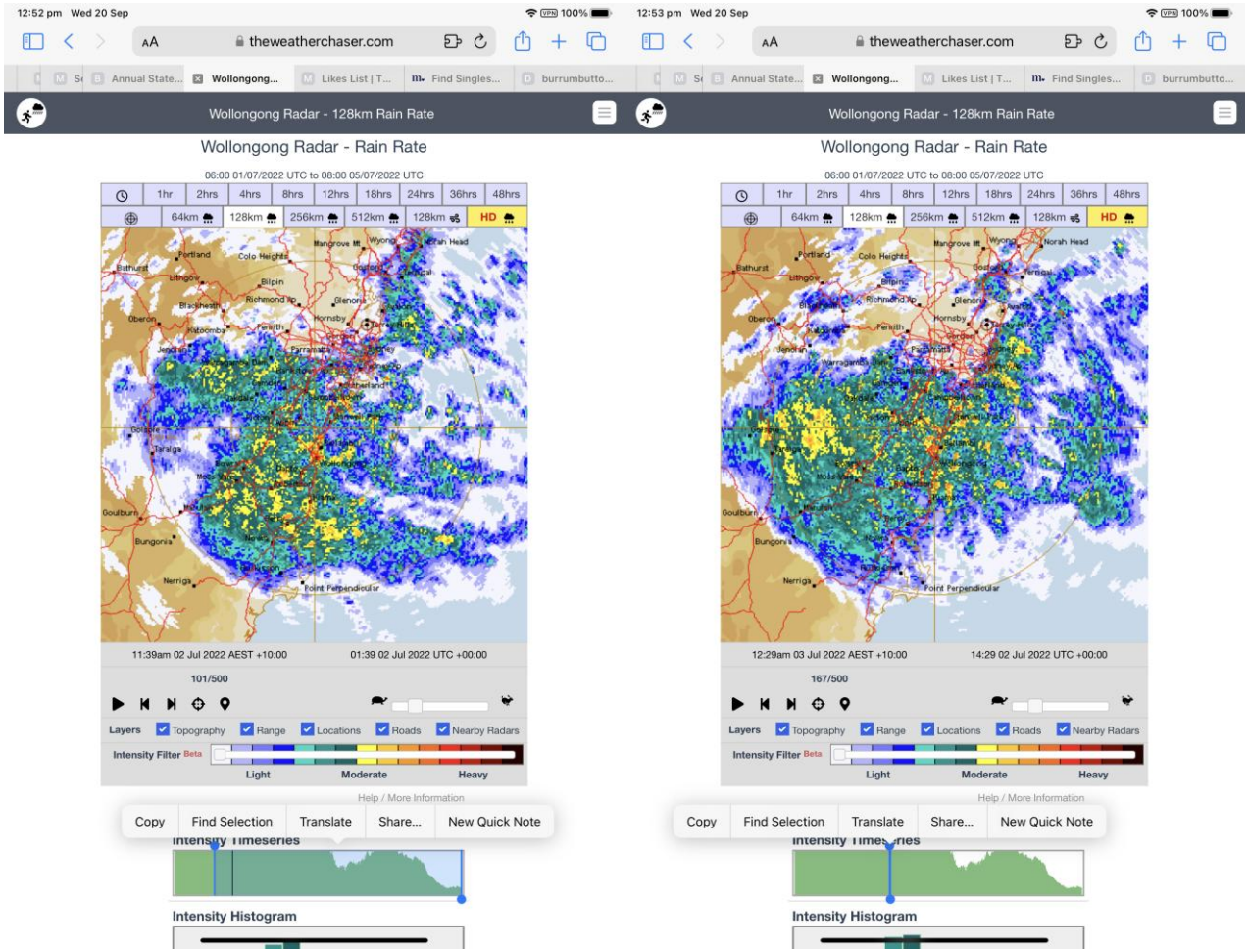
A B

Figure 7: Weather radar images on April 7 at 1024 AEST (A) and April 8 at 0114 AEST (B)



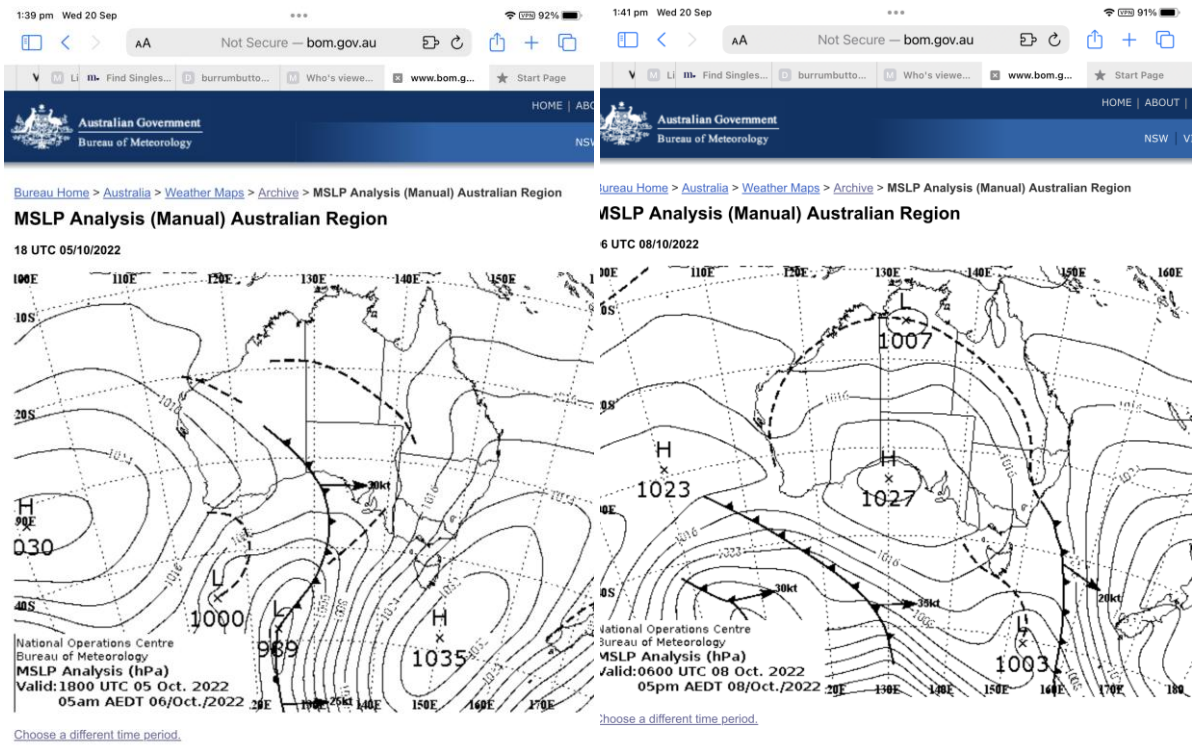
A B

Figure 8: Synoptic weather/surface pressure maps for July 1 1600 AEST (A) and July 3 0400 AEST (B)



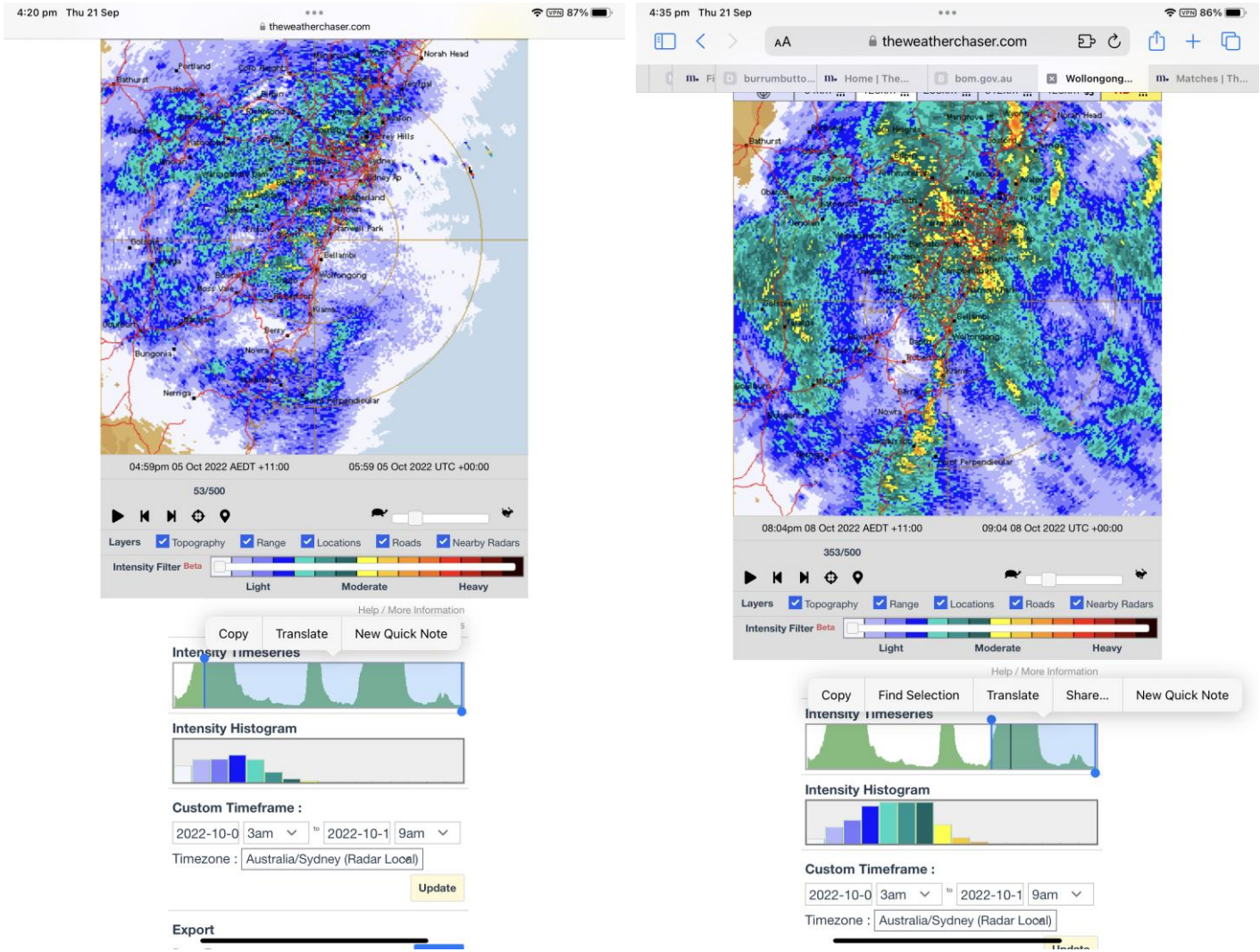
A B

Figure 9: Weather radar images on July 2, 1139 AEST (A) and July 3, 0029 AEST (B)



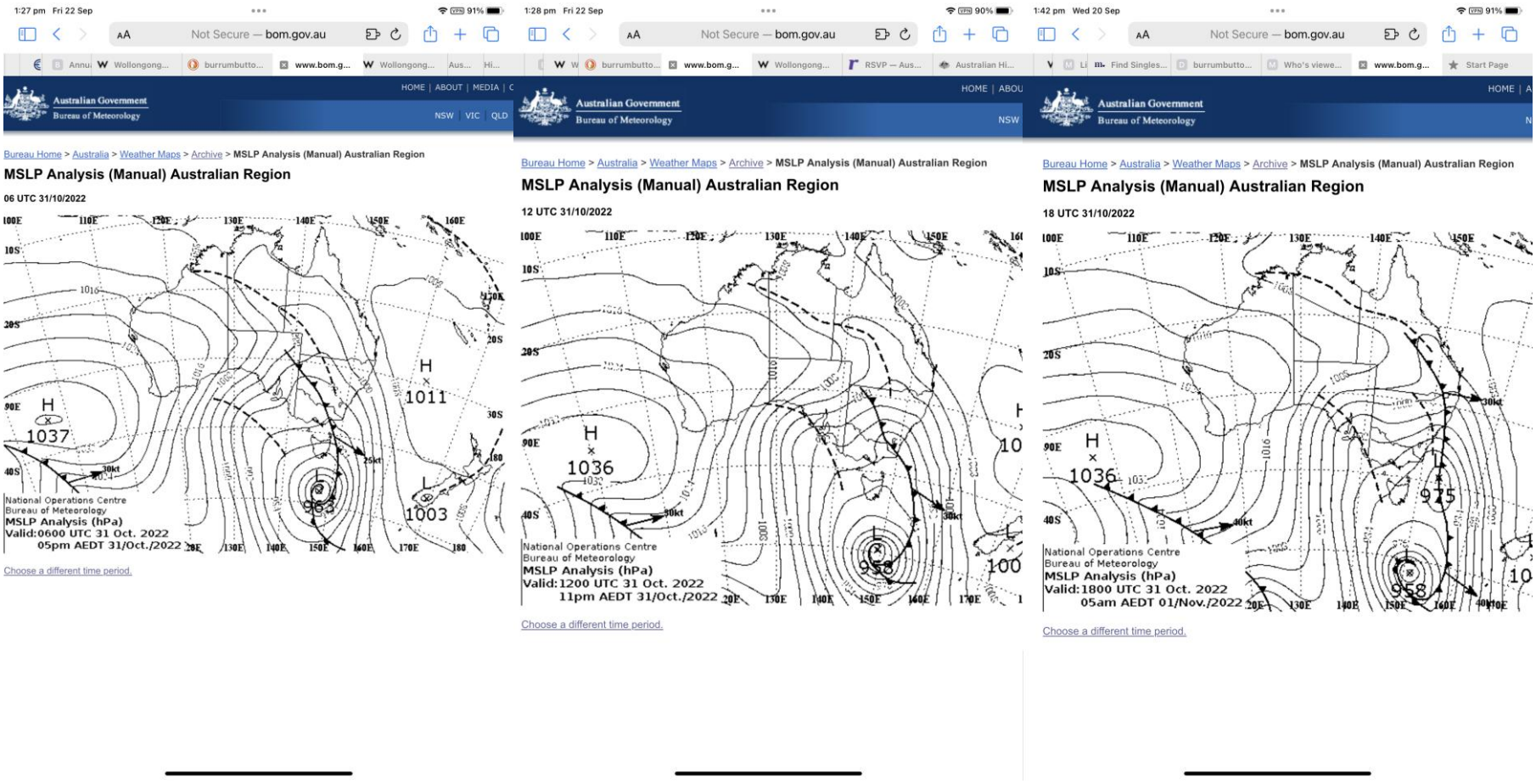
A B

Figure 10: Synoptic weather/surface pressure maps for October 6 0500 AEDT (A) and October 8 1700 AEDT (B)



A B

Figure 11: Weather radar images on October 5, 1659 AEDT (A) and October 8, 2004 AEDT (B)



A B C

Figure 12: Synoptic weather/surface pressure for October 31 at 1700 AEDT (A), 2300 AEDT (B) and November 1 at 0500 AEDT (C)

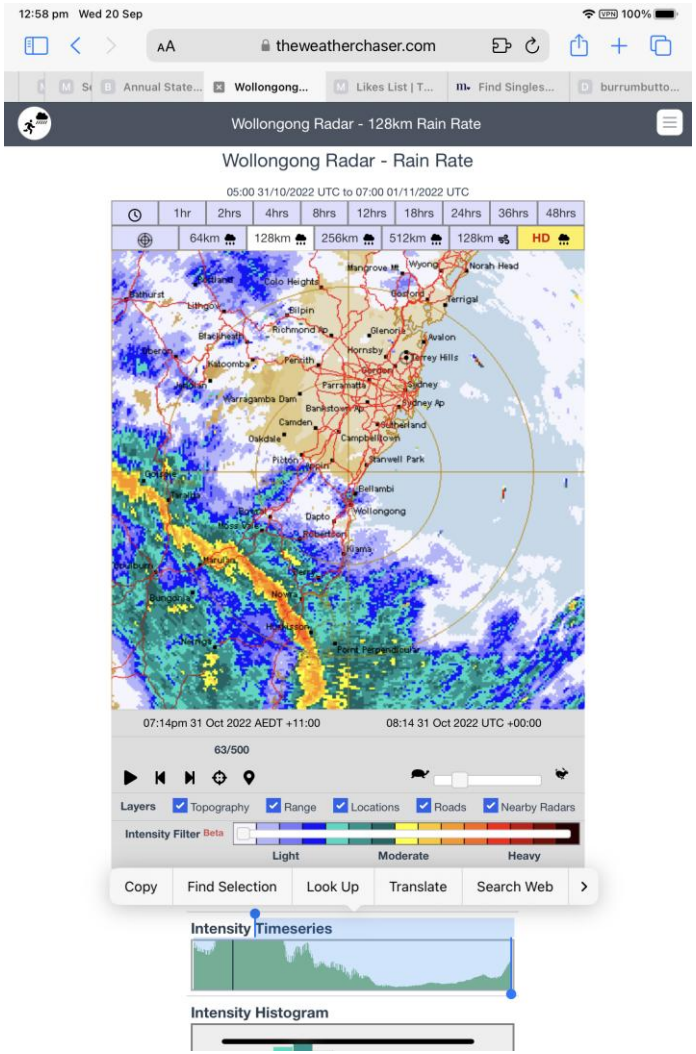


Figure 13: Weather radar images on October 31, 2022 at 1914 AEDT

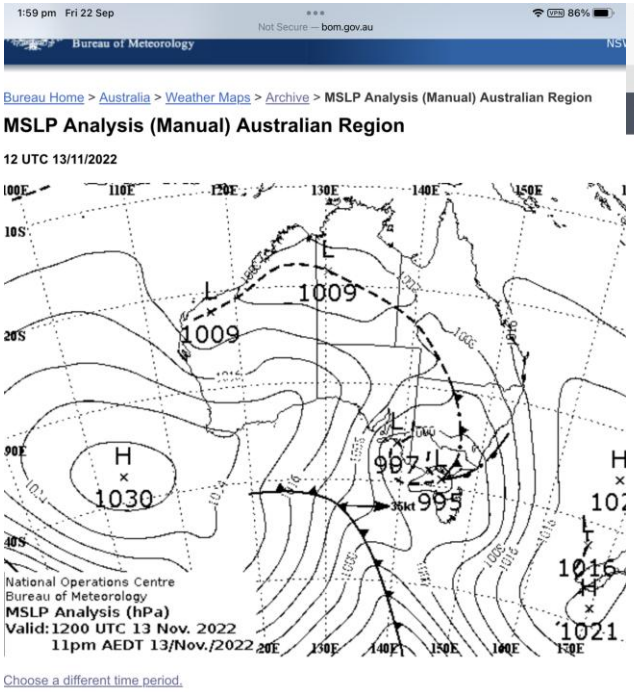


Figure 14: Synoptic weather/surface pressure

November 13, 2022 at 2300 AEDT

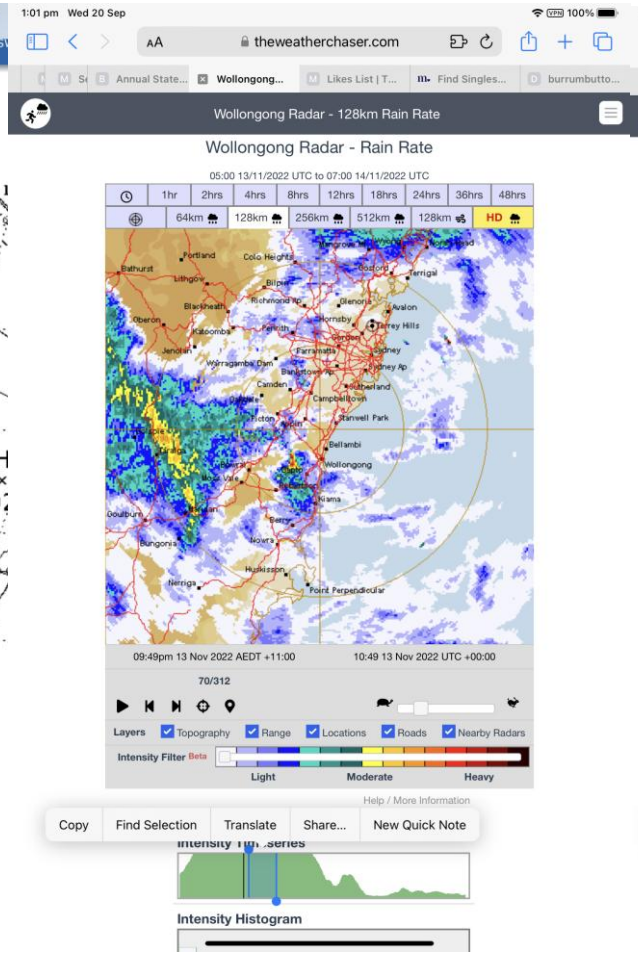


Figure 15: Weather radar images

November 13 at 2149 AEDT

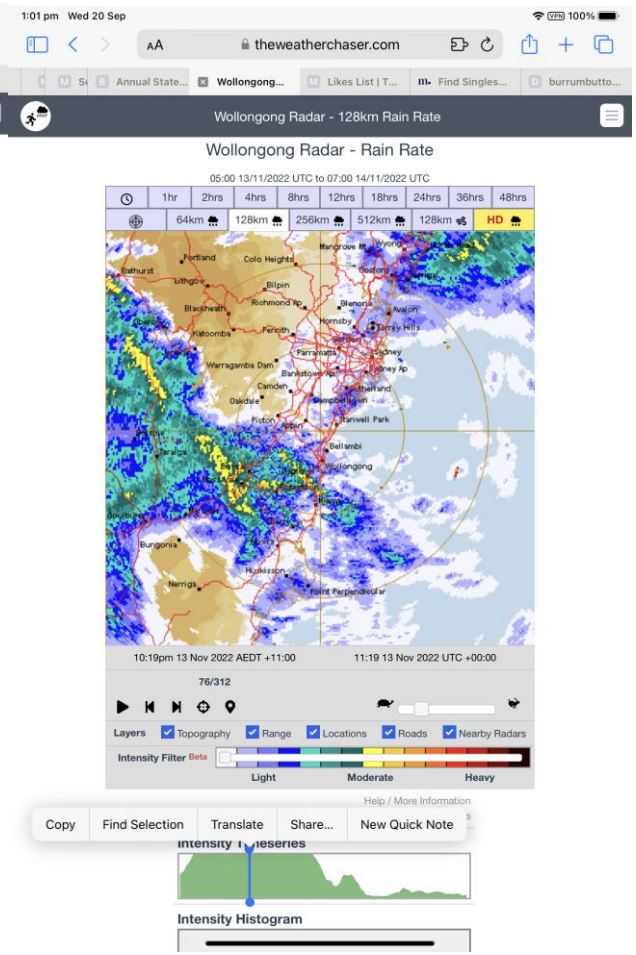


Figure 16: Weather radar images on

November 13 at 2219 AEDT

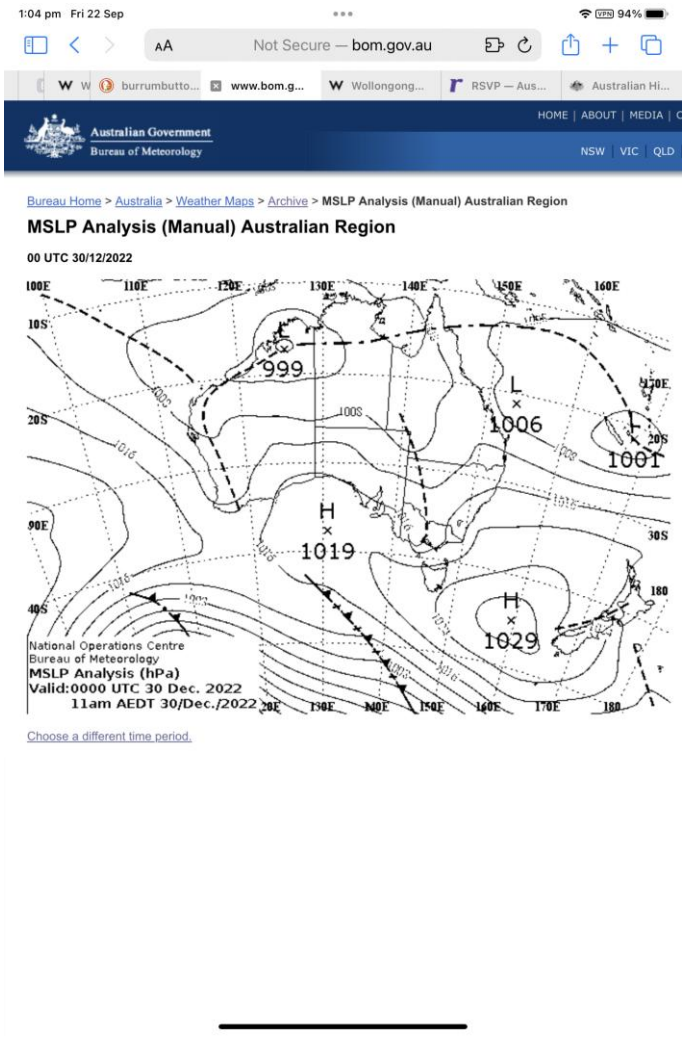


Figure 17: Synoptic weather/surface pressure December 30, 2022 at 1100 AEDT

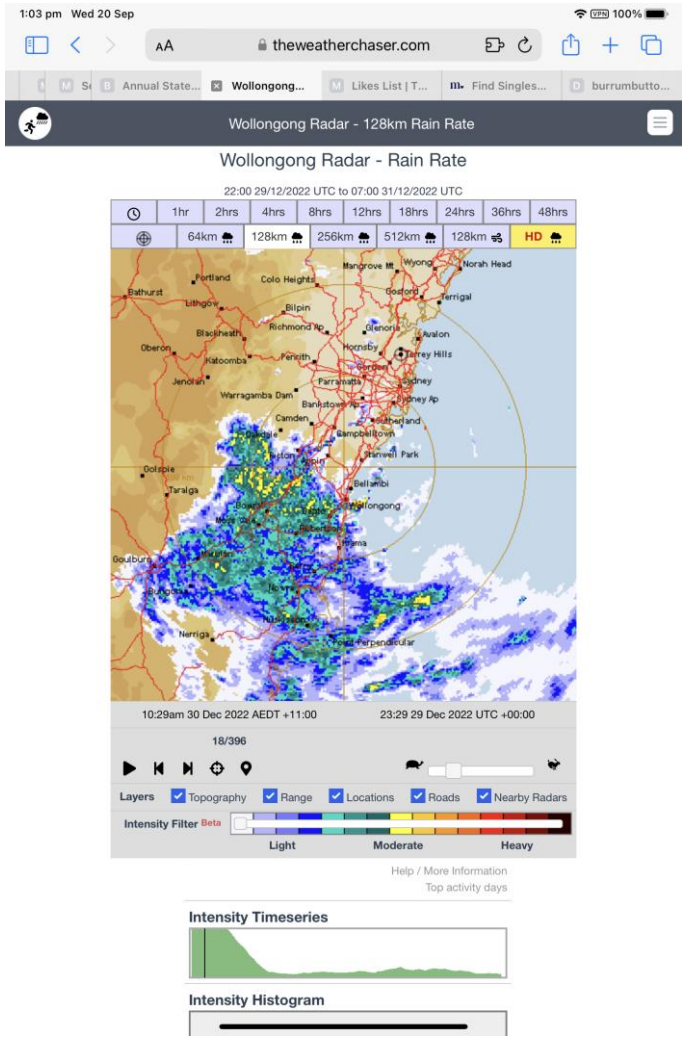


Figure 18: Weather radar images for December 30, 2022, at 1029 AEDT