Australian Government
Bureau of Meteorology

INTENSE RAINFALL & FLASH FLOODING
NOOSA HEADS

1st December 2005

Introduction

Severe thunderstorms caused intense rainfall and flash flooding at Noosa Heads during the afternoon of Thursday 1 December 2005. This report provides an analysis of the heavy rainfall that occurred in the Noosa area in the 24 hours to 9am 2nd December 2005 and a summary of the meteorological characteristics associated with the thunderstorm. It uses operational rainfall data from the ALERT systems operated by Noosa Shire Council and Maroochy Shire Council in conjunction with the Bureau of Meteorology, and meteorological information from the Bureau's radar and weather observation networks.

Figure 1 - Noosa Heads Alert Rain gauge

Rainfall Totals

- In the 24 hours to 9am 2nd December 2005, there was local heavy rainfall in the Noosa Heads area, with much lighter falls recorded elsewhere.

- 276mm was recorded at Noosa Heads in the 24 hours to 9am 2nd December 2005 at Noosa Heads, with over 200mm falling in a 3 hour period. Elsewhere in the catchment,

totals were generally less than 50mm.

- Table 1 shows the 24-hour totals recorded in the area and Figure 2 the areal extent. Figures 3 and 4 show the 3-hour and 1 hour totals for the heaviest period.

Table 1
Rainfall (mm) between 9am 01/12/2005 to 9am 02/12/2005

Station No.	Station Name	Longitude	Latitude	Rainfall
040856	RAINBOW BEACH	153.0886	-25.9000	32
540307	MT BILEWILAM ALERT	153.0464	-26.0108	13
540305	MOUNT ELLIOT ALERT	152.9078	-26.0139	54
540304	MOUNT WOLVI ALERT	152.8675	-26.1767	78
540306	BLACK PINCH ROAD ALERT	152.8917	-26.3125	24
540308	BOREEN POINT ALERT	152.9964	-26.2858	52
540309	LAKE COOROIBAH ALERT	153.0414	-26.3500	161
040757	LAKE COOROIBAH	153.0125	-26.3578	150
540328	MOUNT TINBEERWAH ALERT	152.9714	-26.3869	41
040908	TEWANTIN	153.0403	-26.3911	87
540310	TEWANTIN ALERT	153.0408	-26.3950	86
540323	NOOSA HEADS ALERT	153.0803	-26.3817	276
040078	EUMUNDI	152.9450	-26.4769	14
540093	EUMUNDI ALERT	152.9594	-26.4958	17
540052	EUMUNDI TM	152.9594	-26.4958	16
040121	MALENY	152.8519	-26.7528	46
040059	COOROY	152.9128	-26.4181	20
540325	COOROY ALERT	152.9211	-26.4064	23
540324	POMONA ALERT	152.8431	-26.3672	17
040782	COORAN TM	152.8136	-26.3297	36
540326	COORAN ALERT	152.8136	-26.3297	39

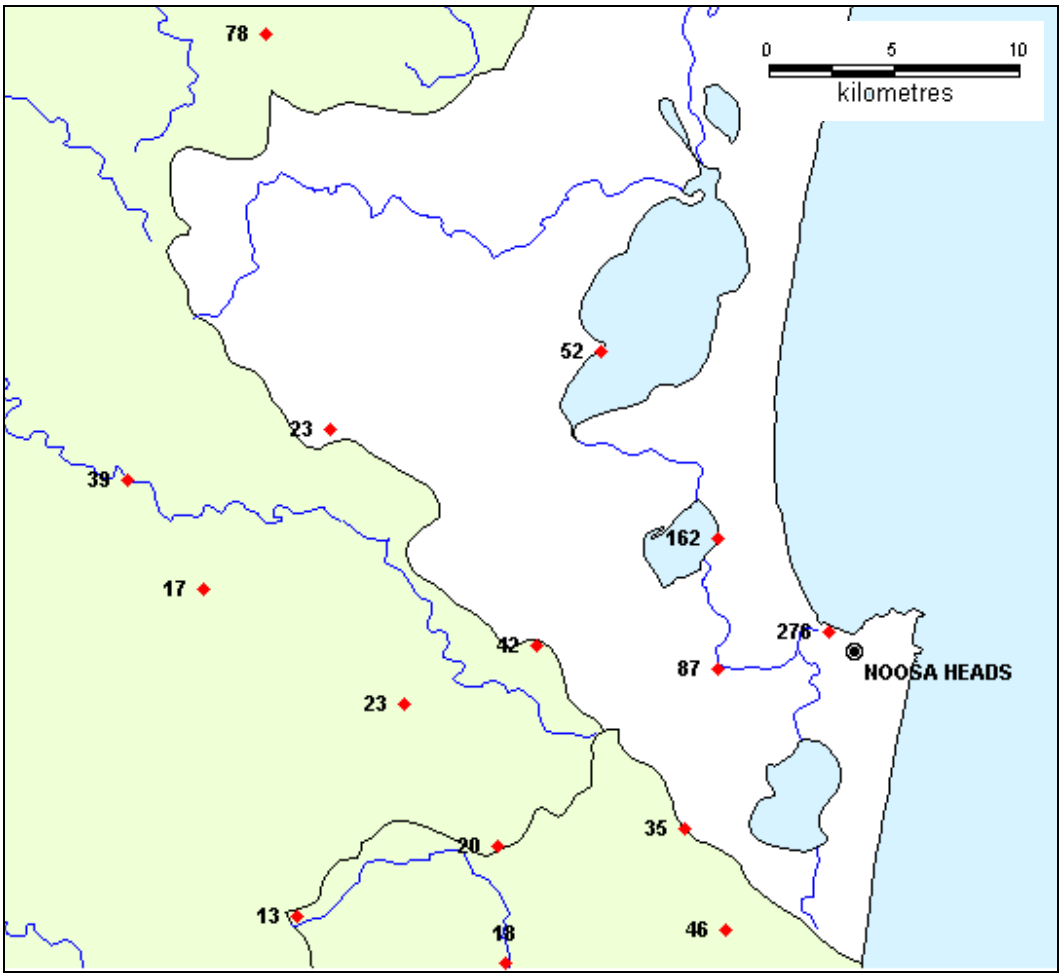

Figure 2 - Rainfall 24 Hours to 9am 2nd December 2005

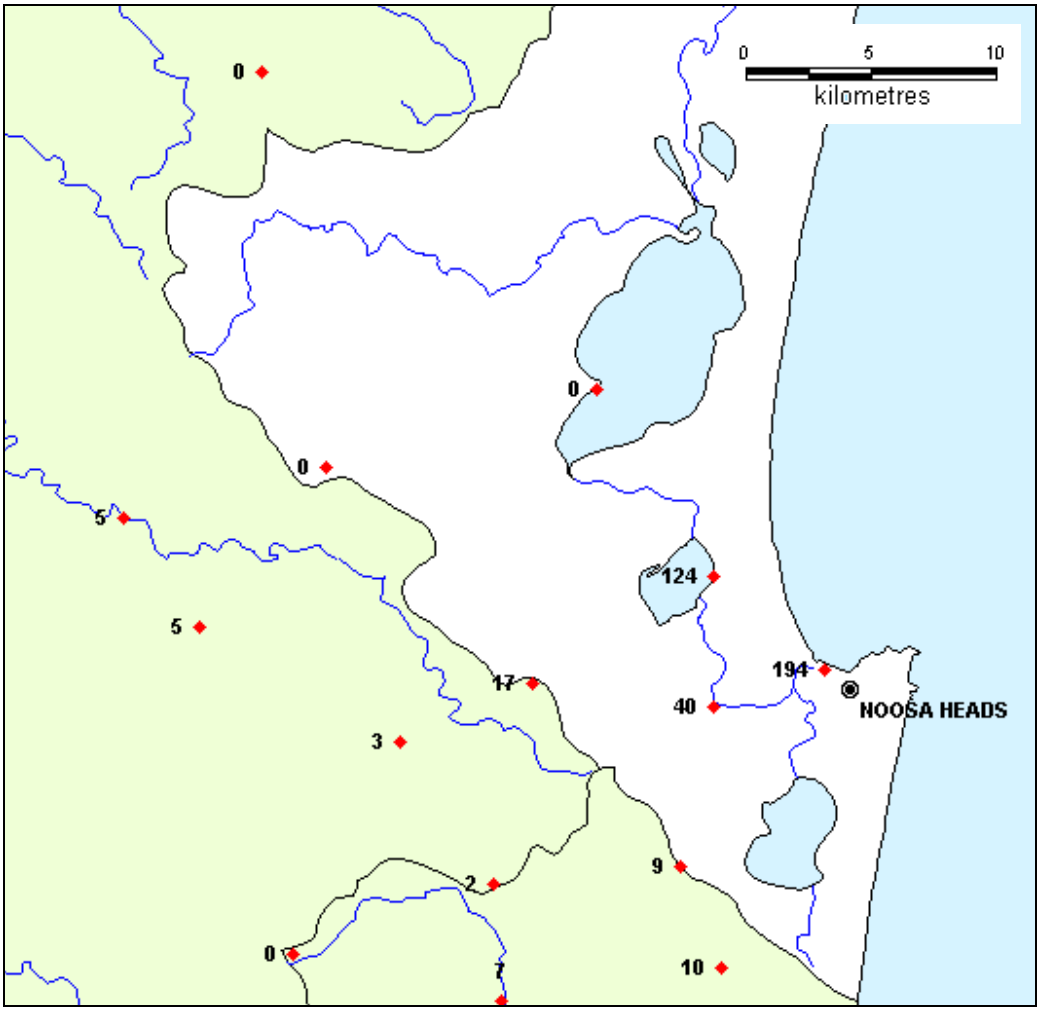

Figure 3 - Rainfall 3 Hours to 4pm 1st December 2005

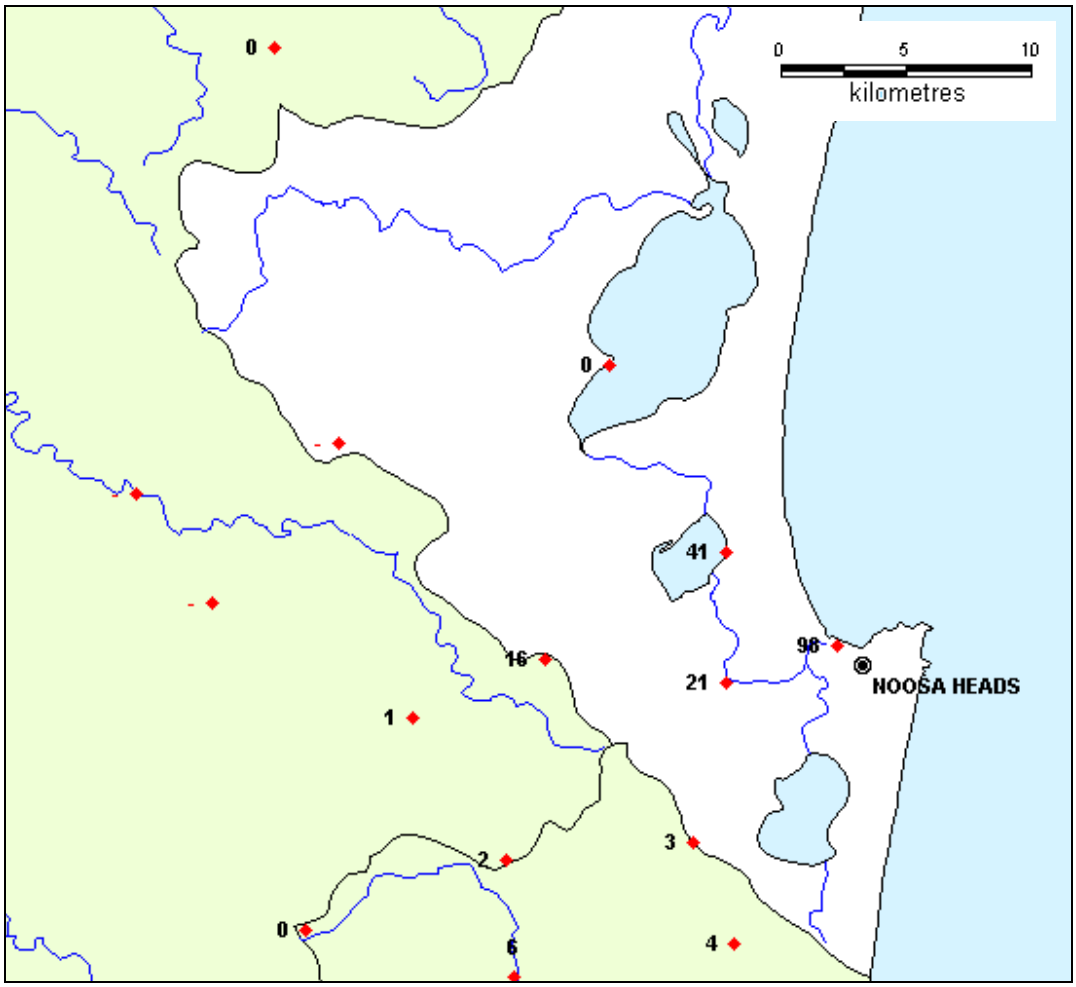

Figure 4 - Rainfall 1 Hour to 3pm 1st December 2005

Temporal Patterns

- Heavy rainfall commenced at Noosa Heads about 10:30am 1st December, with the peak intensity recorded between 1pm to 2pm. Rain had general eased by approximately 4pm.
- The heaviest hourly total at Noosa Heads was 98 mm between 1pm and 2pm, with a peak 60-minute value of 125mm between 1:35pm and 2:35pm.
- Figures 5 shows the 30-minute period rainfall for the Noosa Heads and Figure 6 the cumulative rainfall.

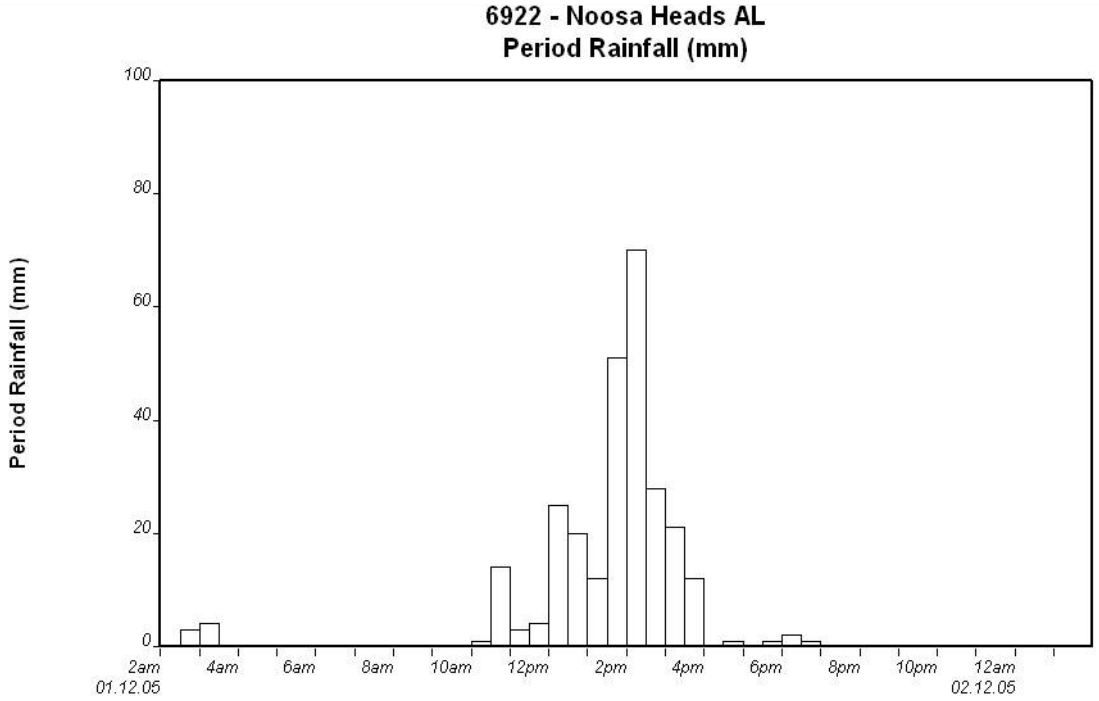

Figure 5 - Noosa Heads 30 minute Rainfall

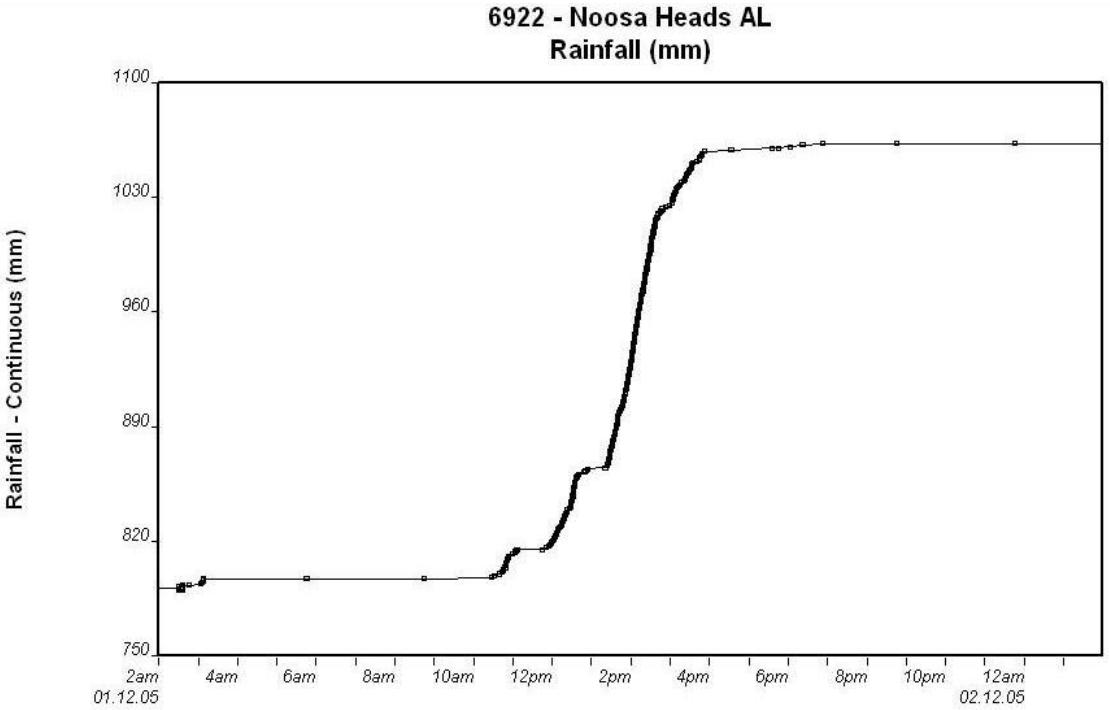

Figure 6 - Noosa Heads Cumulative Rainfall

Intensity- Frequency- Duration Analysis

- Intensity- Frequency- Duration Analysis (IFD) of the actual event was done for the Noosa Heads ALERT rainfall station which is located adjacent to the mouth of the Noosa River.
- The IFD analysis indicates that for the intervals between 60 minutes to 6 hours the rainfall intensity was in excess of 100 Year Average Recurrence Interval (1% Annual Exceedance Probability) for Noosa Heads.
- The IFD analysis is tabulated in Table 2 and plotted in Figure 7.

Table 2

RAINFALL INTENSITY FREQUENCY DURATION ANALYSIS

LOCATION: 540323 NOOSA HEADS ALERT

Analysis of the rainfall for the 20 hours to Fri Dec 2 05:45:15 2005

Rainfall (mm)	Period Ending	ARI (years)
14	5 mins ending at 14:07:31 01/12/2005	2-5
17	6 mins ending at 14:08:31 01/12/2005	2-5
26	10 mins ending at 14:09:46 01/12/2005	5
49	20 mins ending at 14:15:16 01/12/2005	20-50
71	30 mins ending at 14:25:16 01/12/2005	50-100
125	60 mins ending at 14:34:46 01/12/2005	> 100
176	2 hours ending at 15:24:16 01/12/2005	> 100
208	3 hours ending at 15:12:31 01/12/2005	> 100
260	6 hours ending at 16:27:31 01/12/2005	> 100
266	12 hours ending at 20:45:16 01/12/2005	20-50

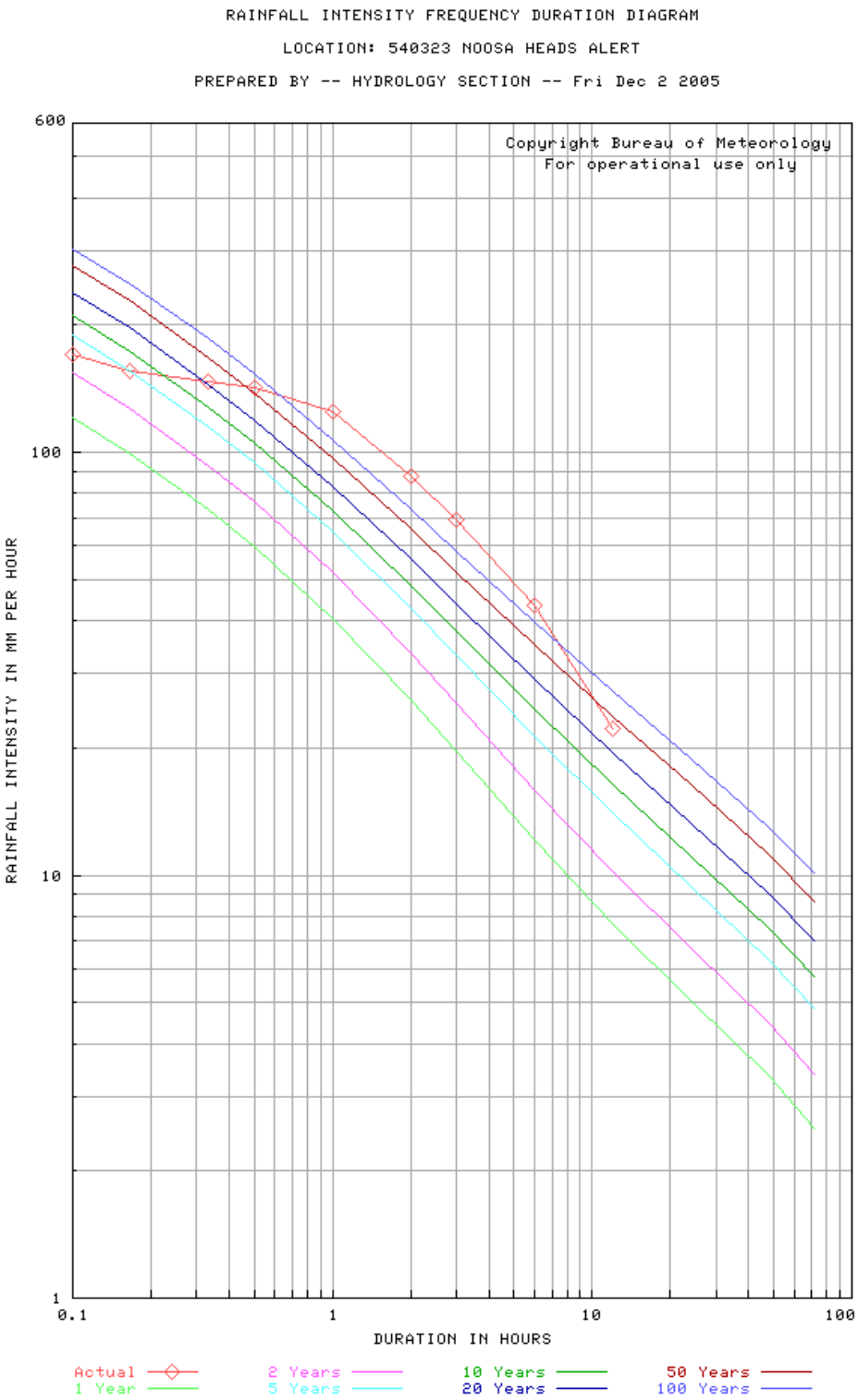

Figure 7 - IFD Analysis for Noosa Heads Alert

Meteorology of the Noosa Heads Flash Flood

The radar echoes from Marburg in Figure 8 give an indication how the showers and thunderstorms became anchored over Noosa (NSA on the radar scan) during the period extreme rainfall.

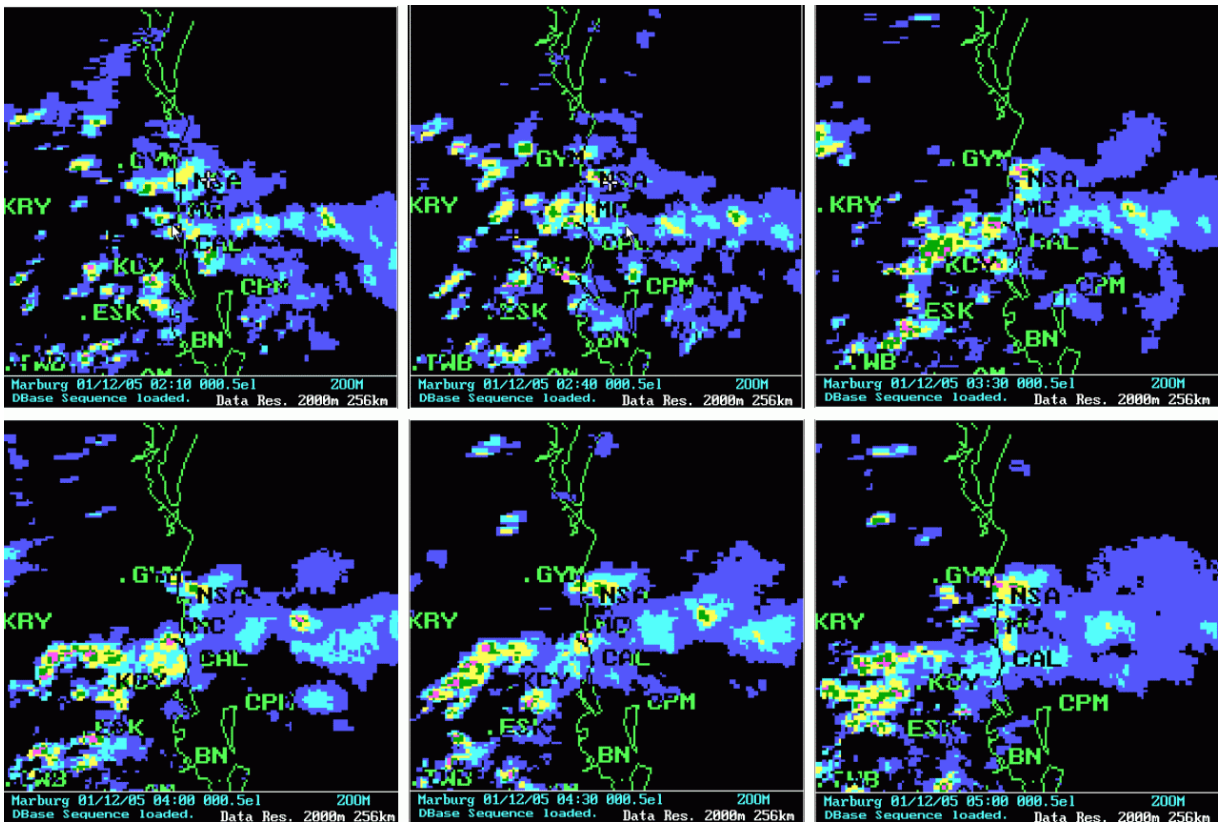

Figure 8. Rain echoes in Southeast Queensland on Marburg radar on 1 December 2005 from 0210 UTC to 0500UTC (1210 to 1500 local time).

Instability-Convective Available Potential Energy (CAPE)

CAPE represents the amount of buoyant energy available to accelerate a parcel vertically, or the amount of work a parcel does on the environment. The higher the CAPE value than the more energy there is available to foster thunderstorms. CAPE is especially important when air parcels are able to reach the Layer of Free Convection. To find CAPE from the Brisbane radiosonde trace on the morning of 1 December 2005 (Figure 9), simply locate the area on the diagram where the parcel sounding (dashed line) is warmer or farther to the right than the atmosphere sounding (solid right line). The CAPE in this case was 1692 j/kg, which is large. Usually a CAPE of 1500 j/kg would be considered large enough to help trigger severe thunderstorms.

Vertical wind profile

Additionally the wind structure at Brisbane from Figure 9, showed the direction backed with height up to at least 700hPa. This vertical wind profile is associated with large-scale ascent and aids the formation of heavy rain. Data from aircraft ascending from and descending into Brisbane airport confirm this wind structure (Figure 10).

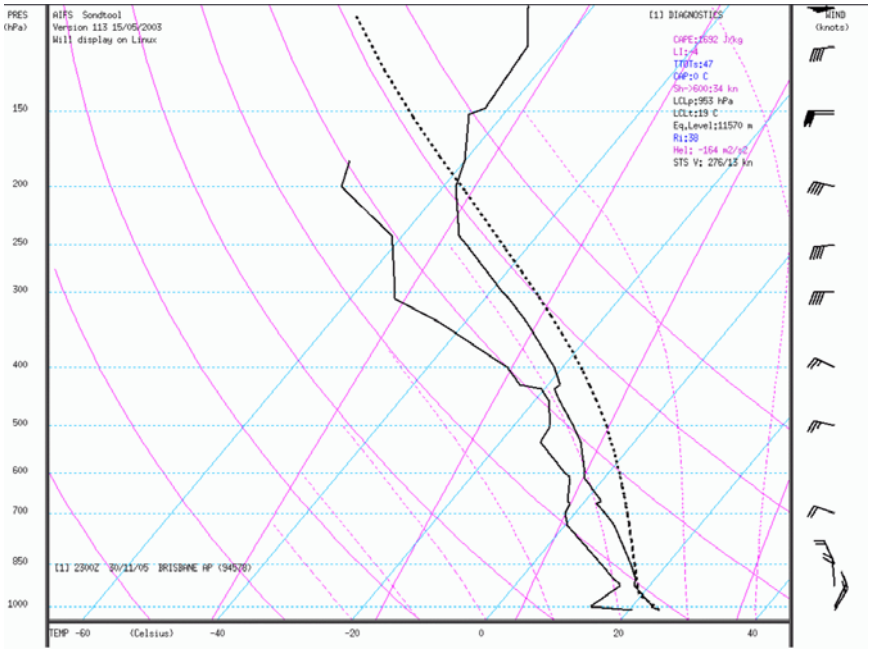

Figure 9. Brisbane radiosonde trace 2300UTC 30 November 2005.

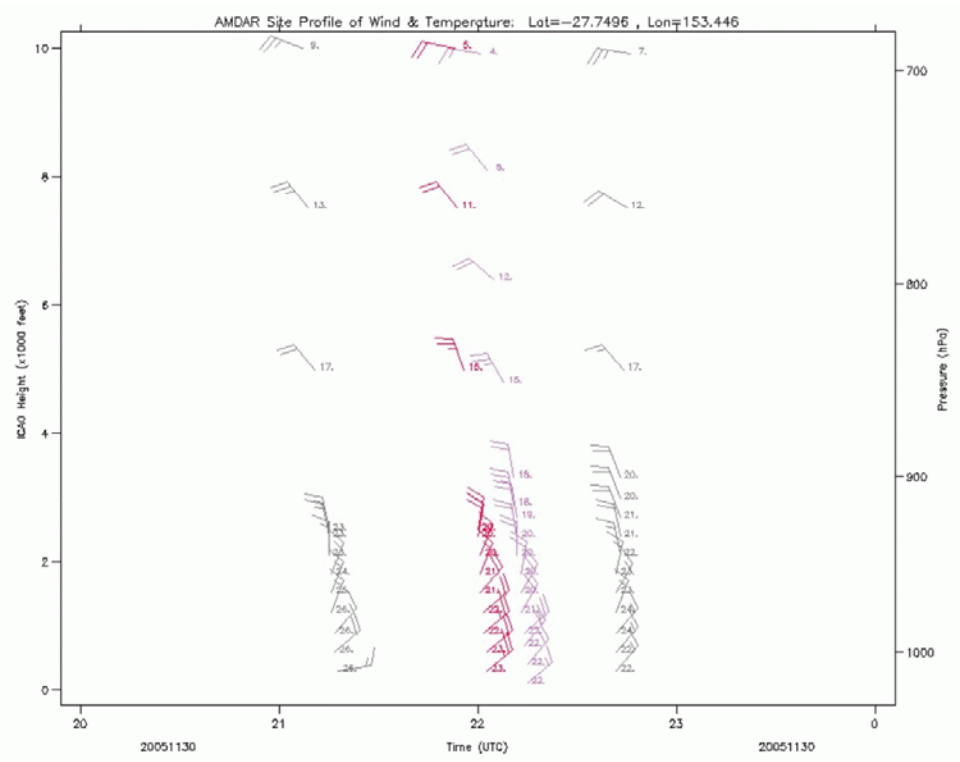

Figure 10. Aircraft wind observations at Brisbane Airport around 2300UTC 30 November 2005.

Low-level wind characteristics

In Figure 11 the surface observations are illustrated over southeast Queensland immediately before the heaviest and most prolonged rainfall occurred at Noosa. The wind flow along the Sunshine coast was from the northeast with temperature and dewpoint: 23^0C and 22^0C at Maroochydore, 22^0C and 21^0C at Tewantin and 25^0C and 23^0C at Double Island. This moist tropical air stream assisted the development of thunderstorms. The showers and thunderstorms were initially mobile and moving towards the east-southeast. However the winds immediately south of Tewantin (at Nambour and then Maroochydore) subsequently turned westerly. These westerly winds appear to be related to outflow from the large storm complex that can be seen overland near the southern parts of the Sunshine Coast in Figure 8. It is thought that these westerly winds converging with the onshore flow caused the redevelopment of thunderstorms cells on the western flank of the storms in the Noosa area. The end result was that thunderstorms remained over Noosa rather than moving seawards.

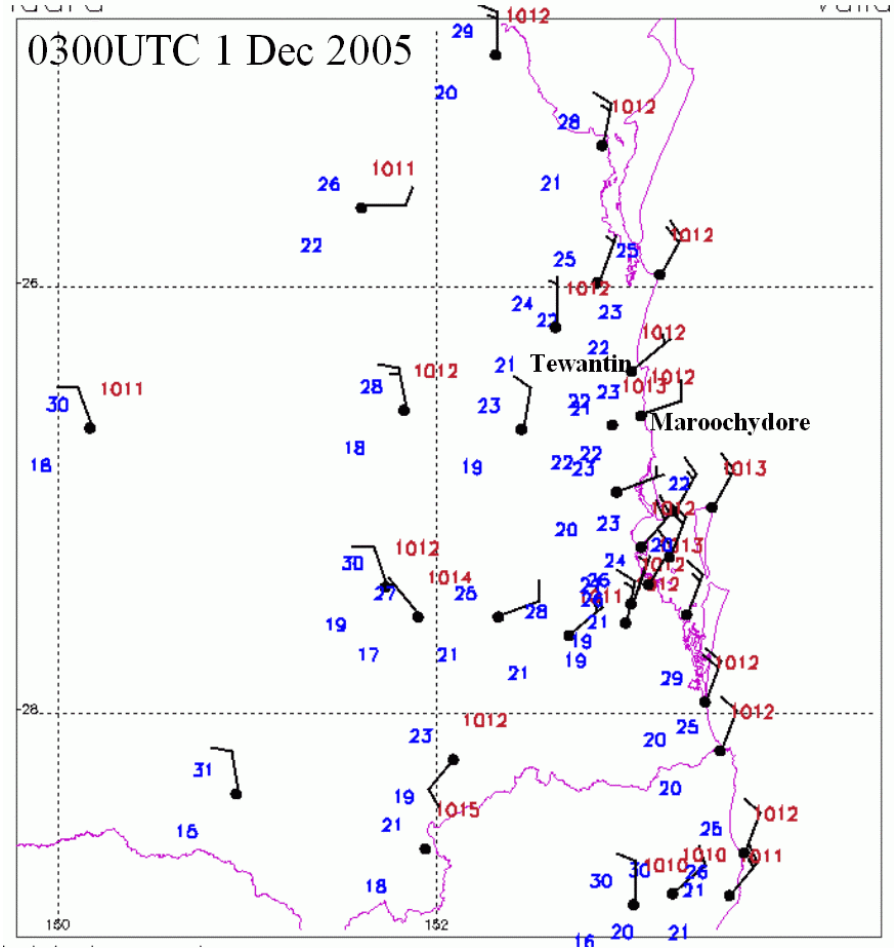

Figure 11. Surface observations showing wind speed and direction, temperature and dewpoint in degrees Celsius and mean sea level pressure.