Australian Government
Bureau of Meteorology

# Bureau of Meteorology Report on the Severe Thunderstorms in Southeast Queensland, 16th – 20th November 2008

The following report summarises the 5-day period commencing 16th November 2008, when a succession of severe thunderstorms brought widespread havoc to southeast Queensland. The storms occurred in three distinct waves, the first propagating across the Gold Coast hinterland and Brisbane's western suburbs on the 16th, the second affecting mainly the Ipswich-Toowoomba corridor on the 19th, and the third targeting Brisbane's CBD and inner north on the 20th. During this period, violent wind gusts along with localised flooding and hail brought the damage bill into the hundreds of millions of dollars. Two lives were lost in floodwaters.

## 16th November, 2008.

*General description:*

Large, potentially thunderous clouds started forming over northern NSW early in the afternoon, with mature storms soon spilling off the border ranges into southeast Queensland. A north-easterly track then carried the storms over Wonglepong, Canungra and Mt Tamborine, where the first reports of wind and hail damage were documented. The offending storm subsequently merged with a second cell – also originating from across the border – resulting in a new cell that tracked across Redbank Plains through the western and north-western suburbs of Brisbane, culminating in an extremely intense wind storm at the Gap. After advancing through Caboolture, the storm eventually decayed on the Sunshine Coast.

Damaging hailstones were observed at several locations along the storm's path, including Wonglepong, Yatala, Guanaba, and Ferny Hills, some as large as golf balls. Intense rainfall and flash flooding also occurred at many locations. Recorded rainfall intensities included 36mm in 10 minutes at Enoggera and Everton Hills and 60mm in 20 minutes at Ferny Hills. However the intensity and duration of the damaging wind was the standout feature of the storm, particularly in the north-western suburbs of The Gap, Keperra, Arana Hills, Upper Kedron, Ferny Grove, and Ferny Hills. There was widespread damage to trees, power lines and some structures. Many of these areas were without electricity for over 24 hours. Damage was also reported from other suburbs including Everton Hills, Albany Creek, and Narangba. Emergency Services documented 716 damage incidents in the Brisbane, Moreton Bay and Caboolture areas on the morning following the storms, with an estimated 230000 residents without power. Numerous unofficial reports were also received, most notably 3-4 cm hail at Mt Tamborine, a possible tornado at Canungra, and a rainfall report of 52mm in just 15 minutes at Morayfield.

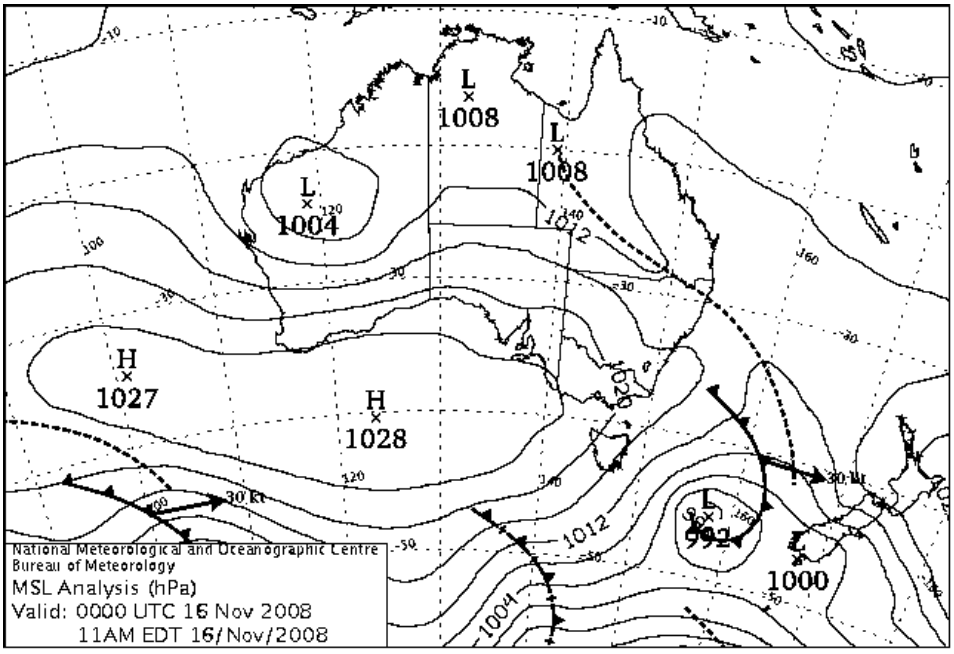
The following table shows a list of maximum official wind gusts for the 16th (times are local, directions are degrees from north, and speeds are in km/h followed by knots):

| Location | Time (local) | Wind Direction (degrees) | Wind Direction | Wind Speed (km/h) | Wind Speed (knots) |
|---|---|---|---|---|---|
| Gayndah Airport | 20:28 | 153 | SSE | 61 | 33 |
| Amberley Amo | 16:21 | 116 | ESE | 83 | 45 |
| Cape Moreton Lighthouse | 23:33 | 150 | SSE | 65 | 35 |
| University Of Queensland Gatton | 16:08 | 157 | SSE | 70 | 38 |
| Gympie | 19:24 | 190 | S | 61 | 33 |
| Archerfield Airport | 16:37 | 183 | S | 55 | 30 |
| Gold Coast Seaway | 19:35 | 165 | SSE | 59 | 32 |
| Kingaroy Airport | 18:01 | 183 | S | 65 | 35 |
| Redcliffe | 17:55 | 133 | SE | 59 | 32 |
| Beaudesert Drumley Street | 14:23 | 146 | SE | 59 | 32 |
| Oakey Aero | 16:09 | 182 | S | 74 | 40 |
| Toowoomba Airport | 15:59 | 194 | SSW | 55 | 30 |

Note that the peak winds associated with the storms were almost certainly well in excess of the values above as none of the instruments sampled the storms at their maximum intensity. Higher estimates were obtained through analysis of Doppler radar data – see the discussion linked below.

*Meteorological notes:*

The 10 am weather chart shows a humid air-mass of northerly origin flooding into southeast Queensland ahead of a dominant surface trough. The coastal section of this trough became detached after crossing the Great Dividing Range, subsequently advancing northward along the coast as a southeast wind change. This set-up is commonly associated with severe thunderstorms in spring and summer, where the passage of a trough or front provides the necessary trigger (along with solar heating) to initiate spontaneous overturning of an unstable atmosphere. In this case, thunderstorms formed well ahead of the change due to favourable conditions in the upper atmosphere. The most intense storms, however, were located close to the southeast change as it moved through the coastal strip of southeast Queensland.



The extreme damage in the The Gap was thought to have been caused by a 'microburst', a localised severe downdraught which induces an outward (horizontal) burst of damaging wind at the surface. Dual Doppler radar instrumentation estimated wind speeds up to 180km/h near The Gap at the peak of the storm.

A Bureau of Meteorology report summarising the microburst with associated radar and satellite imagery can be found at:
http://www.bom.gov.au/weather/qld/cyclone/thunderstorms/16Nov2008/qldth20081116.shtml

## 19th November, 2008.

*General description:*

Thunderstorm cells first became visible around mid-afternoon across the eastern escarpment of the Darling Downs, where they rapidly grew to maturity. By sundown, the storms had merged into a more or less continuous rain sheet, spreading from the Lockyer Valley to the Gold Coast Hinterland. At about 6.30pm, 3cm hail was unofficially reported south of Toowoomba from a severe storm cell embedded within the rain mass. By 10.30pm, several more of these cells had developed into an organised complex, slowly advancing north-eastward through Ipswich, the Brisbane Valley and eventually Caboolture. Moderate to heavy rain then persisted until the early hours of the 20th, causing extensive flooding to homes and waterways in the Lockyer Valley and Brisbane's western suburbs, many still recovering from the previous episode of storms.

The most intense recorded rainfall was at Tallegalla Alert (near Rosewood) with187mm in 2 hours and 109mm in 1 hour however numerous locations through the Lockyer Valley and Ipswich areas recorded 2 hour totals of greater than 100mm with average recurrence intervals (ARIs) estimated to be between 50 and 100 years.

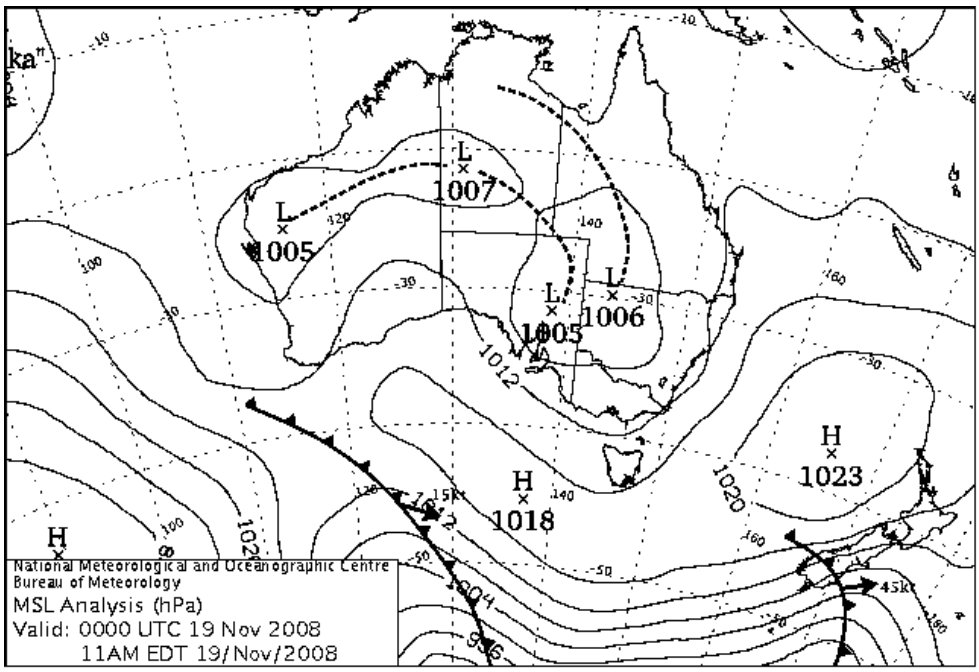
Though wind was not the principal category of severity, Archerfield recorded a gust of 70 km/h just after midnight, with extensive roof damage to at least 5 homes at Beck Street, Paddington in Brisbane's inner west.

The following table shows a list of maximum official wind gusts for the 19th (times are local, directions are degrees from north, and speeds are in km/h followed by knots):

| Location | Time (local) | Wind Direction | Wind Direction | Wind Speed (km/h) | Wind Speed (knots) |
|---|---|---|---|---|---|
| Archerfield Airport | 00:42 (next day) | 148 | SSE | 70 | 38 |
| Dalby Airport | 21:07 | 238 | WSW | 57 | 31 |
| Toowoomba Airport | 22:01 | 180 | S | 55 | 30 |
| St George Airport | 16:58 | 242 | WSW | 78 | 42 |

*Meteorological notes:*

As with the November 16th scenario, the 10am chart shows most of Queensland under the influence of a tropical air-mass, with sultry north-west to north-easterly winds building up moisture ahead of a significant inland pressure trough. On the surface, this trough was too far from the coast to act as a local trigger for thunderstorms, but its upper-level counterpart at 5500 metres was displaced well to the east, with extra lifting force supplied by a high-level jet-stream. This resulted in widespread rain-bearing cloud in the middle levels, generating moderate to heavy falls across a broad area stretching to the coast.




High altitude guiding winds were swift enough to carry embedded thunderstorms all the way to Brisbane, yet weak enough to allow accumulation of heavy rain from slow-moving cells. Even after the heat of the day had passed, the upper atmosphere was sufficiently dynamic and unstable to sustain thunderstorms right through the night.

The thunderstorm complex which produced the flooding rainfall through the Lockyer Valley and Ipswich areas was actually associated with a small surface low pressure system which was clearly discernible from the wind observations around the greater Brisbane area. This system produced sustained (10 minute average) surface winds greater than 25 knots as it moved out into Moreton Bay. Enhanced winds near this low pressure system may have been responsible for the wind damage in Brisbane's CBD and inner suburbs, although a weak tornado associated with one of the thunderstorm cells may also have been responsible.

A Bureau of Meteorology report providing more detail on the rain and flooding associated with these storms can be found at:
http://www.bom.gov.au/hydro/flood/qld/fld_reports/Bremer_Warrill_Lockyer_and_Laidley_Floods_November_2008.pdf

## 20th November, 2008.

*General description:*

The weather pattern on November 20th was similar to the previous day, but the thunderstorms evolved in a somewhat different manner. A distinct line of storms moved through southeast Queensland, producing mostly wind and hail damage in the Brisbane metropolitan area. Rainfall was intense but over a shorter period, with faster moving storms organised into a single line that marched across southeast Queensland from Beaudesert to the Sunshine Coast in less than 3 hours (beginning around 5pm). During its brief passage, this line of storms carved out a destructive path, starting from a 54 knot wind gust at Toowoomba and an 80 knot wind gust at Warwick, and ending in the loss of five Norfolk Pine trees at Scarborough on the Redcliffe peninsula. Damage was concentrated around Brisbane's CBD and inner north, with numerous reports of hail up to golf-ball size. A large tree was uprooted in the city and a 56 knot gust was measured at the Bureau's Inner Beacon on Moreton Bay.

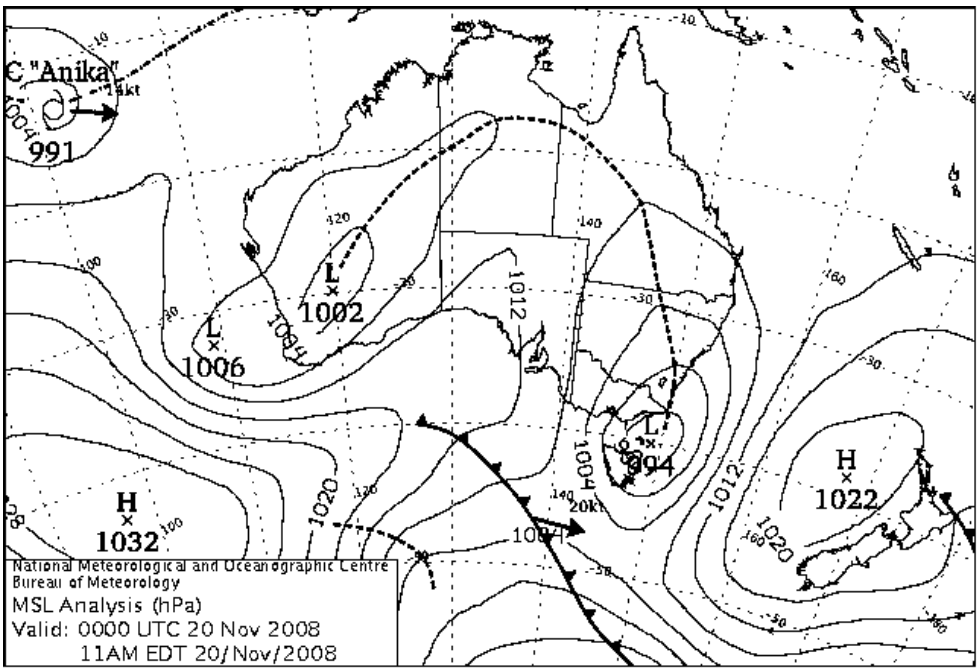
On the same evening, at approximately 6 to 7pm, an extremely severe storm struck the community of Blackwater in central Queensland, with reports indicating hail of *at least* cricket ball size (7cm) and extremely strong wind gusts. Naturally damage in the community was widespread, with 100 houses damaged (many broken windows), 20 houses unroofed, 40 caravans and cabins damaged, and many trees down. Unfortunately there is no official Bureau anemometer near Blackwater so no official recordings of wind speed from the storm are available.

The following table shows a list of maximum official wind gusts in southeast Queensland for the 20th (times are local, directions are degrees from north, and speeds are in km/h followed by knots):

| Location | Time (local) | Wind Direction | Wind Direction | Wind Speed (km/h) | Wind Speed (knots) |
|---|---|---|---|---|---|
| Cape Moreton Lighthouse | 18:56 | 326 | NW | 76 | 41 |
| Double Island Point Lighthouse | 18:18 | 348 | NNW | 80 | 43 |
| University Of Queensland Gatton | 18:31 | 285 | WNW | 70 | 38 |
| Gympie | 18:38 | 353 | N | 57 | 31 |
| Maryborough | 17:41 | 345 | NNW | 65 | 35 |
| Hervey Bay Airport | 17:32 | 334 | NNW | 57 | 31 |
| Toolara (Kelly) | 18:07 | 345 | NNW | 83 | 45 |
| Coolangatta | 18:21 | 228 | SW | 85 | 46 |
| Gold Coast Seaway | 18:32 | 240 | WSW | 76 | 41 |
| Brisbane Aero | 19:16 | 235 | SW | 81 | 44 |
| Maroochydore Aero | 18:26 | 349 | N | 63 | 34 |
| Tewantin Rsl Park | 17:26 | 001 | N | 57 | 31 |
| Brisbane | 18:52 | 263 | W | 72 | 39 |
| Redcliffe | 19:13 | 358 | N | 57 | 31 |
| Beaudesert Drumley Street | 18:07 | 243 | WSW | 76 | 41 |
| Inglewood Forest | 14:56 | 207 | SSW | 65 | 35 |
| Warwick | 16:20 | 232 | SW | 93 | 50 |
| Toowoomba Airport | 17:57 | 224 | SW | 100 | 54 |

*Meteorological notes:*

The chart started out looking much like the previous day, with eastern Queensland dominated by a tropical air-mass of northerly origin, explosively lifted to condensation by a combination of surface and upper-level troughs. However, by late afternoon the surface trough started accelerating towards the coast before finally pushing over the border ranges into Queensland as a southerly wind change.




The closer proximity and eventual late passage of the trough provided a more classic set-up for severe storms, the trough itself acting as launching pad for the rapid uplift and condensation of very moist air. Once the storms cleared, their spreading tops merged into a blanket of lighter rain which persisted over southeast Queensland until the following morning.