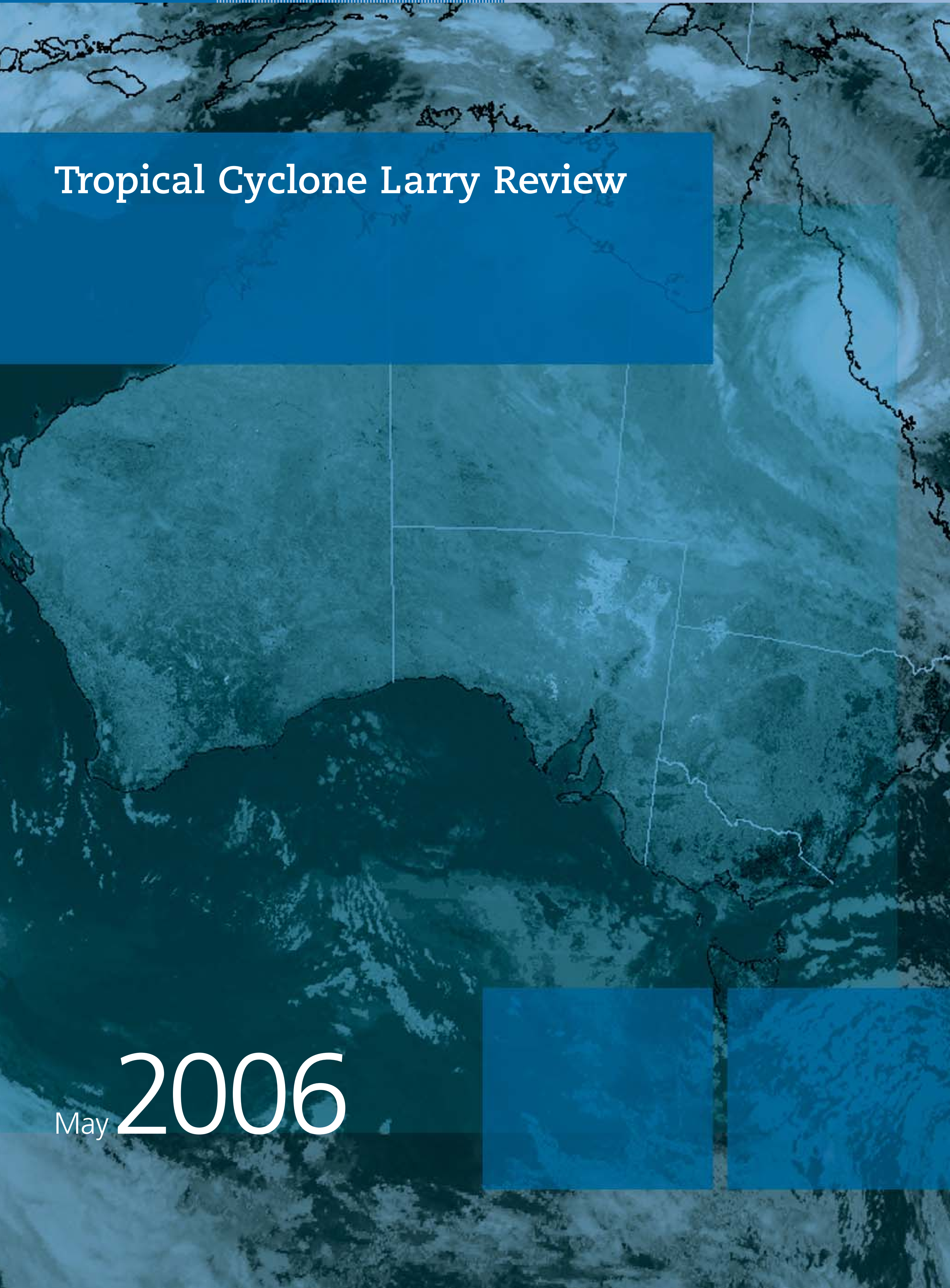
GUY CARPENTER

Tropical Cyclone Larry Review



May 2006

Tropical Cyclone Larry Review

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Cover picture – Tropical Cyclone Larry, 19 March 2006, 20:33 UTC
Source: Australian Government, Bureau of Meterology

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Tropical Cyclone Larry Review

Overview

On 20 March 2006, Cyclone Larry made landfall south of Innisfail, a coastal town of 8,500 people in Queensland, bringing destructive winds to the region. The cyclone's intensity at landfall remains unclear, however it seems Larry's landfall wind speeds were lower than those of a category 5 cyclone. Although not confirmed by the Australian Bureau of Meteorology (BoM), it is estimated that Larry was a category 4 storm on the Australian Tropical Cyclone Intensity Scale (see Table 1) as it came ashore between 06:20 and 07:20 AEST (20:20 and 21:20 UTC 19 March). As shown in Table 2, a category 4 cyclone on the Australian scale can equate to a category 3 or category 4 hurricane on the Saffir-Simpson Scale.

TABLE 1: AUSTRALIAN TROPICAL CYCLONE INTENSITY SCALE

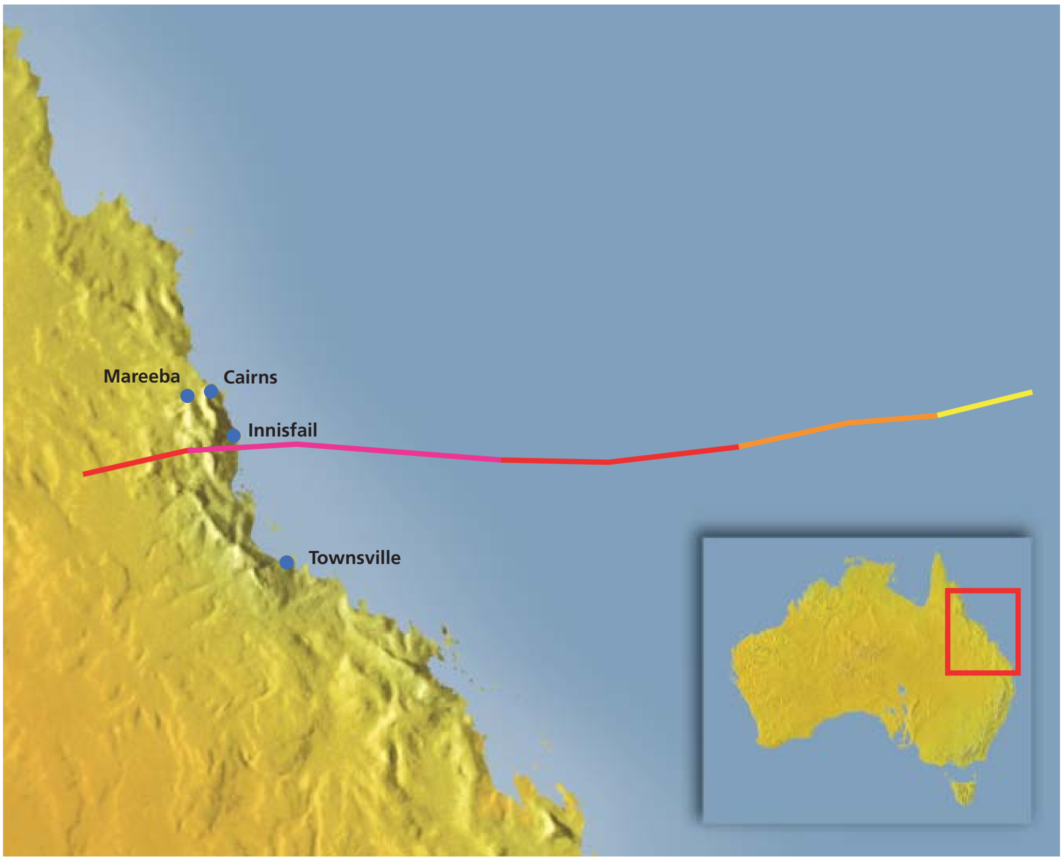
(Source: BoM)

CATEGORY	STRONGEST GUST (KMPH)	AVERAGE MAXIMUM WIND (KMPH)	APPROXIMATE CENTRAL PRESSURE (HPA)	TYPICAL EFFECTS
1	< 125	63 - 88	> 985	Negligible house damage. Damage to some crops, trees and caravans. Craft may drag moorings.
2	125 - 169	89 - 117	985 - 970	Minor house damage. Significant damage to signs, trees and caravans. Heavy damage to some crops. Risk of power failure. Small craft may break moorings.
3	170 - 224	118 - 159	970 - 955	Some roof and structural damage. Some caravans destroyed. Power failures likely. (e.g. Winifred)
4	225 - 279	160 - 199	955 - 930	Significant roofing loss and structural damage. Many caravans destroyed and blown away. Dangerous airborne debris. Widespread power failures. (e.g. Tracy)
5	> 279	> 200	< 930	Extremely dangerous with widespread destruction.

FIGURE 1: PATH OF CYCLONE LARRY

- Tropical Depression
- Tropical Storm
- Category 1
- Category 2
- Category 3
- Category 4
- Category 5

● Town



Larry packed sustained winds of around 190 kmph (120 mph) as it made landfall and major damage was reported along the Queensland coast. By global standards, Larry was a relatively small storm with destructive winds (+170 kmph) extending up to 50km (31 miles) from the centre. In contrast, Hurricane Katrina, which hit the United States in 2005, had destructive winds extending greater than 160km (100 miles) at its peak. Larry crossed on a neap tide, so the effects of the 1.8m (6 foot) storm surge were minimised. However, some low lying areas did receive some salt water inundation due to the storm surge.

TABLE 2: COMPARISON BETWEEN THE SAFFIR-SIMPSON SCALE AND AUSTRALIA'S TROPICAL CYCLONE INTENSITY SCALE

(Source: BoM)

10-MIN AV. WIND SPEED (KNOTS)	1-MIN AV. WIND SPEED (KNOTS)	SAFFIR-SIMPSON	AUSTRALIAN SCALE	WIND GUSTS (KMPH)	WIND GUSTS (KNOTS)
57	65	Category 1	Category 2	148	80
61	70			157	85
65	75			169	91
70	80		Category 3	181	98
74	85	Category 2		193	104
78	90			202	109
83	95			215	116
87	100	Category 3	Category 4	226	122
91	105			235	127
96	110			248	134
100	115	Category 4		259	140
105	120			272	147
109	125		Category 5	283	153
113	130			293	158
118	135			306	165
122	140	Category 5		317	171
126	145			326	176
131	150			339	183

The Queensland government stated around 12,500 sq km of land was affected by Larry, from Mareeba in the north to Tully in the south and west to beyond Mount Garnet. About 250,000 people live in the area hit by Larry and officials said the cyclone was unusual in the extent of destruction it left up to 200km (125 miles) inland.

Larry caused significant damage to houses, businesses, infrastructure, crops and state forests, incurring a total economic damage bill of at least A$1.5bn (US$1.1bn) and an insured loss estimated to exceed A$350m (US$255m).

Meteorological Summary

Larry developed on 17 March from a low pressure system located in the Coral Sea, 1,200km (745 miles) off the Queensland coast. The system became a tropical cyclone the following day whilst tracking west towards the Queensland coastline. Larry reached category 5 status on 19 March before weakening slightly prior to landfall. Larry continued to weaken after coming ashore but sustained its inland track into western Queensland to the north of Mount Isa, approximately 200km (125 miles) inland. Below is the timeline of the storm from the time it made landfall:

- 08:00 AEST 20 March (22:00 UTC 19 March) – Larry was a category 4 cyclone with extreme wind gusts of around 230 kmph (144 mph) extending as far as 50km (31 miles) from the storm's centre.
- 10:30 AEST (00:30 UTC) – The storm was located approximately 160km (100 miles) north-east of Georgetown and packed winds of between 125-170 kmph (78-105 mph). These wind speeds extended 45km (28 miles) from the centre of the storm.
- 16:30 AEST (06:30 UTC) – Larry was situated about 55km (34 miles) north-north-east of Georgetown. The cyclone was moving west-south-west at 30 kmph (20 mph) and packed maximum sustained winds of 140 kmph (86 mph). Destructive winds extended 40km (25 miles) from the centre of the storm.
- 22:30 AEST (12:30 UTC) – Larry was located around 55km (34 miles) south of Croydon. Larry had been downgraded to a category 1 storm by this time, with a central pressure of 990hPa and destructive winds extending out to 40km (25 miles) from the centre.
- 01:30 AEST 21 March (15:30 UTC 20 March) – Larry weakened into a tropical low when positioned near Iffley Station (south of the Gulf of Carpentaria).
- 16:00 AEST (6:00 UTC) – Ex-Tropical Cyclone Larry was located around 130km (80 miles) north-north-west of Mount Isa at this time. A severe weather warning was issued for eastern Berkly and eastern Roper-McArthur Districts, where thunderstorms with wind gusts of up to 100 kmph (64 mph) and heavy rainfall occurred. The system continued to move west-south-west at around 25 kmph (18 mph) whilst dissipating.

Event Summary

Wind gusts of around 280 kmph (175 mph) and sustained winds of 190 kmph (120 mph) were recorded as Larry hit land, causing extensive damage and prompting Queensland State Premier Peter Beattie to declare a state of emergency in the region. Mr Beattie said property damage in the area was “immense”. Roofs were torn off houses and power lines and trees were downed as the cyclone ripped through the coast. Reports said thousands of buildings were damaged and the region’s banana and sugarcane crops were devastated. The storm cut power to around 120,000 homes and injured 30 people. No-one was killed. The swath of destructive winds stretched from Cardwell in the south to Cairns in the north, the BoM said.

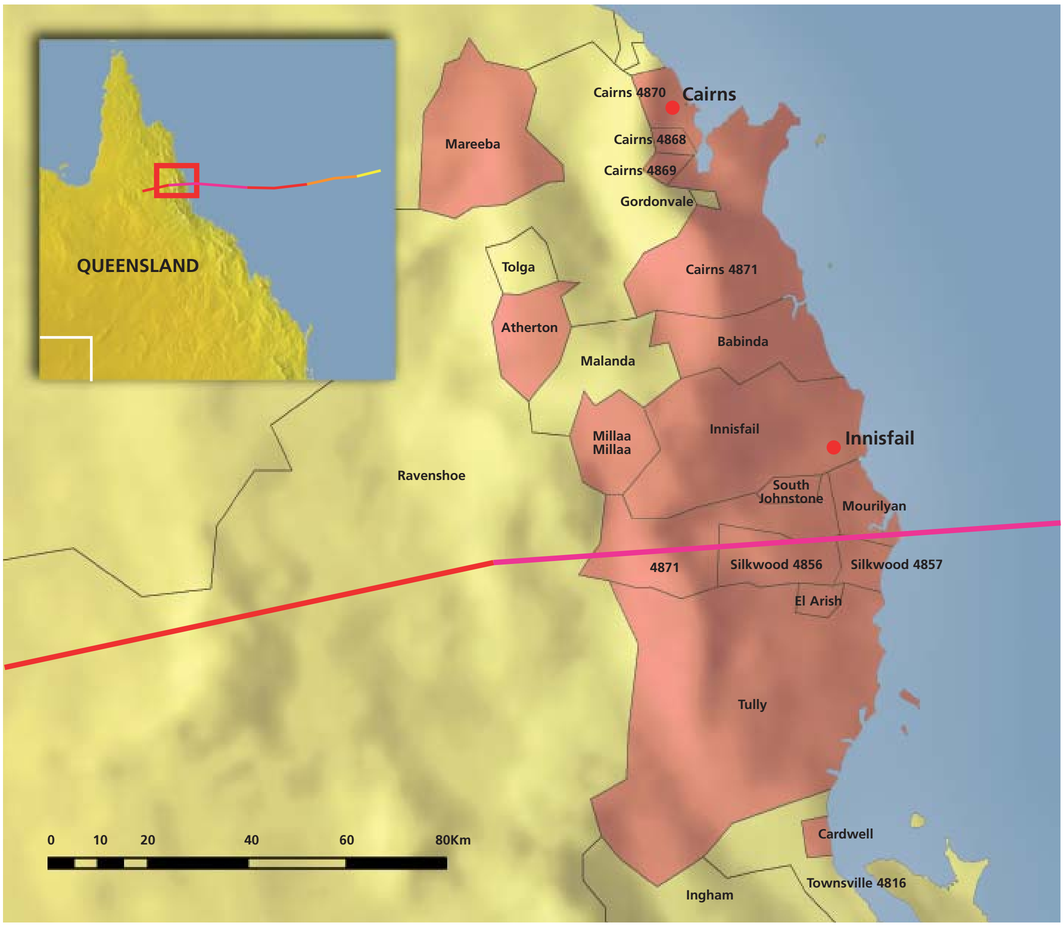
The towns of Innisfail, Silkwood and Babinda were hardest hit by the storm with extensive roof and structural damage, according to reports. In Innisfail, the Counter Disaster and Rescue Service (CDRS) said up to 10,000 buildings were damaged, leaving thousands of people homeless. Assessments carried out by Queensland’s Disaster Management Services (QDMS) showed 50% of homes in Innisfail were damaged while 35% of private industry structures needed repairs. Around 25% of Innisfail’s government buildings were also severely damaged, including the hospital, while the town’s roads and bridges were impassable.

Smaller communities in the region also took the brunt of the cyclone. The most severe damage to buildings occurred in the town of Silkwood (population 384). QDMS said 99% of Silkwood homes lost roofs or suffered structural damage. Homes south of Silkwood sustained severe damage also. Around half the commercial properties in El Arish (population 774) incurred damage. Several homes in the immediate coastal communities of Kurrimine Beach (population 850) and Mission Beach (population 1,000) were also severely damaged.

FIGURE 2: LOCATIONS IN QUEENSLAND DAMAGED BY CYCLONE LARRY

- Tropical Depression
- Tropical Storm
- Category 1
- Category 2
- Category 3
- Category 4
- Category 5

- Affected locations
- Affected 4 digit postcode areas



Property damage was also reported further afield in Atherton, Eacham, Mareeba, Cardwell and Tully. Furthermore, in Babinda (population 1,200), 80% of buildings sustained major damage and virtually all crops were destroyed, according to CDRS. The city of Cairns also suffered disruption and damage as a result of Larry. Schools and businesses were forced to shut before the storm hit land. The cyclone also caused some property and infrastructure damage in the city.

FIGURE 3: DAMAGE IN INNISFAIL HIGH STREET

FIGURE 4: AERIAL PICTURE OF INNISFAIL: THE RED DOTS POSITIONED OVER PROPERTIES INDICATE WHERE TARPAULIN WAS USED TO COVER THE DAMAGED ROOF OF A BUILDING

FIGURE 5: COMMERCIAL DAMAGE IN AND AROUND INNISFAIL INCLUDED BUSINESS INTERRUPTION. PHOTOS SHOW DAMAGE TO HOTEL CASTOR IN MOURILYAN 8KM SOUTH OF INNISFAIL

In addition to property damage, Larry devastated Queensland's banana and sugar industries. The banana industry reported losses of at least A$350m (US$255m), with around 80% of crops destroyed. The Australian Banana Growers Council (ABGC) said the bulk of the industry's production would be affected for about a year and the bill for infrastructure damage would also be high. However, the ABGC added that banana growers in Queensland did not have crop insurance after insurers withdrew from the market following a series of storms in the 1990s. The sugar industry, meanwhile, estimated its losses at A$200m (US$145m), with 10% of Australia's sugar production lost in the cyclone. Larry also affected avocado production. Furthermore, building industry sources estimated the cost of repairing government-owned infrastructure such as roads, bridges, railways and power facilities at between A$400m (US$285m) and A$600m (US$430m).

The storm also passed directly over Australia's Great Barrier Reef, damaging a narrow band of coral, according to scientists. Heavy rain was recorded in the coastal parts of the Tully and Murray Rivers with up to 300mm (12 inches) falling in 12 hours. This caused moderate to major flooding in the Tully and Murray Rivers and in smaller coastal streams in the area.

The federal government announced a major aid package for the region. Under the package, A$10,000 (US$7,150) tax-free grants went to small businesses affected by the disaster, while unemployment benefits will be paid to affected farmers and small businesses for six months. The federal and Queensland governments also agreed to make available concessional loans of up to A$200,000 (US$143,000).

FIGURE 6: INDUSTRIAL DAMAGE AT MOURILYAN MILL, MOURILYAN

Insured Losses

According to the Insurance Disaster Response Organisation (IDRO), insured losses from Cyclone Larry will reach at least A$350m (US$255m). Insurers reported over 18,000 claims for home, contents, motor vehicles, commercial property, boats and light aircraft. The IDRO believes the losses will rise. Standard & Poor's Rating Services, meanwhile, estimated insured losses of between A$300m (US$220m) and A$400m (US$293m) and said the loss will be split between insurers and reinsurers as some catastrophe reinsurance contracts even with high retentions will be activated for those insurance companies with a significant presence in the region. Business interruption claims are also expected in Innisfail and the surrounding area.

However, Larry's impact on the insurance industry was limited by the number of uninsured and underinsured homes in the region and the fact it did not hit a major metropolitan centre (e.g. Cairns). A 2005 report by the Australian Securities and Investments Commission (ASIC) examining the underinsurance of home buildings in Australia found that at least 27% and possibly as many as 81% of homeowners are underinsured by 10% or more. Following a study of the Canberra bushfires in 2003, the report showed that homeowners affected by the fires were underinsured by between 27% and 40% on average.

Currently, Larry's insured loss of A$350m (US$255m) ranks outside Australia's ten most costly natural disasters, according to recent figures published by Risk Frontiers (see Table 3). However, Larry's eventual final loss figure is likely to rise and it will be one of the most expensive natural peril's to hit Queensland.

TABLE 3: AUSTRALIA'S TEN MOST EXPENSIVE NATURAL DISASTERS

(Source: Risk Frontiers[1])

DATE	EVENT	LOCATION	ORIGINAL INSURED LOSS (A$M)	INSURED LOSS AS AT 2004 (A$M)
28/12/1989	Earthquake	Newcastle	862	3,567
24/12/1974	TC Tracy	Darwin	200	3,277
14/04/1999	Hailstorm	Sydney	1,700	2,735
16/02/1983	Bushfires	Victoria	176	1,335
18/03/1990	Hailstorm	Sydney	319	1,221
18/01/1985	Hailstorms	Brisbane	180	1,185
25/01/1974	TC Wanda	Brisbane	68	740
10/11/1976	Hailstorm	Sydney	40	612
03/10/1986	Hailstorm	W Sydney	104	588
05/11/1984	Flood	Sydney	80	551

[1] All indexed tropical cyclone losses have been reduced by 50% to adjust for critical building code changes in exposed locations despite the true reduction factor being unique to each tropical cyclone. Using Tropical Cyclone Tracy as an example, research by Risk Frontiers suggests that the current loss for the event would reduce by approximately 65% if Tracy were to recur today and all buildings affected were constructed as per the new building code (i.e. post-1980 construction).

To convert historical losses to current losses, adjustments need be made to account for changes in population, inflation and wealth. Risk Frontiers has developed an indexation methodology incorporating two surrogate factors to account for these factors - changes in both the number and value of dwellings. The approach adjusts only for changes in building value, and thus is independent of land value. Since damage to dwellings often makes up a major component of most catastrophe losses, this approach assures close alignment to insured losses.

Historical Comparisons

Apart from Tropical Cyclone Ingrid (March 2005), Larry was the first severe tropical cyclone to make landfall at a populated location on Queensland's east coast since Rona crossed near the Daintree River in February 1999. The most devastating cyclones to hit Queensland's east coast prior to Larry are listed in Table 4:

TABLE 4: SIGNIFICANT CYCLONES TO HIT THE EAST COAST OF QUEENSLAND PRIOR TO 2006

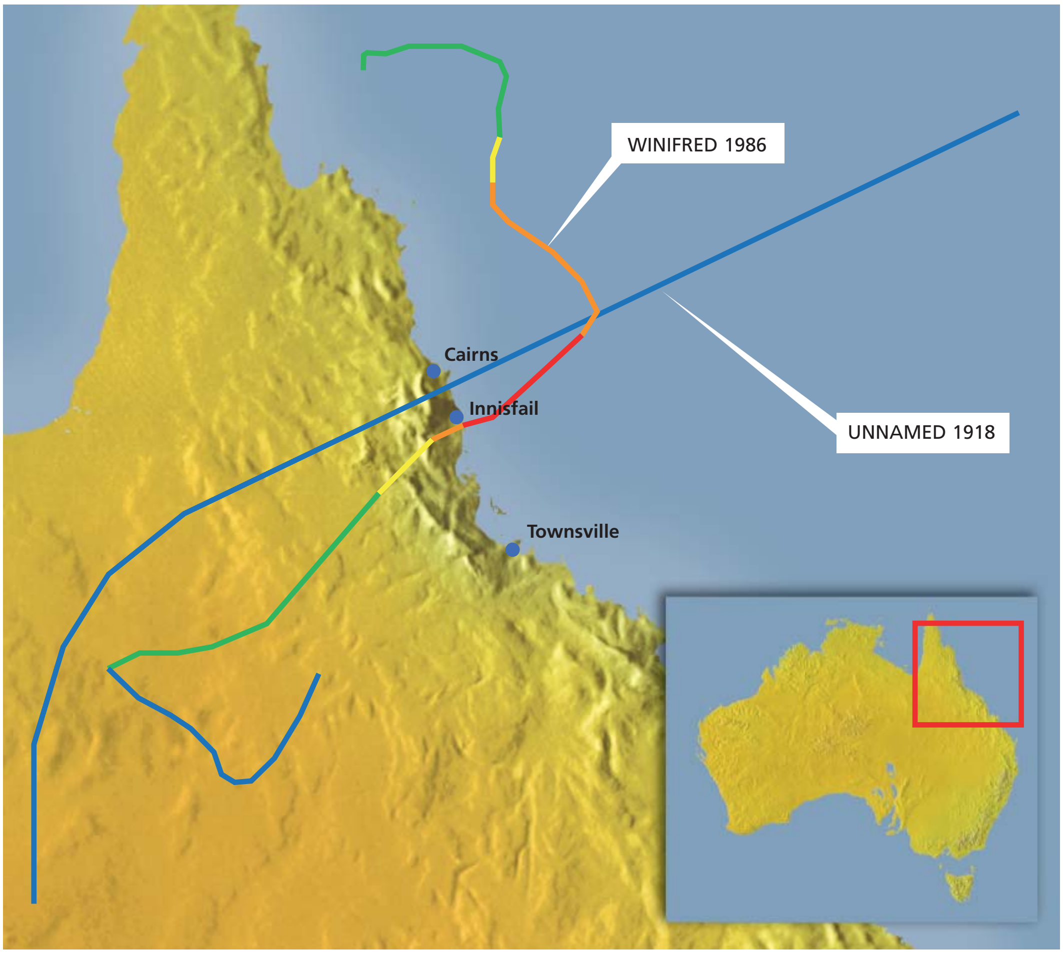
(Source: BoM)

CYCLONE NAME	LOCATION	CATEGORY ON IMPACT	YEAR
Rona	Cow Bay near the Daintree River	3	1999
Aivu	Ayr (south of Townsville)	3	1989
Winifred	Near Innisfail	3	1986
Althea	North of Townsville	4	1971
Ada	Whitsunday Islands	4	1970
Not named	Innisfail	5	1918
Not named	Mackay	5	1918
Mahina	Bathurst Bay	5	1899

Two of the most notable tropical cyclones to impact the Innisfail area prior to Larry include an unnamed event during 1918 and Tropical Cyclone Winifred in 1986 (see figure 7).

FIGURE 7: SIGNIFICANT HISTORICAL CYCLONES AFFECTING THE INNISFAIL REGION

- Tropical Depression
- Tropical Storm
- Category 1
- Category 2
- Category 3
- Category 4
- Category 5
- Town



N.B. No wind speed data is available for the 1918 event

Unnamed Tropical Cyclone: 10 March 1918 (*Source: Jeff Callaghan, BoM Brisbane*)
This category 5 cyclone (Australian Tropical Cyclone Intensity Scale) is believed to be the most powerful storm to hit a populated area of Queensland. It crossed the coast and passed just north of Innisfail. A pressure value of 926hPa was read at the Mourilyan Sugar Mill at 19:00 on 10 March with the eye wall reaching Innisfail at 21:00.

At the time, Innisfail was a small town with 3,500 residents and only around 12 houses remained intact with the rest being blown flat or unroofed. Based on an interpretation of a report from the Harbours and Marine Engineer, the water at Maria Creek was 4.7m (15 feet) above the tide for that day.

Around 16:40 on 10 March, a tidal wave surged in from the east into Bingil Bay, taking the bridge over the creek 400m (437 yards) inland. Mission Beach was inundated by 3.6m (12 feet) of water and debris reached a height of 7m (23 feet).

All buildings and structures were destroyed by the storm surge in the Bingil Bay/Mission Beach area. The majority of buildings in Babinda were also destroyed and some reports suggest that not one building was left standing. There was widespread damage in Cairns and on the Atherton Tablelands. Reports suggest that 37 people died in Innisfail while 40 to 60 people lost their lives in nearby areas.

Tropical Cyclone Winifred: 1 February 1986
(*Source: Jeff Callaghan, BoM Brisbane and Risk Frontiers database extract from PerilAus*)
Tropical Cyclone Winifred, a category 3 storm on the Australian Tropical Cyclone Intensity Scale, formed from a tropical low approximately 450km (280 miles) north of Cairns on 27 January. It reached tropical cyclone intensity by 04:00 on 30 January. The following day Winifred turned south-west and crossed the coast around Cowley Beach, between Tully and Innisfail. The worst affected areas were between Babinda and Tully.

Central pressures of 958hPa were observed at both Cowley Beach and South Johnstone. There was a 1.6m (5 foot) storm surge on the gauge at Clump Point. Instrumentation at Cowley Beach, which was near the southern eye wall at landfall, showed maximum sustained winds at between 126 kmph (78 mph) and 154 kmph (95 mph). Wind gusts of up to 119 kmph (75 mph) were also recorded at Cairns.

TABLE 5: LIST OF LOCATIONS DAMAGED BY CYCLONE WINIFRED

(Source: Jeff Callaghan, BoM Brisbane)

LOCATION	DAMAGE
Innisfail	190 houses damaged, ranging from extensive to minor
Mourilyan	20 houses unroofed, every other house damaged and 12 vessels sunk in harbour
South Johnstone	30 houses unroofed and 50 damaged
El Arish	One house destroyed, 15 unroofed and most others damaged
Babinda	16 buildings (shops, churches, houses) severely damaged, 50 houses unroofed and 500 houses damaged
Silkwood	25 houses severely damaged and 25 partly damaged
Mirriwinni	50 houses damaged
Kurrimine Beach	25 houses severely damaged and 51 partly damaged
Cairns	5 houses unroofed and 10 damaged
Millaa Millaa	12 houses damaged and up to 300 farm buildings damaged
Malanda	30 houses damaged and 20 farm buildings severely damaged

Meanwhile, some extreme wind effects were observed to the north. A severely damaged house on a 70m (75 yard) ridge north of Innisfail was calculated (by James Cook University) to have been hit by a 269 kmph (167 mph) wind gust.

Winifred rapidly lost intensity as it moved inland. However, floods occurred after the system dumped heavy rain over the region. Around 305mm (12 inches) of rain fell in Topaz, 373mm (15 inches) in Ravenshoe, 212mm (8 inches) in Tully, 221mm (8.5 inches) in Innisfail and 251mm (10 inches) in Babinda. Rainfall totals exceeded 500mm (20 inches) in some coastal areas, particularly over the Tully, Herbert and Johnstone catchments. A near record flood occurred in the Herbert River and a major flood occurred in the Tully River.

Overall, Winifred caused widespread and severe damage in the region and incurred an index adjusted insured loss of A$131m (US$100m), making it the sixth most expensive cyclone to make landfall in Queensland (see Table 6). At least three people were killed.

TABLE 6: TEN MOST COSTLY CYCLONES TO MAKE LANDFALL IN QUEENSLAND

(Source: IDRO and Risk Frontiers)

DATE	EVENT	LOCATION	ORIGINAL INSURED LOSS (A$M)	INSURED LOSS AS AT 2004 (A$M)
25/01/1974	TC Wanda	Brisbane	68	740
04/03/1973	TC Madge	Queensland	30	478
24/12/1971	TC Althea	Townsville	25	398
20/03/2006	TC Larry	N Queensland	350 est.	350 est.
18/01/1970	TC Ada	Queensland	12	237
02/01/1986	TC Winifred	Innisfail	40	131
03/02/1990	TC Nancy	Brisbane	33	74
19/12/1976	TC Ted	Queensland	15	67
04/04/1989	TC Aivu	Townsville	26	57
02/12/1980	Not named	Brisbane	7.5	42

N.B. Tropical Cyclone Wanda's loss in 1974 was predominantly caused by flooding rather than wind.

Evolving exposure

Exposure along the Queensland coast has changed significantly since Cyclone Winifred made landfall. In 2001, the total number of houses and flats in the region extending from Babinda down to South Mission Beach and roughly 20km (12 miles) inland was approximately 8,000, according to Australian Census data. This represents around a 100% increase compared to 1981. This value is consistent with the exposure increase that has occurred in the state of Queensland over the same period of time.

Based on the 1981 and 2001 Australian Census data, there is roughly a 50:50 split between the number of pre-1980 and post-1980 houses and flats in the region extending from Babinda down to South Mission Beach, ignoring any demolitions and retrofits that may have occurred over time. The importance of this split results from the marked improvement in the quality of construction that occurred in tropical cyclone-prone areas in the 1980s.

Residential Building Damage

The property damage left in the wake of Cyclone Larry has generated much attention as it is the first comprehensive test of the newer building standards that specify more wind resistant construction design. As expected, newer houses (post-1980 construction) generally performed better than older houses (pre-1980 construction).

The construction, design, age and location of structures each have an influence on the risk of building damage. Generally, however, the more brittle the exposed building material and the weaker the connection between building elements, the greater the susceptibility to wind and debris damage. Advances made in cyclone resistant construction since the 1970s have resulted in improved building performance under wind loads and this was evident in the damage survey reports from Larry.

Building age is highly significant because it reflects both the level of conformance to the Building Code of Australia, and the degree to which factors such as metal fatigue and the corrosion of metal fixings may have progressed. Where buildings were structurally damaged, a common form of failure was the attachment of the battens to the rafters (see Figure 8).

It was evident that some of the older houses which had been retrofitted also performed well under the conditions. In particular, houses that had their roofs replaced in line with more recent building standards remained structurally sound after the event.

Many houses, irrespective of their age, also experienced water ingress of varying degrees. This occurred in houses that had suffered no structural damage as water entered through windows, doors and garages.

FIGURE 8: ROOF DAMAGE IN HUDSON

Wind loading standards in Australia were first implemented by structural engineers in 1952 and have been updated over time. After the experience of the severe destruction caused by Cyclone Althea (Townsville) in 1971 and Cyclone Tracy (Darwin) in 1974, efforts were made to strengthen building standards in Queensland and elsewhere in Australia, especially for domestic structures. Standard AS1170.2 Minimum design wind loads on structures was first published in 1973 and was subsequently revised in 1975, 1981, 1983, 1989 and 2002. This Standard was first adopted under the Queensland Building Act in 1975. However, housing was not explicitly addressed in the Act until the 1981 amendment. This was implemented in July 1982. The wind loading code is based on a design event for which there is a 5% probability of exceedance in any 50 year period (i.e. a notional 1,000 year Average Recurrence Interval or 0.1% Annual Exceedance Probability).

FIGURE 9: THE DIFFERENT BUILDING STANDARDS WERE VERY EVIDENT IN INNISFAIL

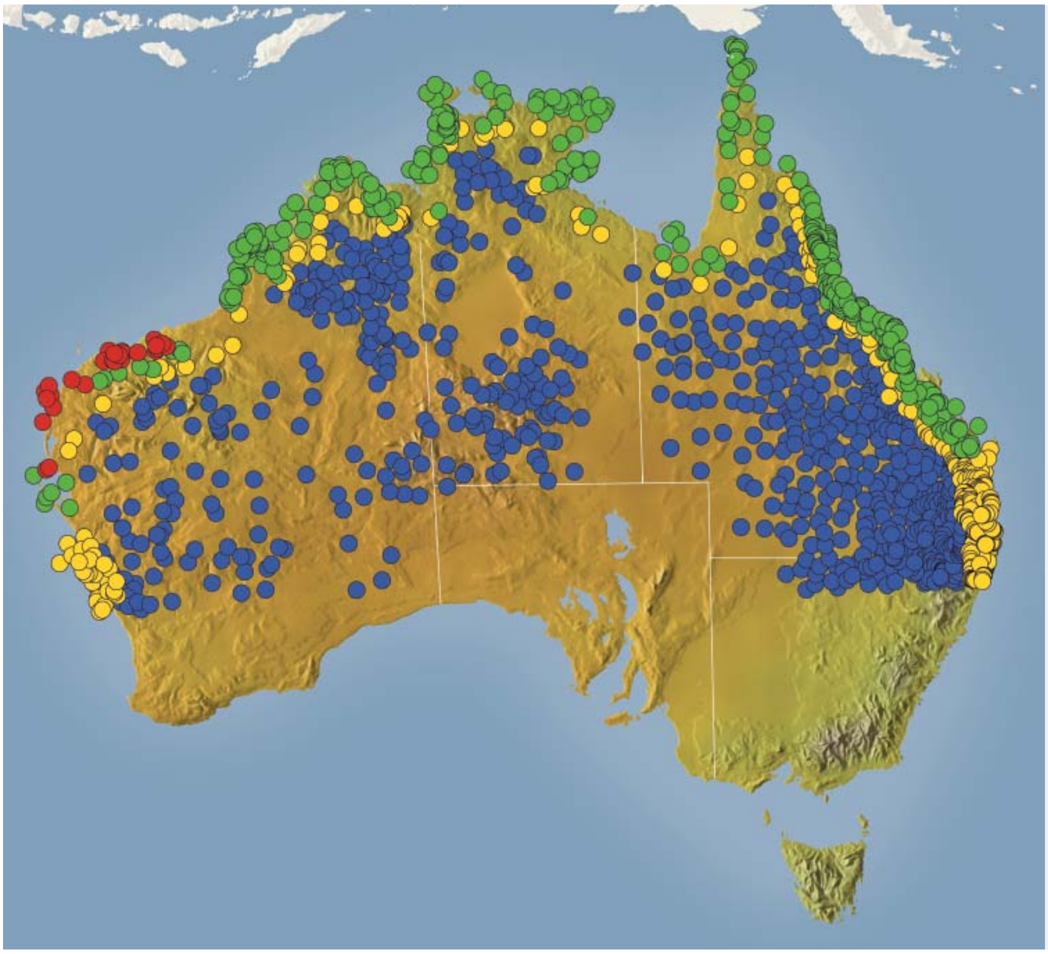
Australia is divided into different wind regions so that more rigorous construction requirements are applied to areas more exposed to tropical cyclones. In Figure 10, exposed Census Collection District centroids are classified according to these wind regions where region D is considered most at risk and region A4 least at risk to tropical cyclone winds.

FIGURE 10: CENSUS COLLECTION DISTRICTS DEFINED BY WIND LOADING DESIGN REGION

(Source: Risk Frontiers)

Wind regions by district

- D
- C
- B
- A4



From a catastrophe modelling perspective, it is important to distinguish between these different building types covering both construction and age. Analysis of the commercial catastrophe models covering Australia show that the percentage damage difference between various building types for a modelled 250 year probable maximum loss (PML) can be as high as 66%, with building age being the main differentiator.

Frequency of Landfalling Tropical Cyclones on the Australian East Coast

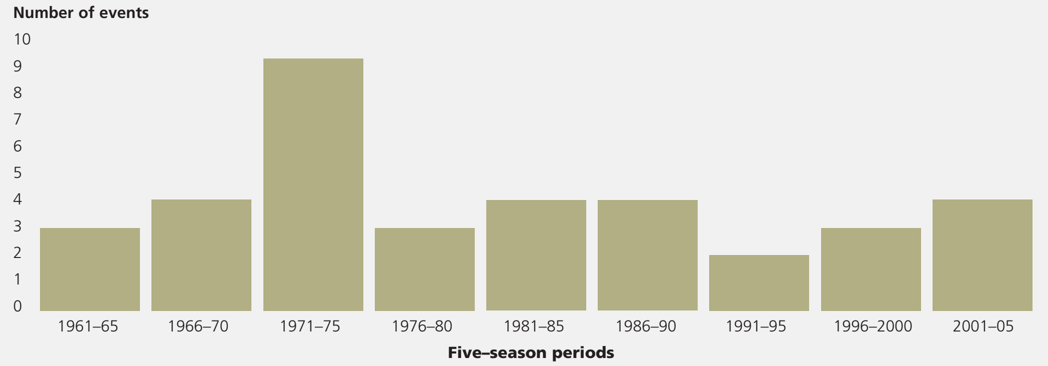
Having explored the damage caused by Cyclone Larry and the changing exposure and building standards along the Queensland coast, the following analysis focuses on the tropical cyclones that have crossed the east coast of Australia over the last 45 years and considers the potential implications had Larry made landfall in Cairns. Only events that crossed the coast with a central pressure less than or equal to 995hPa have been examined. The analysis begins from the 1961 season (November 1961 to April 1962) and ends at the 2005 season.

Cyclone activity in the South West Pacific region is strongly related to the El Niño - Southern Oscillation (ENSO), which is the name given to the large-scale spatial anomalies in sea surface temperature in the Pacific. Its extreme phases characterise the well-known El Niño and La Niña episodes. Cooler ocean temperatures exist in the western Pacific and Coral Sea during El Niño and ocean temperatures near the Queensland coast are typically above average during the La Niña phase. Consequently, cyclone activity tends to shift further away from the east coast of Queensland and further north during El Niño, resulting in fewer than normal landfalling cyclones. The opposite occurs during La Niña.

Figure 11 shows successive five-season period frequencies of cyclones that have crossed the east coast. Within each of the five-season periods, there are different numbers of El Niño, La Niña and neutral events. There has been between two and four cyclones for each of the five-season periods with only one exception, that being 1971-1975. It comes as no surprise that the La Niña phase of the ENSO cycle dominated this five-season period.

FIGURE 11: NUMBER OF TROPICAL CYCLONES TO CROSS THE EAST COAST OF AUSTRALIA DURING FIVE-YEAR PERIODS

(Source: Risk Frontiers)

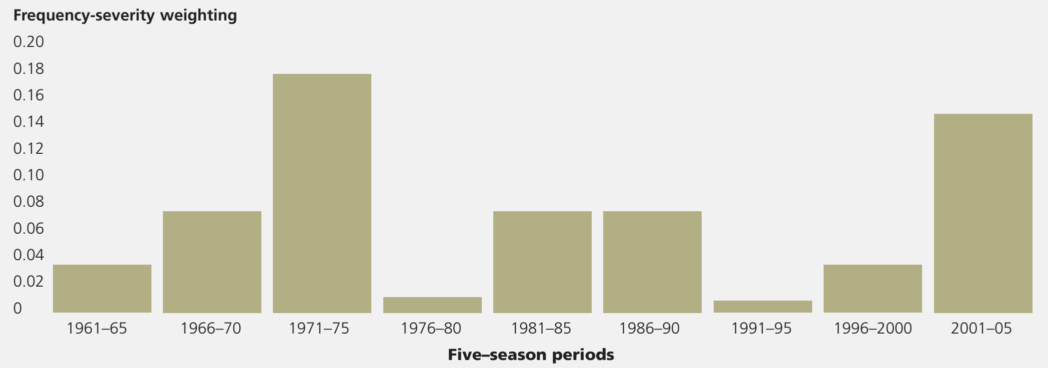


However, the results shown in Figure 11 only partially explain the damage potential of tropical cyclones in each five-season period. Another decisive factor is the intensity of each cyclone (see Figure 12). According to a study by William M. Gray[2], when normalised for coastal population, inflation, and wealth per capita, tropical cyclone generated damage rises dramatically with each tropical cyclone (damage potential) category. Hurricane destruction or loss potential goes up by a factor average of four for each increased category on the Saffir-Simpson scale.

Importantly, Gray also noted that damage extent for individual tropical cyclones varies significantly due to differences in coastal shape, terrain, population, wealth per capita, the direction and speed of the landfalling cyclone, storm surge and rainfall amounts. In Figure 12, a category 1 event has been assigned a weighting value equal to 1/256, category 2 = 1/64, category 3 = 1/16 and category 4 and 5 = 1/4. These are relative weightings based on Gray's research where a landfalling category 2 hurricane typically causes about four times the normalised damage of a category 1 hurricane and so forth.

FIGURE 12: COMBINED FREQUENCY-SEVERITY OF TROPICAL CYCLONES THAT HAVE CROSSED THE EAST COAST OF AUSTRALIA DURING FIVE-YEAR PERIODS

(Source: Risk Frontiers)



[2] *Source Ref: Gray (2003): Chapter 1 "Twentieth Century Challenges and Milestones", William M. Gray, 'Hurricane! Coping with Disaster" edited by Robert Simpson, American Geophysical Union, Washington. DC, 2003.*

What if Larry made landfall over Cairns

Therefore, there are many factors to consider when assessing the damage potential of a cyclone. Wealth per capita, population and the number and value of buildings within the vicinity of the landfall location are all key considerations. Consequently, as Larry came ashore only 95km (58 miles) south of Cairns, it is a good opportunity to consider the implications had the cyclone made a direct hit on the city.

In 2001, the total number of houses and flats covering a similar size area affected by Larry but centred on Cairns was approximately 44,000. This number represents residential buildings only and is based on Australian Census data. The number of residential buildings can be used to show that the potential impact in terms of exposure would be approximately 5.5 times more than the Innisfail region. Moreover, the resulting loss would be even greater than this as Cairns has a higher proportion of commercial, industrial and marine exposure. The overall increased demand on resources would also likely raise the level of post-event inflation (demand surge).

FIGURE 13: AERIAL PICTURE OF CAIRNS SHOWING THE CITY'S HIGH EXPOSURE

Also, if an equivalent event to Larry were to strike Cairns, there would be different terrain and topography characteristics. The storm surge would also be different because of the potential variances in bathymetry. Further differences include levels of insurance penetration and higher average sum insured values. One mitigating factor, however, is the higher proportion of post-1980 construction in the city.

Yet, with all these variables considered, and the current estimate for Cyclone Larry standing at more than A$350m (US$255m), analysis suggests that the insured loss could easily have reached between A$1.5-A$3bn (US$1.1-US$2.2bn) had Larry come ashore in Cairns.

Conclusion

The analysis carried out in this report shows that Tropical Cyclone Larry was not unusual in terms of severity or frequency. Wind speeds and storm size were comparable to Tropical Cyclone Tracy in 1974, yet the losses and damage statistics were very different to those in Darwin. This is testament to the improved quality of building design that was implemented to withstand cyclonic events.

Population density along with wealth per capita has risen significantly in these coastal regions increasing the actual physical exposure. However, because of the advancements in building standards the risk has not necessarily increased at the same proportion.

These factors also demonstrate the importance of providing detailed exposure data for the various catastrophe models to ensure more accurate results that reflect the building type and age within a portfolio. Construction pre-1980 can be as much as 66% more vulnerable in terms of modelled 250 PML than construction post-1980. Portfolios that fail to distinguish this type of information will be modelled on an average construction class which could potentially inflate or deflate loss figures depending on the portfolio construction mix.

Also, the overall final loss figure is very much determined by the impact of post loss inflation and it will be a number of months before these aspects are finalised.

Special thanks to Ryan Crompton of Risk Frontiers for his contribution to this report.

Risk Frontiers is a not-for-profit organisation, sponsored by insurance industry partners including Guy Carpenter. They provide insurers, reinsurers and reinsurance brokers with Probabilistic Catastrophe Models and Relative Risk Ratings on specific and combined perils in Australia and also undertake contract research for clients on a range of other topics involving natural perils including post-event damage surveys, building damage assessment and investment decision and cost-benefit analyses.

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Special thanks also to Arthur Williams of Cape York Airlines, Cairns, Queensland who carried out the aerial photography and provided the plane for the survey.

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