HARDEN UP QUEENSLAND

GREEN CROSS Australia

CASE STUDY: The Brisbane 1974 Floods Tropical Wanda

Tropical cyclone *Wanda* crossed the coast near Maryborough. Torrential rain followed and in the 5 days to 9am 29 January falls reached 900 mm in the Brisbane area. Mt Glorious had 1318 mm. The Bureau in Brisbane recorded 314 mm in the 24 hours to 9am 26 January and the 1931 flood was exceeded at 9am 27 Jan. In the Brisbane Ipswich region 6007 houses were flooded. 56 of these were destroyed or condemned. Some houses were completely washed away in the creek flooding. In the city of Ipswich 1,800 residential or commercial premises were partially or totally inundated and 41 houses were washed away. Damage on a large scale was 200 million 1974 dollars. 12 People were drowned in Brisbane and Ipswich. Additionally several elderly people suffered fatal heart attacks while being evacuated and a 2yr old child drowned in a Brisbane creek. Major floods also affected the Gold Coast and NE NSW. 700 people were evacuated from caravan parks in the Broadbeach area. Around 1000 people were evacuated from the canal estates of Miami Keys, Moana Park, Rialto, Mermaid Waters, Florida Gardens and Burleigh Waters. Houses were swamped from water up to 1.5m deep. Evacuations also occurred along the coastal strip at Surfers (where waist deep water flooded streets near the river), Miami, Nobbys (where water came up to window sills and to the tops of caravans) and Bundall Rd Southport where floods spread over the Isle of Capri and Sorrento.

Evacuations were carried out at Biggera Waters, Hollywell and Paradise Point. 200 people were stranded on Hope Island and Nerang was completely isolated. In total 2500 Gold Coast people were evacuated. The Nerang River rose to a record level of 9.91 m. Heavy swells caused severe beach erosion along southern Qld and NE NSW. The South Nobby station recorded significant swell heights to 4.5 metres. Maximum heights were probably nearly double this. The maximum storm surge associated with Wanda was 1.0 m between Noosa and Double Island Point.

Major flooding occurred in the Nerang River, The Brisbane City CBD, upper Brisbane, Bremer, Warrill and Logan rivers and creeks. See Bureau of Meteorology report of these floods- http://www.bom.gov.au/hydro/flood/qld/fld_reports/brisbane_jan1974.pdf

Mean Sea Level

Wanda was a weak cyclone when it crossed the coast near Maryborough (see Figure 1).The winds were strongest in the night after landfall. This occurred as the pressure gradient increased (right frame Figure 1) as the pressure dropped in the centre of the weak cyclone and at the same time a high strengthened in the Tasman Sea. Tewantin and Caloundra then had average 50 knot easterlies and Cape Moreton had average 56 knot easterlies.

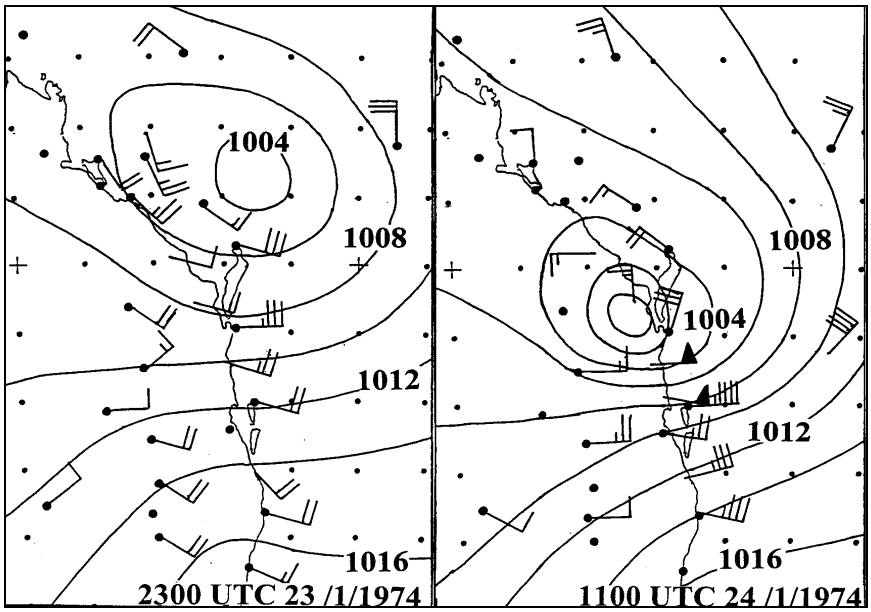


Figure 1 Mean sea level analyses of the landfall of tropical cyclone *Wanda.*

Wanda then moved inland (Figure 2) and became absorbed into a large overland monsoon depression. Note the strong high in the Tasman Sea forming a strong blocking pattern.

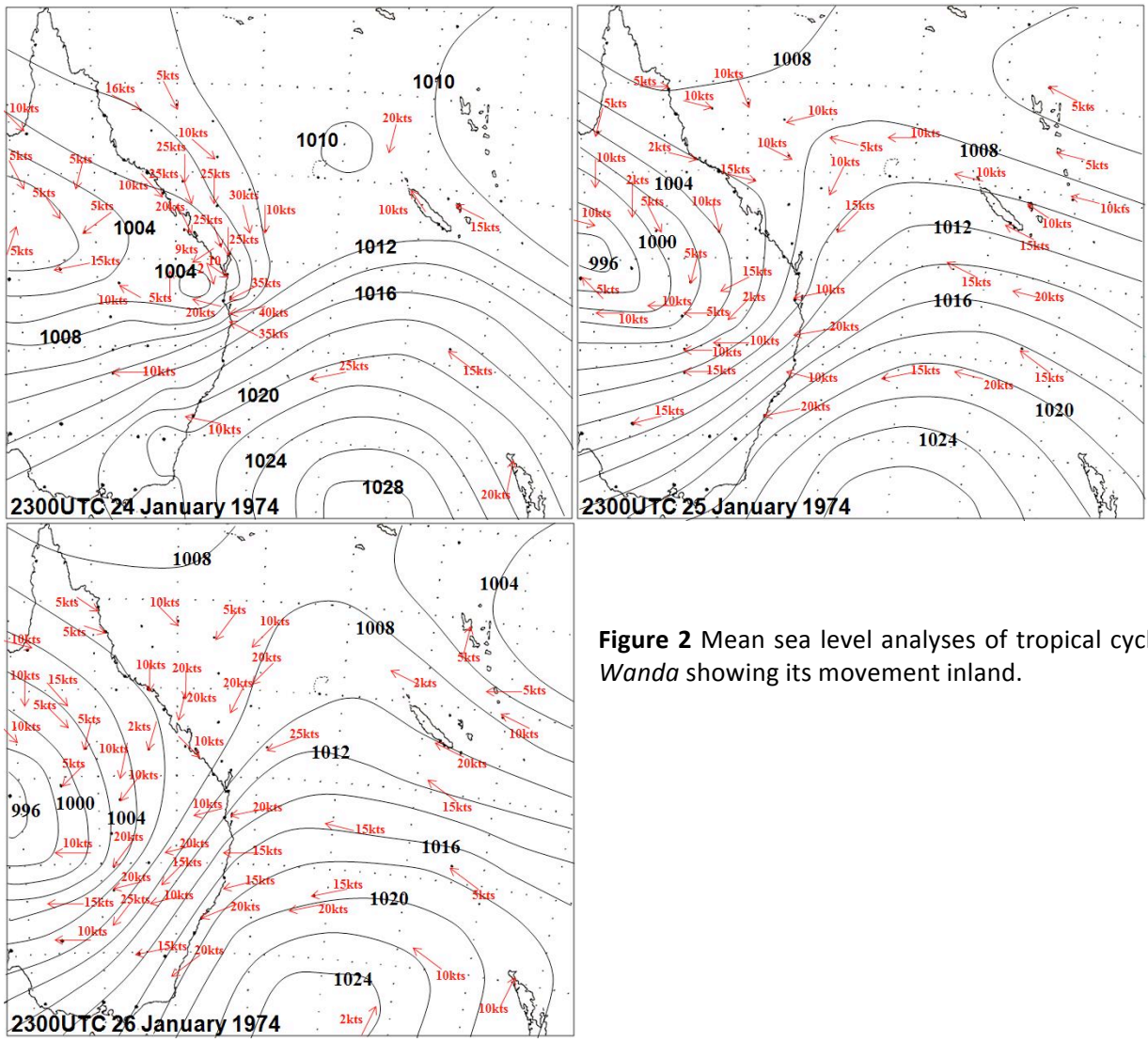


Figure 2 Mean sea level analyses of tropical cyclone *Wanda* showing its movement inland.

Rainfall

For the five day period from 9am Thursday 24 January 1974 to 9am Tuesday 29 January 1974 rainfall in the Brisbane metropolitan area ranged from 500mm to 900mm and exceeded 300mm in all but the extreme western parts of the Brisbane River catchment area. Among the highest 5 day totals were 1318mmm at Mount Glorious, in the catchment of the middle reaches of the Brisbane River, and 819mm at New Beith, near the head of Oxley Creek. The Brisbane Bureau recorded 650mm during this period.

In the catchments of the Brisbane Metropolitan creeks heavy rain commenced about 2am on Friday 25 January and continued until about 2pm the same day. During that 12 hour period falls ranged from 197mm at the Bureau to 236mm at Enoggera Reservoir and 280mm at Mount Nebo. The rain then eased but between 6pm Friday and 3am Saturday 26 January very intense rainfall was experience for the second time with 151mmm being recorded at the Bureau, including 82mm between 9pm and midnight. In this latter 3hour period 202mm fell at Enoggera Reservoir.

Near continuous rain interspersed with particularly heavy falls continued over the Brisbane Valley during Saturday 26 January and Sunday 27 January. At the Bureau the third period of intense rainfall was experienced between 5pm Saturday and 3am Sunday 27 January, when 132mm were recorded, and although the rain eased on Sunday, 47mm were recorded in the 24hours to 9am Monday 28 January.

Interaction with the middle and upper levels.

As described above *Wanda* showed an intensification tendency at landfall and this was associated with elements we observe with East Coast Low (ECL) development. The development of ECLs are reasonably easy to understand using an approach suggested in the nineties by Hirschberg and Fritsch (e.g. 1993) which is consistent with the potential vorticity arguments of Hoskins et al (1985). The low level cyclone develops as an area of 200hPa warm temperature advection (associated with a tropopause undulation) moves over the heavy rain area to the east of the developing low-pressure system. The tropopause undulation is very easily detected on 200hPa charts as a large warm temperature anomaly centre. The heavy rainfall area can be detected by warm air advection flow at 700hPa.

We have found this to be applicable to all major ECLs affecting Australia since the early 1960s. Below we see some degree of 200hPa warm air advection over the Brisbane region as *Wanda* made landfall. This advection is much weaker than you would see with an ECL but the 700hPa warm air advection is similar to what you would see with an ECL. This intensification pattern is typical with what we call a tropical hybrid type development. The 700hPa warm air advection over Brisbane at 2300UTC 24 January 1974 (right lower frame Figure 3) was coincident with the period of heaviest rain at Brisbane Airport with 61mm in the past 6hours and 128mm in the next 6hours.

References cited above

Hirschberg Paul A. and J. Michael Fritsch 1993.On Understanding Height Tendency *Mon.Wea. Rev*. Vol. 121, No. 9, pp. 2646–2661.
Hoskins, B.J., I. Draghici and H. C. Davies. 1978. A new look at the Omega equation. *Quart. J. or the Roy Met. Soc*. 104, 31-38.

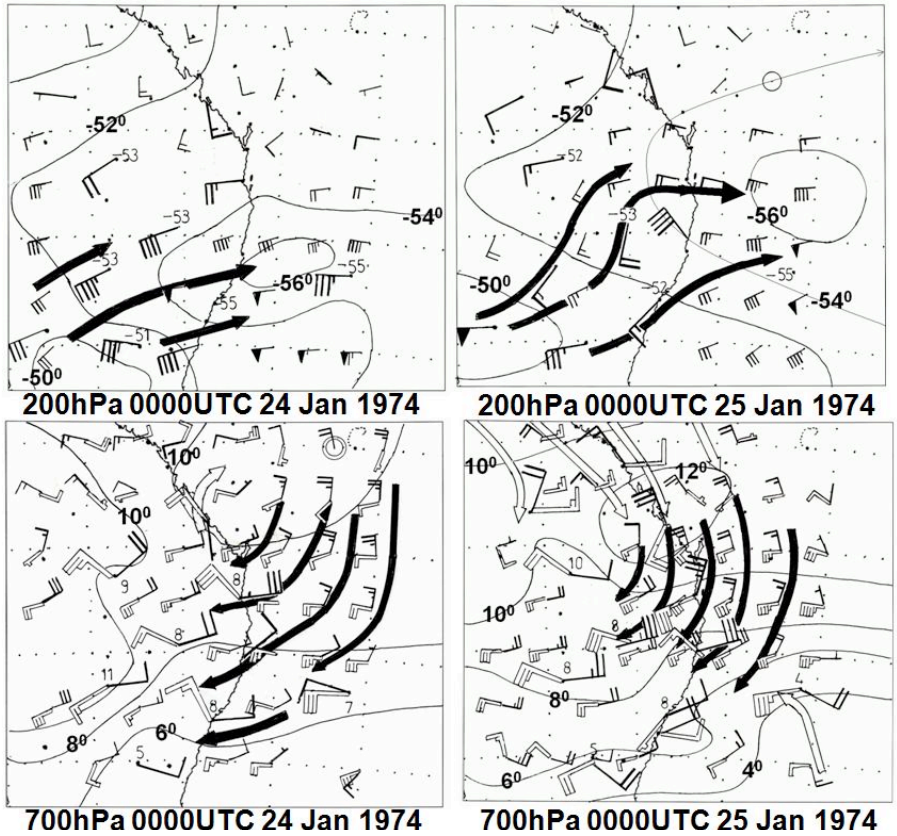


Figure 3 NCEP/NCAR wind and Temperature data with actual observations also plotted (large plots). Top frames 200hPa and lower frames 700hPa with 850hPa to 500hPa shears (unfilled plots) also shown. Large black stream lines indicate 700hPa warm air advection region.

Creek Flooding

Much of the loss of life and the worst house damage occurred with the flash flooding Brisbane and Ipswich creeks. The fast response of most of these systems makes warning very difficult and in Figure 4 the incredible hast response of Kedron Brook in Brisbane's western suburbs is shown.

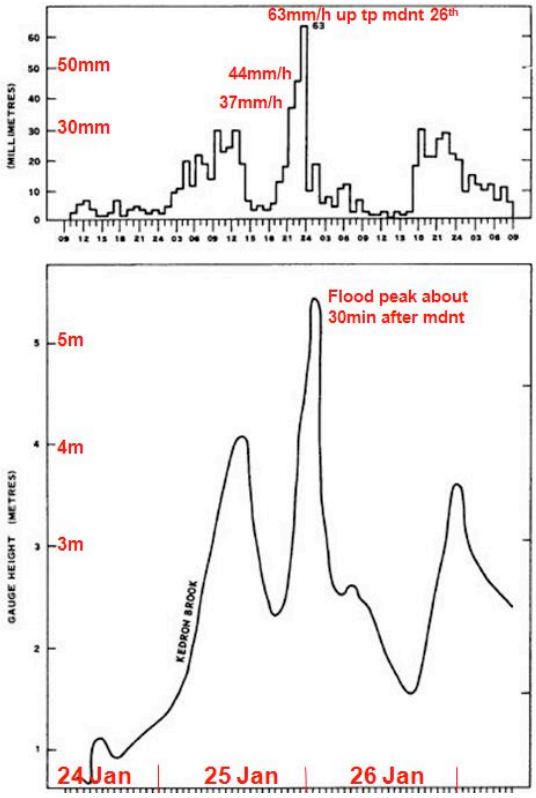


Figure 4 Flood hydrograph of Kedron Brook at Osborne Road. The rainfall hyetograph at the top of the diagram shows how rapidly the brook responds to the heavy rainfall.

There were considerable problems in issuing warnings for the Ipswich creeks. No specific warnings were issued for the several flash floods that occurred in the Deebing, Bundamba, Woogaroo, Sandy and Ironpot Creeks, although warnings of major flooding were current for the main river systems. Most of these creeks attained record levels and caused considerable damage. No significant flood problems had been experienced in the creeks in the twentieth century and network development at the time in the area was inadequate to provide even factual data, let alone specific warnings.

Bremer River

The unprecedented run off from these creeks led to (along with the increased run off from the main Bremer River and Warrill Creek catchments) very rapid rises in the Bremer River at Ipswich.

The Bremer rose by more than 10.5metres during Saturday 26 January to reach a height of 19.35metres by 6am Sunday 27January. Subsequently a peak of 19.7metres was recorded at Ipswich at 3pm Sunday but the recession in the Bremer River Flooding was counteracted by backwater flooding from the Brisbane River. This resulted in the Bremer at Ipswich remaining at a height above 19.2metre for around 39hours.

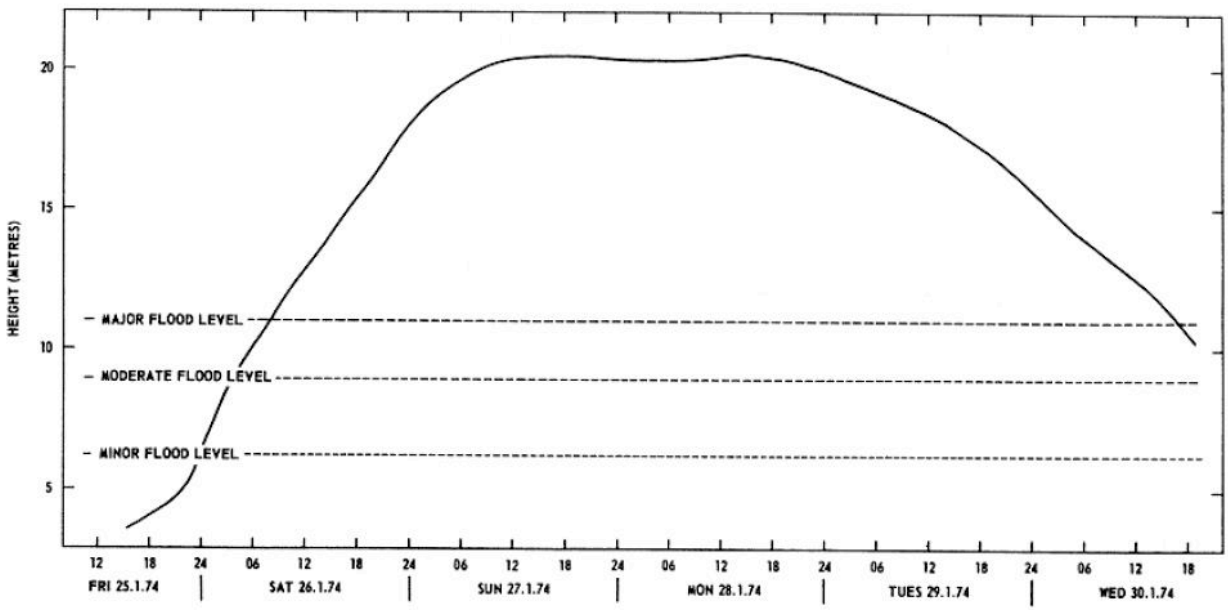


Figure 5 Flood hydrograph of the Bremer River at Ipswich 25-30 January 1974.

Brisbane River

In the Brisbane City Reaches of the Brisbane River the imminence of a major flood was not apparent during the daylight hours of Saturday 26 January. A minor flood height of 3.56m occurred at the Port Office gauge on the high tide at noon 26 January, to which the main contributions were local Brisbane Creek run off and a storm surge in Moreton Bay. However with the heavy catchment rain it continued to rise and passed the 1931 height at 9am Sunday 27 January when the Port office Gauge reached 4.5metres. It was the heavy rain which fell over most of the Brisbane Valley principally during the period 3pm Saturday and 3pm Sunday which was responsible for converting a minor flood in Brisbane into one of major proportions. From Figure 6 the River at the Port Office peaked at 6.6metres (5.45m on the datum used today) on the high tide at 2.15am Tuesday 29 January.

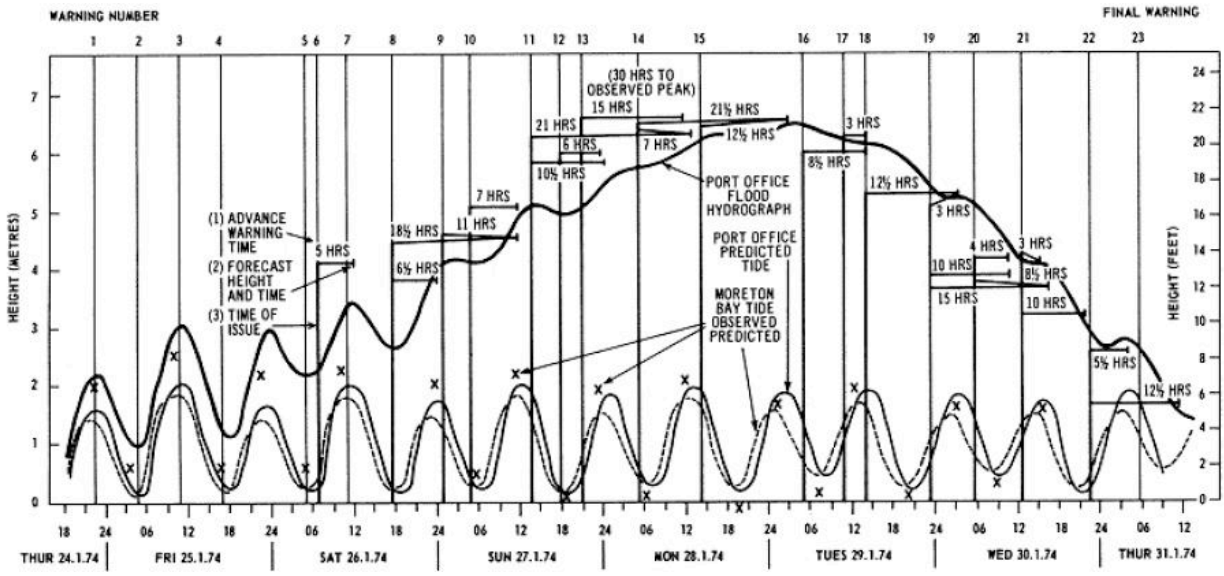
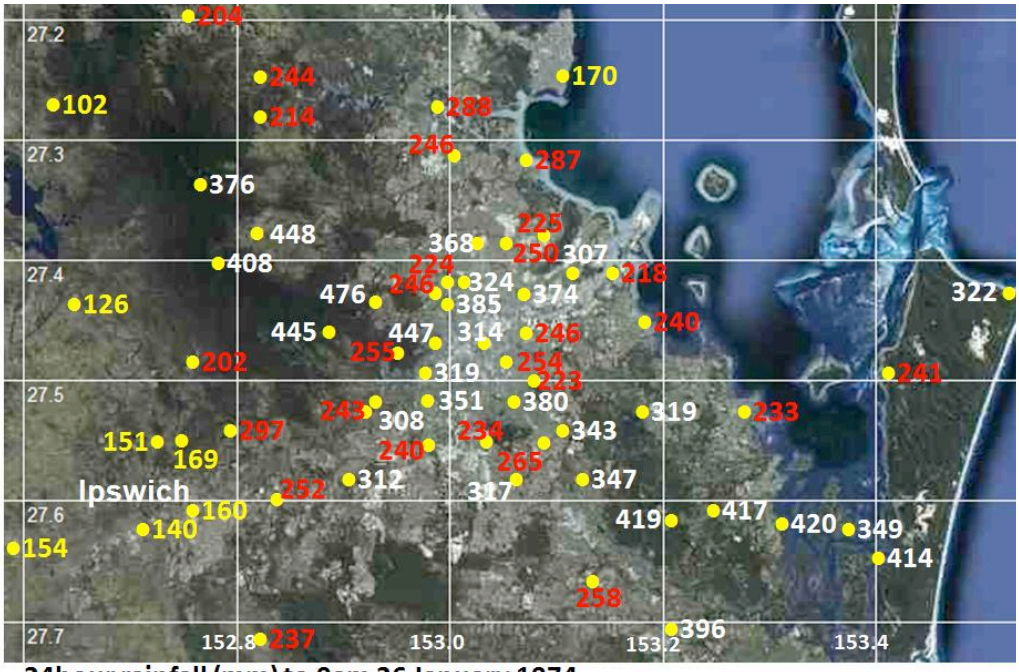
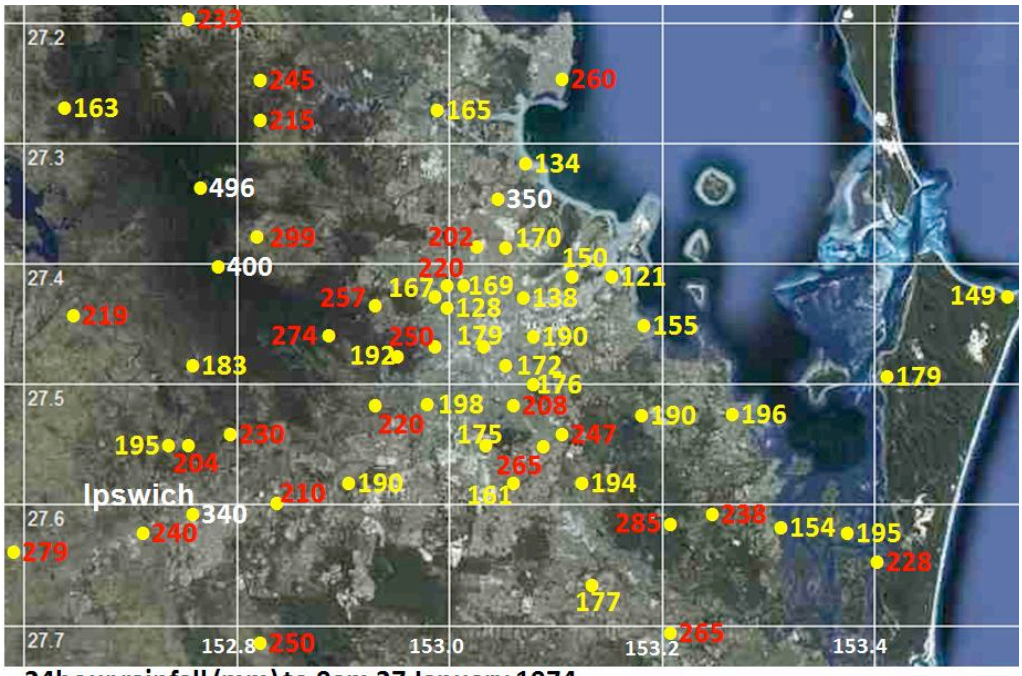


Figure 6 Flood hygrograph of the Brisbane River sat the Port Office 24-31 January 1974 together with observed and predicted Moreton Bay tides.

Rainfall Maps in the Brisbane Region



24hour rainfall (mm) to 9am 26 January 1974
Enoggera Rsv. 476mm Highvale 448mm Mt Cootha 447mm Gold Ck. 445mm



24hour rainfall (mm) to 9am 27 January 1974
Mt Glorious 496mm Mt Nebo 400mm

Figure 7 shows the heavy rainfall which was reported in the Brisbane region with the largest totals on the ranges just west of the CBD with a secondary peak in the Mount Cotton Redland Bay region (southeast sector top frame). 24 hour rainfall totals in the Brisbane region for 26 January 1974 (top) and 27 January 1974 (bottom). Totals (mm) greater than 300mm (white) 200mm-300mm (red) and less than 200mm (yellow).

Gold Coast Rainfall Maps

In Figure 8 the heavy rainfall in the Gold Coast region is shown with three reports of 24 hour totals in excess of 500mm.

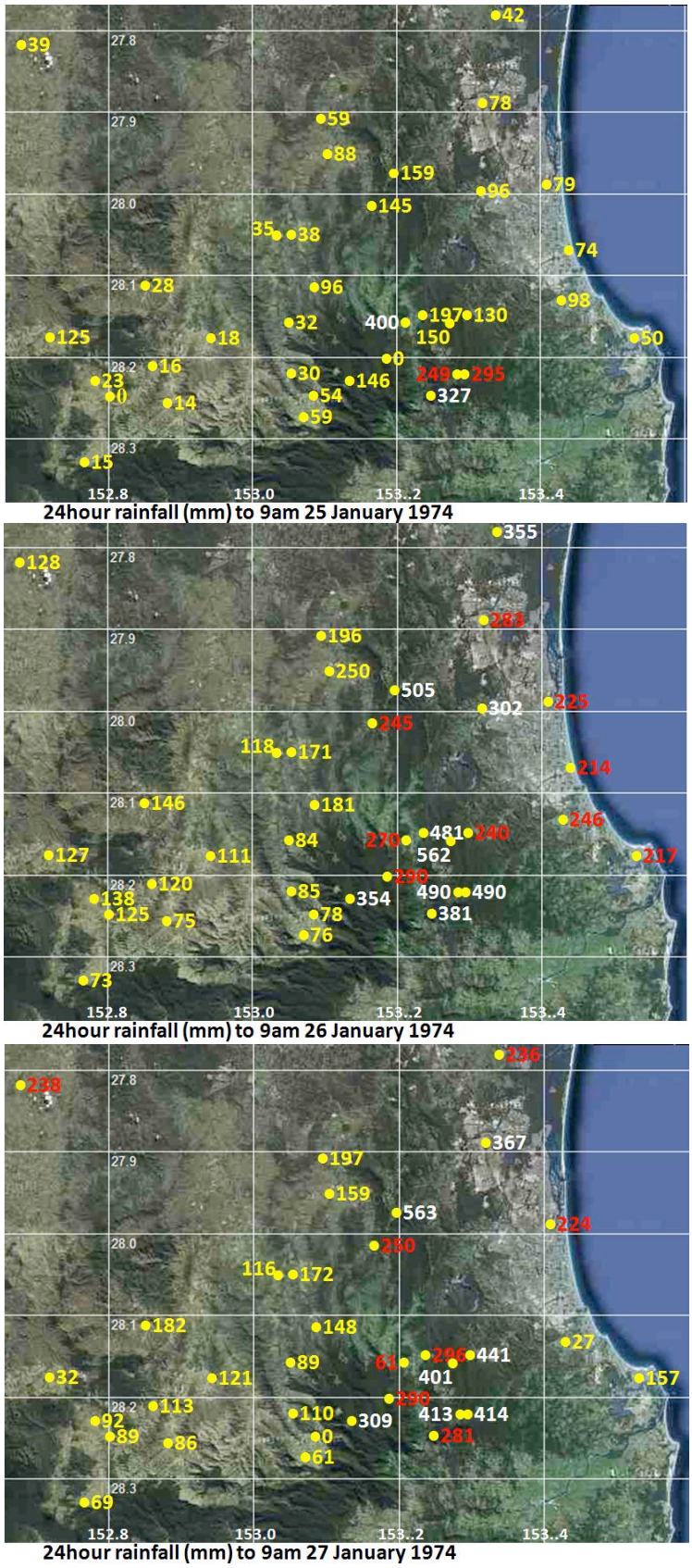


Figure 8 24 hour rainfall totals in the Gold Coast region for 25 January 1974 (top), 26January 1974 (centre) and 27 January 1974 (bottom). Totals (mm) greater than 300mm (white) 200mm-300mm (red) and less than 200mm (yellow).
Heaviest storm rainfall

Overall from Figure 9 the heaviest rain fell highest rain fell on the ranges just west of the coast with Springbrook and Mount Glorious both recording 1152mm.

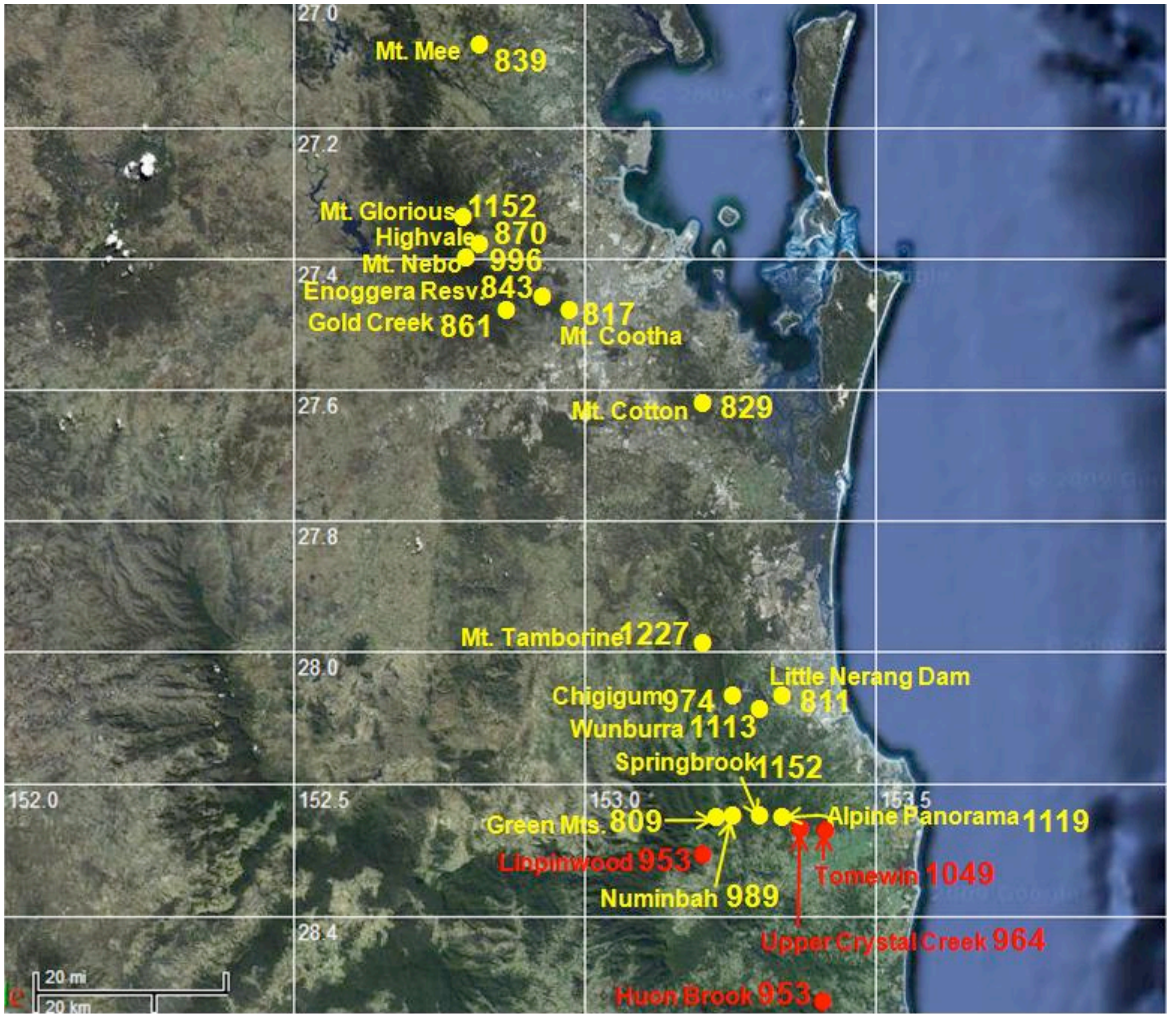


Figure 9 Rainfall (mm) in the 72hours to 9am 28 January 1974 – Totals greater than 800mm –Yellow (Queensland) Red (NSW).