

CASE STUDY: Tropical Cyclone Ului, March 2010

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From Figures 1 to 3 *Ului* (the western cyclone) halted its westward movement and turned towards the south. *Tomas* accelerated to the south (Figure 1) and then towards the southeast so that the domain in the remaining figures have been shifted west. *Ului* slowly weakened during the period but remained a very strong system and along with the high to the south it generated a huge area of gales in the Coral Sea. Ship reports indicated the very large seas and in Figure 3 there were reports of ships rolling and pitching heavily in 6 to 7metre waves. During 19 March (Figure 4) *Ului* began moving towards the southwest and closer to the Queensland Central Coast. It was weakening fairly rapidly as the interaction with a passing trough in the middle levels of the atmosphere caused it to tilt, which prevented the rain and thunderstorms wrapping completely around the centre.

We can see this in the top frame of Figure 5 when the red areas in the microwave images are heavy rain grading down to the light rain in the green areas. However the effects of the passing middle level trough began to diminish and *Ului* started to stand more upright and re-intensify. We can see rain areas start to wrap around its northern side by 2100UTC 19 March (lower frame Figure 5). By 0800UTC 20 March (top frame Figure 6) it has clearly formed a tight eye with very heavy rain around the southern side of the eye. Creal Reef Automatic Weather Station (AWS) can be seen to be reporting south-southeast winds averaging 59knots at the time. 52 minutes later the AWS reported average winds of 73knots from the southeast and the barometer had fallen to 989.3hPa.

Five hours later at 1300UTC 20 March (lower frame Figure 6), *Ului* had passed north of Creal Reef and was heading towards Hamilton Island, which was reporting south-southeast winds averaging 54knots. Two hours later at 1500UTC, the average wind at Hamilton Island was averaging 84 knots (Figure 7) and the bar had dropped to 977.9hPa. Maximum winds averaging 93knots from the southeast were recorded at Hamilton 19minutes earlier when the bar was 976.3hPa. The AWS on Hamilton Island is located on a hill 56metres high and obviously receives much more wind than the sheltered parts where the resort facilities are located.

Significant wind damage was reported around the Central Coast and Whitsundays district, mainly between Airlie Beach and Mackay. Reports of damage include widespread tree damage, large areas of sugarcane destroyed and localised structural damage, particularly to roofs. About 50,000 homes lost power following the passage of the system. The worst coastal damage from wind and storm surge was at Midge Point. Many boats were also damaged or destroyed due to large seas and swell created by *Ului*, particularly around Shute Harbour near Airlie Beach.

Unfortunately a young champion lifesaver lost his life after being struck by his surf ski in the vicious Kurrawa shore break during the Australian titles on 19 March. At the time the Tweed buoy was recording significant wave heights of 2 metres approaching from the east-northeast (60degrees). These waves probably emanated from angular spreading of the massive southeast swell heading up into the northwest Coral Sea. See the ship reports in Figures 3 and 4 northeast of Fraser Island where average swell heights of 6 to 7metre from the southeast were reported.

Waves

Record wave heights were recorded on the Mackay buoy, which was installed in September 1975. The significant wave heights reached 5.7metres and the maximum wave height of 9.4 metres late on the 20th and early on 21st. At the time the peak periods were 10 seconds and the waves came from the east-southeast (107 degrees). Figures 8 and 9 illustrate detailed analyses of wind and pressure fields to show how such large waves can be generated inside the Great Barrier Reef.

Significant wave heights approaching from the east reached 3metres in the semi-sheltered waters where the Emu Park buoy is located on the afternoon and evening of the 20 March. Largest waves on the Southeast Queensland buoys were at Mooloolaba where the significant wave height reached 3 metres around 4pm local time 20 March. These waves had a peak period of 11 seconds and came from the east northeast (60 degrees).

Storm surge

The largest storm surge measured was on the Laguna Keys tide gauge. It peaked at 2.45metres at 02.20am on 21 March 2010. In Figure 10 the heavy radar reflectivity south of *Ului* (eyewall) can be seen moving towards Laguna Keys. In this report we have used data from the Bureau of Meteorology, observational data from Pacific Island Nations and data from the National Centres for Environmental Prediction/ National Centre for Atmospheric Research (NCEP/NCAR) Reanalysis Project, which is available at: http://nomad3.ncep.noaa.gov/ncep_data/index.html. Wind data was also obtained from the Advanced Scatterometer (ASCAT) aboard the EUMETSAT METOP satellite: <http://manati.orbit.nesdis.noaa.gov/ascat/>. Wave data was obtained from the Queensland Government Environment Protection Agency's web site at: http://www.epa.qld.gov.au/environmental_management/coast_and_oceans/waves_and_storm_tides/wave_monitoring/. Microwave data obtained from the US Navy Naval Research Laboratory site: http://www.nrlmry.navy.mil/tc_pages/tc_home.html

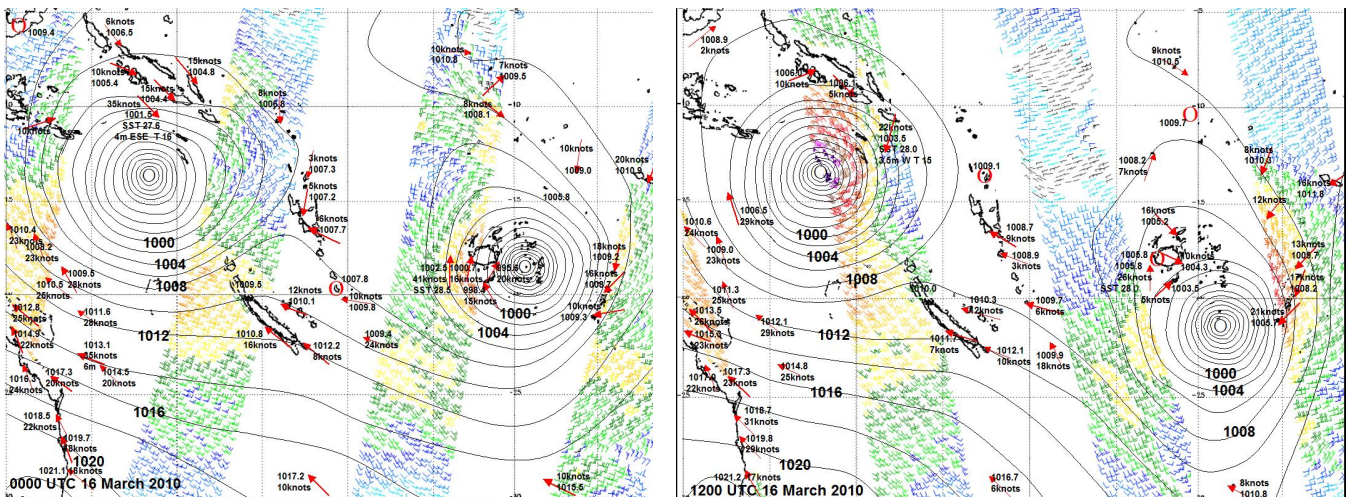


Figure 1 Mean Sea Level Pressure analyses with available observations (including ships) overlaid on Ascat wind fields for 0000UTC 16 March 2010 (10am Australian Eastern Standard Time 16th) and for 1200UTC 16 March 2010 (10pm Australian Eastern Standard Time 16th).

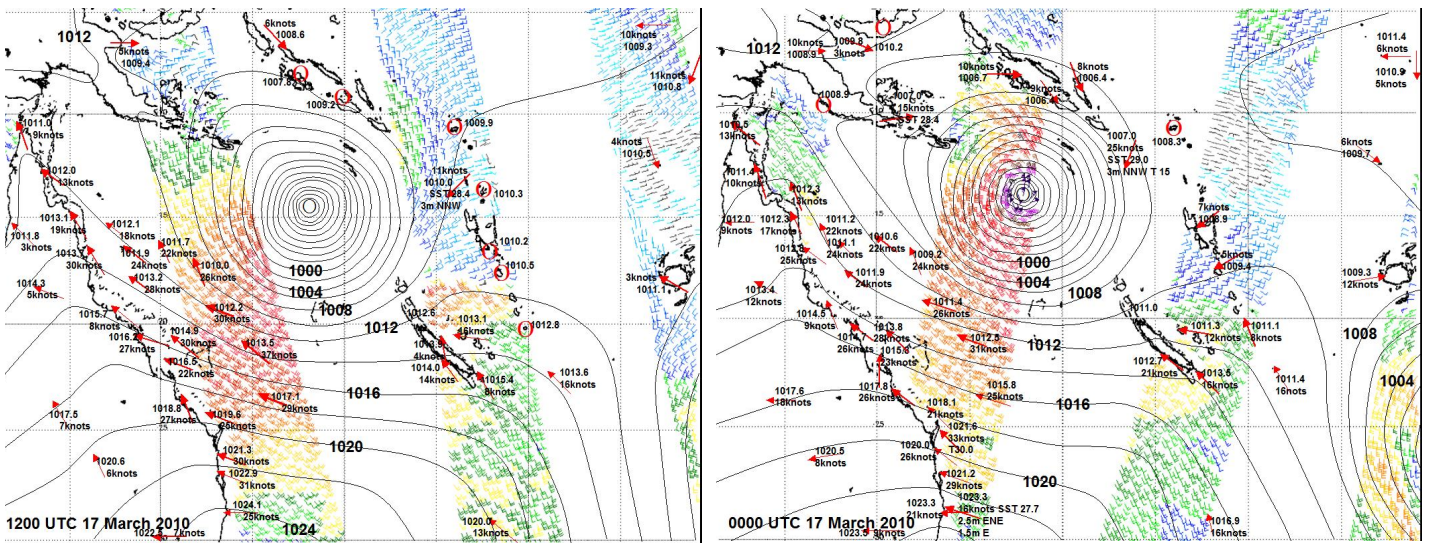


Figure 2 Mean Sea Level Pressure analyses with available observations (including ships) overlaid on Ascat wind fields in the top frame for 0000UTC 17 March 2010 (10am Australian Eastern Standard Time 17th) and in the lower frame for 1200UTC 17 March 2010 (10pm Australian Eastern Standard Time 17th).

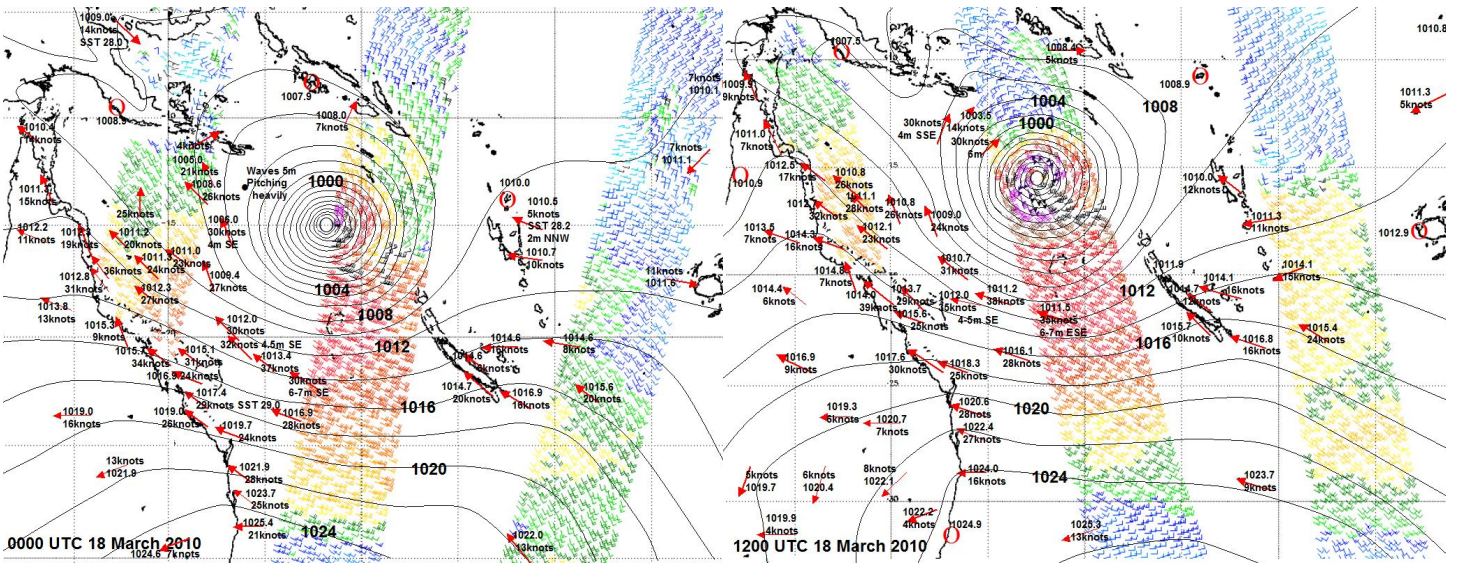


Figure 3 Mean Sea Level Pressure analyses with available observations (including ships) overlaid on Ascat wind fields in the top frame for 0000UTC 18 March 2010 (10am Australian Eastern Standard Time 18th) and in the lower frame for 1200UTC 18 March 2010 (10pm Australian Eastern Standard Time 18th).

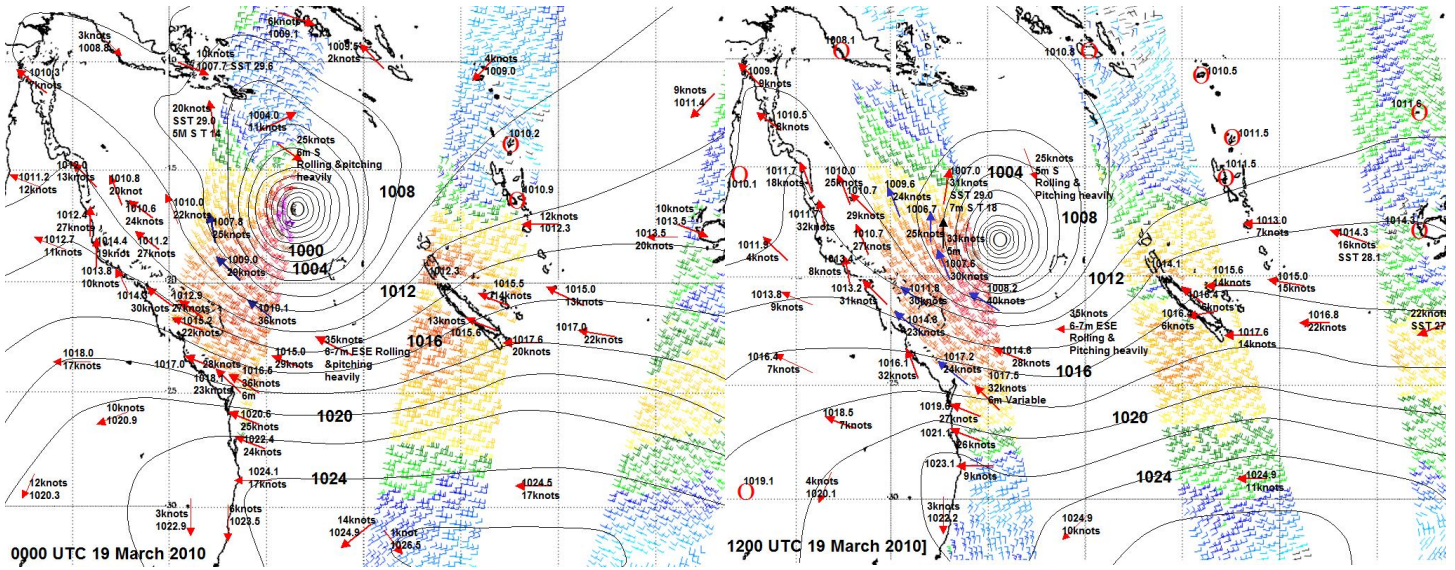


Figure 4 Mean Sea Level Pressure analyses with available observations (including ships) overlaid on Ascats wind fields in the top frame for 0000UTC 19 March 2010 (10am Australian Eastern Standard Time 19th) and in the lower frame for 1200UTC 19 March 2010 (10pm Australian Eastern Standard Time 19th).

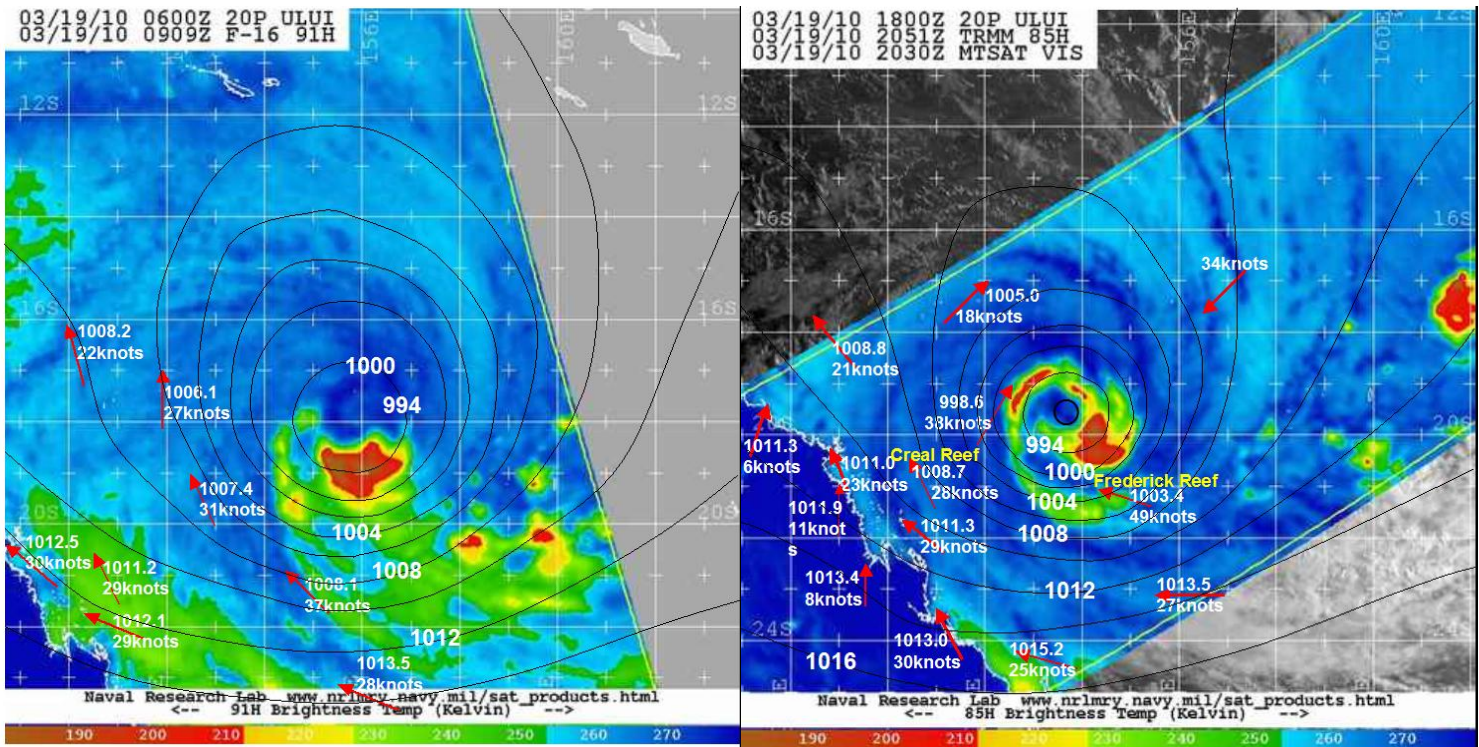


Figure 5 Microwave data, mean sea level pressure and wind observation and isobars every 2hPa to 1000hPa then the 994hPa isobar is drawn and a centre circle to highlight a defined eye. In top panel for 0909UTC (0900UTC observations and isobars) 19 March 2010. Bottom panel for 2051UTC (2100UTC observations and isobars) 19 March 2010.

Tropical Cyclone Ului, March 2010

Data by J. Callaghan

28th September 2011

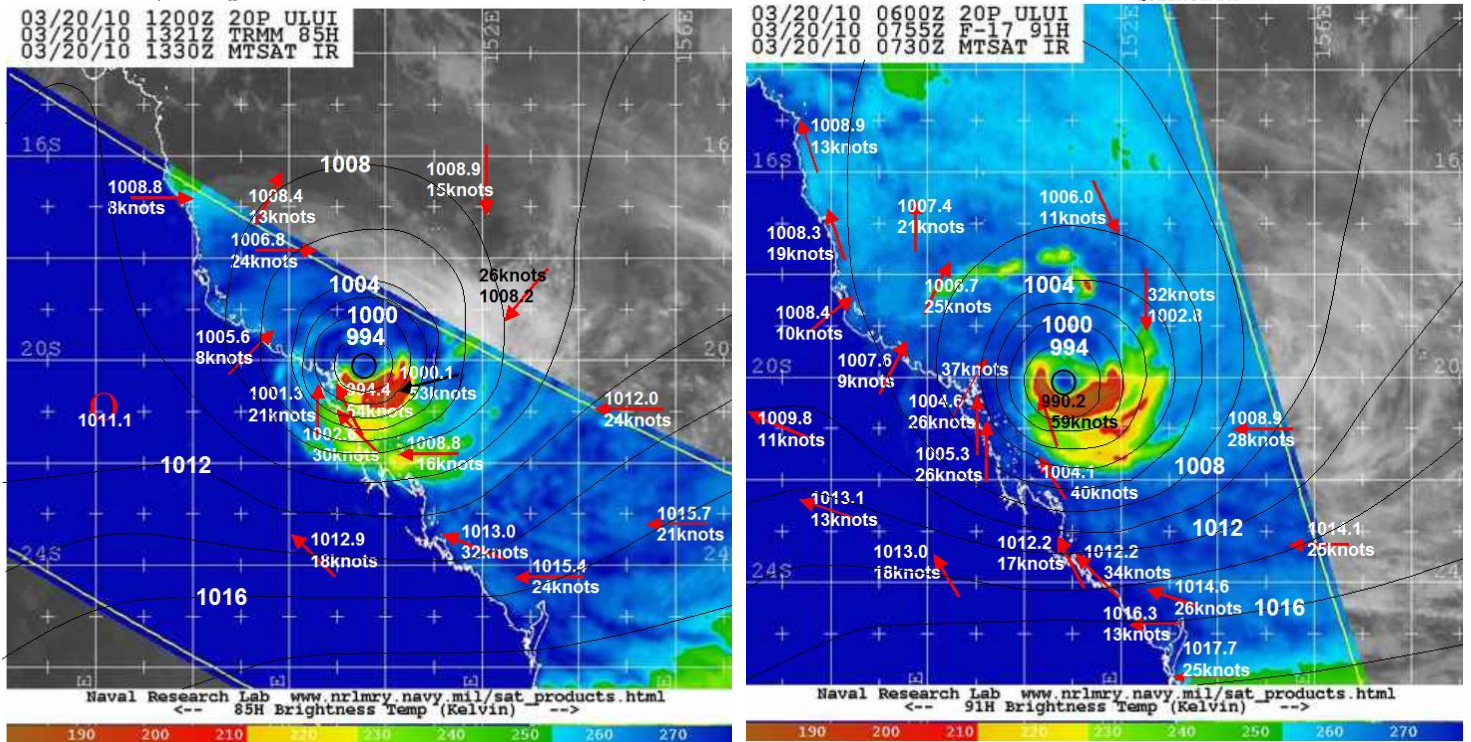


Figure 6 Microwave data, mean sea level pressure and wind observation and isobars every 2hPa to 1000hPa then the 994hPa isobar is drawn and a centre circle to highlight a defined eye. In top panel for 0755UTC (0800UTC observations and isobars) 20 March 2010. Bottom panel for 1321UTC (1300UTC observations and isobars) 20 March 2010.

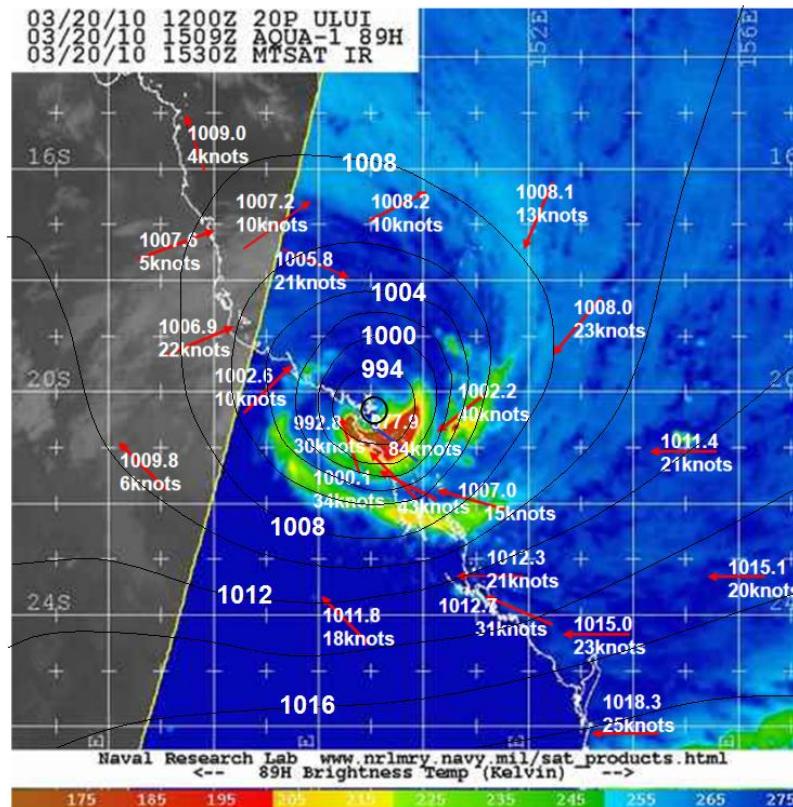


Figure 7 Microwave data, mean sea level pressure and wind observation and isobars every 2hPa to 1000hPa then the 994hPa isobar is drawn and a centre circle to highlight a defined eye for 1509UTC (1500UTC observations and isobars) 20 March 2010.

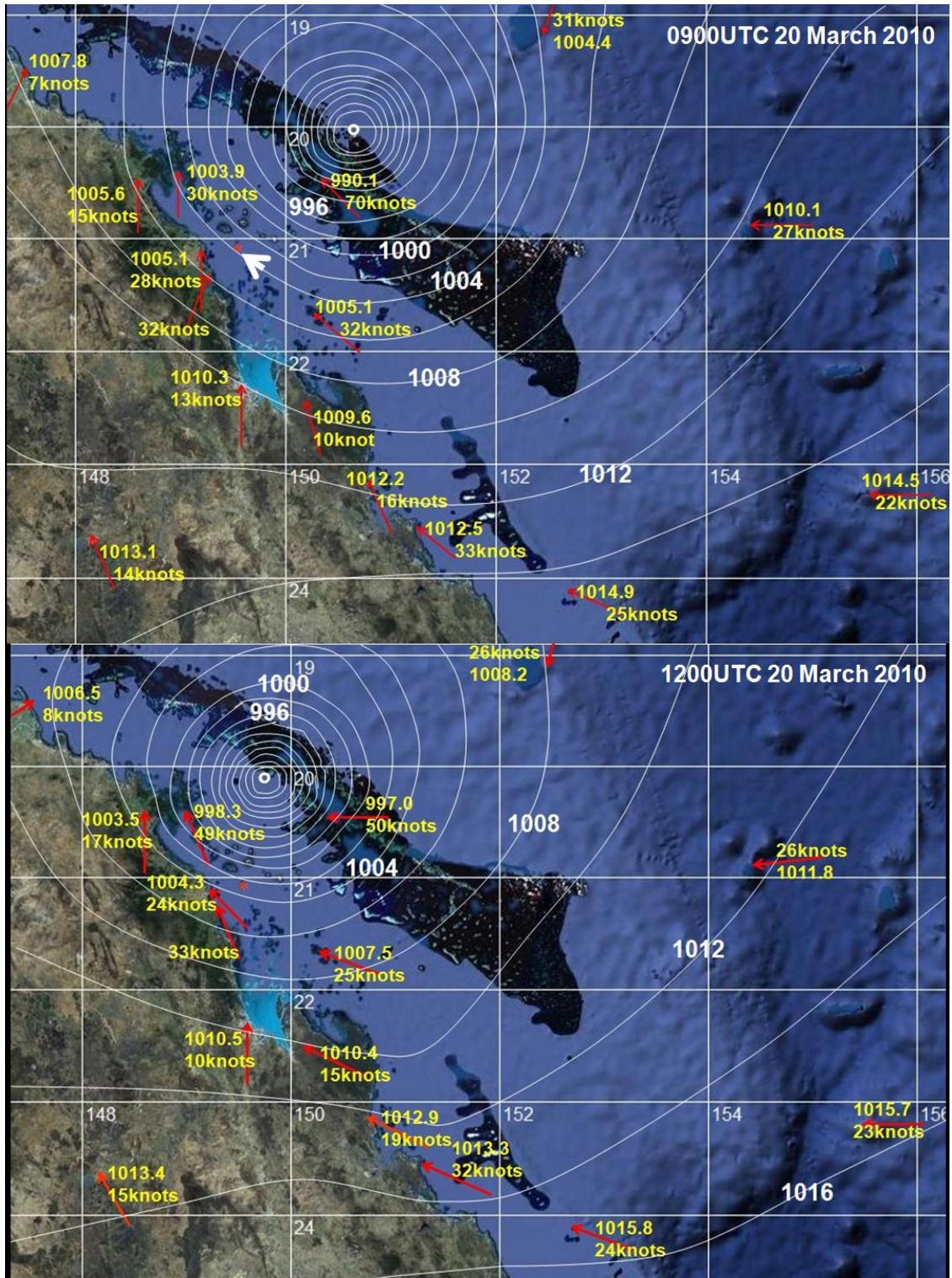


Figure 8 Mean sea level pressure analyses with pressure and average wind observations for 0900UTC 20 March 2010 (top) and 1200UTC 20 March 2010 (bottom) the Mackay wave rider buoy is marked by the red dot (highlighted by the white arrow in the top frame).

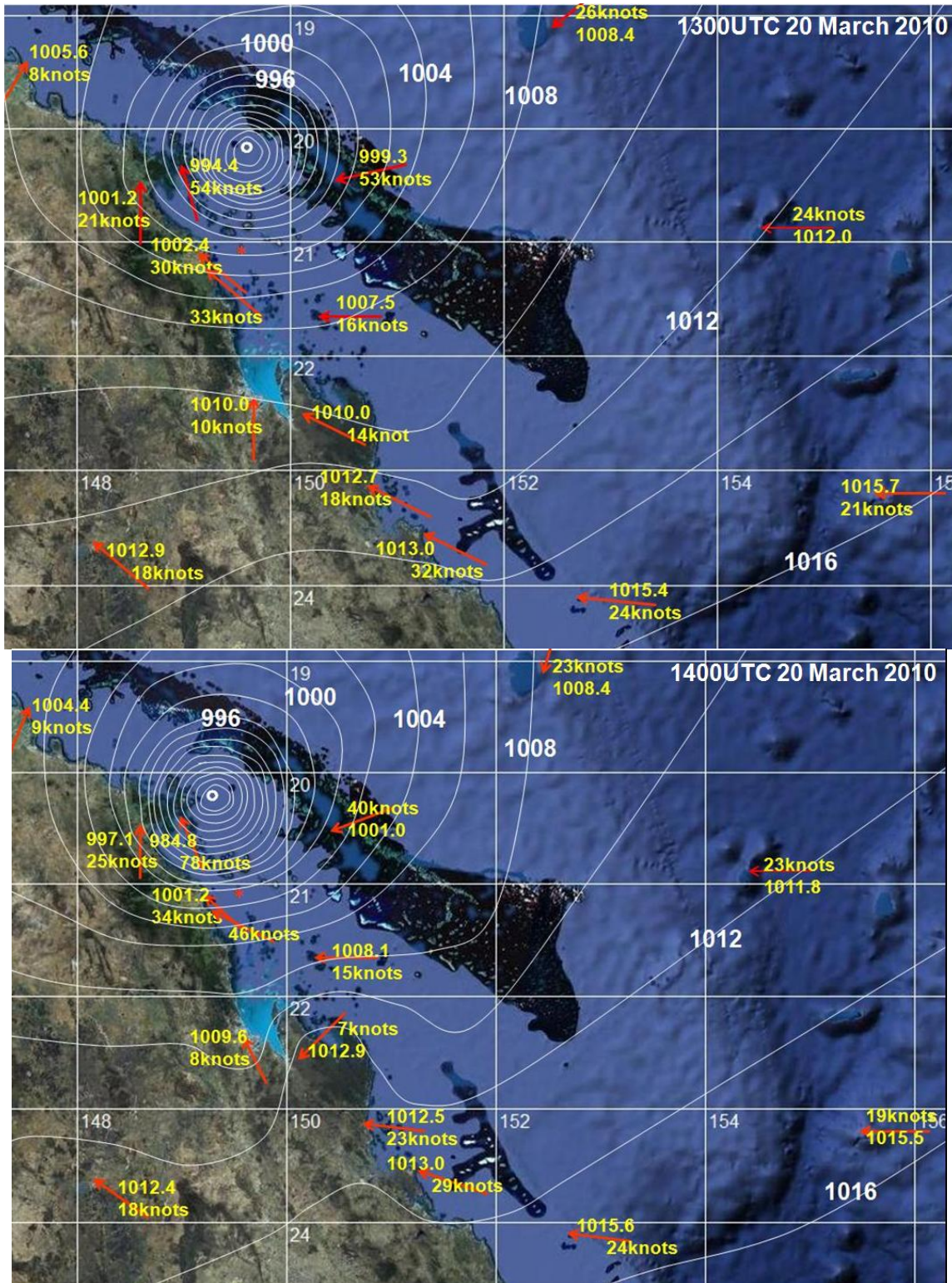


Figure 9 Mean sea level pressure analyses with pressure and average wind observations for 1300UTC 20 March 2010 (top) and 1400UTC 20 March 2010 (bottom) the Mackay wave rider buoy is marked by the red dot.

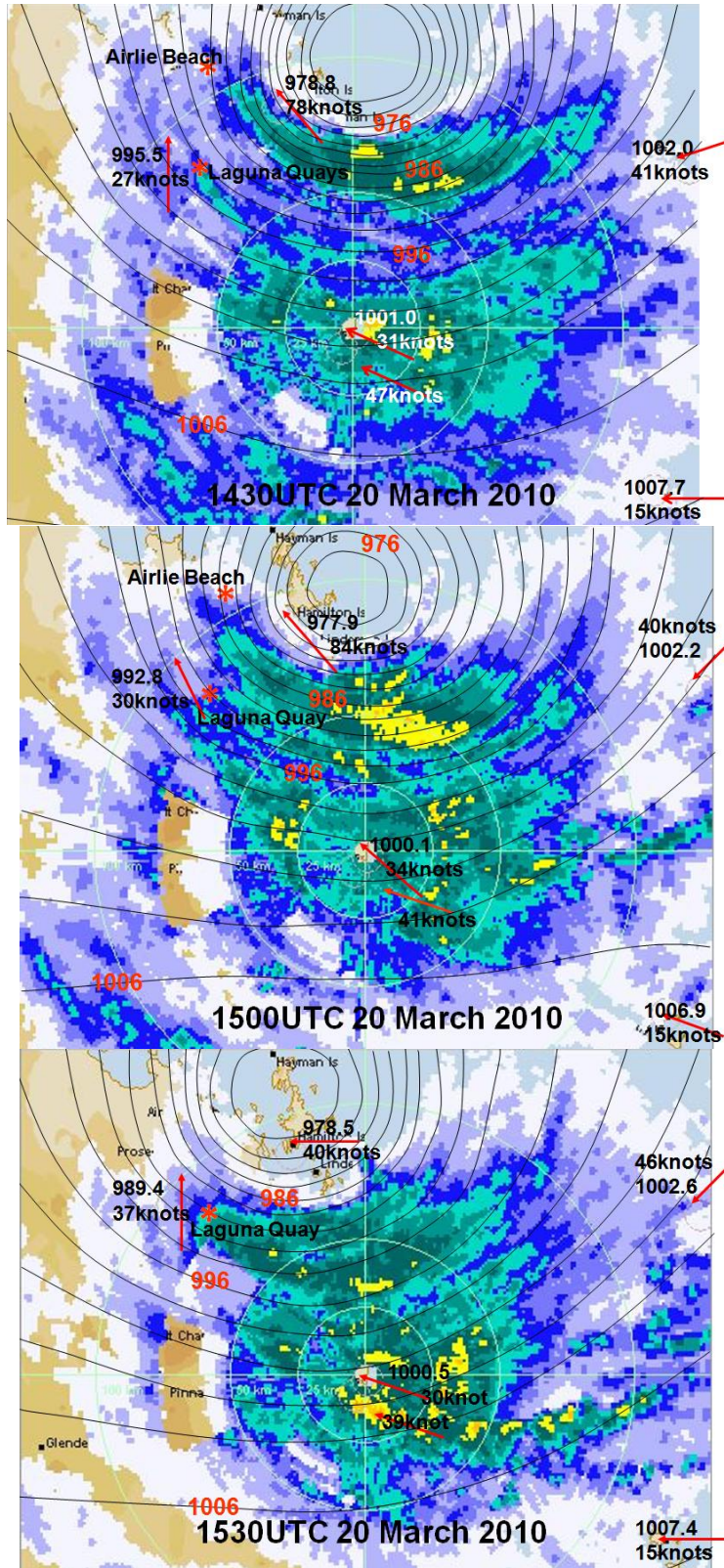


Figure 10 Mean sea level pressure analyses with pressure and average wind observations overlaid on radar imagery for 1430UTC 20 March 2010 (top), 1500UTC 20 March 2010 (centre), and 1530UTC 20 March 2010 (bottom) with the location of Laguna Keys marked by the red star.