CASE STUDY: Tropical Cyclone *Tessi,* April 2000

Introduction

Like tropical cyclone *Steve, Tessi* underwent extremely rapid development near the coast as it passed close to Townsville, Australia's largest tropical population centre.

Tropical Cyclone *Tessie* was named at 1800 UTC 1 April 2000 (4 am local time 2nd) and almost reached hurricane force intensity near the coast 21 hours later. An Australian Institute of Marine Science (AIMS) automatic weather station (AWS) on Magnetic Island (15 km northeast of the Townsville Meteorological Office) recorded 10 minute average wind speeds to 59 knots.

The mean sea level sequence (MSL) (Figure 1) show a tropical low, with an absence of any monsoon flow, moving towards the northeastern Australian coast (top panel). By 2300 UTC 1 April (centre panel in Figure 1) the low had become a tropical cyclone and note how the 1008 hPa isobar decreased in radius (indicating rising pressures around the system). At 2000 UTC 2 April 2000 (lower panel) it was a very small "midget" cyclone with the pressure continuing to rise around it.

Impact of *Tessi*

The cyclone formed a small compact radar eye (diameter 10 to15 km) near the coast after 1800 UTC 2 April 2000. It appears the worst wind damage was just outside this eye in the area around Mutarnee (a small village 60 km northwest of Townsville). Here many large trees were uprooted and the roof of a farmhouse was lifted off, battens and all, and deposited 50 metres away in a cane field. The most extensive tree damage was further east in the normally uninhabited beach areas where some isolated beach huts were unroofed. The eye wall cloud passed over this uninhabited area consisting mostly of marsh land.

Tropical cyclone *Tessie* was responsible for setting new weather records for April at the Townsville Meteorological Office; highest wind gust (70 knots), highest daily rainfall (271.6mm) and the highest monthly rainfall (539mm to 27 April 2000). However official daily rainfall is measured up to 9am local (2300 UTC) and 423.4 mm was measured in the 24 hours up to 1500 UTC 3 April 2000. The maximum wind gust at Townsville occurred at 1540 UTC 2 April 2000 when the centre of cyclone was 40 km away.

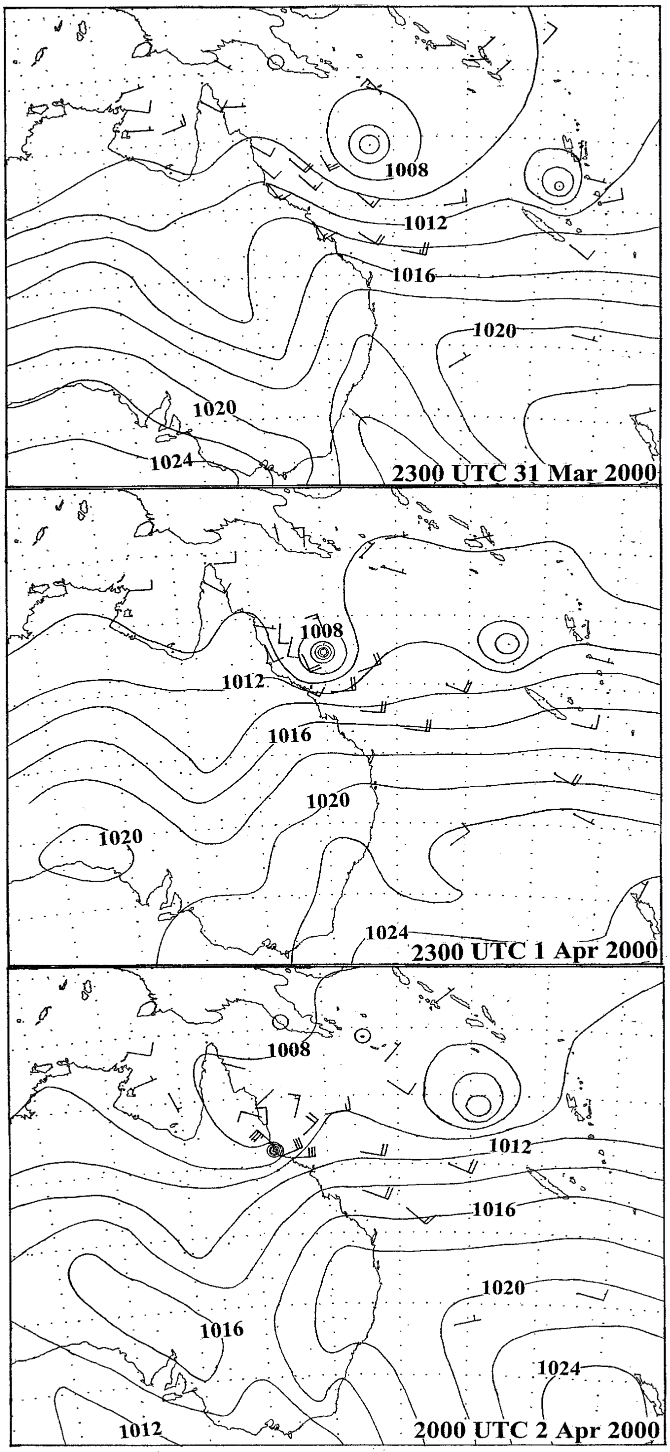
The cyclone caused widespread wind damage in Townsville mainly to trees and power lines. Most structural damage was due to falling trees though there were isolated reports of roof damage attributed to the wind itself. Widespread flooding occurred with the associated downpour, which also led to a severe landslide in one of the more affluent residential areas of Townsville on Castle Hill. There was also wave damage along the Strand at Townsville with several boats destroyed.

Gales extended down the coast to Gumlu (120 km southeast of Townsville). Here an anemometer failed at 60 knots. It was a pressure tube anemometer 6.5 metres above the ground. The extent of the gales on the northern side was 30 km (from Lucinda AWS).

MSL analyses in the Townsville area.

Figure 2 shows the MSL sequence indicating the cyclone passing to the north of Townsville between 1500 UTC and 1600 UTC 2 April 2000. The maximum wind speed was reported from the AIMS AWS at 1600 UTC. Notice that the intense pressure gradient extended onto the coast near Rollingstone just after 1600 UTC. This occurred when the destructive winds reached this area. The vortex shrunk in size between 1800 UTC and 2000 UTC with the most intense pressure gradient right on the coast and over the sea.

Explosive intensification period - 85 GHz data
Microwave data obtained from the US Navy Naval Research Laboratory site: -
http://www.nrlmry.navy.mil/tc_pages/tc_home.html



The 85-GHz microwave channel is sensitive to precipitation sized ice particles, which scatter the upwelling radiation and reduce the brightness temperature. This result is termed an “ice scattering signature,” as the depressed brightness temperature indicates the presence of precipitation sized ice aloft. A low 85-GHz brightness temperature can therefore imply increased convection and precipitation.

The rapid increase in intensity over the period between 2310 UTC 1 April 2000 and 2000 UTC 2 April 2000 is studied using 85 GHz imagery in Figure 3. This shows the change in convective structure over the rapid intensification phase. At 2310 UTC 1 April 2000 (top panel) the centre of the low at MSL was located at the south-western edge of an organised deep convection band. By 2000 UTC 2 April 2000 (lower panel) the centre of the cyclone was on the coast and almost surrounded by a ring of colder temperatures signifying deep convective showers and thunderstorms.

Figure 1 Mean sea level analyses and wind observations for 2300UTC 31 March 2000 (9am 1 April local time) to 2000UTC 2 April 2000 (6am 3 April 2000).

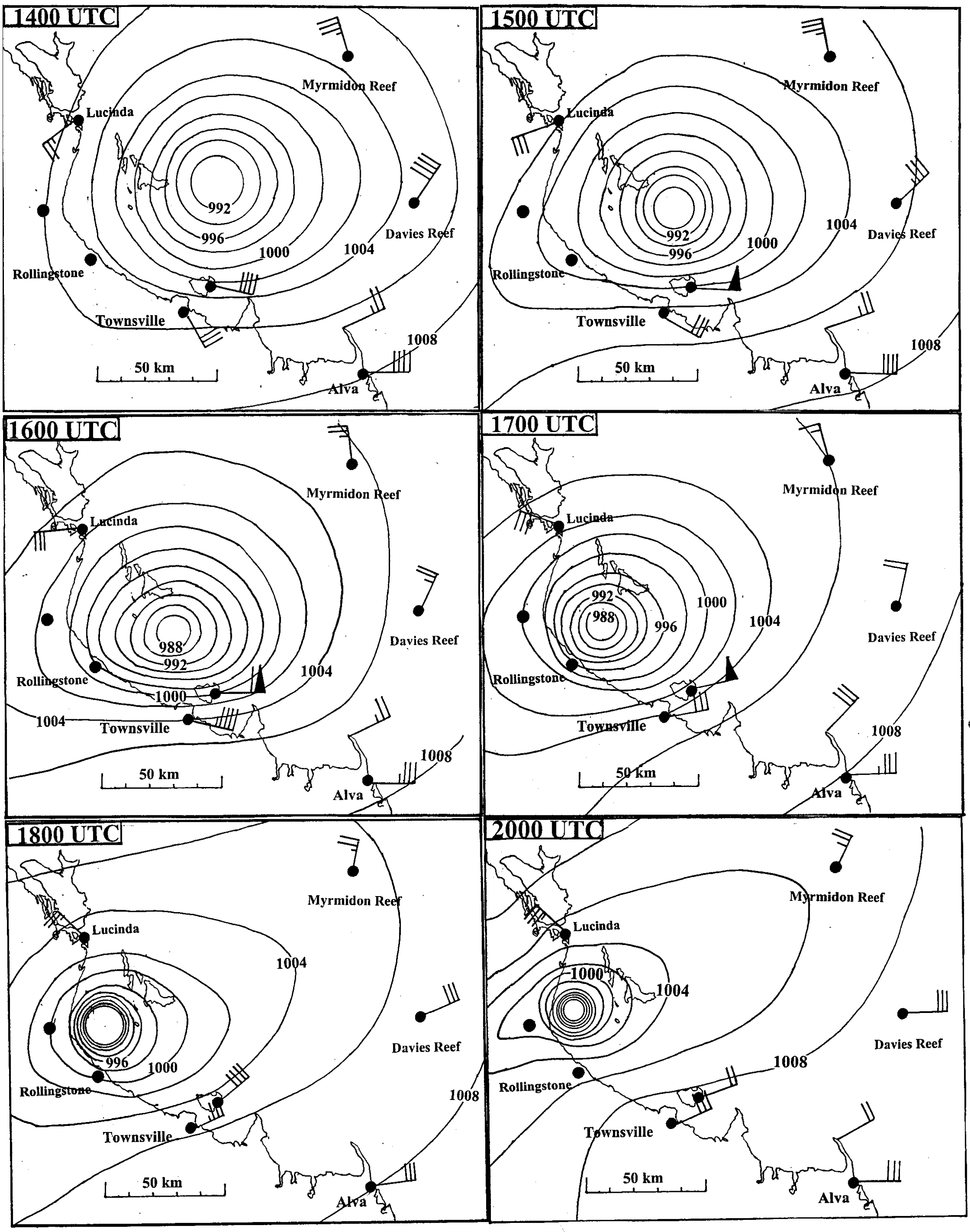


Figure 2 Mean sea level analyses and wind observations for 1400UTC 2 March 2000 (0am 3 April local time) to 2000UTC 2 April 2000 (6am 3 April 2000).

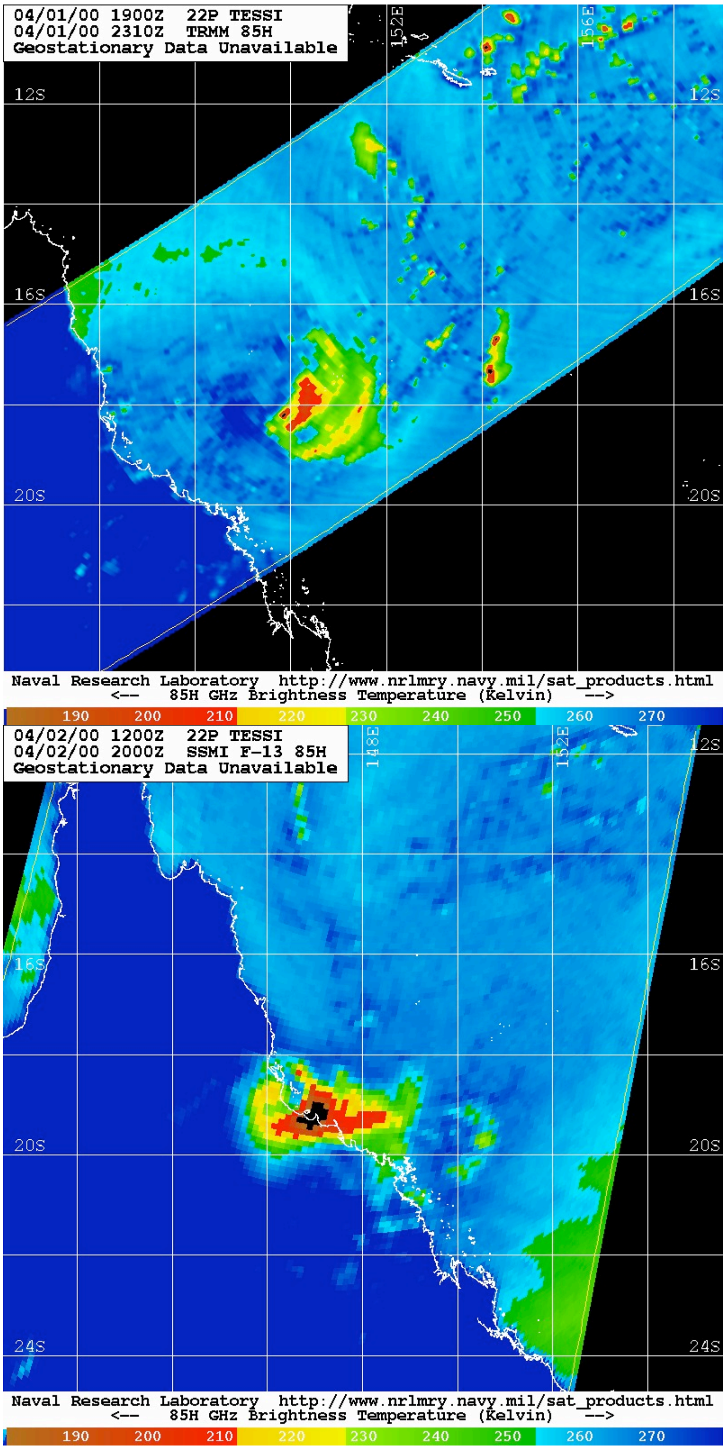


Figure 3 This shows the rapid increase in intensity over the period between 2310 UTC 1 April 2000 (top) and 2000 UTC 2 April 2000 (bottom) using 85 GHz microwave imagery.