



Australian Government
Bureau of Meteorology

Severe Tropical Cyclone *Bianca*

21 January – 30 January 2011

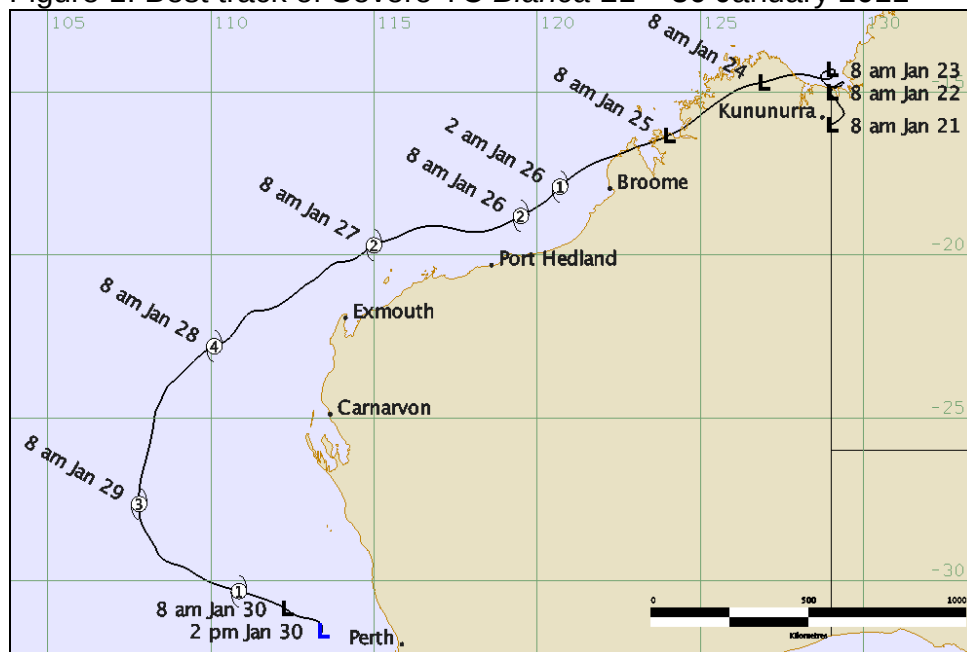
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A. Summary

A low pressure system developed over land near Wyndham on 21 January and moved north over the Joseph Bonaparte Gulf during 22 and 23 January. The system then tracked southwest across the Kimberley before moving over open water north of Broome again later on 25 January. The system reached cyclone strength and was named *Bianca* at 2 am AWST (Western Standard Time) 26 January (18 UTC (Coordinated Universal Time) 25 January) and tracked west southwest, parallel to the Pilbara coastline. The system intensified, reaching Category 3 at 2 pm AWST 27 January (06 UTC 27 January). *Bianca* then moved southwest and reached a peak intensity of Category 4 at 8 am AWST 28 January (00 UTC 28 January). *Bianca* began to weaken by 2 am AWST 29 January (18 UTC 28 January) as it moved south over cooler SST's and experienced increased wind shear. The system eventually dissipated over open water to the west of Perth, never crossing the Western Australian coastline.

The passage of *Bianca* produced no known significant damage but did produce heavy rainfall in the Kimberley and coastal parts of the Pilbara. The system also caused higher than normal tides along the Pilbara and west coasts.

Figure 1: Best track of Severe TC *Bianca* 21 – 30 January 2011



B. Meteorological Description

Intensity analysis

A low pressure system developed over land near Wyndham on 21 January and moved north over the Joseph Bonaparte Gulf during 22 and 23 January. The system was clearly visible on Wyndham radar with a well developed low level circulation, however wind shear over the area was high and the system remained below cyclone intensity while over water. The low pressure system moved inland over the north Kimberley on 24 January. The system tracked quickly southwest along the Kimberley coastline. During the early part of 25 January the system had a broad circulation with curved bands located well away from the low level circulation centre (LLCC). At this time the system was still interacting with land but conditions had become more favourable for development with a decrease in wind shear. By 8 pm AWST 25 January (12 UTC 25 January) the low centre was located northwest of Broome and over open water. Radar and microwave imagery showed curved convection developing near the LLCC and by 2 am AWST 26 January (1800 UTC 25 January) a consistent Dvorak Data T-number (DT) of 3.0 was assigned and the system reached cyclone strength.

For a brief period a closed circulation around a 30 nautical mile (nm) diameter eye was evident on radar at around 2 am AWST 26 January (1800 UTC 25 January). Within a few hours the system reached Category 2 (DT of 3.5). Around 6 am AWST 26 January (22 UTC 25 January) a separate band of deep convection began to develop about 200 km to the west of *Bianca* (refer Fig 2.). Despite being over open water with only moderate easterly shear over the system, the Port Hedland radar showed the circulation had become more ragged and disorganised with two distinct convective bands evident instead of a closed circulation. By 12 pm AWST 26 January (04 UTC 26 January) it was apparent that development of the system had been hindered with convection confined to the southern quadrants in a C shape. Microwave imagery showed this mass had weakened by 4 pm AWST 26 January (08 UTC 26 January) with a complete though ragged circulation evident on the Dampier radar.

Learmonth radar showed that a C-shaped band with convection in northern quadrants persisted through the day on 27 January as the system moved to the west, well north of the NW Cape. Wind shear analyses showed about 20 knots of southeast shear over the system. Microwave imagery showed deep, cold convection wrapping only halfway around the system centre however Dvorak analyses yielded DT of 4 to 4.5 and the cyclone reached Category 3 by 2 pm AWST 27 January (06 UTC 27 January) with an eye beginning to emerge around 9 pm AWST 27 January (13 UTC 27 January).

Later on 27 January, *Bianca* began to move towards the south southwest. Sea surface temperature (SST) analyses (refer Fig. 3) showed a relatively warm patch of SSTs extending down the Western Australian coastline. This enabled *Bianca* to continue to steadily intensify, reaching a consistent DT of 5.5 at 10 pm AWST 27 January (14 UTC 27 January). The cyclone reached a peak intensity (refer Fig 4) of 175 km/h (95 knots) 10 minute mean wind around 8 am 28 January (00 UTC 28 January). *Bianca* maintained a clear eye pattern through until 12 pm AWST 29 January (04 UTC 29 January) despite being located over water temperatures well under 28°C.

Bianca began to weaken at about 6 pm AWST (10 UTC) 28 January as the system succumbed to cooler SSTs and increased wind shear ahead of an approaching mid-level trough in the higher latitudes. By 12 pm AWST 29 January the eye wasn't visible and overnight, the deep, cold convection weakened rapidly. Around this time the system tracked in a south easterly direction, towards the Western Australian coastline, ahead of an approaching mid-level trough. By early 30 January the LLSC was completely exposed with no cold convection associated with it. The system was downgraded to a low by 8 am AWST 30 January (00 UTC 30 January) to the west of Perth and *Bianca* never made landfall.

Comparisons of Satellite Consensus (SATCON), Cooperative Institute for Meteorological Satellite Studies (CIMSS) Advanced Microwave Sounding Unit (AMSU), Advanced Dvorak Technique (ADT), Cooperative Institute for Research in the Atmosphere (CIRA) and subjective Dvorak intensities showed similar trends throughout the lifetime of *Bianca* (refer Fig. 5). ADT estimates were always lower than the other techniques until well into the weakening phase when it remained higher. As is typical, ADT was slow to intensify in the emerging eye phase. All the methods showed either a plateau or slight weakening in the intensifying trend during 26 January when *Bianca* appeared to be affected by the development of peripheral convection. Subjective Dvorak was higher initially when the eye pattern was appearing but the other methods caught up quickly.

Motion

Bianca initially moved north in a light steering regime to the north of a mid-level ridge and west of a high amplitude trough. During 23 January the system began to move westwards as a mid-level ridge moved eastwards south of the low. *Bianca* remained under this steering influence moving first west then southwest around the ridge until 27 January. During 27 January an approaching mid-level trough began to erode the cradling ridge and the system moved on a more south westerly path.

During 28 January *Bianca* tracked south between the mid-level ridge over Australia and the trough to the west. By 29 January the system was captured in a north westerly steering flow and turned to the southeast, towards the Western Australian coastline. The system weakened before reaching the coast.

Structure

Initially wind shear was high but decreased by 24 January. During the period 25 to 28 January wind shear was light to moderate at times. At times during 25 and 26 January convection was concentrated on one side but Advanced SCATterometer (ASCAT) passes showed a mostly symmetric wind structure. Gale radius was initially estimated at about 110 km (60 nm), this increased to 185 km (100 nm) by 27 January.

Bianca developed an eye which was clearly visible on infrared imagery (IR) satellite imagery from 8 pm AWST 27 January (1200 UTC 27 January) until 12 pm AWST 29 January (04 UTC 29 January). Eye diameter was initially 45 kilometres (km) or 25 nautical miles (nm) and decreased to 28 km (15 nm) by 8 am AWST 28 January (0000 UTC 28 January) when the system was at peak intensity.

By 2 am AWST 29 January (1800 UTC 28 January) wind shear increased to about 20 knots as the system moved south into higher latitudes. During 29 January the system weakened rapidly with convection becoming confined to the south eastern quadrant.

At this point an ASCAT pass showed gales extended to about 330 km (180 nm) in the southeast quadrant but was much smaller in the northeast quadrant. By 9 am AWST 30 January (0100 UTC 30 January) ASCAT passes showed no gales remaining around the system.

C. Impact

Heavy rainfall was recorded through the Kimberley as the system developed and then in coastal parts of the Pilbara as the system tracked west.

The passage of *Bianca* resulted in higher than normal tides from the Pilbara coast through to the coastal parts of the southwest. In general, tides were 1.0 metre (m) to 1.25m above the predicted level along the Pilbara coast (close to the highest astronomical tide) and 0.5m to 0.8m above along the west coast (higher than the highest astronomical tide). No significant damage was reported.

D. Observations

Wind

The maximum sustained wind recorded during Severe TC *Bianca* was 96 kilometres/hour (km/h) or 52 knots at Bedout Island at 10.30 am AWST (0230 UTC) and at 11.20 am AWST (0320 UTC) 26 January as the system passed to the north of the island. The maximum 3 second wind gust was 118 km/h (64 knots) at 10.30 am AWST (0230 UTC), 11.20 am AWST (0320 UTC) and 11.30 am AWST (0330 UTC) 26 January.

Bedout Island recorded sustained gales from 07.10 am AWST until 5.20 pm AWST 26 January (2310 UTC 25 January to 0920 UTC 26 January), a period of about 10 hours. Storm force winds were recorded from 10.20 am AWST to 12.20 pm AWST 26 January (0220 UTC to 0420 UTC 26 January), a period of 2 hours.

Legendre Island recorded sustained gales from 313 pm AWST 26 January (0717 UTC 26 January) to 10 am AWST 27 January (0200 UTC 27 January), a period of about 19 hours.

Varanus Island recorded sustained gales from 12.30 am AWST 27 January (1630 UTC 26 January) to 7.10 pm AWST 27 January (1110 UTC 27 January), a period of about 19 hours.

Learmonth Airport recorded sustained gales or near gales from 6.30 pm AWST 27 January (1030 UTC 27 January) to 3.30 am AWST 28 January (1930 UTC 27 January), a period of about 9 hours.

Rainfall

Lombadina recorded 181.8 millimetres (mm) in the 24 hours to 9 am AWST (0100 UTC) 26 January.

Mardie recorded 191 mm in the 24 hours to 9 am AWST (0100 UTC) 28 January.

Tidal data

The passage of *Bianca* resulted in higher than normal tides along the Pilbara and west coast of WA. In general, tides were 1.0m to 1.25m above the predicted level along the Pilbara coast (close to the highest astronomical tide) and 0.5m to 0.8m above the predicted level along the west coast (higher than the highest astronomical tide).

E. Forecast Performance

The first advice for *Bianca* was issued at 10 am AWST (02 UTC) 24 January for a developing low moving off the Kimberley coastline. Advices continued for the Pilbara coastline and upper West Coast until 6 am AWST (10 UTC) 28 January when *Bianca* was considered too far to the west to pose any threat to the coastline.

At 9am AWST (01 UTC) 28 January advices recommenced as a Cyclone Watch coastal areas between Jurien Bay and Albany as the weakening system was steered in a south easterly direction ahead of a mid-level trough. This advice was cancelled at 6 am AWST 30 January (22 UTC 29 January) as *Bianca* weakened rapidly off the west coast. The remains of the system never crossed the coast but dissipated over the ocean.

Table 1. Best track summary for Severe Tropical Cyclone Bianca.
Refer to the Australian Tropical Cyclone database for complete listing of parameters.

Year	Month	Day	Hour (UTC)	Position Latitude S	Position Longitude E	Position Accuracy nm	Max wind 10min knots	Max gust knots	Central Pressure hPa	Rad. of Gales nm	Rad. of storm force winds	Radius Max. Wind (RMW)
2011	1	21	00	16.0	129.0	30	10		1000			
2011	1	21	06	15.6	129.4	30	10		1000			
2011	1	21	12	15.4	129.3	30	10		1000			
2011	1	21	18	15.2	129.1	30	10		1000			
2011	1	22	00	15.0	129.0	30	10		1000			
2011	1	22	06	14.7	129.4	30	15		1000			
2011	1	22	12	14.8	129.3	30	20	45	1000			
2011	1	22	18	14.5	128.7	30	25	45	1000			
2011	1	23	00	14.3	129.0	30	25	45	1000			
2011	1	23	06	14.3	129.1	30	25	45	1000			
2011	1	23	12	14.4	129.1	30	25	45	1000			
2011	1	23	18	14.5	128.4	30	25	45	1000			
2011	1	24	00	14.7	126.9	30	20	45	1000			
2011	1	24	06	14.8	126.5	30	20	45	1000			
2011	1	24	12	15.0	126.0	30	20	45	1000			
2011	1	24	18	15.7	125.0	30	20	45	1000			
2011	1	25	00	16.3	124.0	20	20	45	999			
2011	1	25	06	16.7	123.1	20	30	45	995			
2011	1	25	12	17.2	121.7	20	30	45	994			
2011	1	25	18	17.9	120.7	15	40	55	989	60		
2011	1	26	00	18.8	119.5	15	50	70	986	60	20	
2011	1	26	06	19.3	118.1	20	50	70	983	60	30	
2011	1	26	12	19.1	116.9	10	55	75	979	90	30	
2011	1	26	18	19.4	115.8	15	55	75	979	90	30	
2011	1	27	00	19.7	115.0	15	55	75	979	100	60	
2011	1	27	06	20.2	114.0	10	65	90	970	100	60	20
2011	1	27	12	20.9	112.9	10	75	105	966	100	60	25
2011	1	27	18	21.7	111.5	10	90	125	951	100	60	25
2011	1	28	00	22.8	110.1	10	95	135	949	100	60	25
2011	1	28	06	23.9	108.8	10	90	125	950	100	60	25
2011	1	28	12	24.8	108.3	10	90	125	950	100	60	25
2011	1	28	18	26.3	108.0	10	70	100	968	100	40	25
2011	1	29	00	27.6	107.8	10	65	90	971	95	40	25
2011	1	29	06	29.0	108.3	10	65	90	973	90	40	25
2011	1	29	12	29.8	109.5	20	50	70	982	105	30	
2011	1	29	18	30.3	110.9	20	35	50	994	70		
2011	1	30	00	30.8	112.3	20	30	45	999			
2011	1	30	06	31.5	113.4	20	20	45	1000			

Figure 2. Microwave (Tropical Cyclone Special Sensor Microwave Imager/Sounder (TC SSMIS) 91GHz) image at 0737 AWST 25 January (2337 UTC 25 January).

(image courtesy of US NRL: <http://www.nrlmry.navy.mil/>)

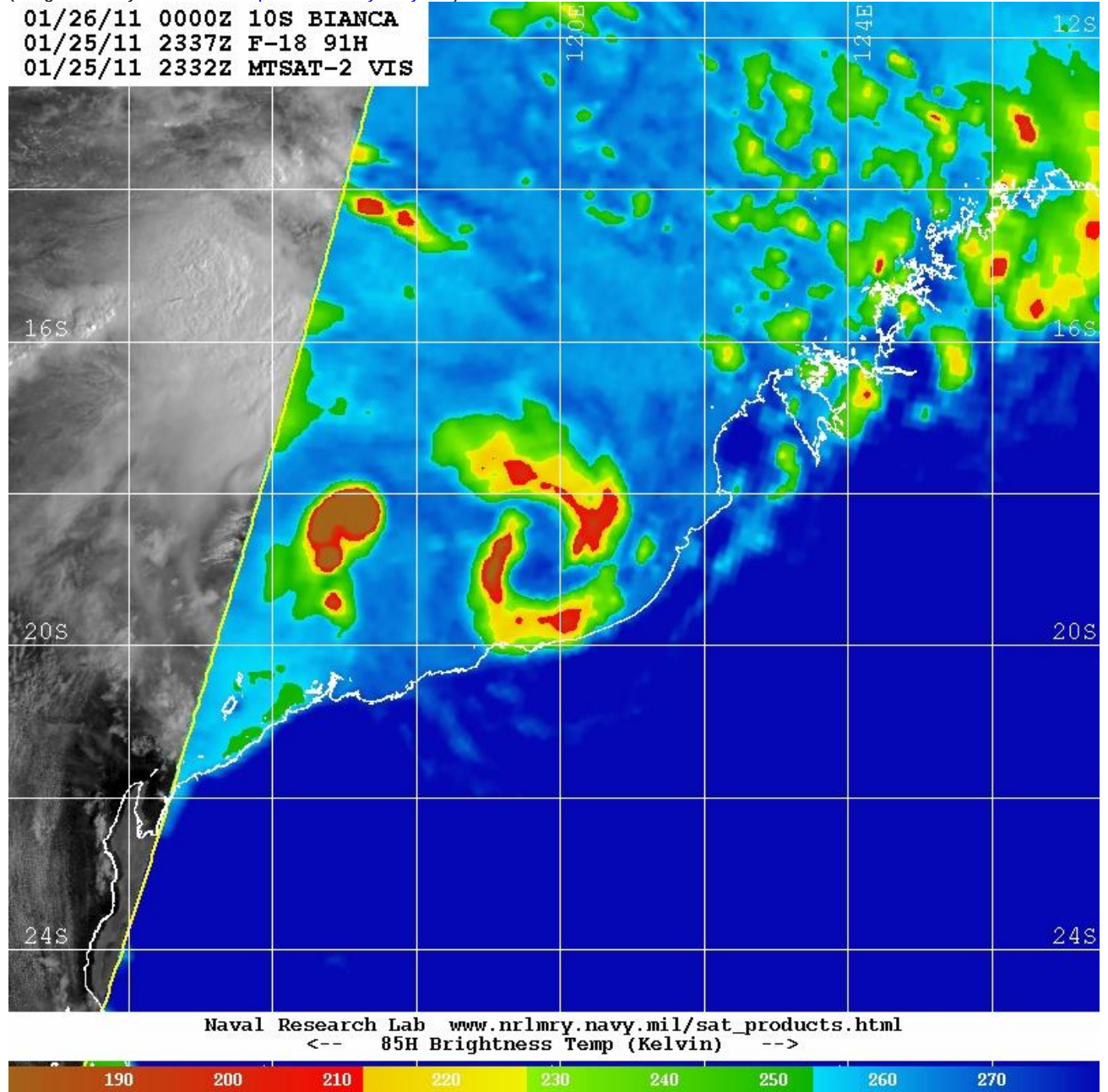


Figure 3. Sea surface Temperatures for 25 January 2011

(image courtesy of NOAA/AOML NRL: <http://www.aoml.noaa.gov/phod/cyclone/data/si.html>)

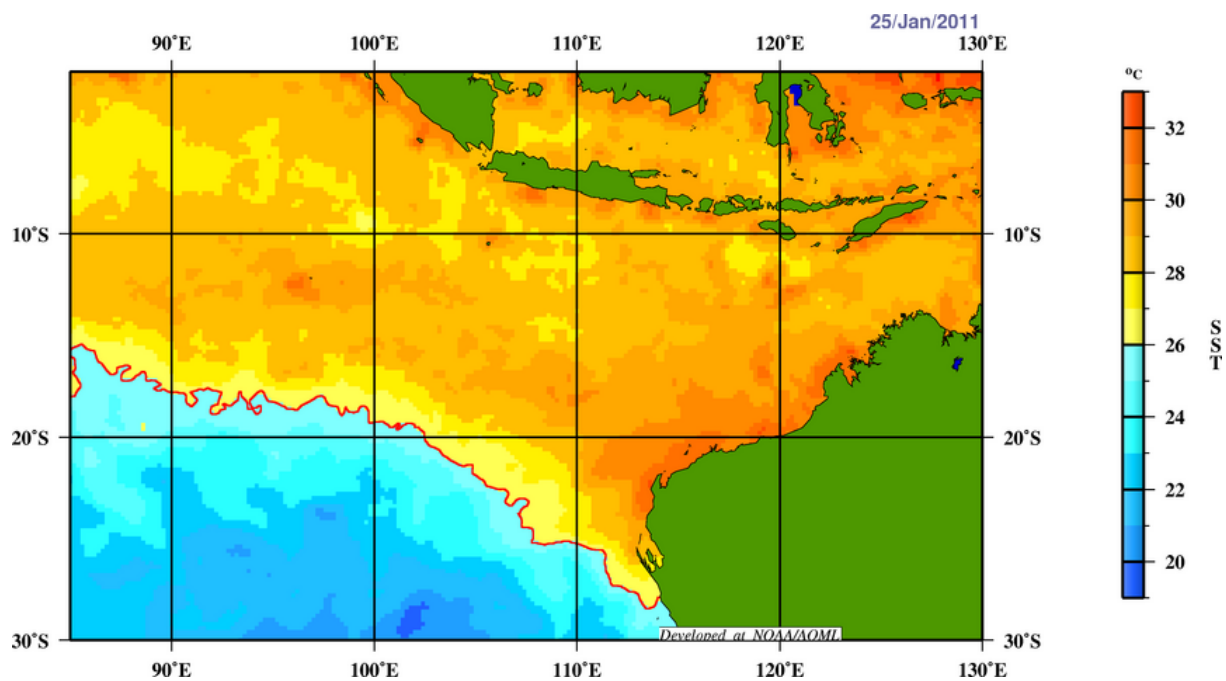


Figure 4. Microwave (Tropical Rainfall Measuring Mission's (TRMM) Microwave Imager (TMI) 85GHz) image at 8.54 am AWST 28 January (0054 UTC 28 January).
(image courtesy of US NRL: <http://www.nrlmry.navy.mil/>)

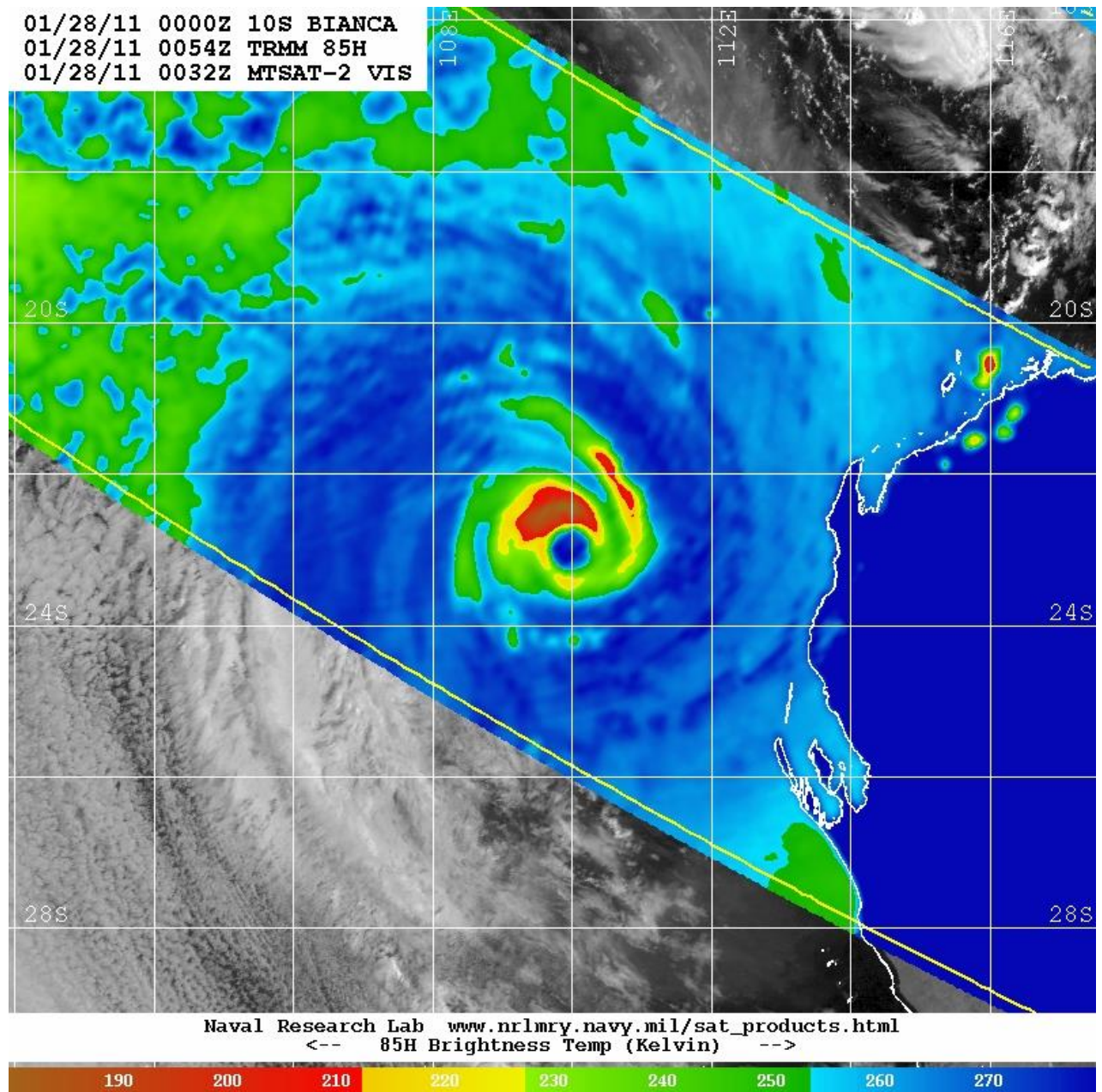


Figure 5. Comparison of objective and subjective intensity analysis techniques.

