Australian Government
Bureau of Meteorology

# Tropical Cyclone *Stan*

## 27 January - 1 February 2016

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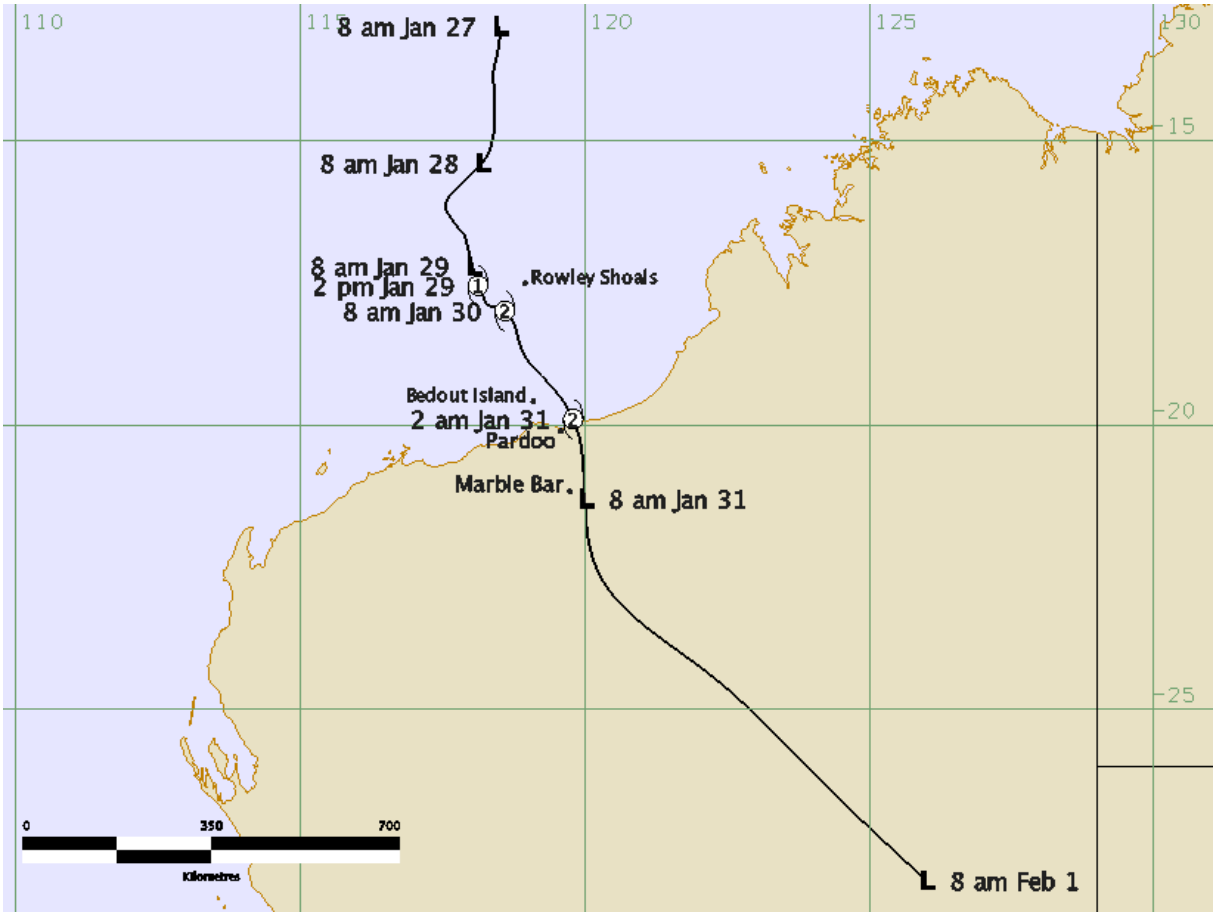
# 1 Summary

A low formed approximately 680 kilometres (km) to the northeast of Broome on 27 January and initially tracked steadily southwards before moving to the south southeast. The low reached tropical cyclone intensity at 0600 Universal Time Coordinated (UTC) (1400 Australian Western Standard Time (AWST) =UTC+8 hours) 29 January when it was located about 310 km to the north of Port Hedland. As the vertical wind shear decreased *Stan* intensified and reached a peak ten minute wind intensity of 55 knots (kn) (102 kilometres per hour (km/h)) at 0600 UTC 30 January. Tropical Cyclone *Stan* crossed the coast between Port Hedland and Wallal about 30 km to the east of Pardoo at around 1800 UTC 30 January. As the cyclone crossed the coast near the time of high tide, the associated storm tide would have resulted in inundation of low-lying coastal areas to the east of the crossing location, but no data is available. The cyclone weakened quickly as it moved southwards over the Pilbara, further inland.

Heavy rainfall associated with TC *Stan* was recorded in the Gascoyne River, Fortescue River and the De Grey River catchments. The highest 24 hour rainfall was recorded at Nullagine with a total of 97millimetres (mm), 50 mm of this was recorded within 1 hour. This heavy rainfall resulted in moderate to major flooding in the upper areas of the De Grey River catchment including the Oakover River, the Coongan River and the Nullagine River.

Five people were rescued from a vehicle stranded in a creek crossing on the Hardy River Road south of Roebourne. The town of Nullagine was divided in two as a result of river level rises. Two vehicles and their occupants were washed off a causeway at Nullagine and subsequently rescued by boat. People were rescued from a vehicle stranded in a floodway near Paraburdoo. There was no major damage to homes or other infrastructure due to the community being well prepared.

Figure 1. Best track of STC *Stan* 27 January – 1 February 2016 (times in AWST, UTC+8).



# 2 Meteorological Description

## 2.1 Intensity analysis

A low became evident near 13°S 118.5°E around 0000 UTC 27 January. The low was steered in a southerly direction as it slowly developed, reaching a Dvorak Data-T (DT) 1.0 classification at 1200 UTC 27 January. *Stan* was under moderate to strong easterly shear during this stage and satellite imagery showed convection predominantly located to the west of the centre. Despite this *Stan* intensified at a standard rate of one T number a day and reached tropical cyclone strength at 0600 UTC 29 January. The easterly shear decreased during 29 January and *Stan* continued to intensify as it approached the Pilbara coast. The cyclone reached peak intensity of 55 kn (102 km/h) at 0600 UTC 30 January (refer Figure 2) when it was located about 180 km north of Port Hedland. Rowley Shoals recorded a peak 10-minute mean wind of 49 kn (91 km/h) between 0100 and 0130 UTC 30 January. Satellite and microwave imagery during the day showed curved banding with deep cold convection around the centre which began to decrease from around 1000 UTC 30 January. As *Stan* neared the Pilbara coast, it began to weaken. The 1115 UTC SSMIS pass (refer Figure 3) showed the deep convection had decreased significantly. *Stan* crossed the coast about 30 km to the east of Pardoo at 1800 UTC 30 January and weakened quickly. Gales were not recorded at either Mandora Automatic Weather Station to the east of the cyclone or at Marble Bar as *Stan* passed close by around 0000 UTC 31 January. Gales did however persist at Bedout Island until 0030 UTC 31 January in the offshore southerly flow. The remnants of *Stan* continued until 1 February when the low decayed completely over central parts of inland Australia.

A comparison of objective and subjective intensity estimates is shown in Figure 4. Satellite Consensus (SATCON), Cooperative Institute for Meteorological Satellite Studies (CIMSS) Advanced Microwave Sounding Unit (AMSU) and National Environmental Satellite, Data, and Information Service (NESDIS) Advanced Dvorak Technique (ADT) estimates were lower than subjective Dvorak and CIMSS ADT techniques, particularly when Stan neared the coast and development appeared to cease around 0600 UTC 30 January.

## 2.2 Structure

*Stan* was a small cyclone with an initial gale radius of 60 nautical miles (nm) (111 km). This increased to 90 nm (167 km) in the western quadrants as the system moved south. As *Stan* crossed the coast gale radii had decreased to 60 nm (111 km) in the northwest quadrant and down to 30 nm (55 km) in the southwest quadrant. At 0000 UTC 31 January gales were confined to the northwest quadrant with a radius of 120 nm (222 km), this was estimated from gales persisting at Bedout Island at this time. Radius to maximum winds (RMW) was initially 20 nm (37 km), this contracted to around 15 nm (28 km) during *Stan*'s most intense period. The RMW expanded to 30 nm (55 km) as *Stan* weakened.

## 2.3 Motion

Initially the low was located to the west of the mid-level ridge with an amplifying trough located to the southwest of the state steering the system to the south. On 28 January the mid-level ridge was eroded and the trough increased in strength, as a result *Stan* moved to the southeast. As the mid-level trough moved east *Stan* was steered in the northwest flow ahead of it and the system moved across the Pilbara coast.

# 3 Impact

Tropical Cyclone *Stan* crossed the coast between Port Hedland and Wallal about 30 km to the east of Pardoo at around 1800 UTC 30 January. There was no wind associated structural damage reported from coastal communities. Heavy rainfall associated with TC *Stan* was recorded in the Gascoyne River, Fortescue River and the De Grey River catchments. The highest 24 hour rainfall was recorded at Nullagine with a total of 97 mm, 50 mm of this was recorded within 1 hour. This heavy rainfall resulted in moderate to major flooding in the upper areas of the De Grey River catchment including the Oakover River, the Coongan River and the Nullagine River.

Five people were rescued from a vehicle stranded in a creek crossing on the Hardy River Road south of Roebourne. The town of Nullagine was divided in two as a result of river level rises. Two vehicles and their occupants were washed off a causeway at Nullagine and subsequently rescued by boat. People were rescued from a vehicle stranded in a floodway near Paraburdoo. There was no major damage to homes or other infrastructure due to the community being well prepared.

As the cyclone crossed the coast near the time of high tide, the associated storm tide would have resulted in inundation of low-lying coastal areas to the east of the crossing point, but no data is available. The cyclone weakened quickly as it moved southwards over the Pilbara, further inland.

# 4 Observations

## 4.1 Wind

Rowley Shoals Automatic Weather Station (AWS) recorded gale force winds at 0630 UTC, 0700 – 0730 UTC 29 January and between 0830 UTC 29 January and 0830 UTC 30 January. Storm force winds were recorded between 0100 – 0130 UTC 30 January. A peak wind gust of 72 kn (133 km/h) was recorded at 0124 UTC and 0130 UTC 30 January.

Bedout Island AWS recorded gale force winds between 0012 - 0016 UTC 30 January and between 1220 UTC 30 January and 0030 UTC 31 January. A peak wind gust of 49 kn (91 km/h) was recorded at 0012 UTC and 0016 UTC 30 January.

Shay Gap AWS did not record gale force winds but recorded a peak wind gust of 51 kn (94 km/h) at 2316 UTC 30 January.

## 4.2 Pressure

Rowley Shoals AWS recorded a lowest mean sea level pressure (MSLP) of 990.1 Hectopascals (hPa) at 2130 UTC 29 January.

Bedout Island AWS recorded a lowest MSLP of 992.7 hPa at 0819 UTC 30 January.

Shay Gap recorded a lowest MSLP of 988.4 hPa at 1930 UTC 30 January.

## 4.3 Rainfall

Nullagine recorded the highest rainfall total of 97 mm in the 24 hours to 9 am 1 February.

# 5 Forecast Performance

The accuracy statistics obtained by comparing the forecast positions against the best track positions for TC *Stan* are

| **Forecast Hour** | **0** | **06** | **12** | **18** | **24** | **36** | **48** | **72** | **96** | **120** | **144** |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **Absolute error (km)** | 48 | 64 | 81 | 86 | 106 | 154 | 207 | 368 | 377 | 167 | 202 |
| **RMS error (km)** | 53 | 70 | 89 | 99 | 121 | 170 | 228 | 385 | 434 | 175 | 202 |
| **Sample Size** | 18 | 18 | 18 | 18 | 18 | 16 | 14 | 10 | 6 | 2 | 1 |

Figure 5 is a plot of the accuracy figures for TC *Stan* compared to the five year mean.

## TABLE 1. Best track summary for Tropical Cylone *Stan*

Refer to the Australian Tropical Cyclone database for complete listing of parameters.

| Year | Month | Day | Hour UTC | Pos. Lat S | Pos. Long. E | Pos. Acc. n mi | Max Wind 10 min kn | Max gust kn | Cent. Press. hPa | Rad. of gales (NE/SE/ SW/NW) | Rad. of storm (NE/SE/ SW/NW) | RMW n mi |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 2016 | 01 | 27 | 0000 | 13.0 | 118.5 | 60 | 20 | 45 | 1005 | | | |
| 2016 | 01 | 27 | 0600 | 13.3 | 118.5 | 40 | 20 | 45 | 1005 | | | |
| 2016 | 01 | 27 | 1200 | 14.0 | 118.4 | 40 | 20 | 45 | 1005 | | | |
| 2016 | 01 | 27 | 1800 | 14.5 | 118.4 | 40 | 25 | 45 | 1003 | | | |
| 2016 | 01 | 28 | 0000 | 15.4 | 118.2 | 40 | 25 | 45 | 1003 | | | |
| 2016 | 01 | 28 | 0600 | 16.3 | 117.6 | 40 | 25 | 45 | 1000 | | | |
| 2016 | 01 | 28 | 1200 | 16.5 | 117.8 | 40 | 25 | 45 | 998 | | | |
| 2016 | 01 | 28 | 1800 | 16.8 | 117.9 | 30 | 30 | 45 | 998 | | | |
| 2016 | 01 | 29 | 0000 | 17.2 | 118.0 | 30 | 30 | 45 | 996 | | | |
| 2016 | 01 | 29 | 0600 | 17.5 | 118.1 | 30 | 35 | 50 | 990 | 60 | | 20 |
| 2016 | 01 | 29 | 1200 | 17.7 | 118.2 | 30 | 40 | 55 | 990 | 60 | | 20 |
| 2016 | 01 | 29 | 1800 | 17.9 | 118.3 | 30 | 45 | 65 | 987 | 60 | | 15 |
| 2016 | 01 | 30 | 0000 | 18.0 | 118.6 | 30 | 50 | 70 | 984 | 60 | 40 | 15 |
| 2016 | 01 | 30 | 0600 | 18.7 | 118.9 | 20 | 55 | 75 | 980 | 90/40/40/90 | 30 | 15 |
| 2016 | 01 | 30 | 1200 | 19.2 | 119.3 | 20 | 50 | 70 | 980 | 60/40/30/60 | 30 | 20 |
| 2016 | 01 | 30 | 1800 | 19.9 | 119.8 | 20 | 50 | 70 | 980 | 50/40/30/60 | 30 | 30 |

| Year | Month | Day | Hour UTC | Pos. Lat S | Pos. Long. E | Pos. Acc. n mi | Max Wind 10 min kn | Max gust kn | Cent. Press. hPa | Rad. of gales (NE/SE/ SW/NW) | Rad. of storm (NE/SE/ SW/NW) | RMW n mi |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 2016 | 01 | 31 | 0000 | 21.3 | 120 | 20 | 40 | 55 | 987 | 0/0/0/120 | | 30 |
| 2016 | 01 | 31 | 0600 | 22.5 | 120.2 | 20 | 30 | 45 | 993 | | | |
| 2016 | 01 | 31 | 1200 | 24.3 | 122.1 | 40 | 20 | 45 | 999 | | | |
| 2016 | 01 | 31 | 1800 | 26.2 | 124.1 | 40 | 20 | 45 | 998 | | | |
| 2016 | 02 | 01 | 0000 | 28.0 | 126.0 | 40 | 20 | 45 | 997 | | | |

Figure 2. 0841 UTC 30 January 89 GHz GMI image of Tropical Cyclone *Stan* near peak intensity.

Image courtesy of https://www.fnmoc.navy.mil/tcweb/cgi-bin/tc_home.cgi

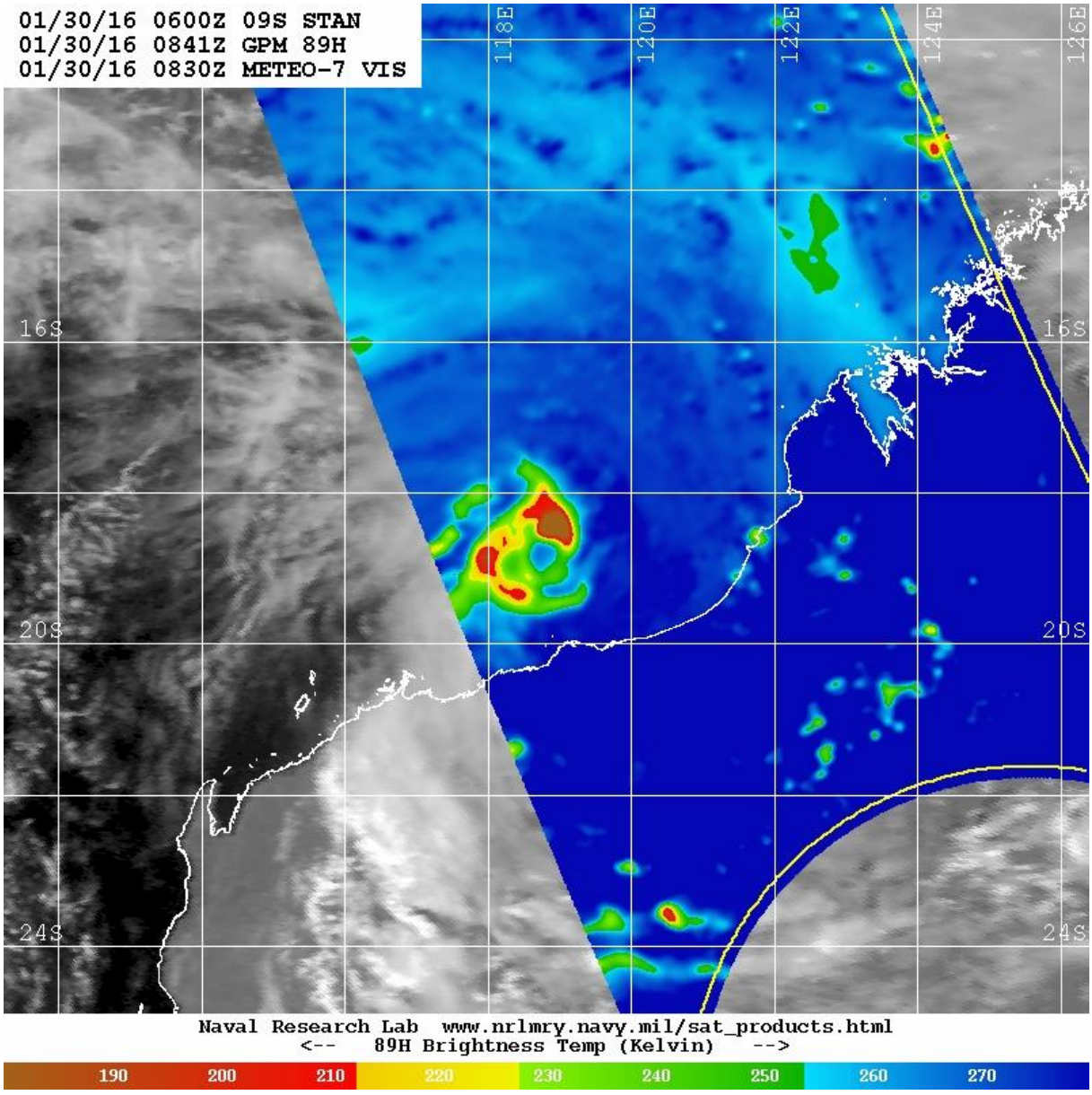


Figure 3. 1115 UTC 30 January 91 GHz SSMIS image of Tropical Cyclone *Stan* as it neared the Pilbara coast.

Image courtesy of https://www.fnmoc.navy.mil/tcweb/cgi-bin/tc_home.cgi

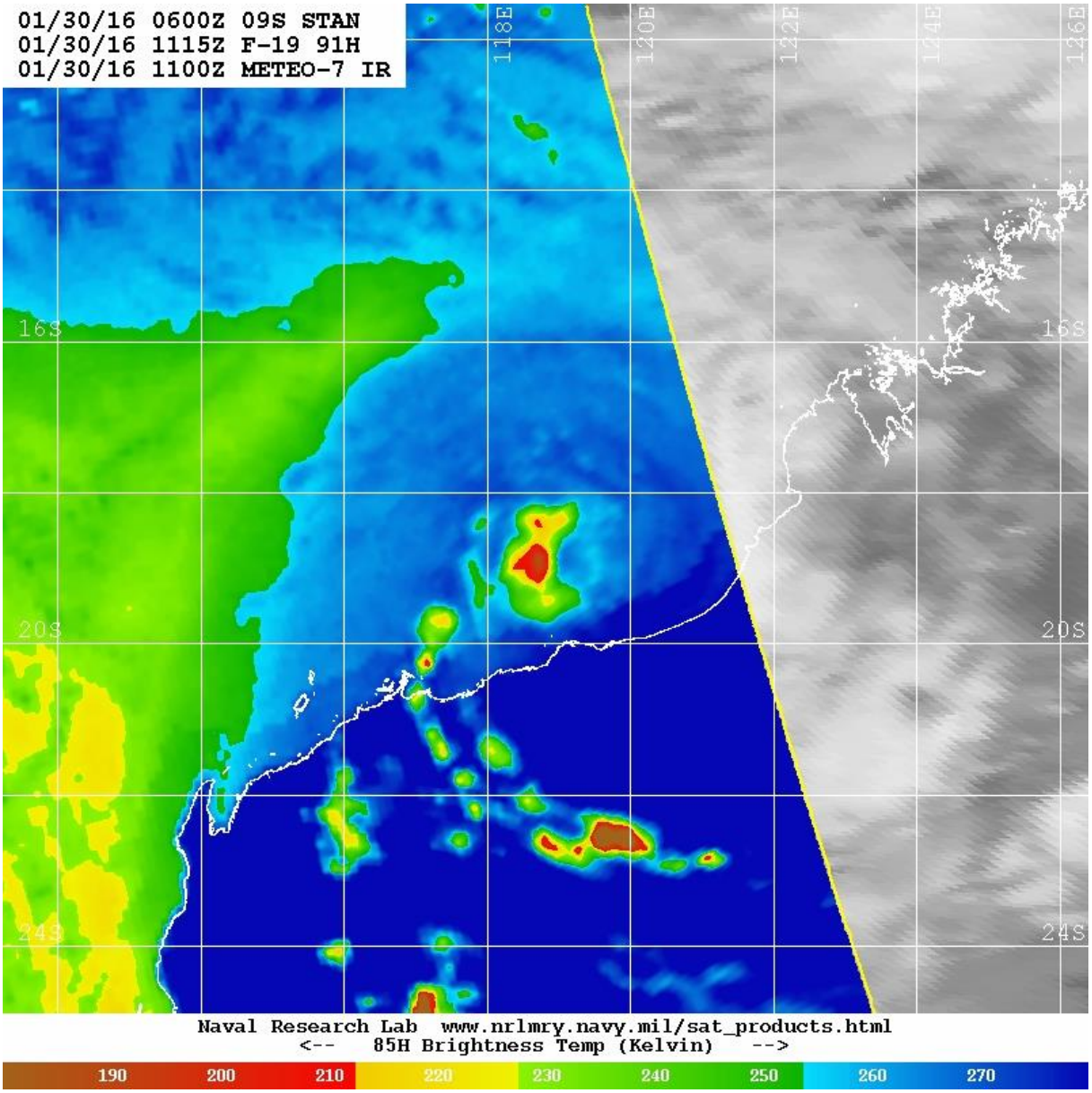


Figure 4. Comparison of objective and subjective intensity estimates.

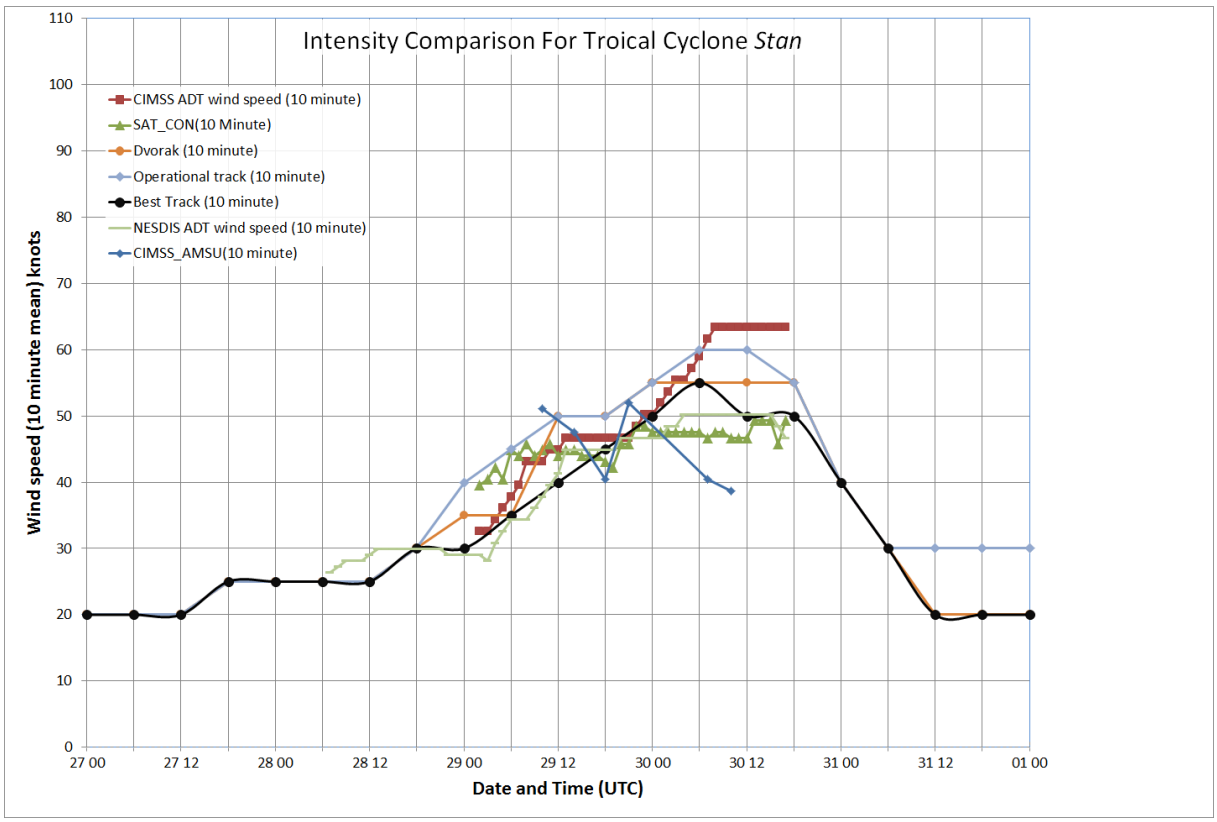


Figure 5. Accuracy statistics for Tropical Cyclone *Stan*