

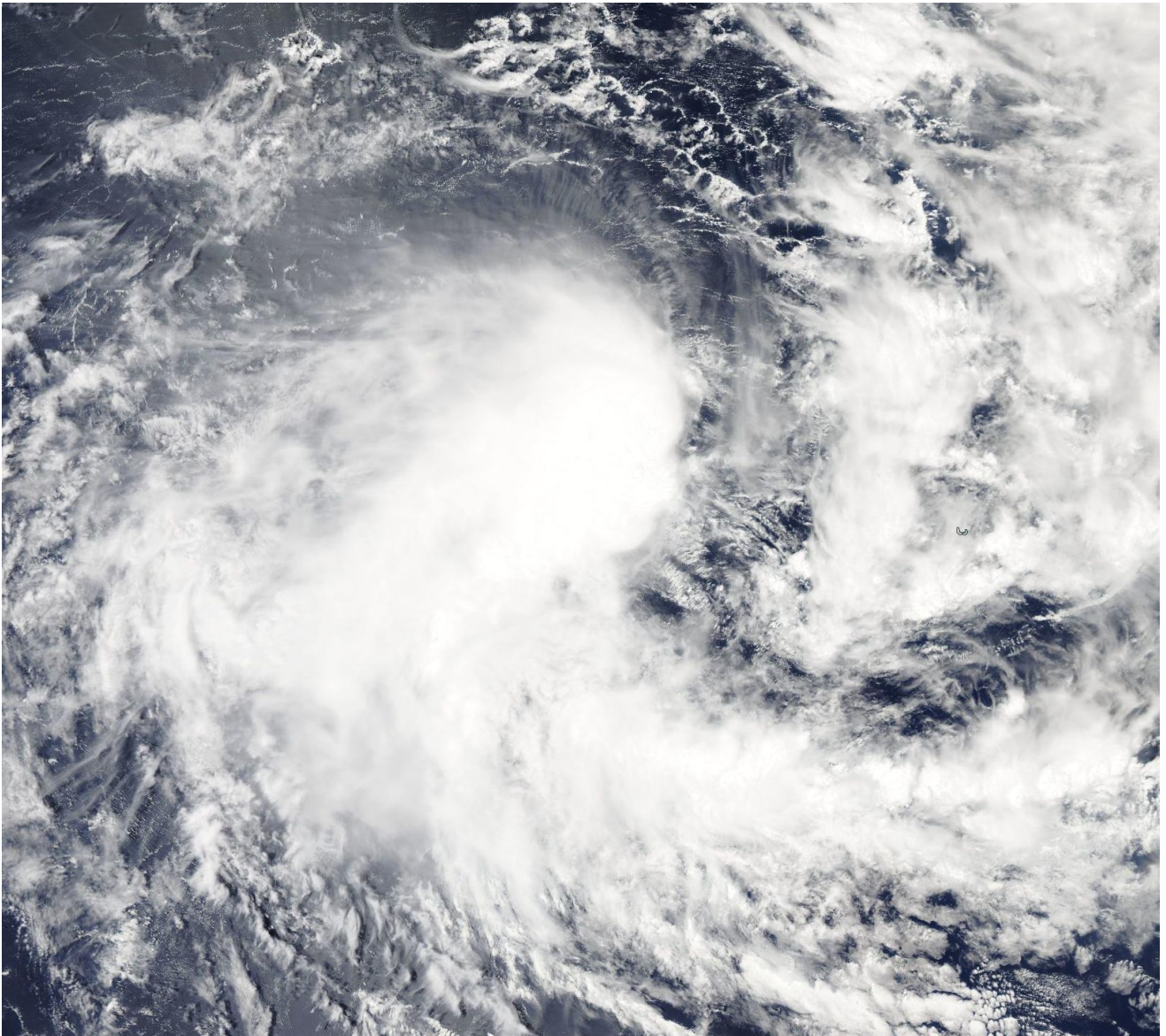
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# Tropical Cyclone Irving

**4 January 2018 – 6 January 2018**

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### Revision history

| Date       | Version | Author           | Description       |
|------------|---------|------------------|-------------------|
| 17/03/2023 | 1.0     | Craig Earl-Spurr | Final draft ready |

### Review status

| Date       | Version | Reviewer    | Description |
|------------|---------|-------------|-------------|
| 09/05/2023 | 1.0     | Peter Clegg |             |

### Release history

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|------------|---------|----------------------|---------------|
| 11/05/2023 | 1.0     | Approved for release | Andrew Burton |

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Cover image: MODIS True Color satellite image of Tropical Cyclone Irving 5 January 2018 (Image courtesy NASA Worldview <https://worldview.earthdata.nasa.gov/>)

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## 1. Summary

Tropical Cyclone Irving formed over open ocean well to the west of the Cocos (Keeling) Islands. Vertical wind shear was a prominent feature of its early lifetime with deep convection and maximum winds to the west of the system centre. Despite the unfavourable vertical wind shear, Irving intensified into a tropical cyclone shortly before entering RSMC La Reunion's area as it moved west through the Indian Ocean.

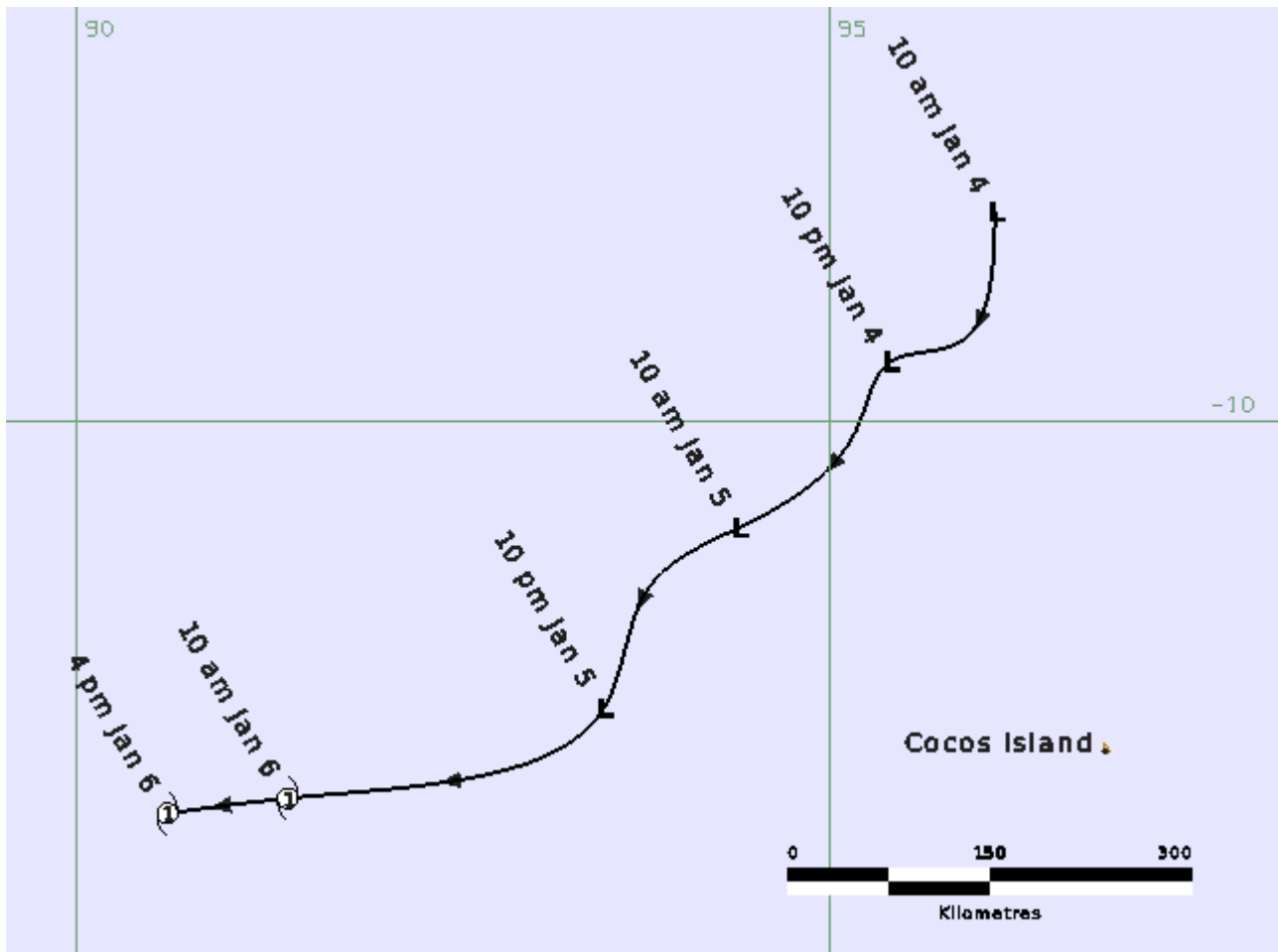


Figure 1. Best Track of Tropical Cyclone Irving while in the Australian Area of Responsibility, east of 90E (times in AWST, UTC +8).

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**Table 1. Best track summary for Tropical Cyclone Irving 4-6 January 2018**

Refer to the Australian Tropical Cyclone database for complete listing of parameters. UTC= WST-8h.

| Year | Month | Day | Hour<br>UTC | Pos.<br>Lat.<br>S | Pos.<br>Long.<br>E | Pos.<br>Acc.<br>nm | Max Wind<br>10min<br>kn | Max<br>gust<br>kn | Cent.<br>Press.<br>hPa | Rad. of gales<br>(NE/SE/<br>SW/NW) | Rad. of storm<br>(NE/SE/<br>SW/NW) | RMW<br>nm |
|------|-------|-----|-------------|-------------------|--------------------|--------------------|-------------------------|-------------------|------------------------|------------------------------------|------------------------------------|-----------|
| 2018 | 1     | 4   | 0000        | 8.6               | 96.1               | 45                 | 25                      | 45                | 1004                   | 0/0/0/0                            | 0/0/0/0                            | -         |
| 2018 | 1     | 4   | 0600        | 9.5               | 95.8               | 45                 | 25                      | 45                | 1004                   | 0/0/0/0                            | 0/0/0/0                            | -         |
| 2018 | 1     | 4   | 1200        | 9.6               | 95.4               | 60                 | 25                      | 45                | 1003                   | 0/0/0/0                            | 0/0/0/0                            | -         |
| 2018 | 1     | 4   | 1800        | 10.0              | 95.2               | 45                 | 30                      | 45                | 1000                   | 0/0/0/0                            | 0/0/0/0                            | -         |
| 2018 | 1     | 5   | 0000        | 10.7              | 94.4               | 45                 | 35*                     | 50                | 999                    | 0/0/90/90                          | 0/0/0/0                            | -         |
| 2018 | 1     | 5   | 0600        | 11.1              | 93.8               | 45                 | 35*                     | 50                | 998                    | 0/0/90/90                          | 0/0/0/0                            | -         |
| 2018 | 1     | 5   | 1200        | 11.9              | 93.5               | 30                 | 35*                     | 50                | 997                    | 0/0/90/90                          | 0/0/0/0                            | -         |
| 2018 | 1     | 5   | 1800        | 12.4              | 92.4               | 45                 | 40*                     | 55                | 995                    | 0/0/90/90                          | 0/0/0/0                            | -         |
| 2018 | 1     | 6   | 0000        | 12.5              | 91.4               | 30                 | 40                      | 55                | 994                    | 75/75/90/90                        | 0/0/0/0                            | 30        |
| 2018 | 1     | 6   | 0600        | 12.6              | 90.6               | 30                 | 40                      | 55                | 994                    | 75/75/90/90                        | 0/0/0/0                            | 30        |



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## **2. Meteorological description**

### **2.1. Intensity analysis**

The Madden-Julian Oscillation passed through the Indian Ocean during early January. An area of enhanced convection formed within the monsoon trough to the north of Cocos Island. A low-level circulation became evident on satellite imagery during 4 January and a Dvorak T number 1.0 was assigned at 0600 UTC 4 January. Deep convection was displaced to the west due to the influence of easterly vertical wind shear, an Advanced Microwave Scanning Radiometer (AMSR) pass at 1845 UTC (refer Fig 2) showed this continuing into the overnight period.

A partial Advanced Scatterometer (ASCAT) pass at 0253 UTC 5 January (refer Fig 3) showed an area of 25-30 knot winds to the west of the centre. With a strengthening monsoon flow, curvature improved during the day and strong poleward outflow became evident on satellite imagery. As vertical wind shear decreased, the separation from the low-level centre to the deep convection reduced and the DT increased to 3.0 at 0000 UTC 6 January. Irving had a peak 10-minute wind mean intensity of 40 knot (75 km/h) while in the Australian region.

Objective intensity aids are available from approximately 0230 UTC 6 January, shortly before Irving moved out of the Australian region. The following is a summary of intensities for 0600 UTC 6 January for comparison;

- Post-event best track - 40 kn (75 km/h)
- Dvorak – 40 kn (75 km/h)
- SATCON – 50 kn (95 km/h) 1-minute mean
- ADT – 45 kn (85 km/h) 1-minute mean



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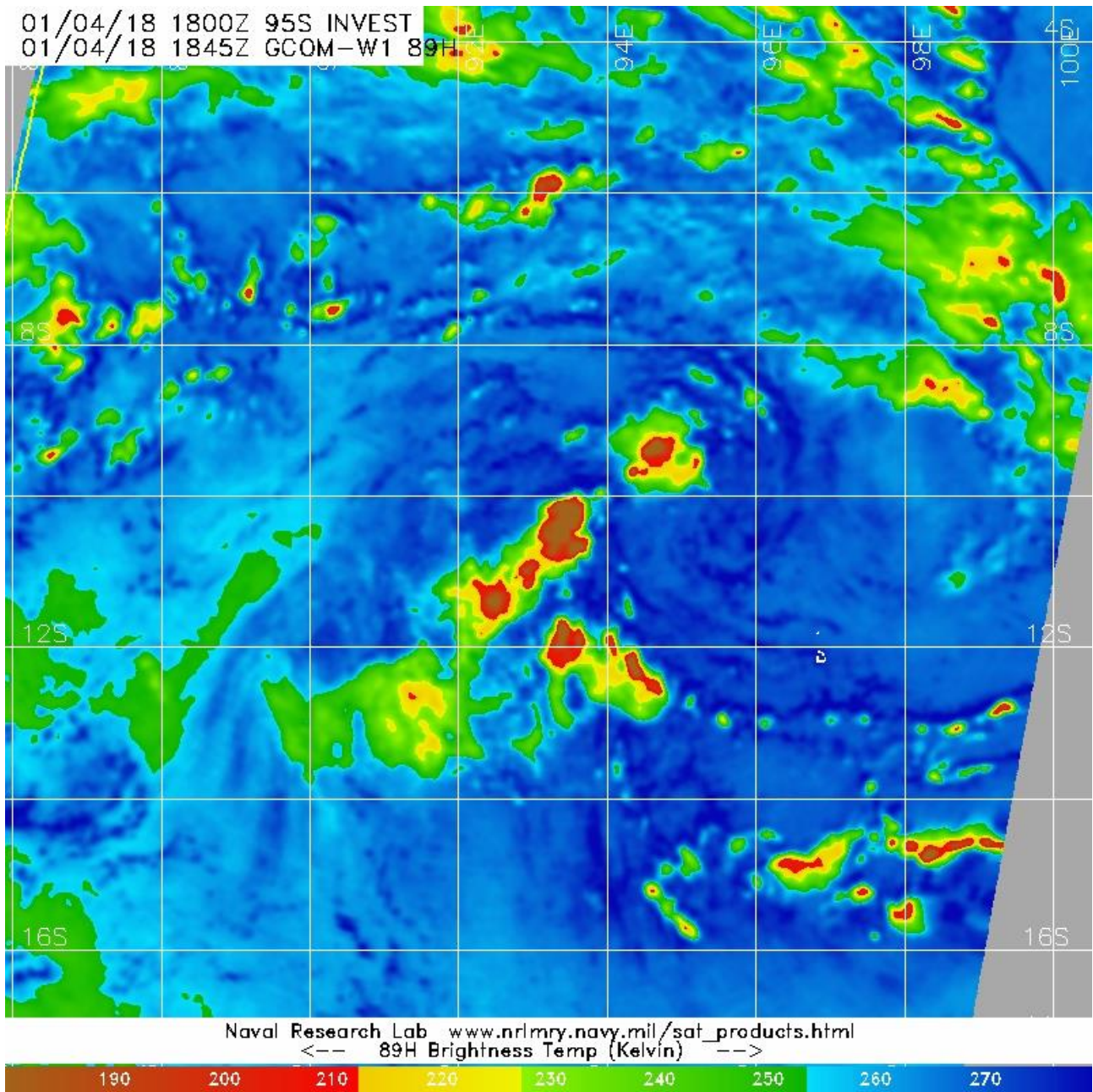


Figure 2. Advanced Microwave Scanning Radiometer (AMSR2) 89 GHz microwave image at 1845 UTC 4 January. Images courtesy NRL: <https://www.nrlmry.navy.mil/TC.html>

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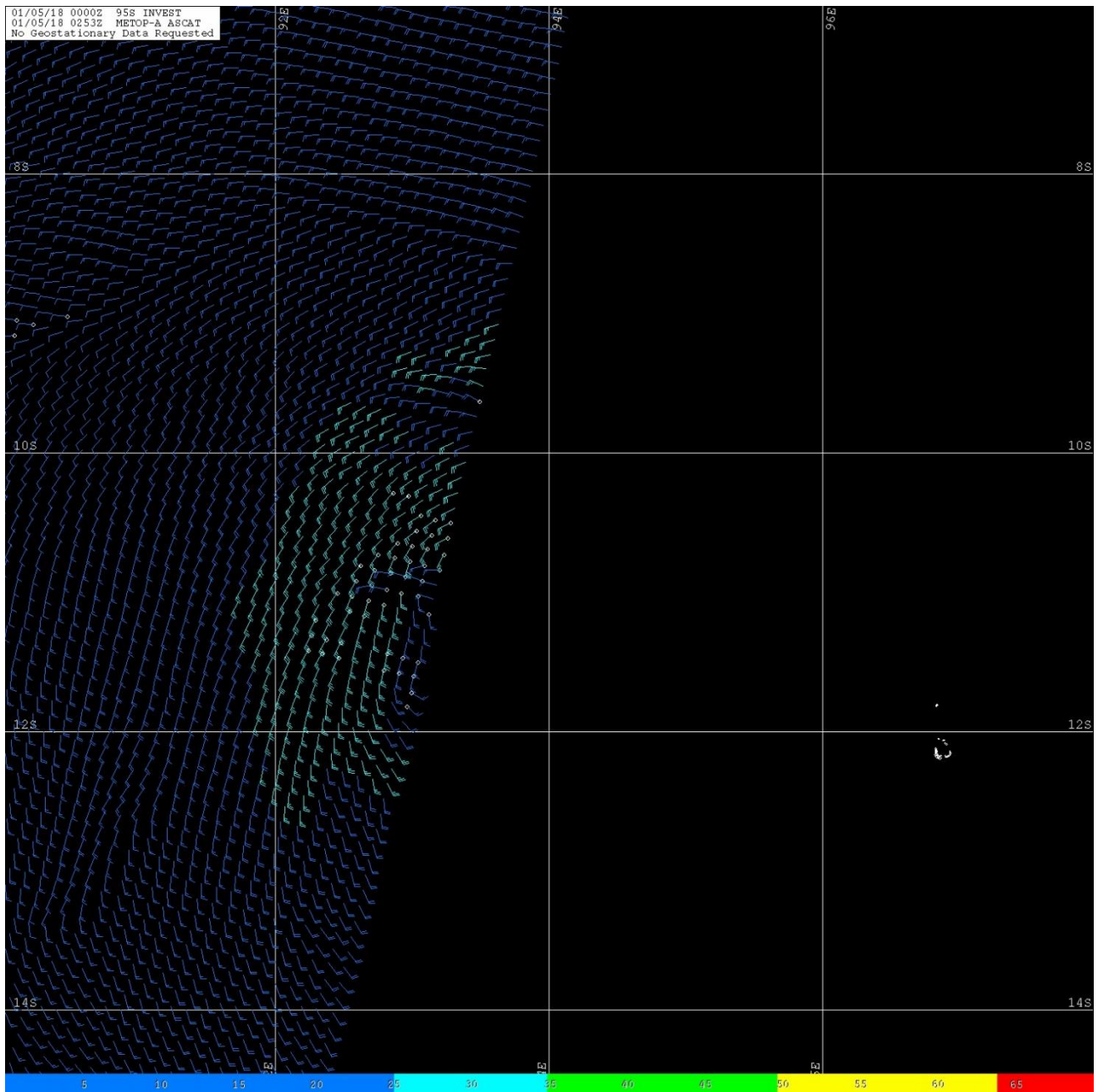


Figure 3. Advanced Scatterometer (ASCAT) pass at 0253 UTC 5 January. Images courtesy NRL:  
<https://www.nrlmry.navy.mil/TC.html>

## 2.2. Structure

Irving was heavily influenced by easterly vertical wind shear during its time in the Australian region. This created an asymmetric wind field with a radius to gales of 90 nautical miles (nm) (165 km) initially on only the western side of the system. The asymmetry remained a feature as gales extended to the eastern side where the radius to gales was 75 nm (140 km).

The radius to maximum winds (RMW) was 30 nm (55 km).

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## **2.3. Motion**

Initial slow south to southwest motion, primarily influenced by a ridge to the southeast, occurred during the formation stages of Irving. Following the passage of a mid-level trough further to the south on 4 January, the ridge steadily strengthened and extended further west. Irving then adopted a marginally faster and more westward track during 5 and 6 January prior to moving into RSMC La Reunion's region.

### 3. Impact

There were no significant impacts to Cocos Island during this event.



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## 4. Observations

There were no notable observations from Cocos Islands during this event.

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## 5. Forecast performance

No tropical cyclone advices were issued for Irving. High Seas Weather Warnings commenced from 0653 UTC 5 January.

There are insufficient data points to present meaningful accuracy statistics for the track and intensity for this event.

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## 6. Appendix: List of abbreviations

| Abbreviation | Term                                                             |
|--------------|------------------------------------------------------------------|
| ADT          | Advanced Dvorak Technique                                        |
| ACST         | Australian Central Standard Time                                 |
| AEST         | Australian Eastern Standard Time                                 |
| AMSR2        | Advanced Microwave Scanning Radiometer                           |
| ASCAT        | Advanced Scatterometer                                           |
| ATMS         | Advanced Technology Microwave Sounder                            |
| AWS          | Automatic weather station                                        |
| AWST         | Australian Western Standard Time                                 |
| C            | Celsius                                                          |
| CI           | Current intensity                                                |
| CIMSS        | Cooperative Institute for Meteorological Satellite Studies (USA) |
| CIRA         | Cooperative Institute for Research in the Atmosphere (USA)       |
| EIR          | Enhanced InfraRed                                                |
| ERC          | Eyewall replacement cycle                                        |
| FNMOCC       | Fleet Numerical Meteorology and Oceanography Centre (USA)        |
| FT           | Final T-number                                                   |
| GCOM         | Global Change Observation Mission                                |
| GHz          | Gigahertz                                                        |
| GMI          | Global Precipitation Measurement Microwave Imager                |
| h            | Hour                                                             |
| hPa          | Hectopascal                                                      |
| HSCAT        | Hai Yang 2 Scatterometer (HY-2B, HY-2C)                          |
| km           | Kilometres                                                       |
| km/h         | Kilometres per hour                                              |
| kn           | Knot                                                             |
| LLCC         | LLCC                                                             |
| MET          | Model Expected T-number                                          |



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|        |                                                 |
|--------|-------------------------------------------------|
| METOP  | Meteorological Operational Satellite            |
| MJO    | Madden-Julian Oscillation                       |
| mm     | Millimetres                                     |
| MSLP   | Mean sea level pressure                         |
| nm     | Nautical mile                                   |
| NOAA   | National Oceanic and Atmospheric Administration |
| NRL    | Navy Research Lab (USA)                         |
| PAT    | Pattern T-number                                |
| RH     | Relative humidity                               |
| RMW    | Radius of maximum winds                         |
| RSMC   | Regional Specialised Meteorological Centre      |
| SAR    | Synthetic Aperture Radar                        |
| SATCON | Satellite Consensus                             |
| SMAP   | Soil Moisture Active Passive                    |
| SMOS   | Soil Moisture and Ocean Salinity                |
| SSMIS  | Special Sensor Microwave Imager/Sounder         |
| TC     | Tropical Cyclone                                |
| TCWC   | Tropical Cyclone Warning Centre                 |
| UTC    | Universal Time Co-ordinated                     |