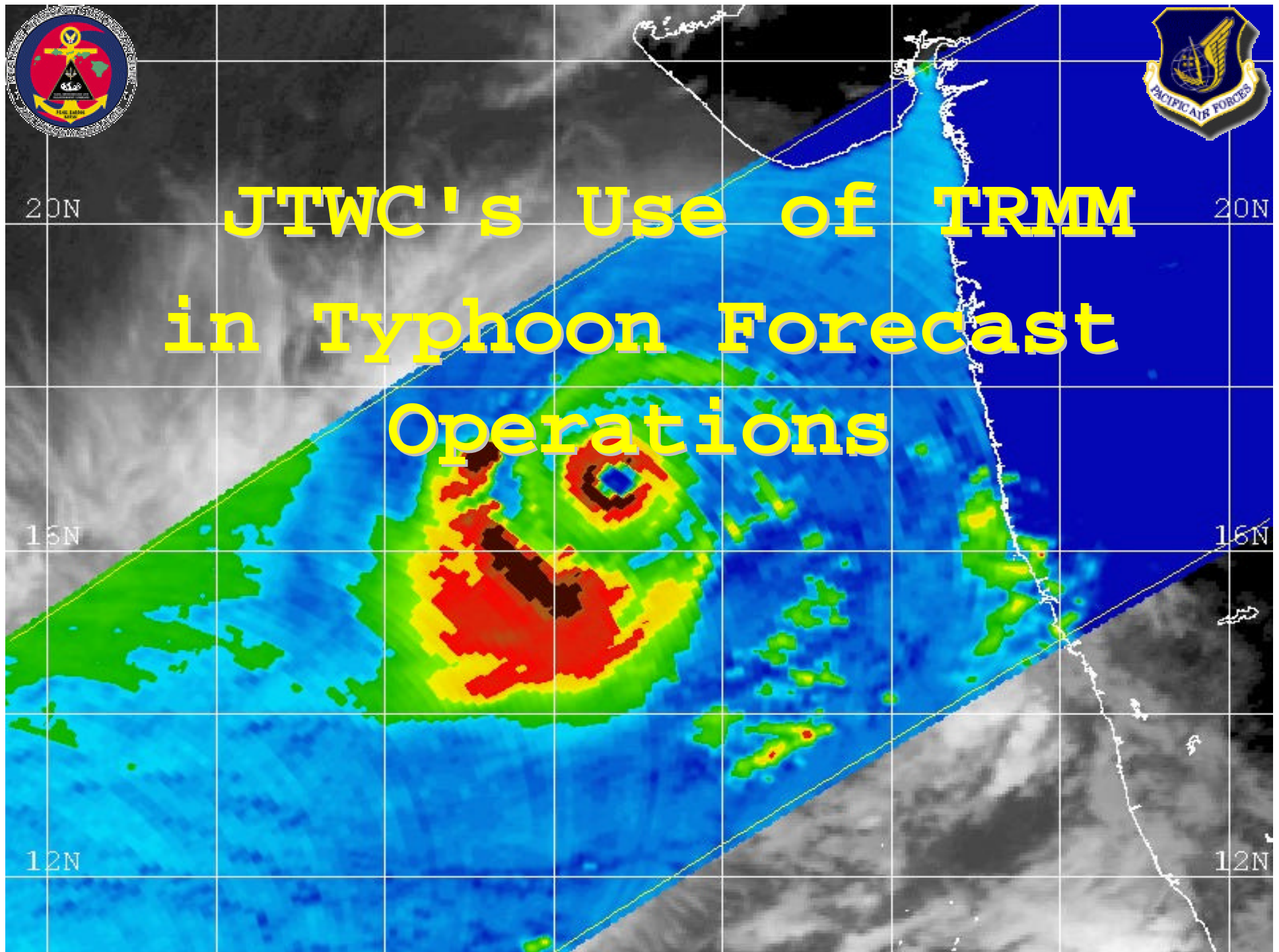




JTWC's Use of TRMM in Typhoon Forecast Operations





Opening Comments

- The current microwave satellite constellation provides limited coverage over tropical systems
- TRMM is essential to JTWC
 - higher resolution (~5-7 km (85 GHz) and 15 km (37 GHz))
 - 37 GHz channel (can define system center better at times)
 - tropical orbit (up to 4 possible passes over a system per day)
 - accurate fixes (especially in early stages) [see fix quality statistics]
- 2001 Totals Thus Far: TRMM comprises about 13% of microwave fixes (34/255) and 1-2% of total fixes



Overview

Use of TRMM in Typhoon Forecast Operations

- Impact Case Studies
 - Tropical Cyclone 01A
 - Tropical Storm 03W Cimaron
- TRMM SSTs
- Fix Quality
- Summary
- Further Examples

Slide 3/24

18 Jun 01



Tropical Cyclone 01A

Use of TRMM in Typhoon Forecast Operations

- High-visibility system due to proximity to Persian Gulf and transiting ships
- TRMM data provided critical/timely info for Japanese and US navy ships transiting the region
- “we need to be aware when ships or planes are in harm’s way, but we also need to keep in mind that what we fix and forecast can impact folks...or affect plan execution--BG Barno Deputy J3 at CINCPAC”

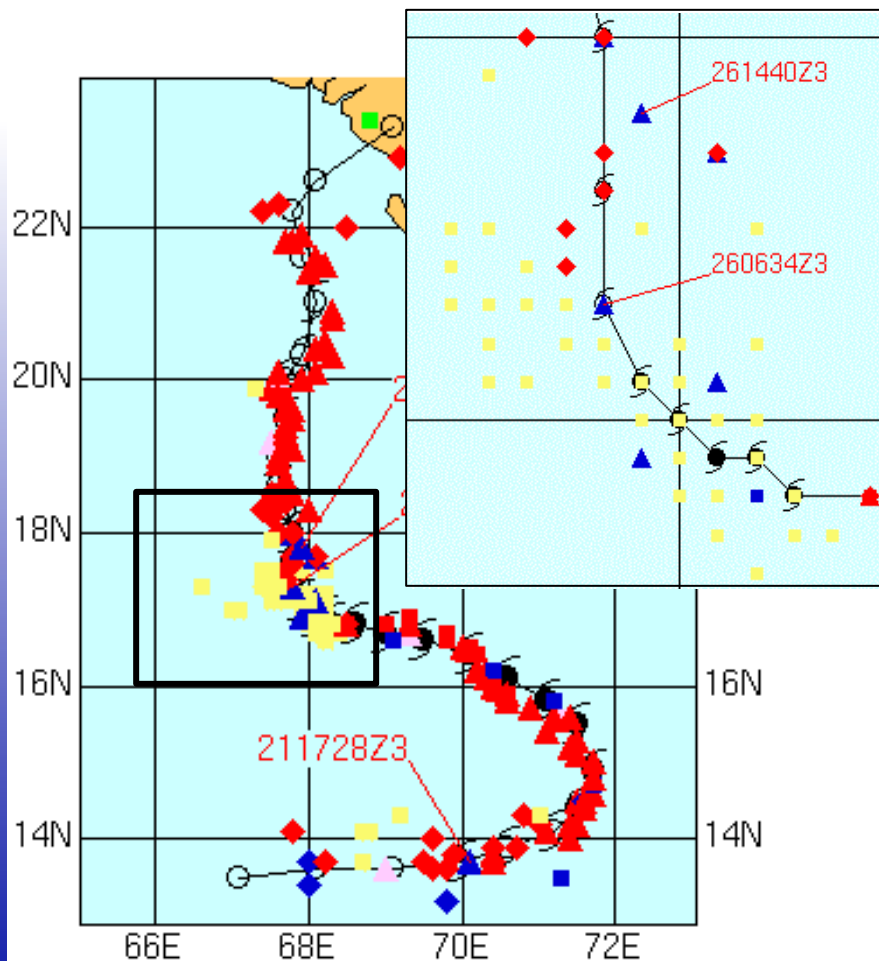
Slide 4/24

18 Jun 01



Tropical Cyclone 01A Best Track

Use of TRMM in Typhoon Forecast Operations



- System weakening from 60 kts at 26/06Z to 50 kts at 26/18Z
- Multiple VIS/IR fixes scattered and therefore flagged
- TRMM fixes vital to determining re-curve north
- USNS Henson was able to move north around western periphery of system

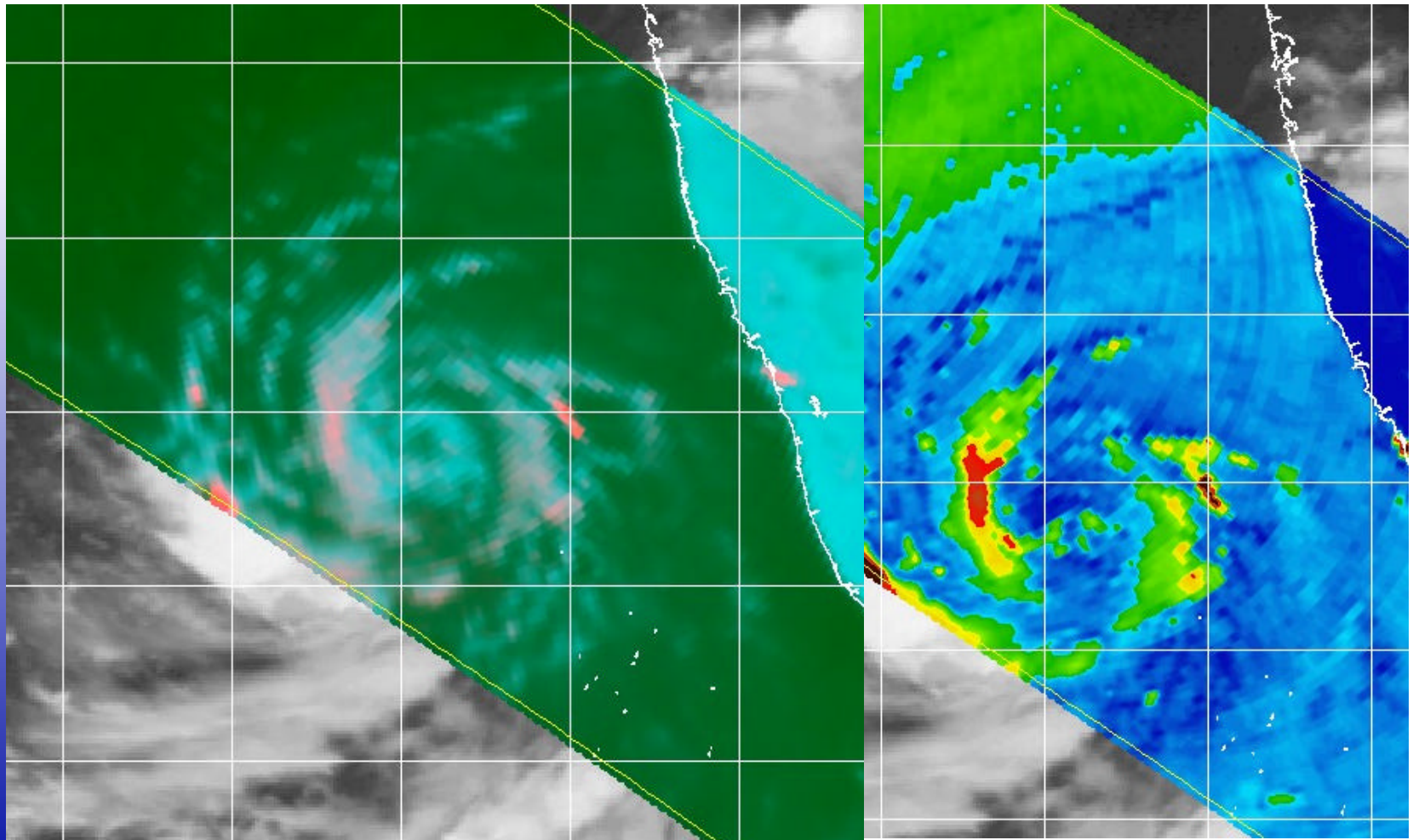
Slide 5/24

18 Jun 01



37 GHz vs. 85 GHz

Use of TRMM in Typhoon Forecast Operations



Slide 6/24

18 Jun 01

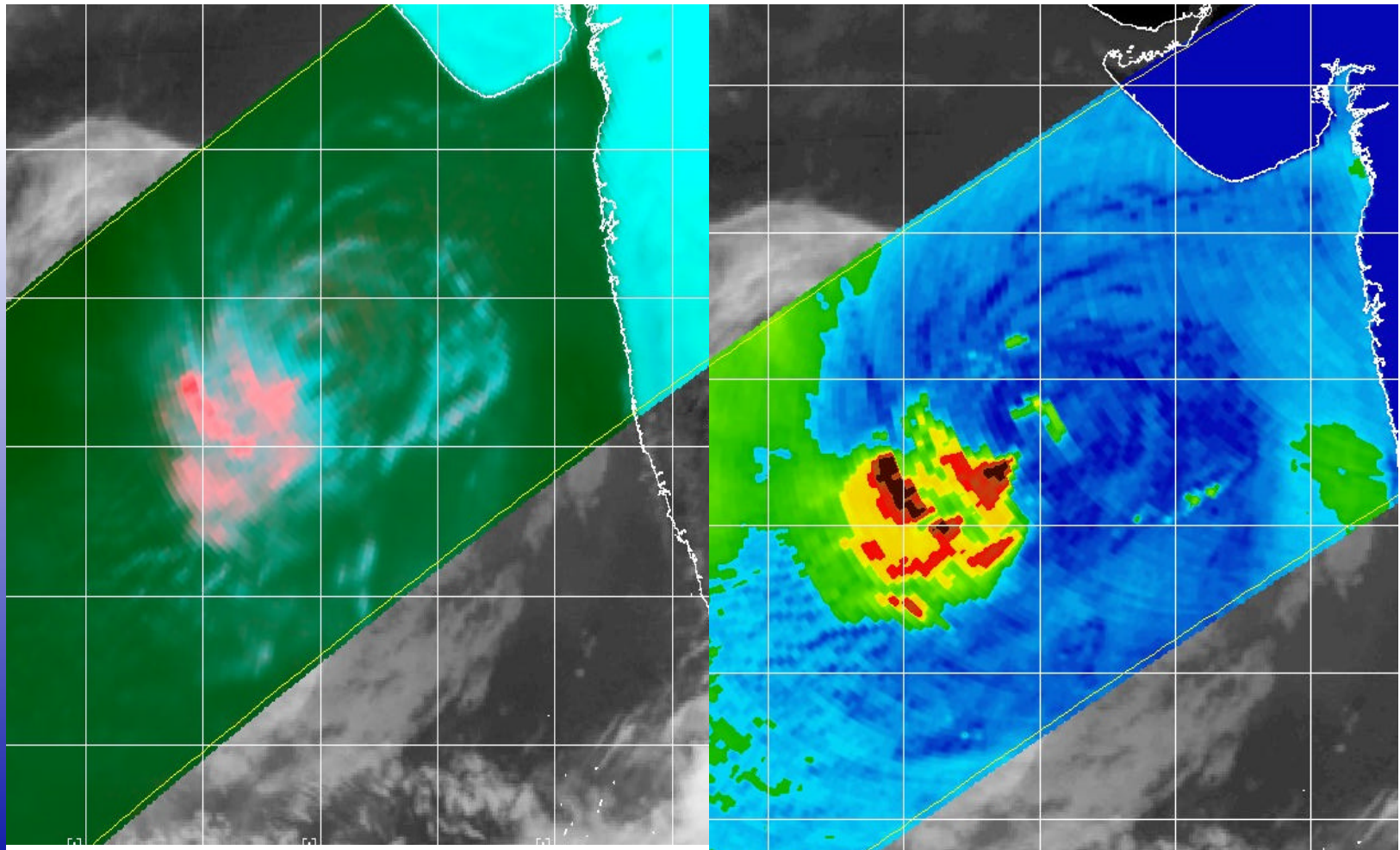
21/1728Z May 2001

*Images courtesy of Naval Research Lab and Jeff Hawkins.



37 GHz vs. 85 GHz

Use of TRMM in Typhoon Forecast Operations



Slide 7/24

18 Jun 01

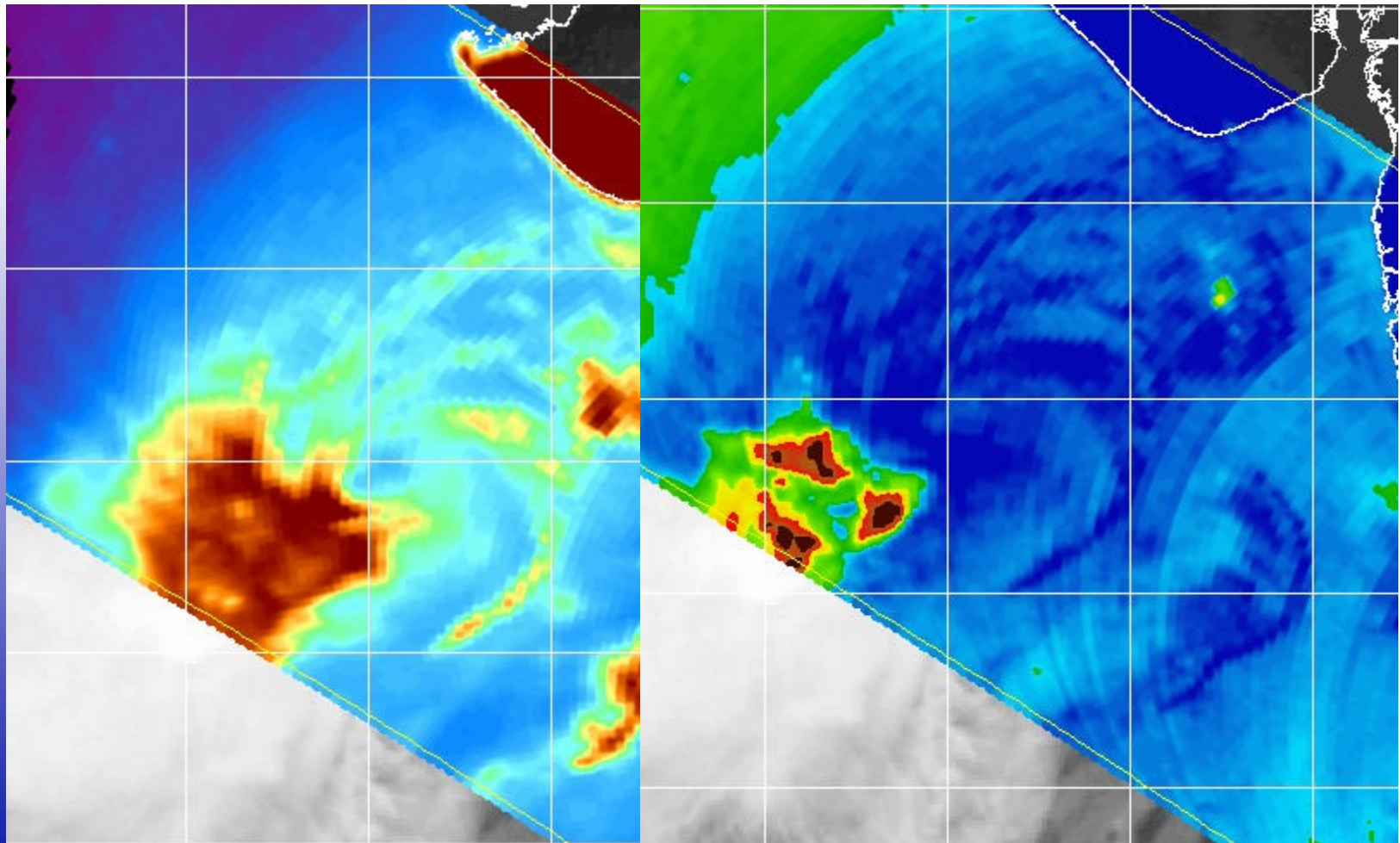
26/0634Z May 2001

*Images courtesy of Naval Research Lab and Jeff Hawkins.



37 GHz vs. 85 GHz

Use of TRMM in Typhoon Forecast Operations



Slide 8/24

18 Jun 01

26/1440Z May 2001

*Images courtesy of Naval Research Lab and Jeff Hawkins.

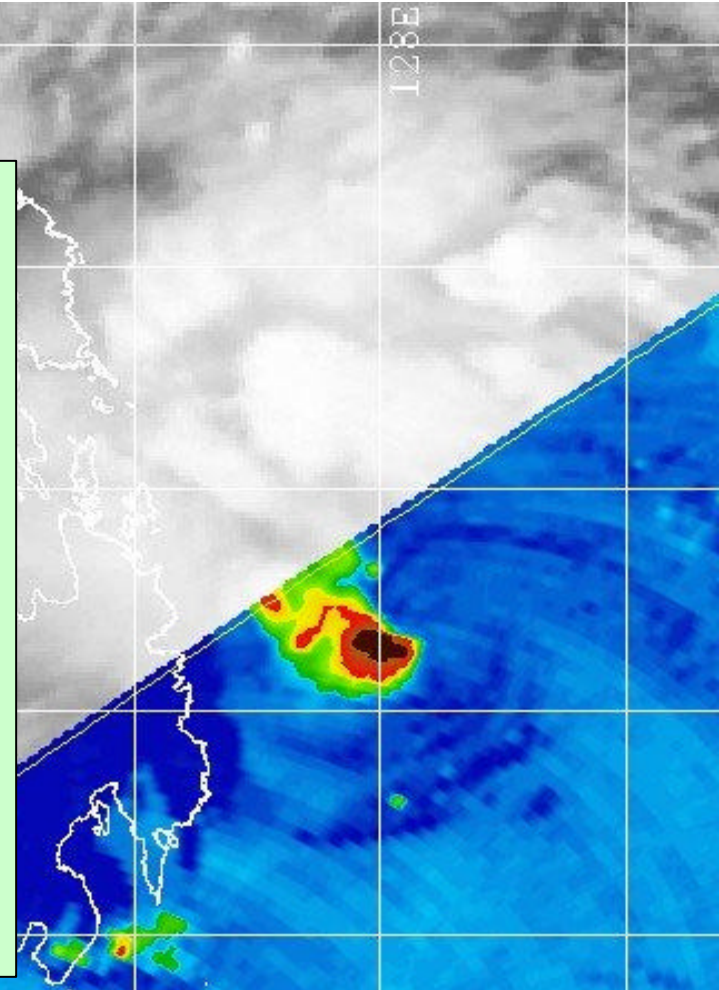


Tropical Storm 03W (Cimaron)

Use of TRMM in Typhoon Forecast Operations

05/06/01	1200Z	98W INVEST
05/06/01	1135Z	TRMM 85H
05/06/01	1024Z	GMS-5 IR

- Critical for location during initial weak stage
- Later, fixes/sat imagery indicated weakening trend, when in reality 37 GHz indicated that system was maintaining and strengthening



Slide 9/24

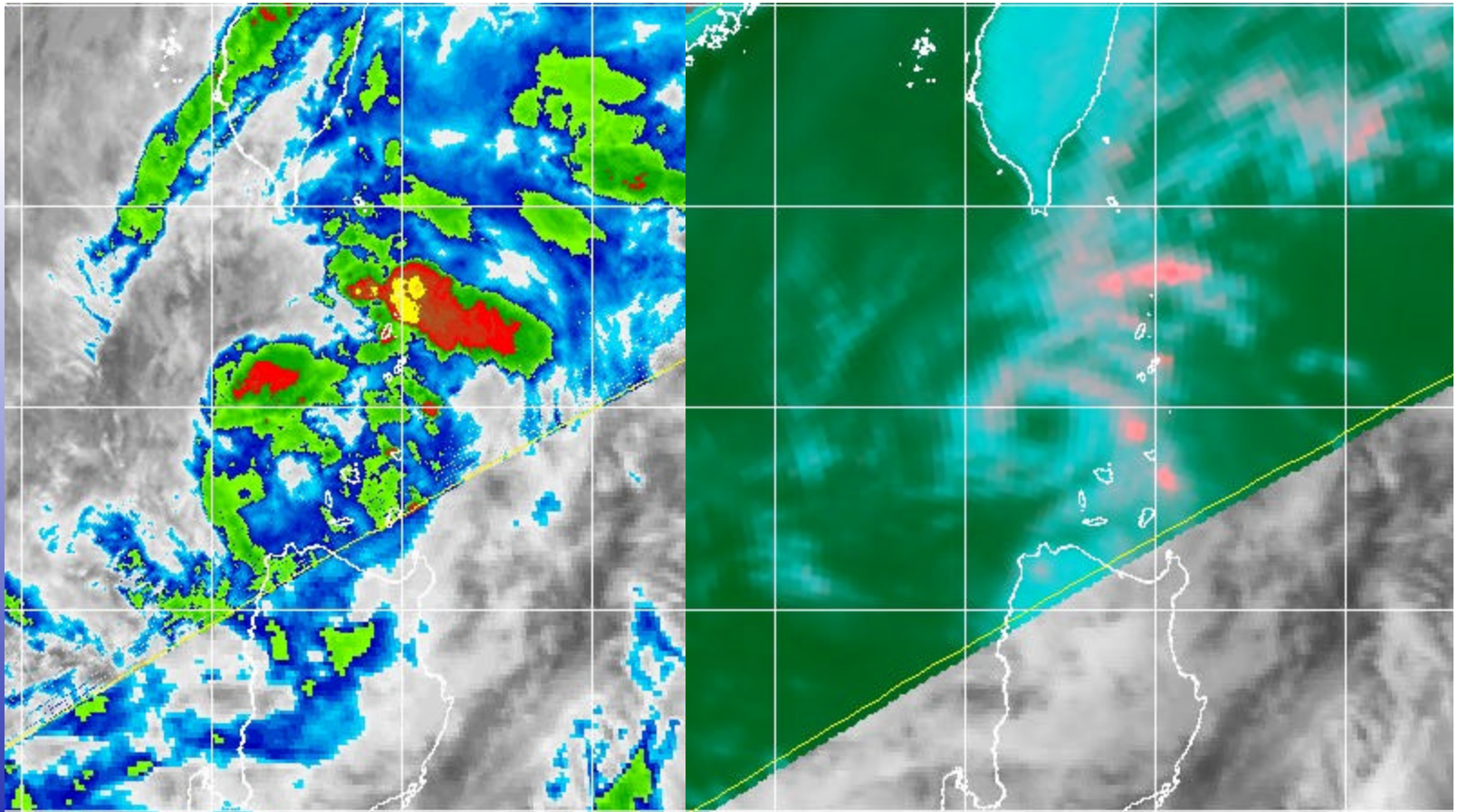
18 Jun 01

*Images courtesy of Naval Research Lab and Jeff Hawkins.



IR vs. 37 GHz

Use of TRMM in Typhoon Forecast Operations



12/1047Z May 2001

Slide 10/24

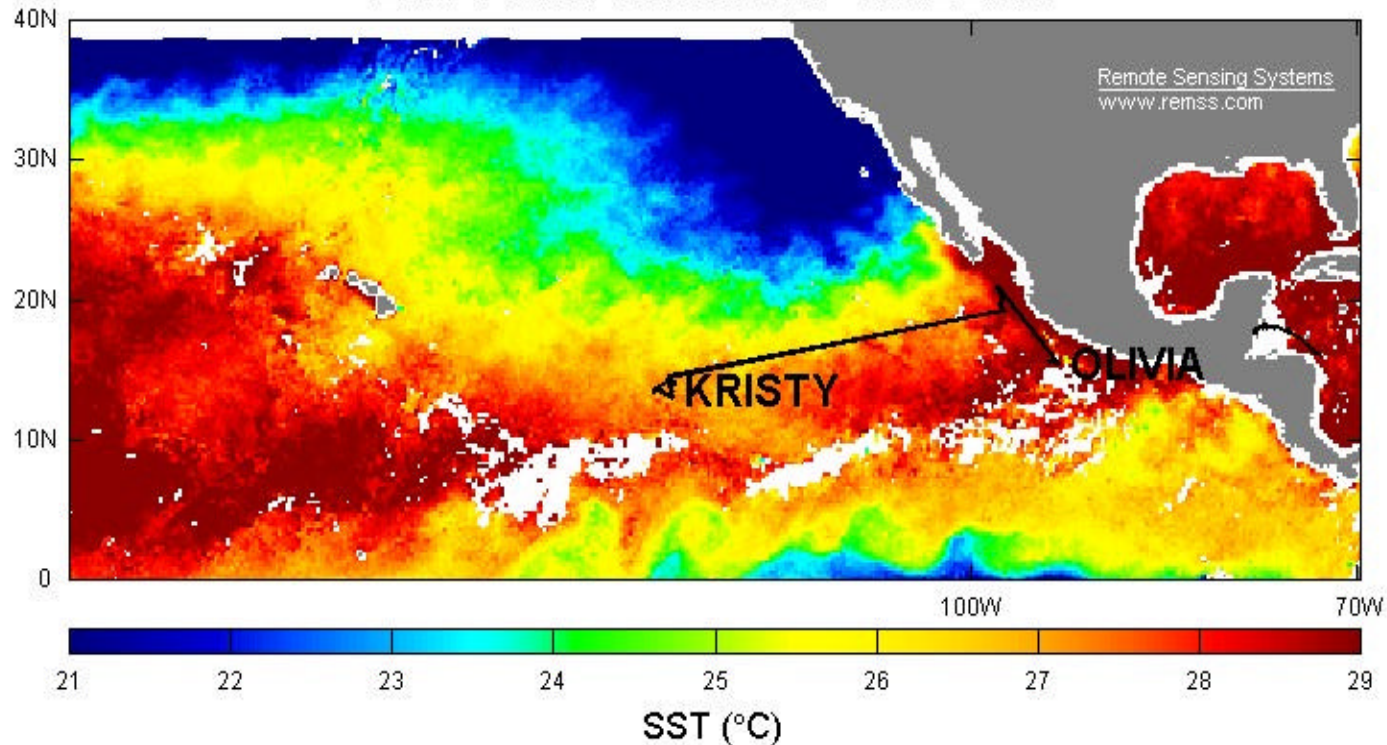
18 Jun 01

*Images courtesy of Naval Research Lab and Jeff Hawkins.



Use of TRMM in Typhoon Forecast Operations

East Pacific TRMM SST 10/02/2000



Storm Type	Storm Name	Forecast	Date	Time (UT)	Latitude (deg)	Longitude (deg)	Wind (m/s)	Pressure (mb)	TMI SST (C)
STO	OLIVIA	00 hr	10/ 4/2000	21:00	16.00	253.90	28.32	994	27.25
???	OLIVIA	12 hr	10/ 5/2000	6:00	16.10	253.30	28.32	???	27.55
???	OLIVIA	24 hr	10/ 5/2000	18:00	16.30	252.50	30.90	???	27.87
???	OLIVIA	36 hr	10/ 6/2000	6:00	16.50	251.50	30.90	???	28.08
???	OLIVIA	48 hr	10/ 6/2000	18:00	16.70	250.50	33.48	???	28.05
???	OLIVIA	72 hr	10/ 7/2000	18:00	17.00	248.50	26.27	???	27.50

Slide 11/24

18 Jun 01

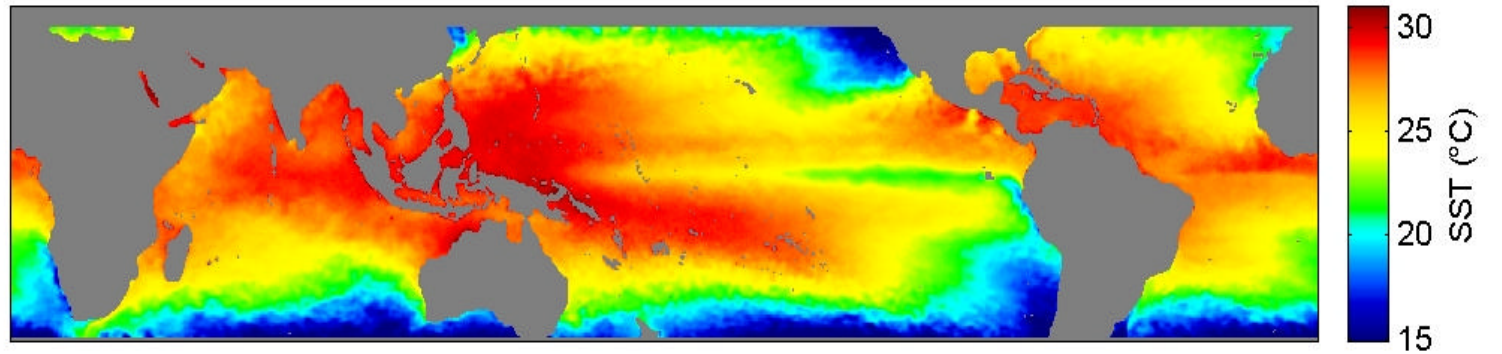




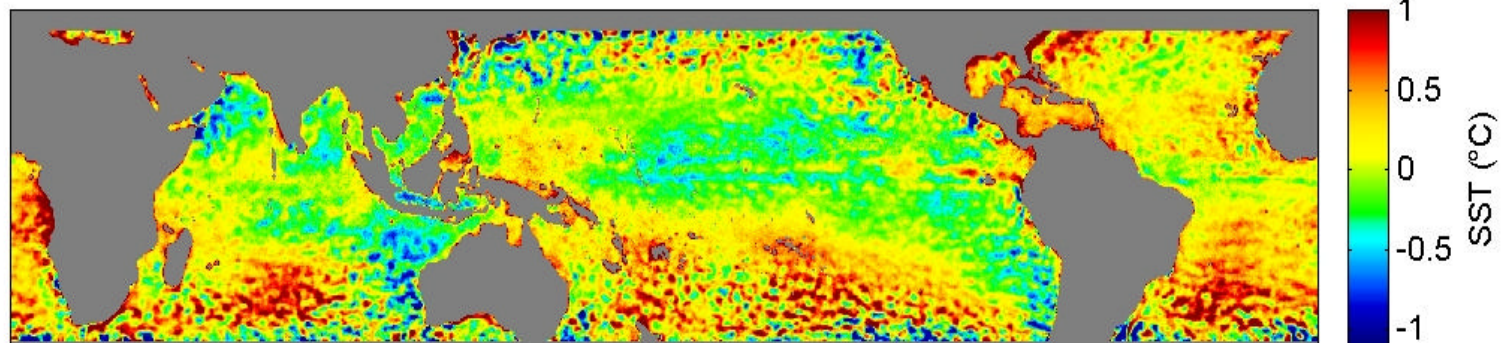
Comparison TMI and Reynolds

Use of TRMM in Typhoon Forecast Operations

Mean SST: TMI



Mean SST Difference, TMI - Reynolds



Slide 12/24

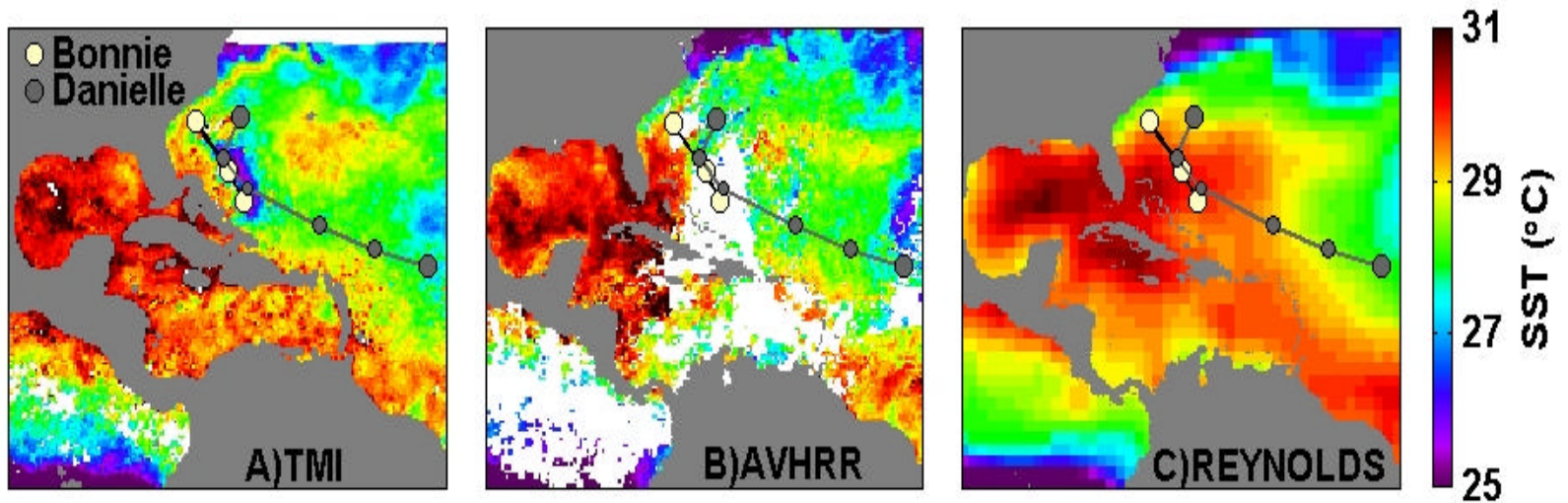
18 Jun 01

Remote Sensing Systems
www.remss.com





SST during Hurricane Danielle



- ❖ TMI views cold wake from Hurricane Bonnie
- ❖ AVHRR misses it due to cloud cover
- ❖ Reynolds (weekly SST) lacks temporal resolution

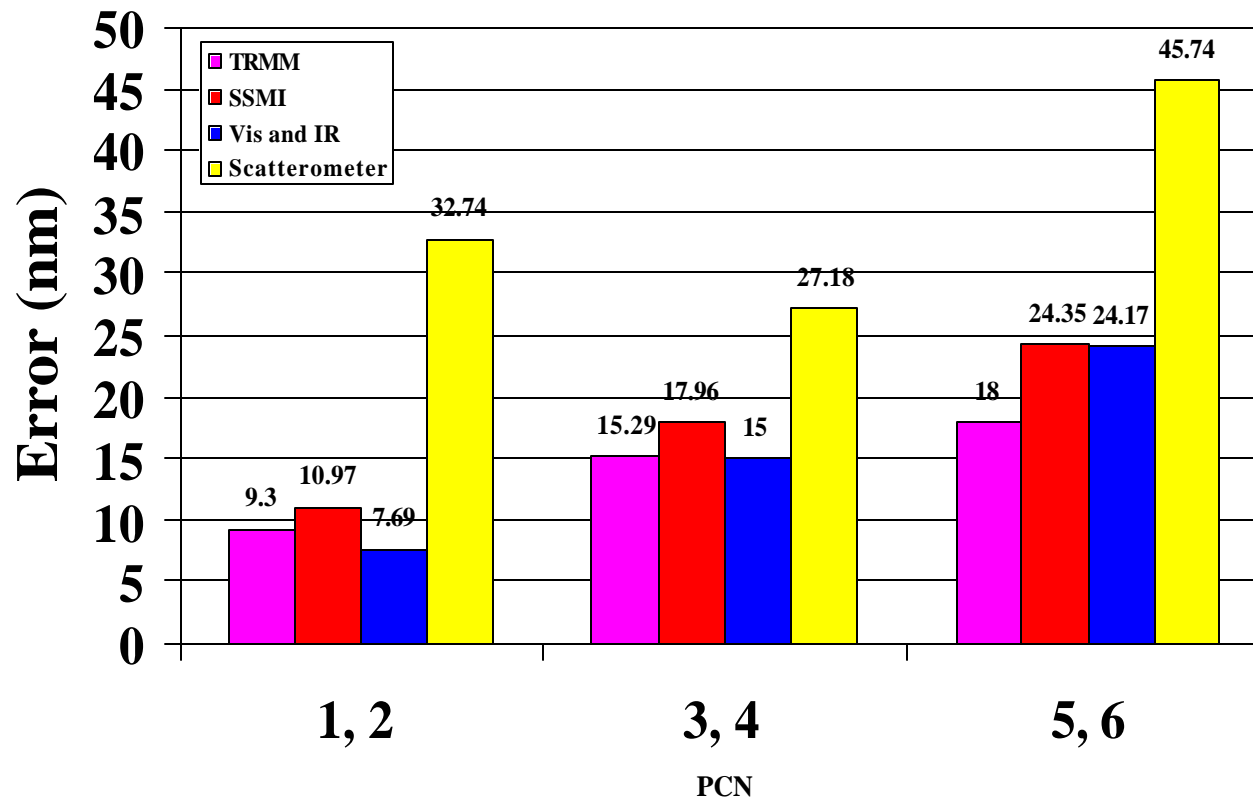




Fix Quality Compared to JTWC Final Track Data

Use of TRMM in Typhoon Forecast Operations

2000 NWP Fix Error



Slide 14/24

18 Jun 01

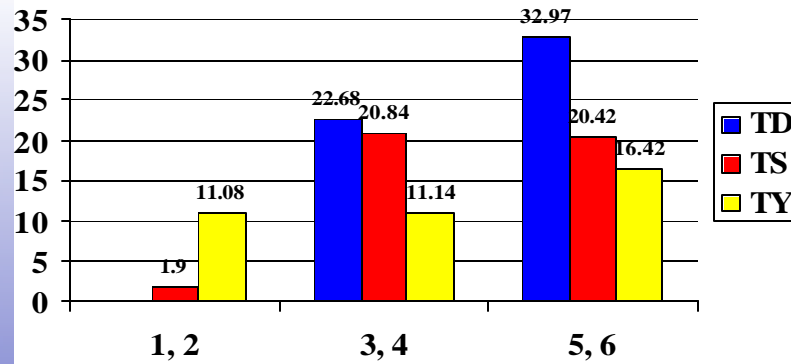
*Analysis performed by Capt Chris Cantrell



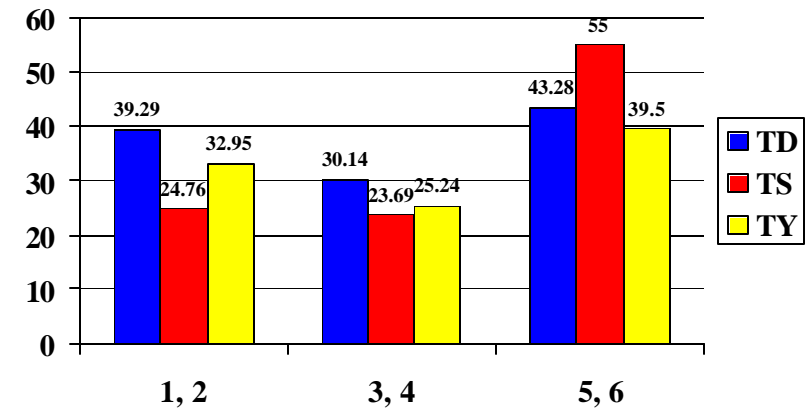
Fix Quality By Intensity

Use of TRMM in Typhoon Forecast Operations

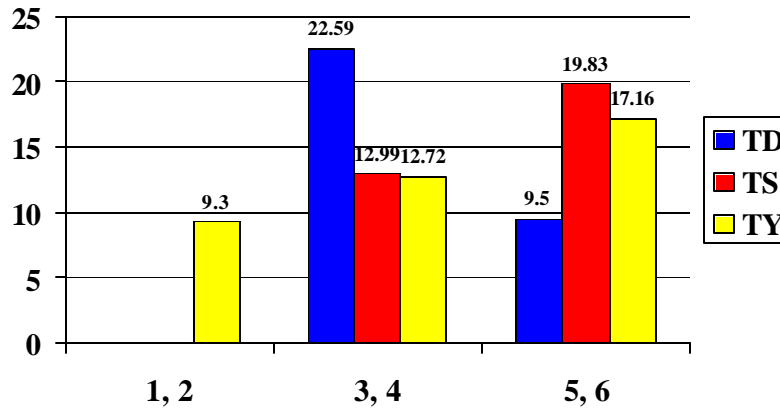
SSMI



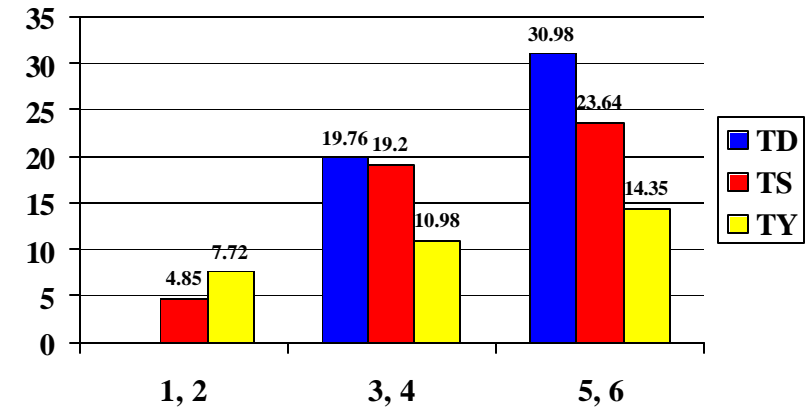
SCATTEROMETER



TRMM



VIS/IR



Slide 15/24

18 Jun 01

*Analysis performed by Capt Chris Cantrell



Summary

Use of TRMM in Typhoon Forecast Operations

- TRMM data has been fully integrated into JTWC warning process
- TRMM is important to the Tropical Cyclone Reconnaissance Mission
- Sensor fix accuracy is comparable to VIS/IR Imagery for PCN 1-4, but 25% better at PCN 5,6



Overview

Use of TRMM in Typhoon Forecast Operations

- TRMM's tropical orbit provides increased coverage over tropical systems
- Improved resolution at 85 GHz and 37 GHz provides better eyewall/convective band definition
- At times, the 37 GHz channel provides a better system position than 85 GHz
- New 35-knot wind radii method recently completed by Larry Connor



Use of TRMM in Typhoon Forecast Operations

More Examples

Slide 18/24

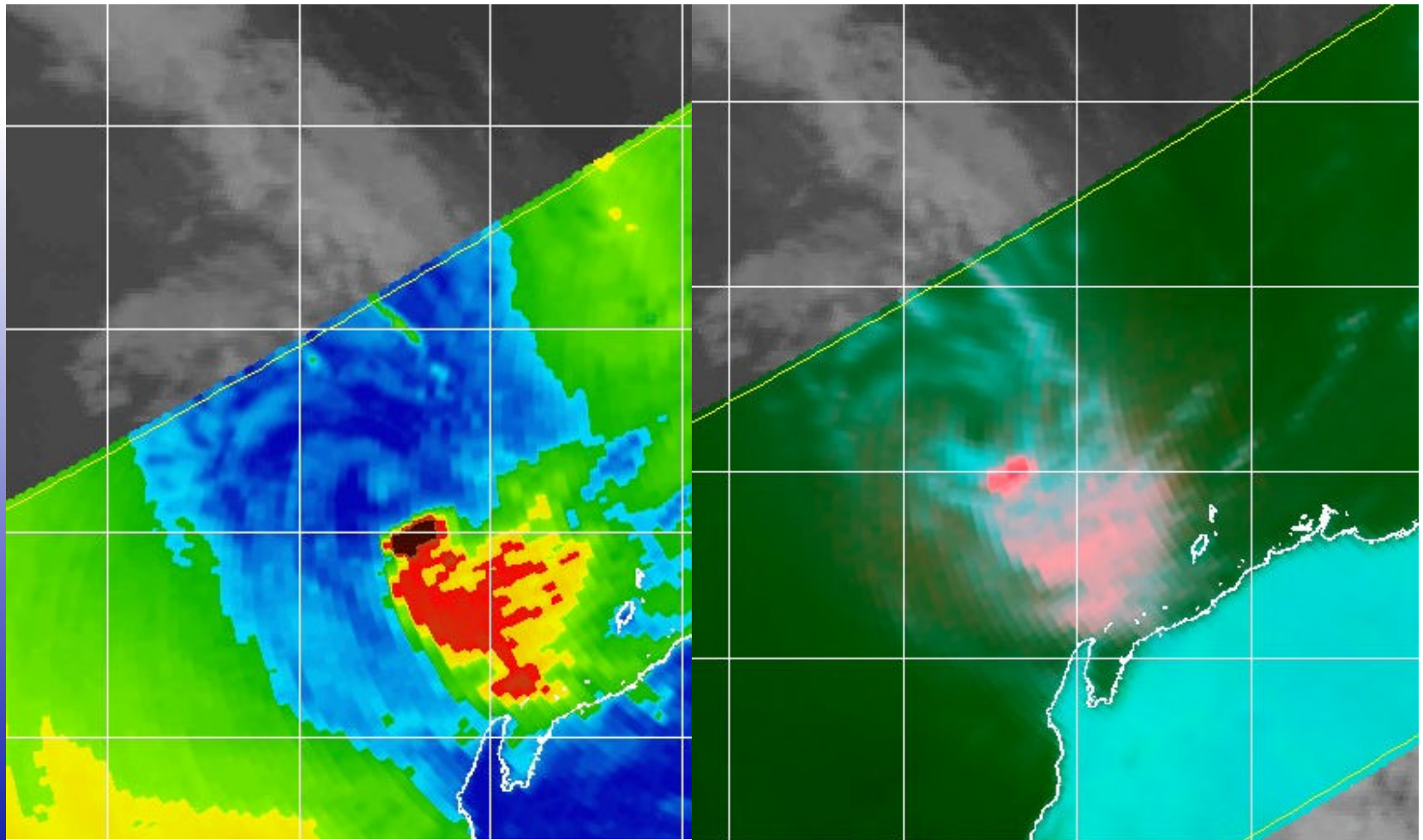
18 Jun 01



TC 20S Alistair: 37 GHz vs. 85 GHz



Use of TRMM in Typhoon Forecast Operations



Slide 19/24

18 Jun 01

20/1759Z Apr 2001

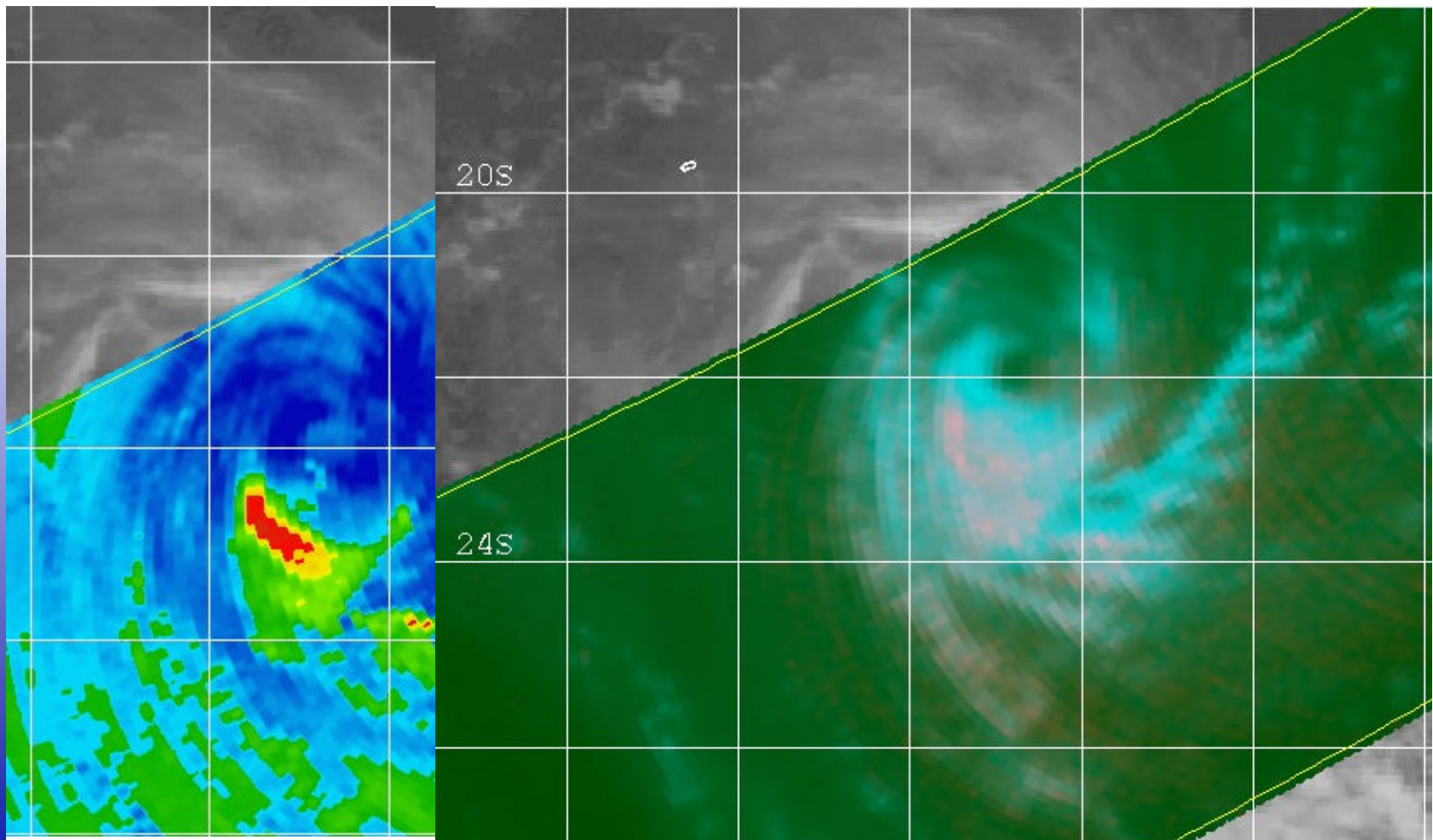
*Images courtesy of Naval Research Lab and Jeff Hawkins.



TC 06S Charly: 37 GHz vs. 85 GHz



Use of TRMM in Typhoon Forecast Operations



Slide 20/24

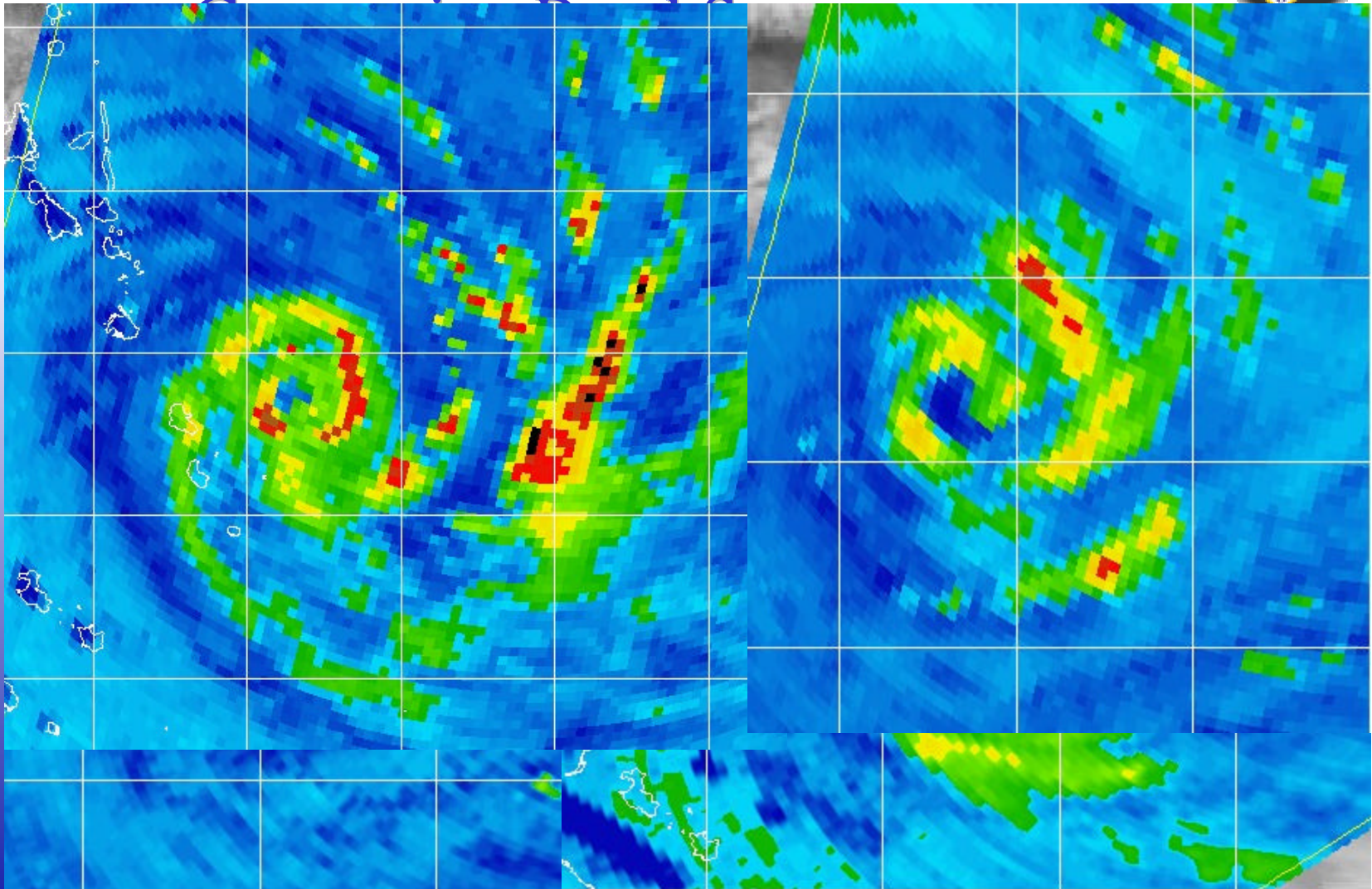
18 Jun 01

20/1759Z Apr 2001

*Images courtesy of Naval Research Lab and Jeff Hawkins.



TC 05S Bindu and TC 13P Paula:



Slide 21/24

18 Jun 01

12/0019Z Jan 2001

28/1648Z Feb 2001

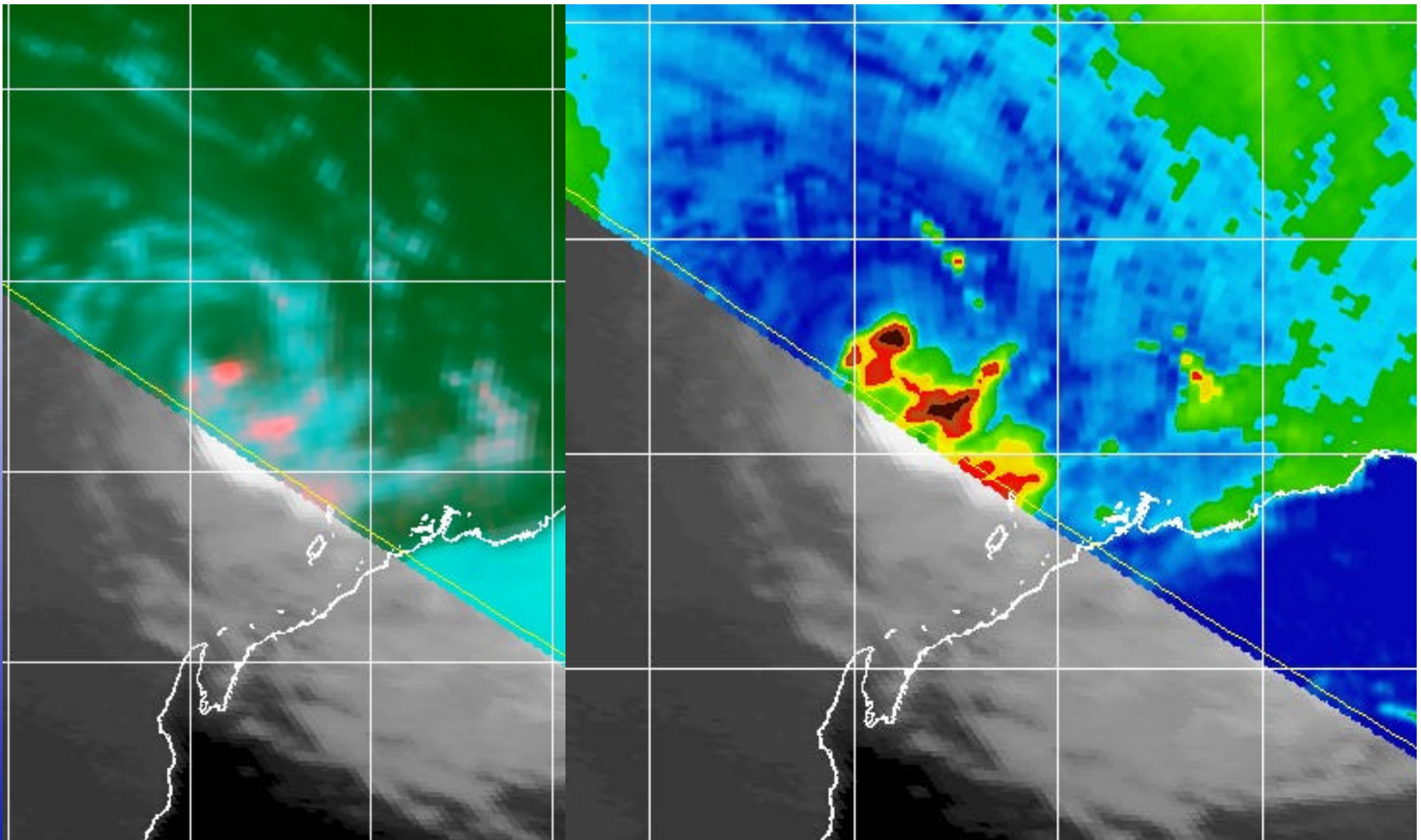
*Images courtesy of Naval Research Lab and Jeff Hawkins.



TC 20S Alistair: 37 GHz vs. 85 GHz



Use of TRMM in Typhoon Forecast Operations



Slide 22/24

18 Jun 01

20/0954Z Apr 2001

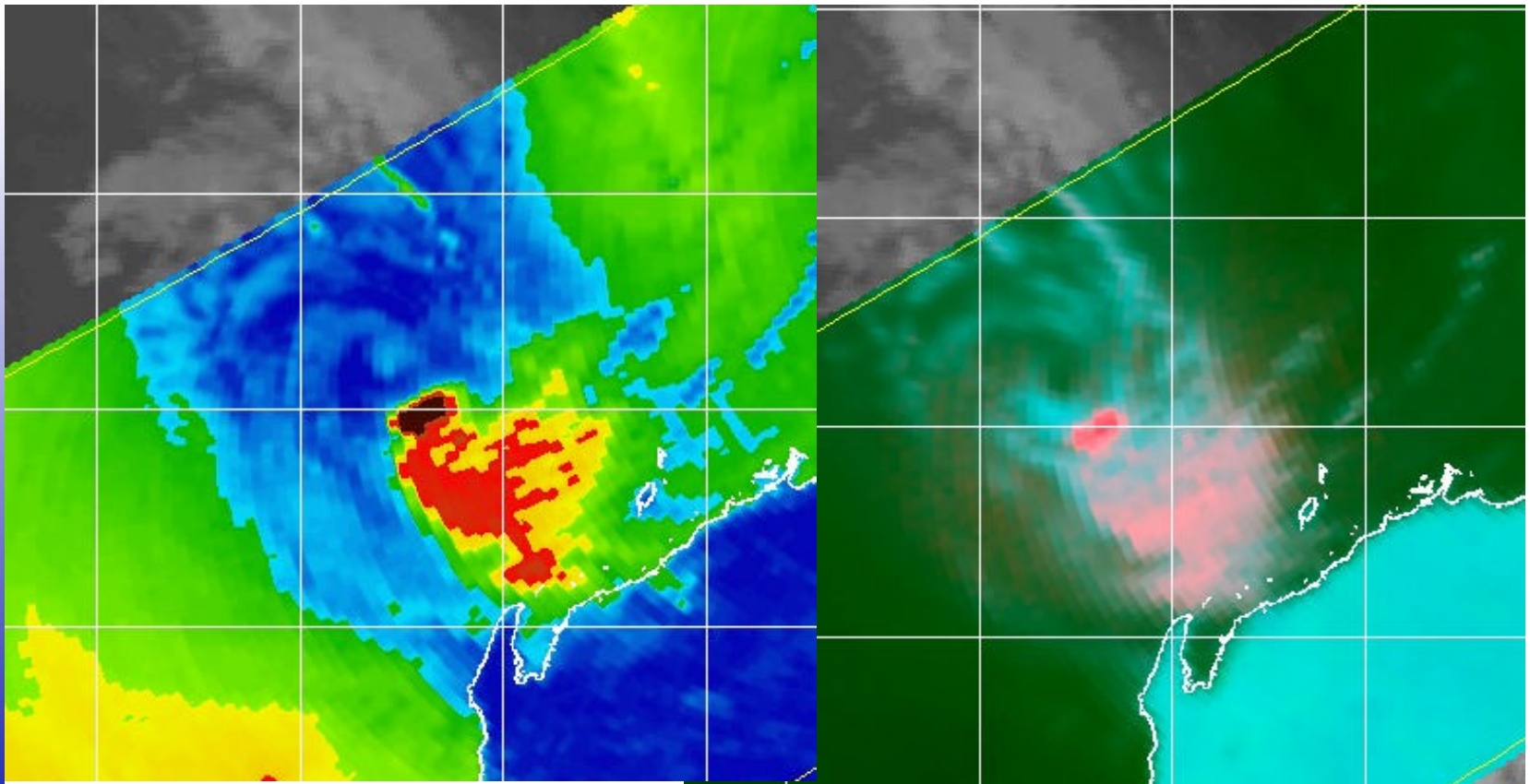
*Images courtesy of Naval Research Lab and Jeff Hawkins.



TC 20S Alistair: 37 GHz vs. 85 GHz



Use of TRMM in Typhoon Forecast Operations



20/1759Z Apr 2001

Slide 23/24

18 Jun 01

*Images courtesy of Naval Research Lab and Jeff Hawkins.



Use of TRMM in Typhoon Forecast Operations

Questions?

Slide 24/24

18 Jun 01