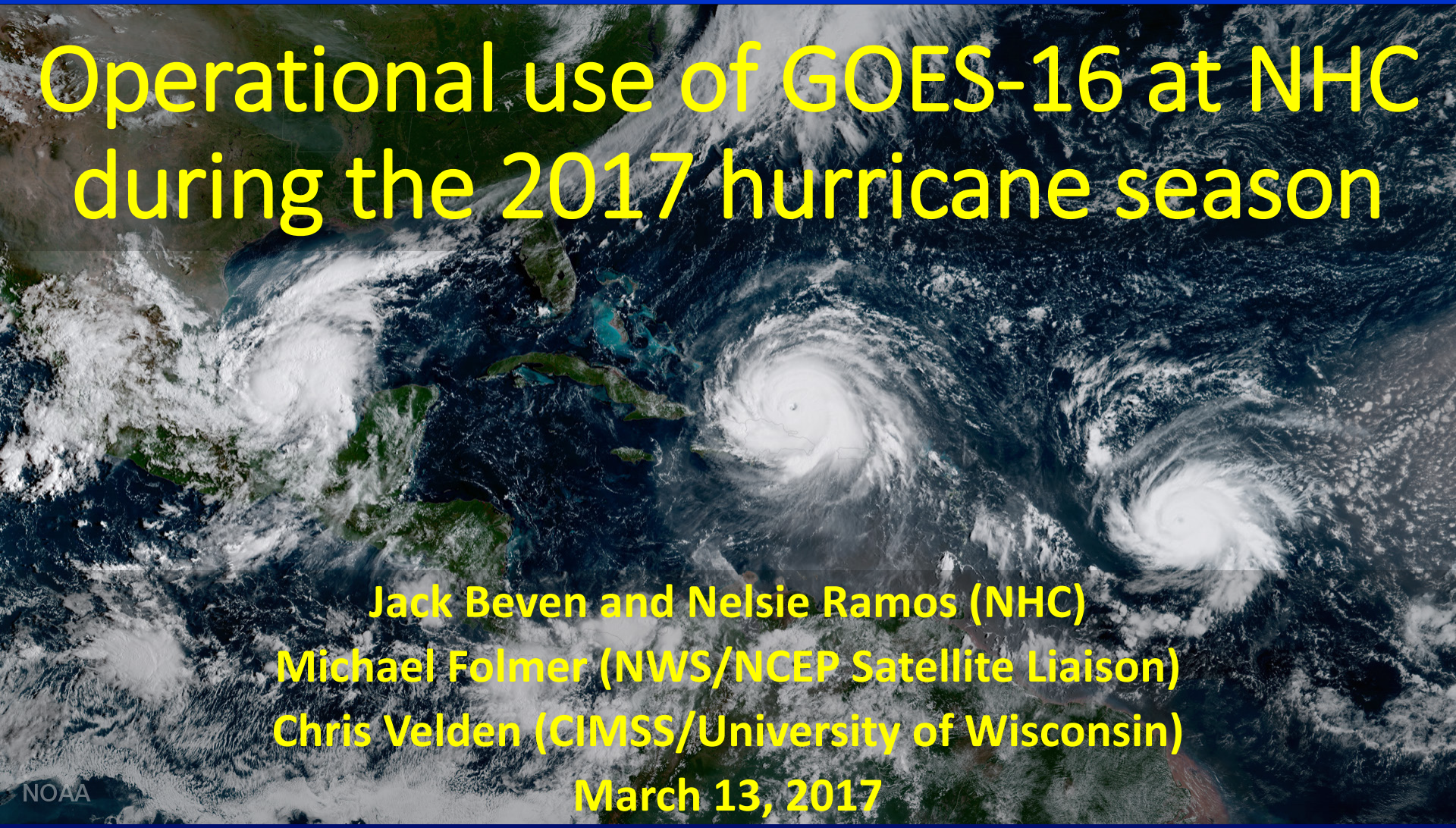
Operational use of GOES-16 at NHC during the 2017 hurricane season



Jack Beven and Nelsie Ramos (NHC)
Michael Folmer (NWS/NCEP Satellite Liaison)
Chris Velden (CIMSS/University of Wisconsin)

March 13, 2017

"GIMME! GIMME! GIMME!"

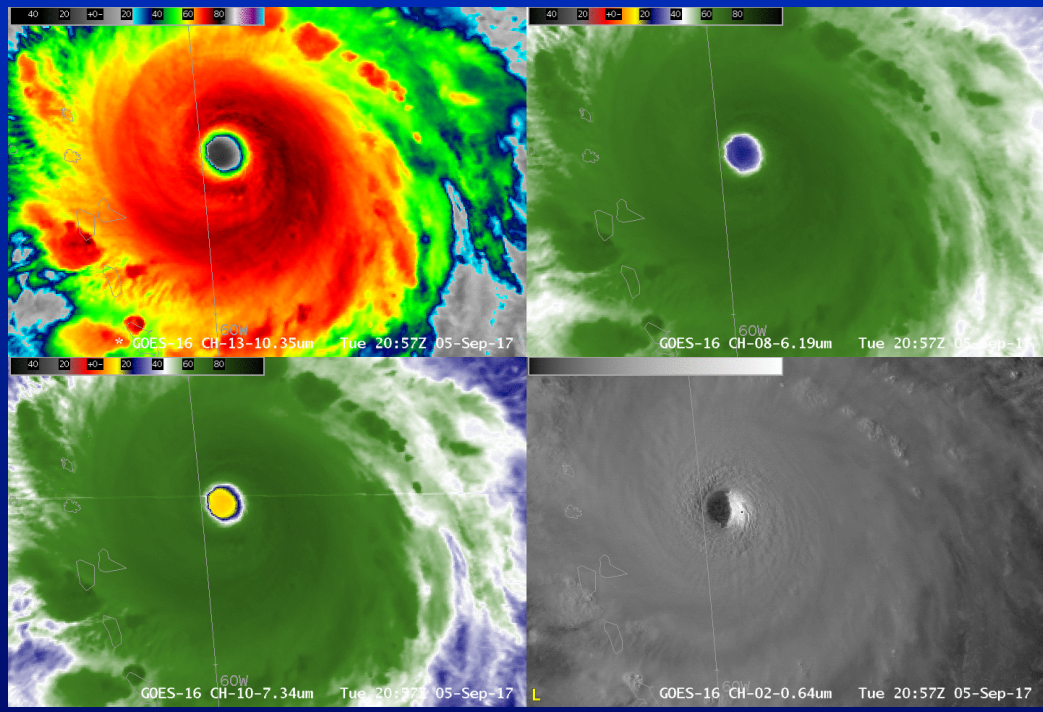
- **GOES-16 was launched in November 2016 and began transmitting data early in 2017.**
- **The satellite was officially "experimental", and the data was to be provided with a lengthy disclaimer.**
- **The "experimental" status did not deter forecasters at NHC and elsewhere from using the data in operations, with NHC mentioning the satellite 35+ times in its TCDs and TAFB using it in their operations.**



The height of the 2017 season courtesy of CIMSS

GOES-16 was used for operational analyses and decision making

- **GOES-16 data had an immediate positive impact on NHC operational decision making.**
- **Examples of this included analyses of TC structure, analyses of the TC environment, center location, and existence of a circulation.**



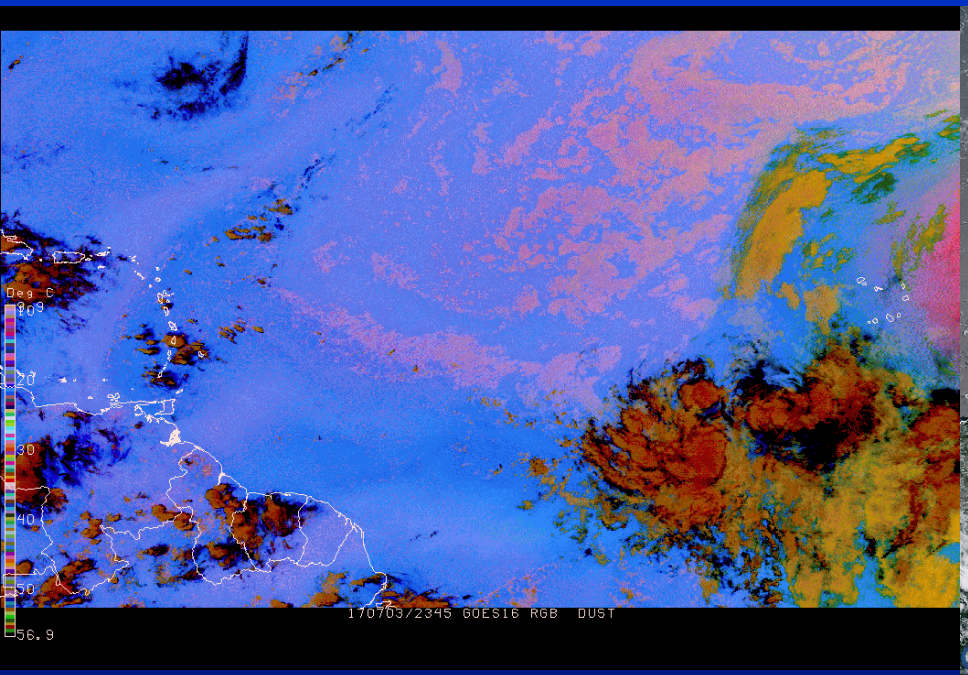
Four animations of Irma courtesy of CIMSS

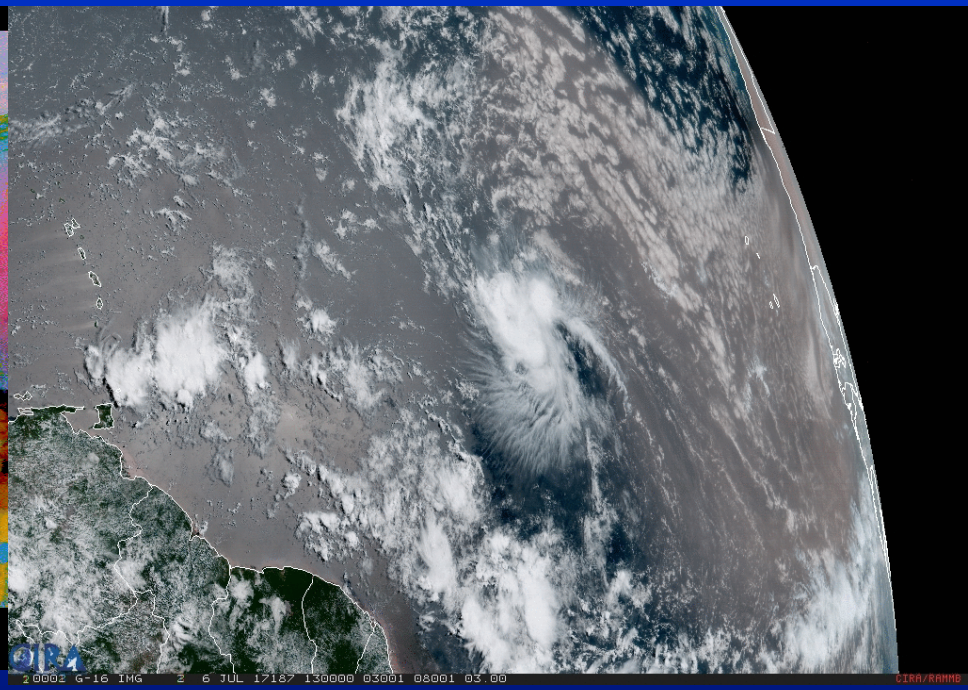
The Structure and Environment of Cindy



“Given the continued presence of dry air near the center, as shown by experimental GOES-16 data, and its generally negative effects on the central convection, little change in strength is expected before landfall.”

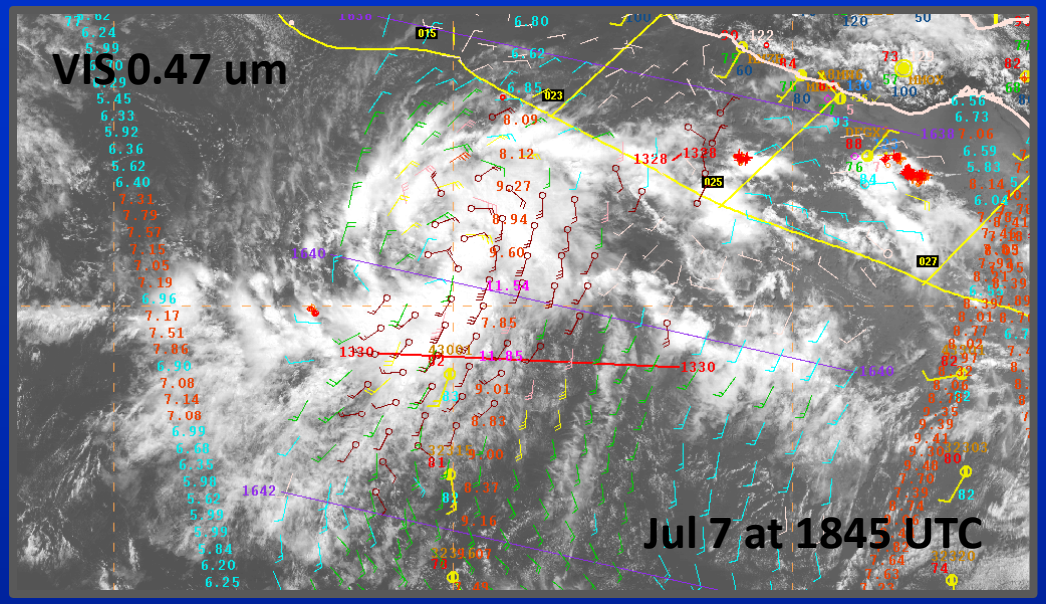
The Demise of Tropical Depression Four

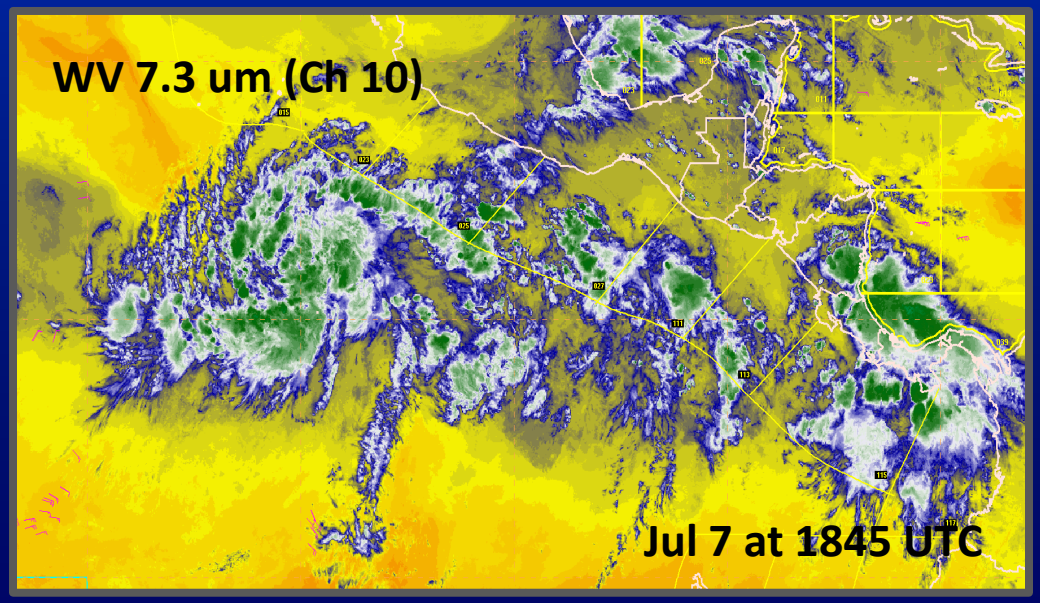




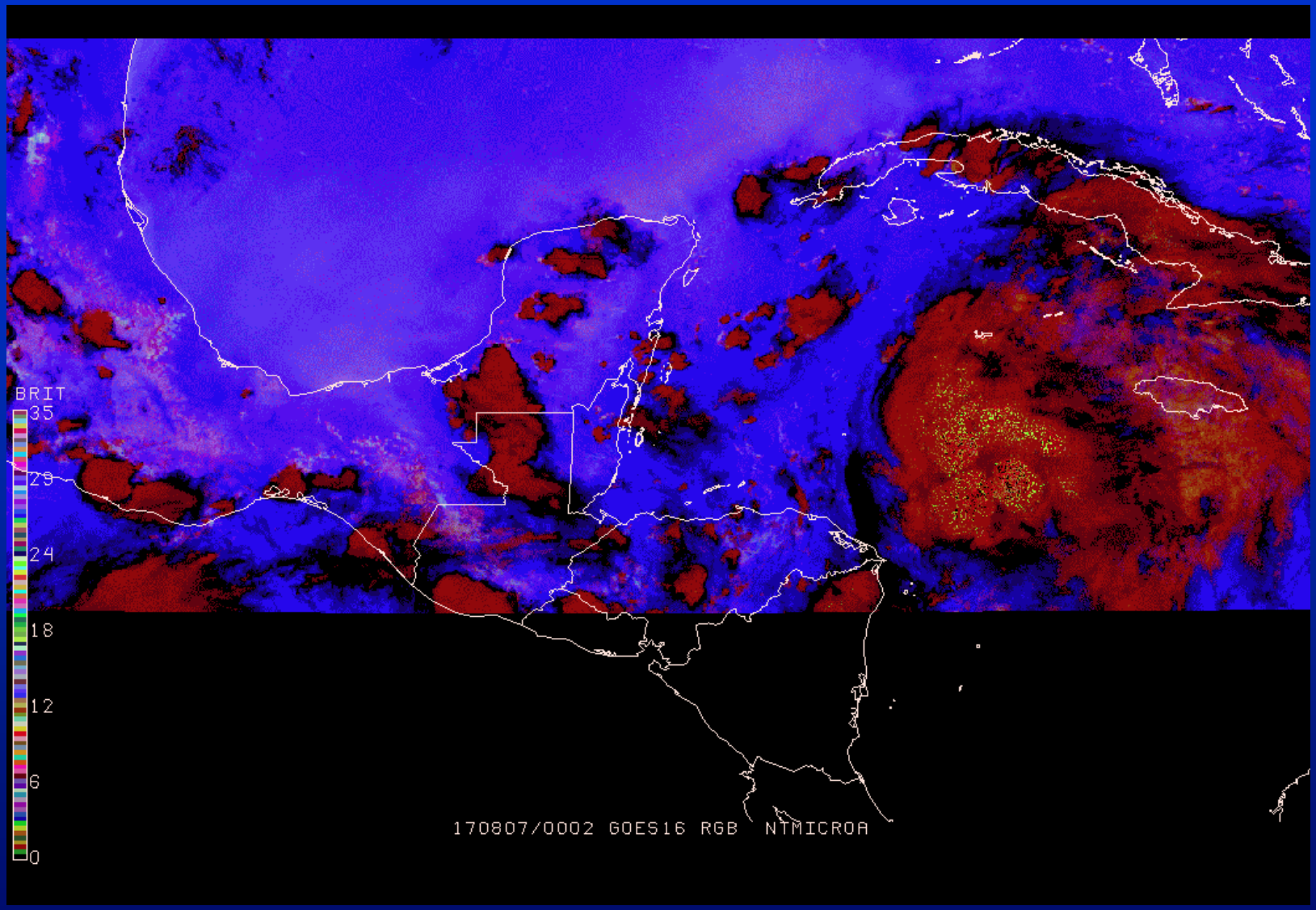
"Experimental multispectral imagery shows a large area of dry and dusty air over the Atlantic near and east of the depression, and it appears likely this will entrain into the circulation during the next couple of days." The forecast therefore called for eventual dissipation without the system becoming a tropical storm, and this verified well.

EPAC Tropical Storm Eugene Genesis



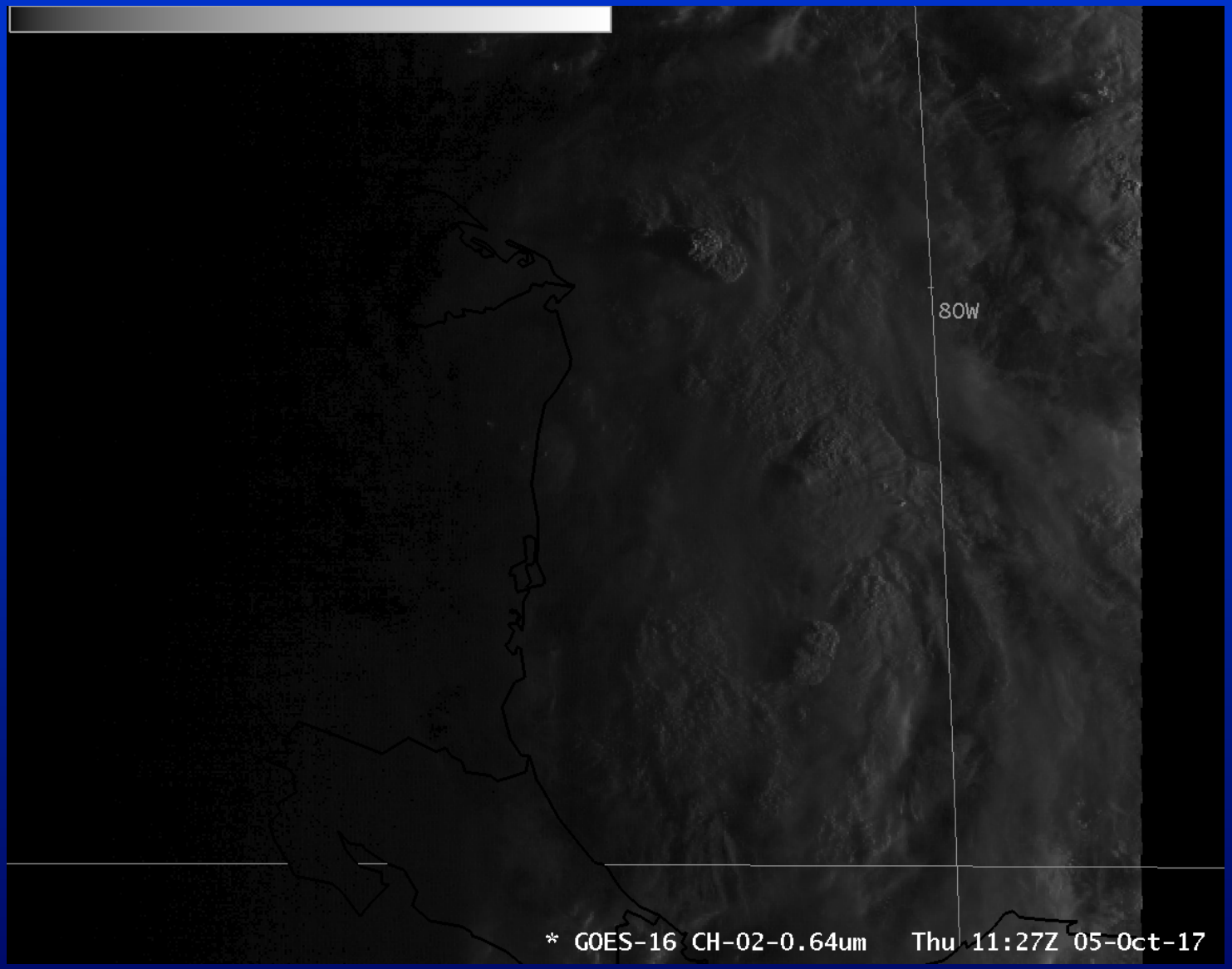


The Genesis of Franklin



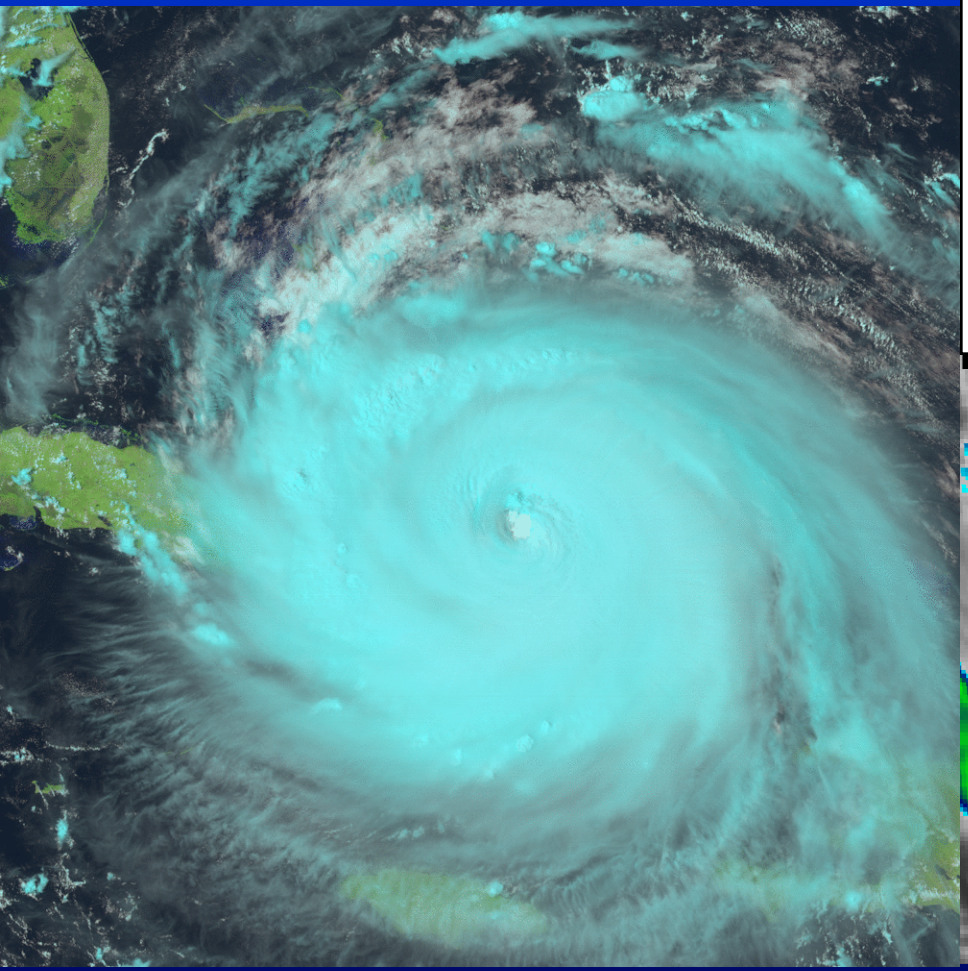
"However, the new GOES-16 nighttime microphysics imagery clearly shows low clouds moving from west to east on the south side of the alleged center, which is suggestive of a closed low-level circulation."

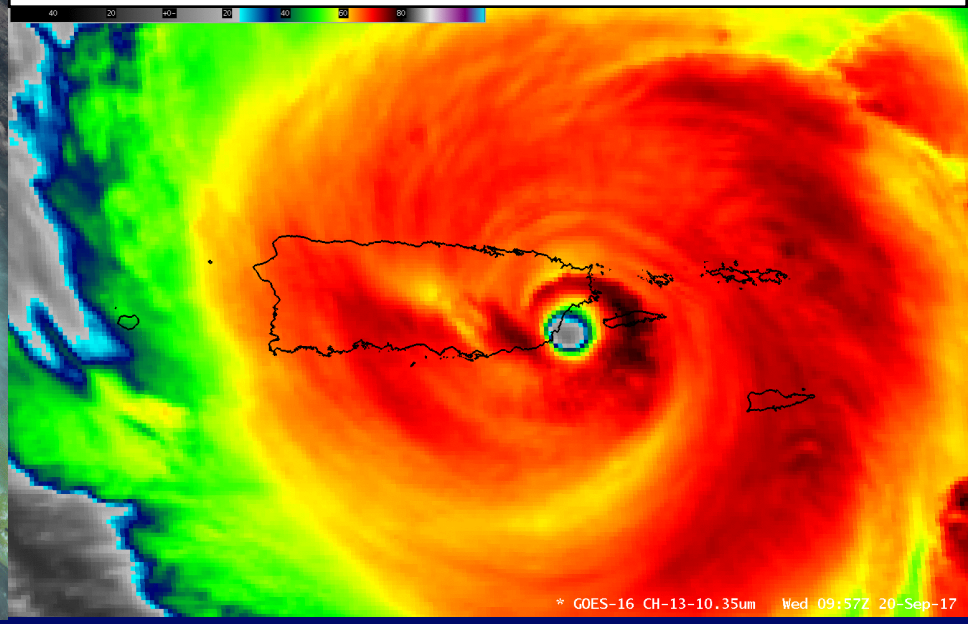
Locating Nate Near Central America



While not the only data source, GOES-16 early morning rapid scan imagery helped show that Nate had moved into northeastern Nicaragua. (Animation courtesy of CIMSS)

Devastating Landfalls

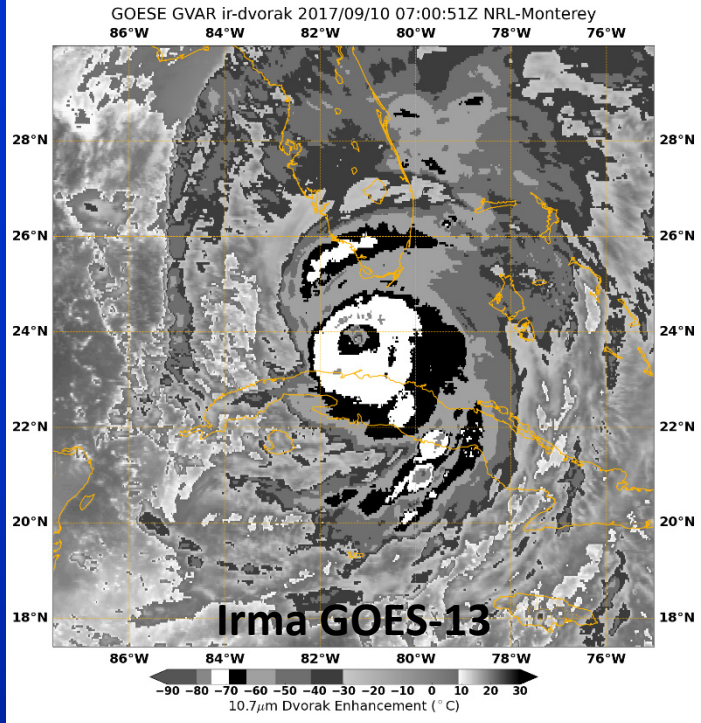


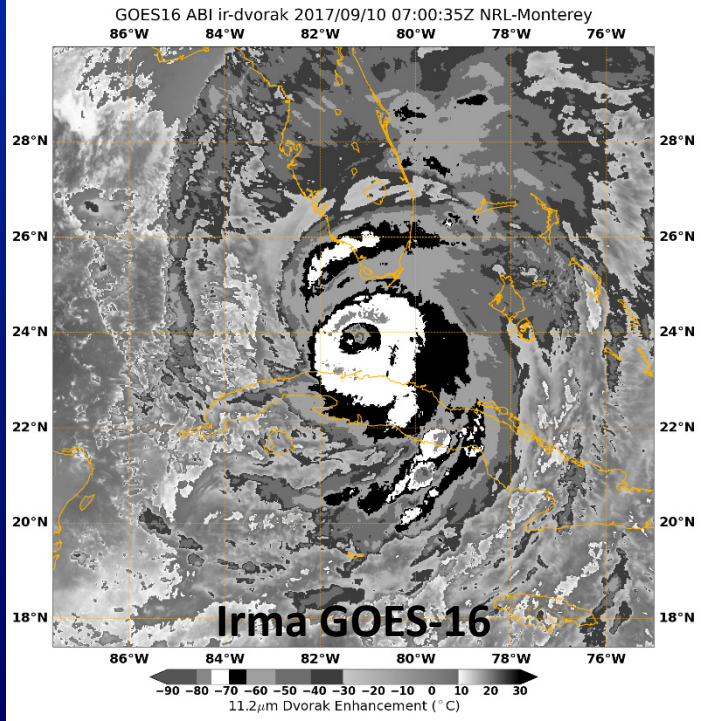


Irma (left, from CIRA), Harvey (top right, from CIMSS, and Maria (bottom right from CIMSS)

Effects on the Dvorak Technique

- The GOES-16 infrared window channel has slightly different spectral characteristics than its counterpart on GOES-13/15.
- Most parts of the Dvorak Technique for estimating the intensity of TCs from satellite imagery are insensitive to these differences. However, one part of the technique that analyzes strong TCs with eyes could have been affected by the changes.
- Experience during the 2017 season suggest that the differences in the channels caused no systematic issues with the eye pattern storms.
- GOES-16 imagery subjectively allowed for better center locations on weak systems, although no quantitative data on the exact impact is currently available.





Effects on the Advanced Dvorak Technique (ADT)

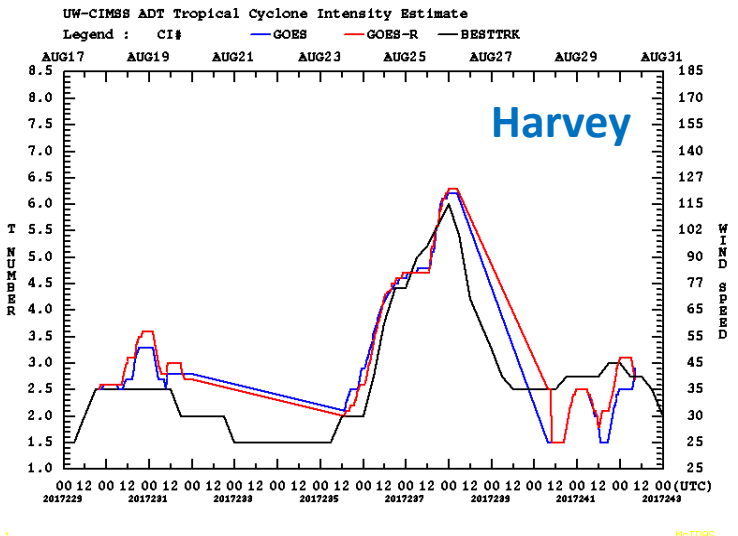
Atlantic: ADT comparisons using GOES-16 vs. GOES-13

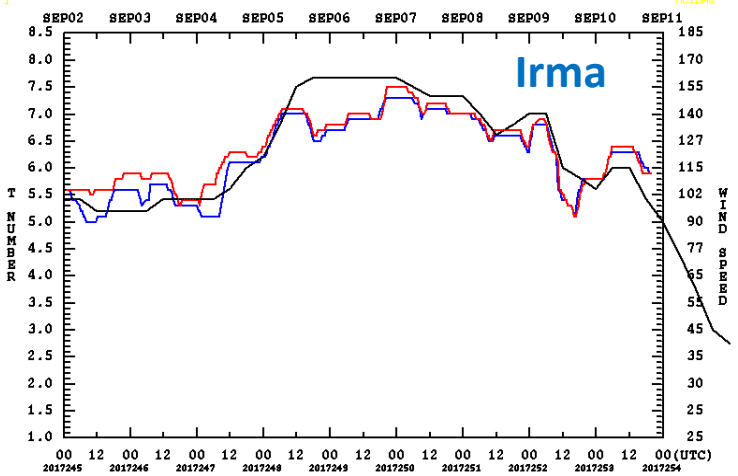
Caveat: GOES-R/16 was stationed at 90W in 2017—viewing angle could exasperate differences in some eastern cases

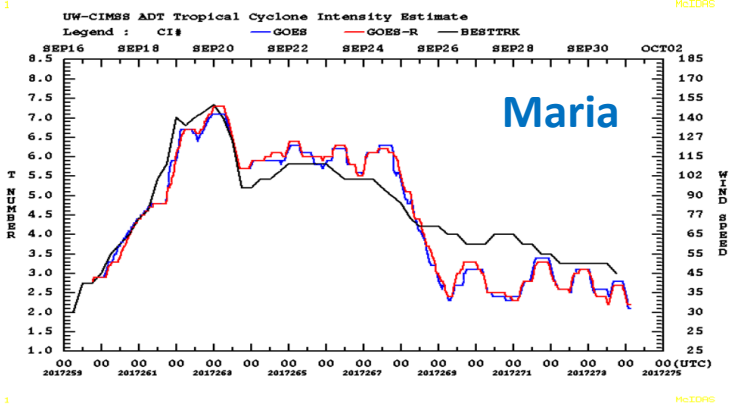
2017 ATL season vs. NHC 6-h Best Track, homogeneous match set

	Bias	RMSE	Ave. Error	Cases
CI#	-0.13	0.61	0.47	322
Vmax (kt)	-2.92	12.27	9.46	322
CI#	-0.10	0.63	0.49	322
Vmax (kt)	-2.05	12.49	9.64	322

Takeaway: Close agreement in seasonal performance statistics







Effects on the Advanced Dvorak Technique (ADT)

EPAC: ADT comparisons using GOES-16 vs. GOES-13

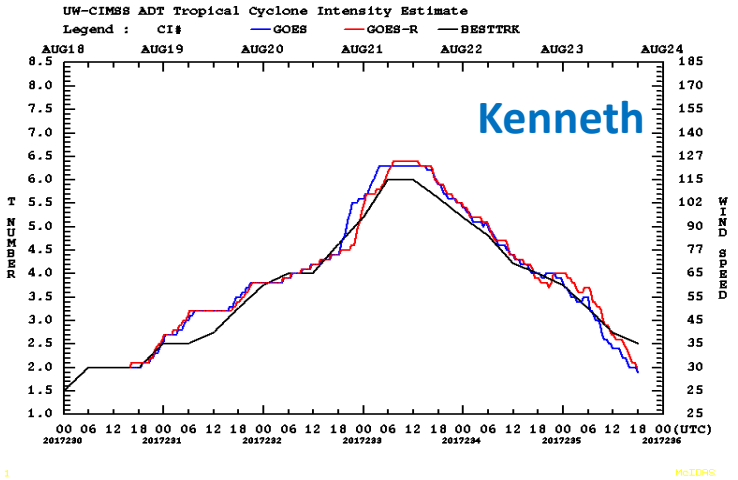
2017 EPAC season vs. NHC 6-h Best Track, homogeneous match set

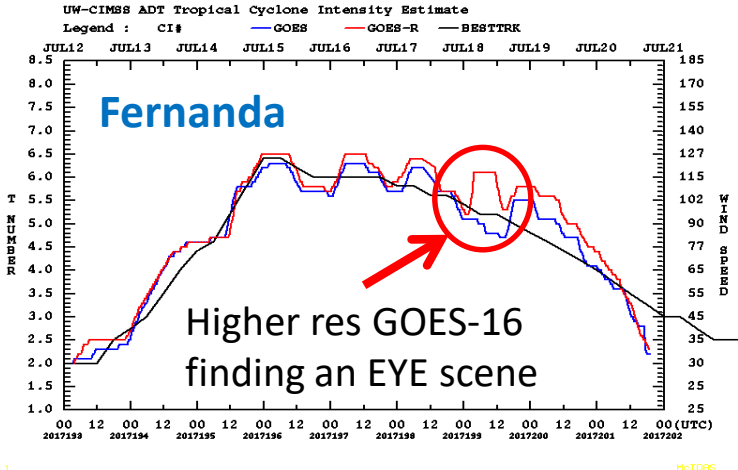
	Bias	RMSE	Ave. Error	Cases
CI#	0.07	0.57	0.43	316
Vmax (kt)	0.46	9.85	7.57	316
CI#	0.19	0.62	0.46	316
Vmax (kt)	2.87	10.66	8.16	316

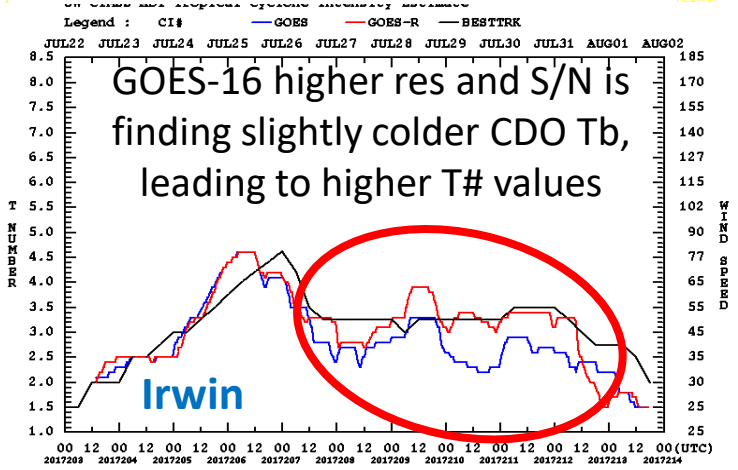
Takeaways: Close agreement in seasonal performance statistics

-- GOES-16 CI# bias a bit higher

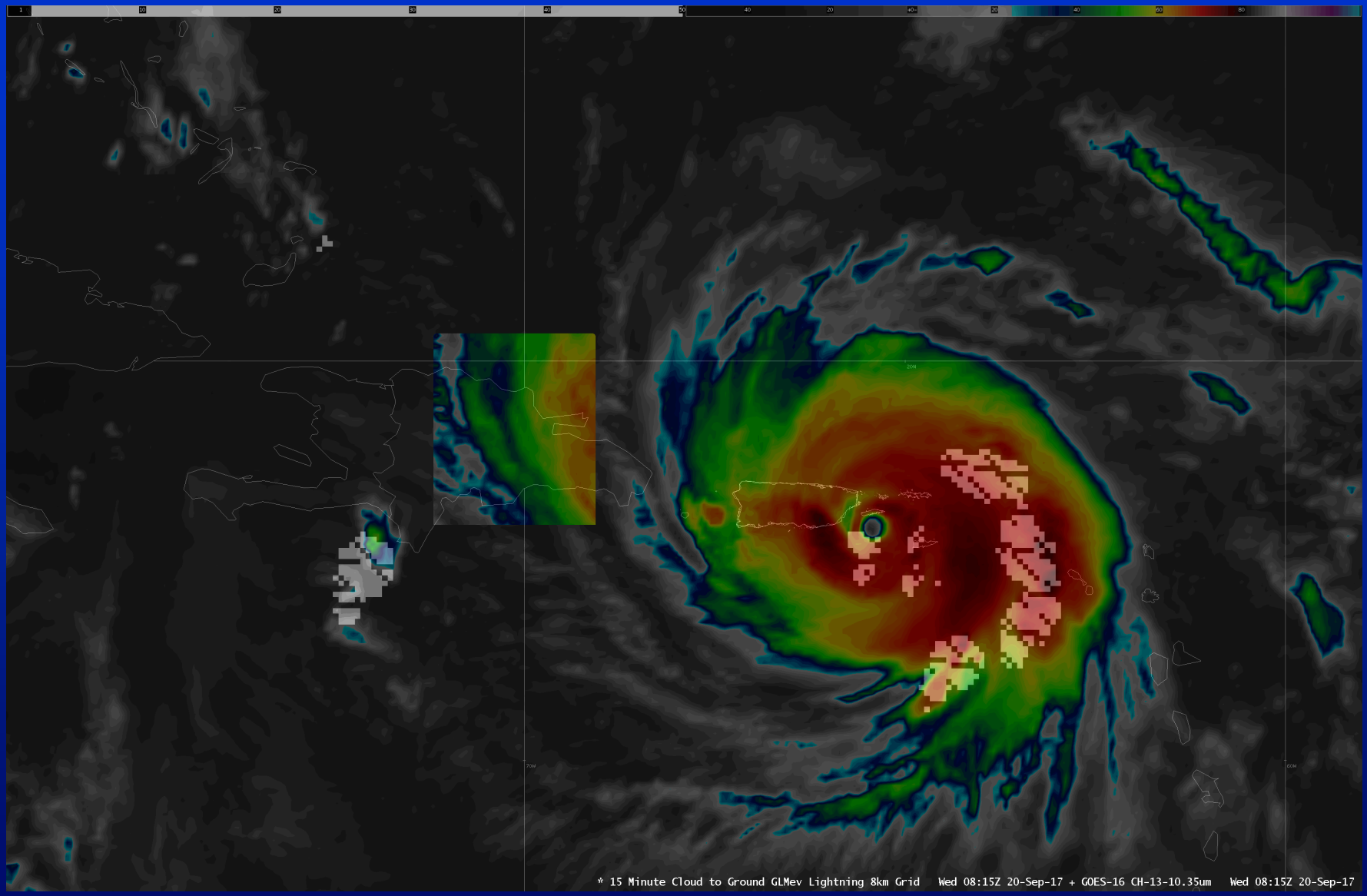
-- GOES-13 results slightly better but NHC relies heavily on GOES-13/15 data due to lack of recon ground truth





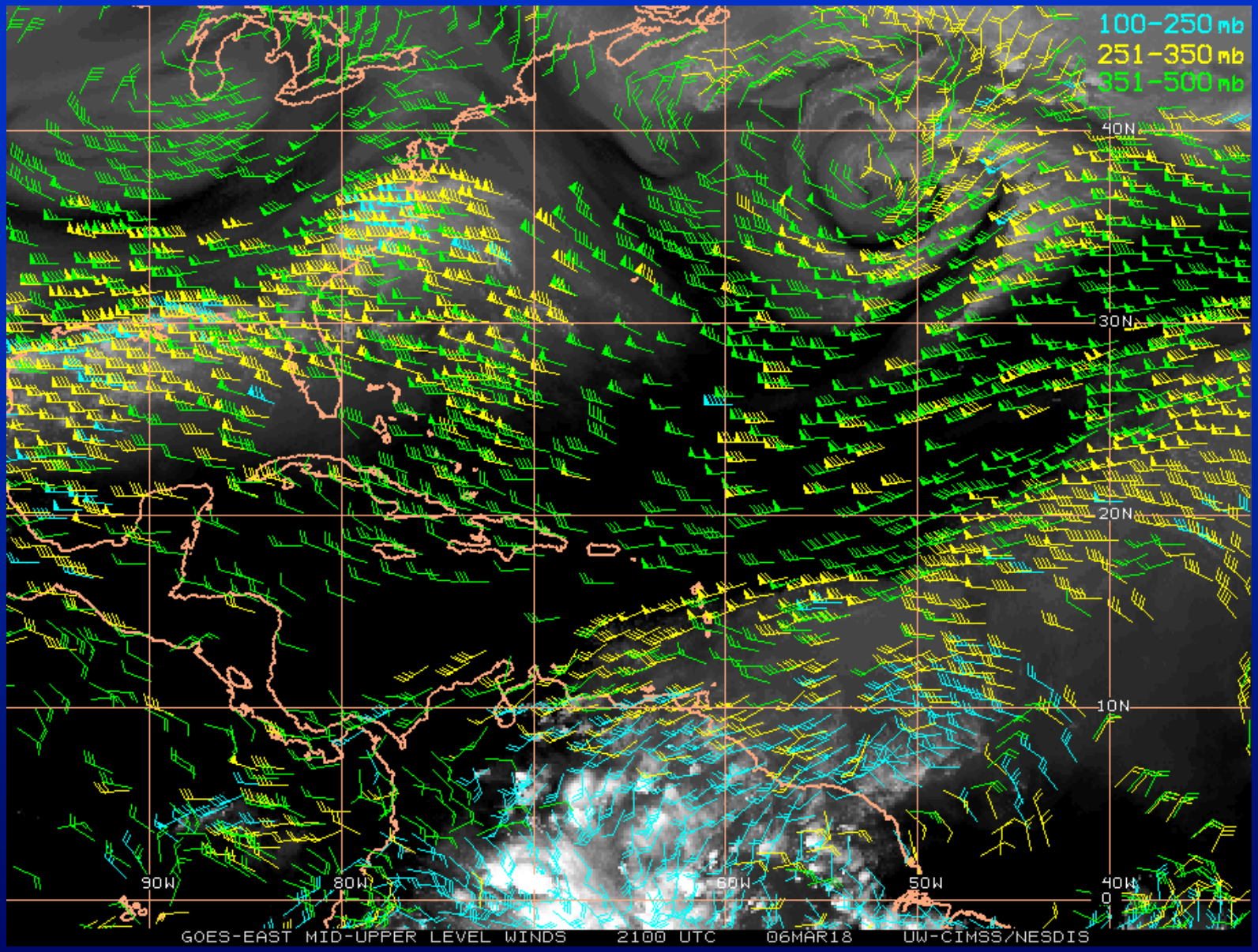


Geostationary Lightning Mapper (GLM) Data



NHC did not receive GLM data through its operational systems during the 2017 season, although some was relayed by the research community.

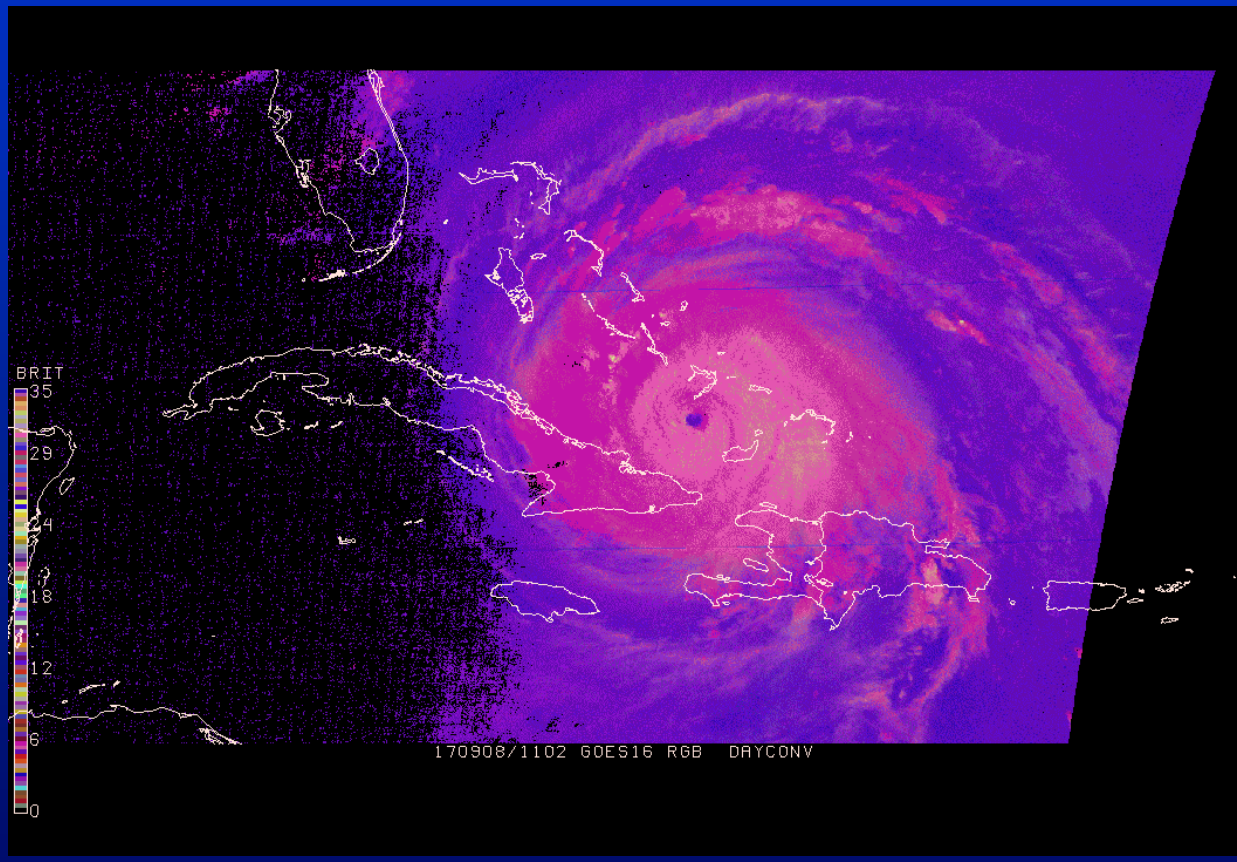
Atmospheric Motion Vector (AMV) Data



NHC also did not receive AMV data through its operational systems during the 2017 season.

For the 2018 season and beyond

- **Use GOES-S/17 data when it becomes available!**
- **Tweak the formulas and displays of RGB imagery so it better matches the SEVIRI products.**
- **Use GLM and AMV data on an operational basis.**
- **Better examine what the microphysical channels and the associated RGB imagery tells us about TC structure and possibly the intensity.**



Irma Day Convection RGB

In Closing

- **GOES-16 made positive impacts on NHC/TAFB operations in 2017**
- **We are just starting to learn how to use the full capabilities of the GOES-R series**
- **Our thanks to everyone who designed, built, and operates the satellites!**

Any questions?