



Tropical Cyclone Product Updates at UW-CIMSS for 2026



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University of Wisconsin-Madison
Cooperative Institute for Meteorological Satellite Studies



Developments from the past year

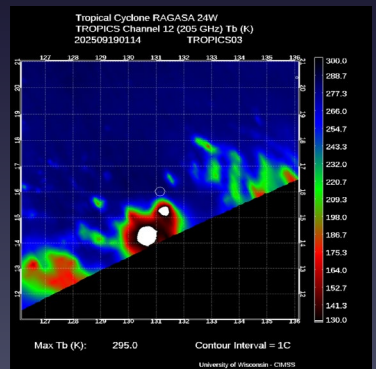


TROPICS, tomorrow.io Collaboration

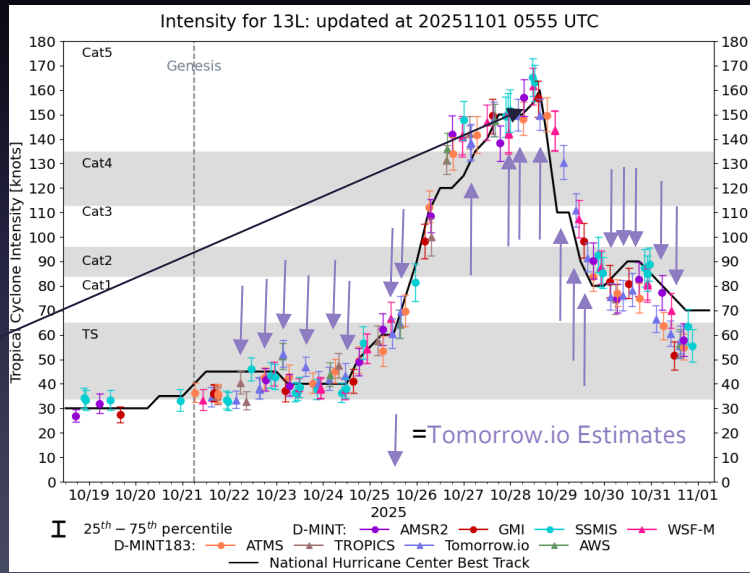
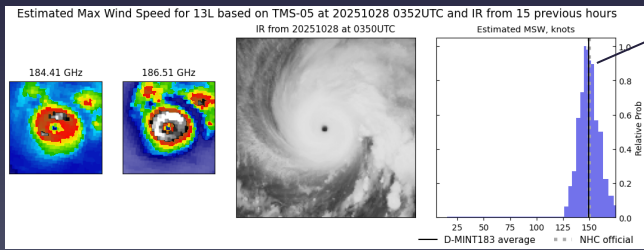


- CIMSS processing of [Tomorrow.io](#) cubesat data through the NOAA NESDIS Commercial Microwave Sounder Pilot Project.
- Collaboration between NOAA, CIMSS and [Tomorrow.io](#) to fast-track algorithms developed during the TROPICS mission for use with the nearly identical [Tomorrow.io](#) sounders.
- Storm-centered TC imagery and intensity estimates (D-MINT183). Two data feeds to comply with data embargo request: One password-protected for NRT products and the other with a 24-hour delay.

Combined TROPICS and [Tomorrow.io](#) 183 GHz imagery for Typhoon Ragasa



CIMSS D-MINT-183 (AI-based) intensity products for Hurricane Melissa. Snapshot of CIMSS Tomorrow.io D-MINT183 intensity on October 28th as the storm approached peak intensity. Combination of Tomorrow.io and GOES-19 imagery are used (below). Time history of all D-MINT intensity estimates for Melissa (right) compared to NHC best track (black solid line) using only a fraction of the total constellation. Note that the intensity estimates are in line with the other D-MINT estimates and are in good agreement with peak intensity from NHC.



(Sept 2025)



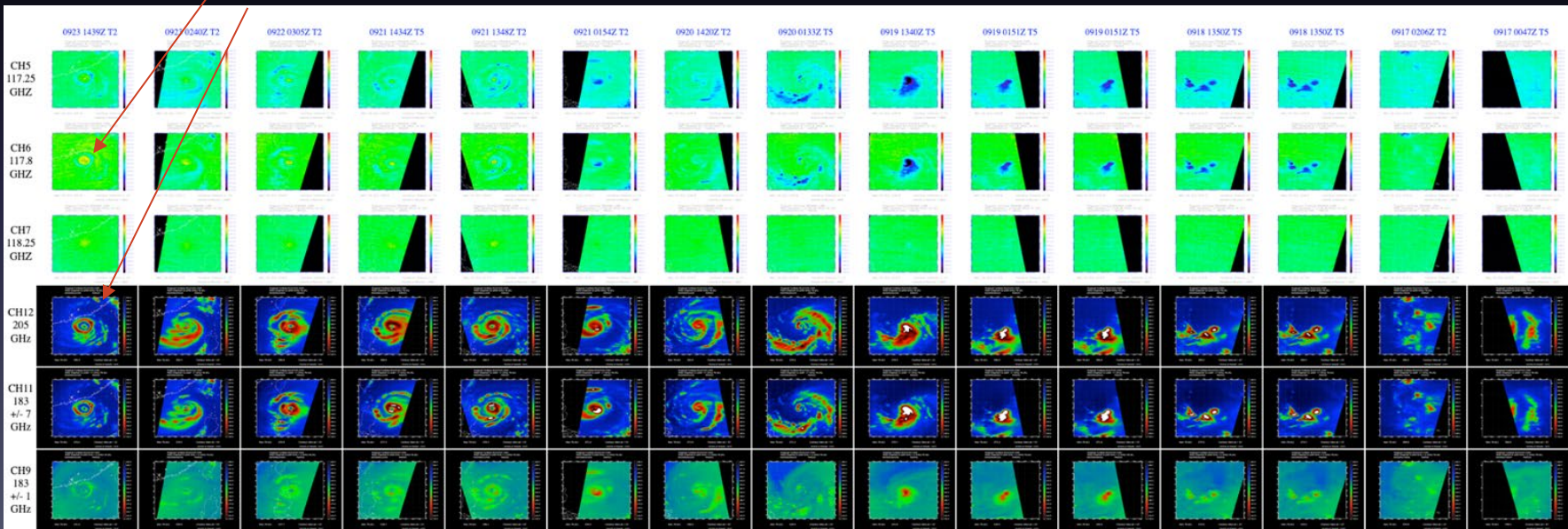
TROPICS, tomorrow.io Collaboration



- CIMSS will continue to produce NRT products as long as NOAA can provide data. Currently through May 2026 but future data buys by NOAA are likely. Only two satellites are likely to be provided. CIMSS may be able to fill in any gaps using the full constellation in post-processing pending [Tomorrow.io](https://tomorrow.io) approval.

*TC warm core in Channel 6.
Ragasa undergoing an ERC*

*Tomorrow.io imagery matrix for Typhoon Ragasa
<https://tropic.ssec.wisc.edu/real-time/tomorrowio/>*

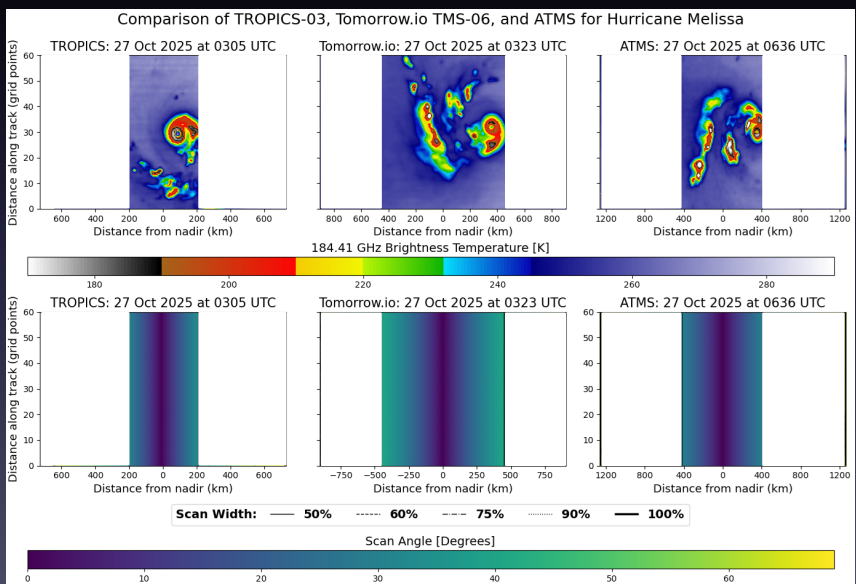




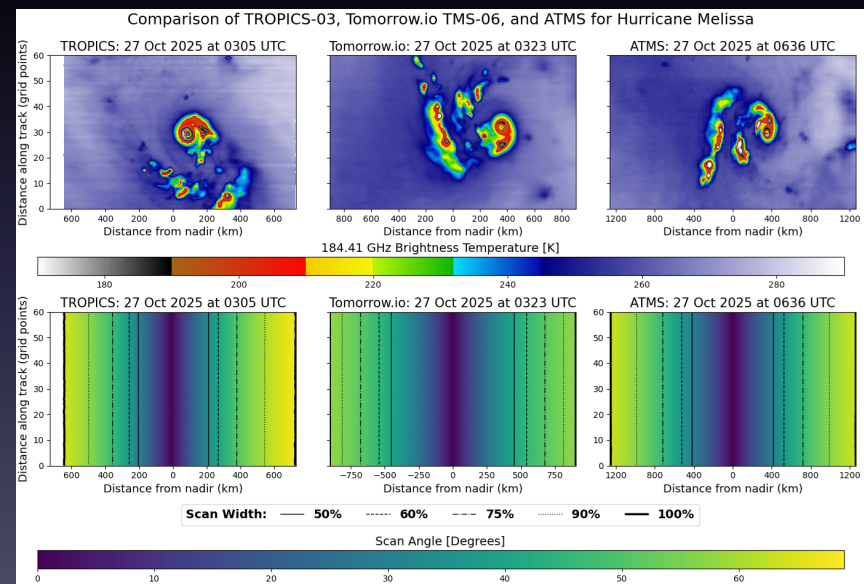
TC Intensity: Progress on D-MINT183



- D-MINT183 - Convolutional neural network to estimate current TC intensity with 183 GHz imagery. Developed to compliment D-MINT and utilize data from SmallSats.
- For the 2025 TC season, only used the inner 50% of the swath to avoid limb effects.
- Focused on expanding the swath width by using limb-corrected brightness temperatures as well as scan angle from nadir.



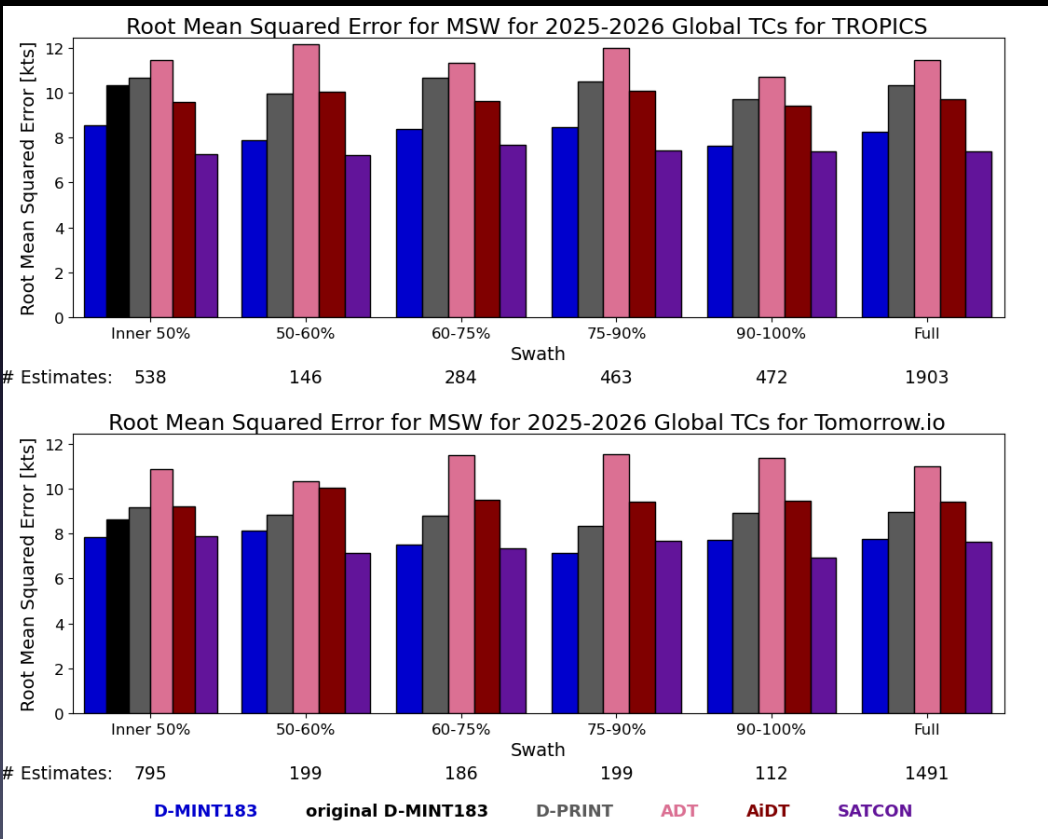
Original range from 2025 TC season



Expanded range



TC Intensity: Progress on D-MINT183



- ❖ The updated **D-MINT183** has even better skill than the **original D-MINT183** for the inner 50% swath for Global TCs.
- ❖ Even at the outer edges of the swath (90-100%), **D-MINT183** has higher skill than other intensity estimates, except for **SATCON**.
- ❖ **D-MINT183** has double to quadruple the number of intensity estimates.



SATCON



- SATellite CONsensus - Blending of objective TC intensity algorithms to create a consensus estimate more skillful than a simple average. Weights are designed to emphasize the strengths of the members and de-emphasize the weaknesses.
- Display allows the forecaster a quick assessment of TC intensity without have to think about which algorithms might be better for a given TC structure. Improved time management, more time for the forecast.

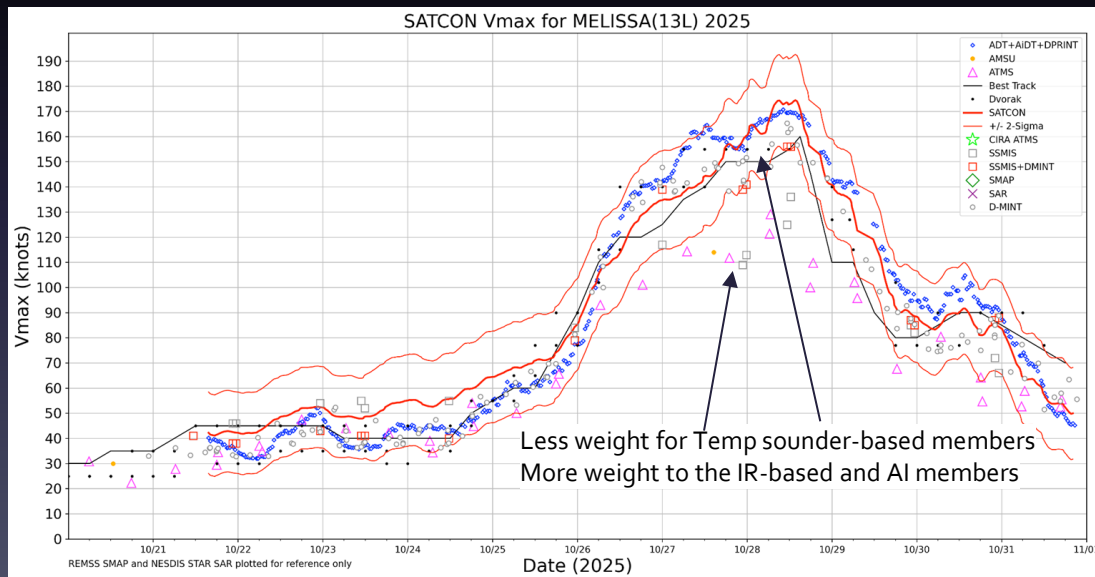
Current Members

CIMSS ADT/AiDT/D-PRINT
(weighted IR member)

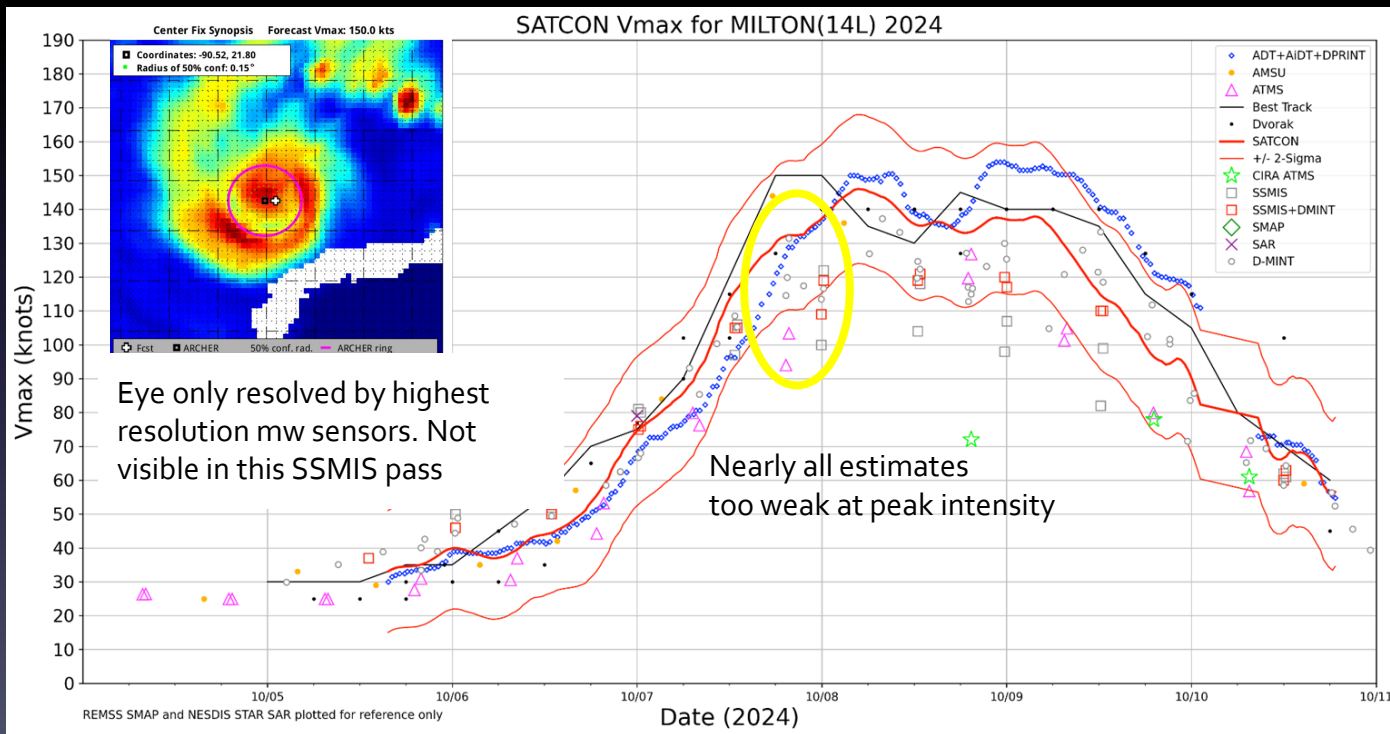
CIMSS ATMS Sounder + D-MINT₁₈₃
(weighted ATMS member)

CIMSS SSMIS Sounder and D-MINT)
(weighted SSMIS member, losing this in 2026)

SATCON is becoming a consensus of ensembles with like members combined prior to weighting



- Biggest challenge continues to be TCs with very small eyes. Challenges for IR eye detection and significantly under-sampled by mw sounders and even some imager channels.





CIMSS website enhancements



Cooperative Institute for Meteorological Satellite Studies
Space Science and Engineering Center / University of Wisconsin-Madison

Tropical Cyclones ...A Satellite Perspective

CIMSS TC Webpage Product Archive

DATA STATUS (as of 18 Feb 2025 / 22:50UTC) : Due to issues with the distribution of Meteosat data, any product using Meteosat imagery is currently unavailable.

TC Image Gallery Who We Are Our Research Archive FAQ Links Contact Us XML

Current Time : 18 February 2025 / 22:54:26UTC

Storm Coverage (Information)

Mouse over and click on individual storm symbol(s) for specific "TC/Track" storm coverage product window

Active Storm Product Summary Pages: Archive

CIMSS TC Intensity, Structure, and Positioning Products "Quick Links"

Intensity: ADT AIDT AI-RI AMSU D-MINT D-PRINT SATCON

Positioning/Structure: ARCHER Meso-AMV M-PERC MIMIC-TC MIMIC-TPW SAL TC Diurnal Cycle

Tropical Outlooks/Regional Websites: Atlantic East Pacific West Pacific Indian Ocean Australia/Fiji

Regional Real-Time Products

Mouse over specific ocean basin (colored regions) for menu of available products; click on desired products

click for Global Mosaics

Tropical Cyclone Image Gallery

CIMSS Satellite Blog coverage of Hurricane Melissa
CIMSS True Color loop of Melissa's landfall on Jamaica: 1 minute meso scale GOES-19 Imagery
Sunrise to sunset CIMSS True Color loop of Melissa: 29 October, 2025

We would like to acknowledge our research sponsors

NOAA NESDIS Naval Research Laboratory-Monterey, CA Office of Naval Research

- Website is still widely used by official forecasters as well as the general public
- Displays are obviously dated and use older technology, but updating website is time intensive and would require a significant amount of effort and resources
- We want to update displays using newer display capabilities to allow better user interaction while retaining current “look and feel” that users are accustomed to
- Will add new satellite information to website to augment current display suite

Intensity estimates for a given storm

Color coded latency values

Intensity values highlighted for easy comparison

Product information and storm history plots presented

Additional storm structure parameters also provided lower in webpage

Storm archive available

Cooperative Institute for Meteorological Satellite Studies / University of Wisconsin-Madison
Tropical Cyclone 13L (Melissa)
Latest Real-Time CIMSS Product Summary
 Current Time : 27 October 2025 / 05:27:15UTC NHC/JTWC

Click on product name to access the full product homepage for each specific storm
 Mouse over images to enlarge; click to view in window

Product Latency Color Code : Less than 3 hours old 3 - 6 hours old 6 - 12 hours old Greater than 12 hours old Not Available

Product	Date	Time	Vmax	MSLP	Scene	CI#	FT#	AdjT#	RawT#	Eye_T	Cloud_T
ADT	27Oct2025	0410UTC	164 kts	895 hPa	EYE	7.8	7.8	8.0	8.0	18.96C	-78.14C
AiDT	27Oct2025	0410UTC	154 kts								
DPRINT	27Oct2025	0410UTC	137 kts	928 hPa	Vmax 25%		Vmax 75%				
					129 kts		145 kts				
DMINT					0305Z 0001Z 2319Z 2319Z						
	27Oct2025	0305UTC	142 kts	924 hPa	Vmax 25%		Vmax 75%				
			136 kts		149 kts						
MW Sounders	27Oct2025	0002UTC	139 kts	937 hPa	Satellite		FOV				
					16		18				
SATCON	27Oct2025	0110UTC	149 kts	926 hPa							
			Consensus Members								
			2 (ADT+Sounders)								

RI Forecast

RI Forecast	Date	Time	Current Vmax	Current MPI
AI-RI	27Oct2025	0000UTC	125 kts	165 kts
	20kt/12h	25kt/24h	30kt/24h	35kt/24h
	3.2%	1.8%	2.2%	3.3%
			40kt/24h	45kt/36h
			0.7%	0.2%
			55kt/48h	65kt/72h
			0.1%	0.1%

Highlights when multiple DMINT values are available



CIMSS website enhancements



- We've composed a short analyst reference guide for onboarding new forecasters to use CIMSS TC products

Analyst Reference Guide: Objective Intensity Techniques

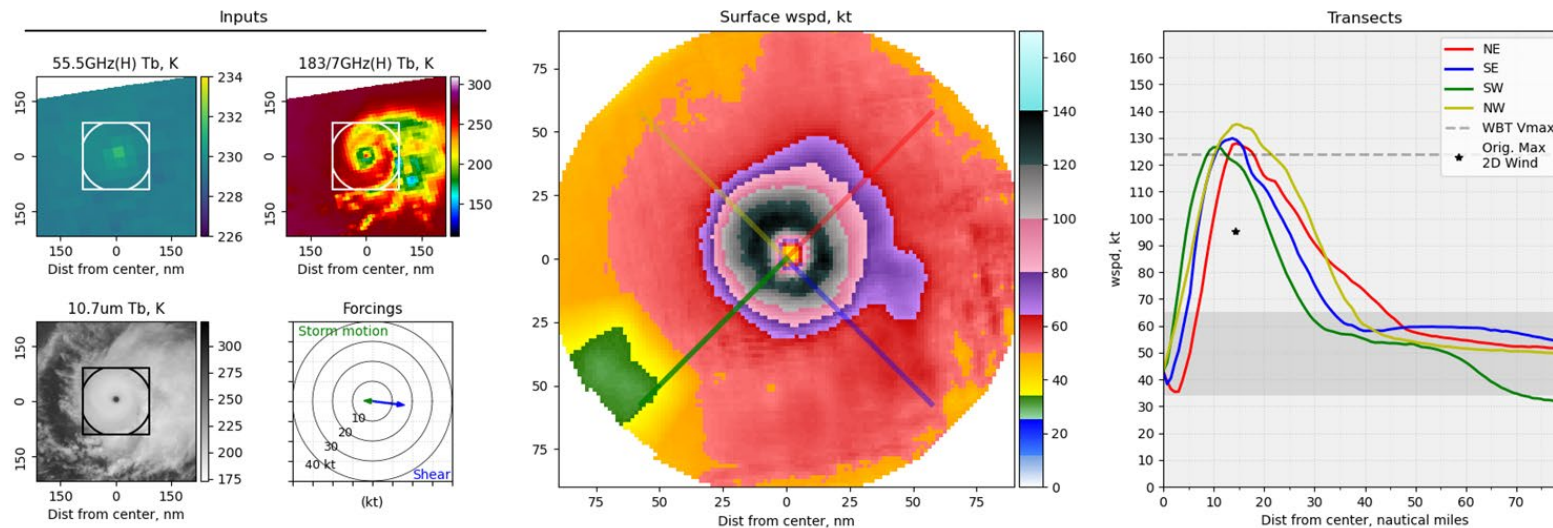
Purpose: This Tropical Cyclone (TC) Proving Ground (PG) document briefly summarizes the characteristics, known biases, and "rules of thumb" for objective TC intensity estimation techniques developed by UW-CIMSS. These guidelines can be used to ascertain differences between SAB subjective Dvorak and objective guidance (ADT, AiDT, DMINT, DPRINT, SATCON, ARCHER) in your remarks.

1. Quick Reference Matrix

Technique	Primary Input	Latency / (Frequency)	Best Performance	Key Limitations
ADT	GEO IR, ARCHER microwave structure inputs (scores)	Real-time (30-min)	Best estimates in mature storms with large and clear eyes.	Can struggle at times with Shear scenes and can plateau in CDO scene types with pre-emergent eyes. Pinhole eyes.
AiDT	GEO IR, ADT output variables (AI-analyzed)	Real-time (30-min)	Helps mitigate some CDO plateau issues & storm dissipation stages (where ADT can sometimes struggle).	Relies somewhat on ADT output (incl biases). Partial and Pinhole eyes.
DMINT (Deep)	Microwave (+ IR context)	2-4hr latency, Swath-depen	Statistically the most skillful of all individual algorithms	Discontinuous -- data gaps between

- TC-Core - Machine learning method for estimating TC 2-D wind field based on microwave imagery (both 37- and 89-GHz as well as 55- and 183-GHz imagery).
- Normalized using D-MINT (37- and 89-GHz version) or D-PRINT (55- and 183-GHz version)
- Bias-corrected using best track radii of 34-, 50-, and 64-kt wind.
- Available on the CIMSS TC website but not linked publicly.

2025_13L: 2025-10-26 18:25 UTC -- ATMS-N20



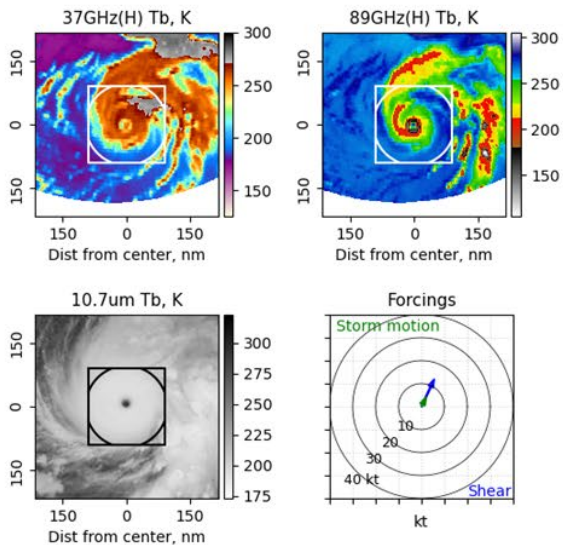
(* star represents original model maximum intensity.)

55- and 183-GHz version uses ATMS imagery

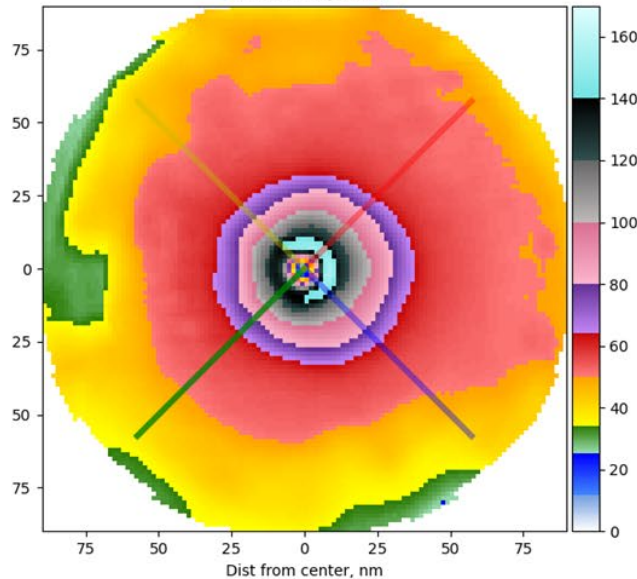
TC-Core rollout

2025_13L: 2025-10-28 11:30 UTC from WSF-M01

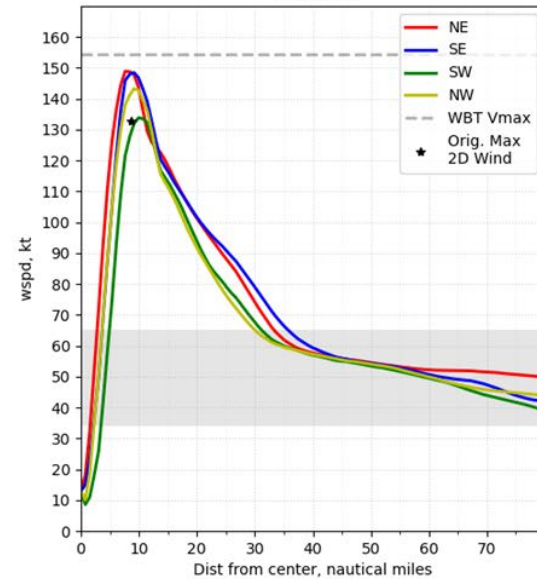
Inputs



Surface wspd, kt



Transects



37- and 89- GHz version was trained with SSMIS, AMSR-2, and GMI imagery, but also has been running on WSF-M data.



Deliveries to GeoIPS



- **GeoIPS is a developing but extensive suite of plugin packages which can ingest, manage, and output a wide range of satellite information**
 - *Developed primarily at NRL and CIRA*
- **CIMSS has been using GeoIPS to develop various plugin packages to mimic our current suite of CIMSS Tropical Cyclone webpage products and displays**
 - *Serving as a testbed user to highlight areas of need for future GeoIPS development*
 - *Ensuring the unique and vital CIMSS tropical cyclone product suite is available for DoD users in case of future data availability interruptions*
- **Have developed and delivered the following products**
 - *AMVs derivation and derived product suite*
 - *ADT/AiDT, ARCHER, DMINT/DPRINT, M-PERC*
 - *SATCON and MW imagery displays are currently being developed*



Deliveries to GeoIPS



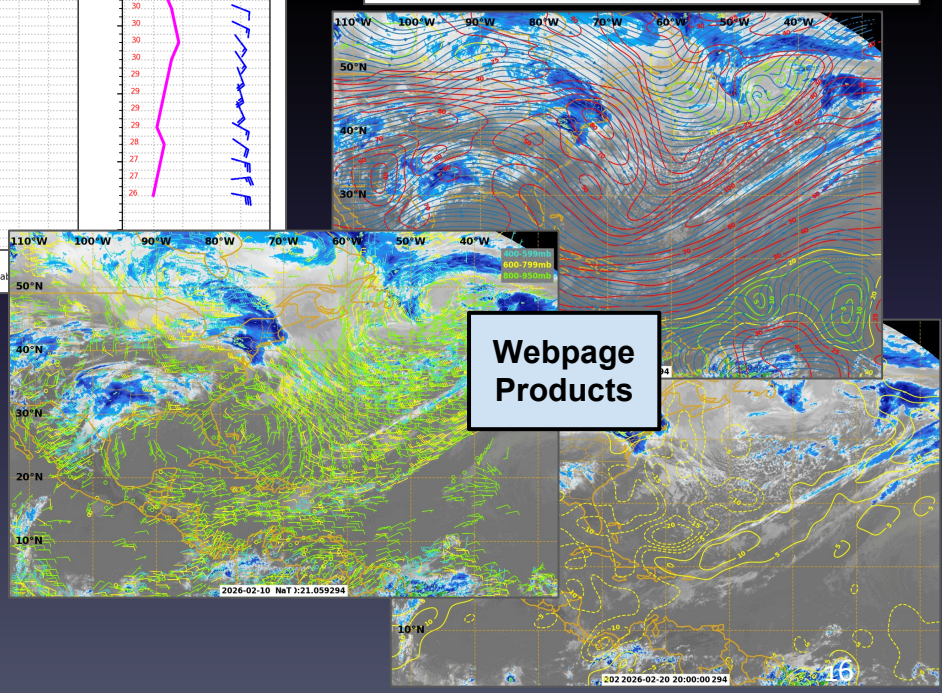
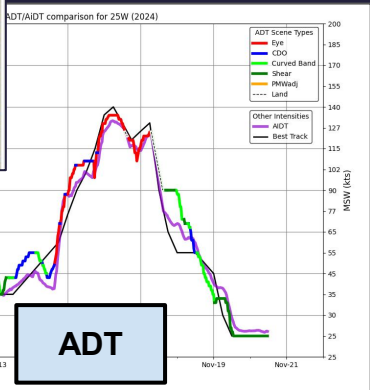
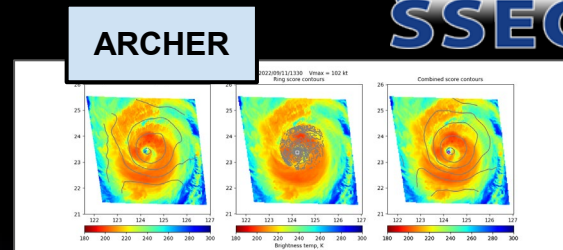
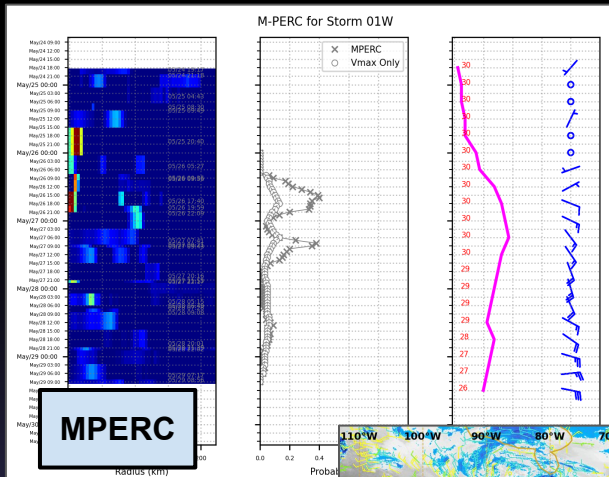
Cooperative Institute for Meteorological Satellite Studies / University of Wisconsin-Madison
Tropical Cyclones
 Deep Multispectral Intensity of TCs estimator (D-MINT)

Scenario: 16F

DMINT

D-MINT HISTORY FILE for 2025_16F

Date	Time	MW Sensor	Average (50 th -70 th percentile)	25 th percentile	75 th percentile	Image
20251011	0204 UTC	SSMISF16	28 kts	25 kts	31 kts	
20251011	0110 UTC	SSMISF17	31 kts	27 kts	33 kts	
20251010	2356 UTC	SSMISF18	32 kts	28 kts	36 kts	
20251010	2123 UTC	AMSR2	30 kts	27 kts	34 kts	
20251010	2101 UTC	ATMS	33 kts	29 kts	36 kts	
20251010	2010 UTC	ATMS	35 kts	31 kts	39 kts	





Current work and Upcoming work



TROPICS, tomorrow.io Collaboration



- Contingent on future data buys from NOAA, we will continue to produce [Tomorrow.io](https://tomorrow.io) products, with future work focused on developing structure extraction tools such as ARCHER/MPERC
- Update display products to include the new tools.
- Though D-MINT183 is still primary intensity estimation tool will continue to explore improvements to temperature sounder-based estimates

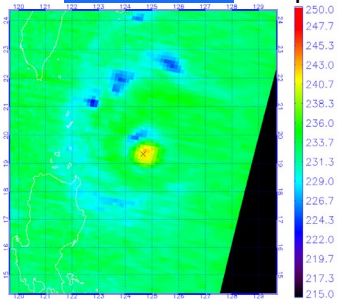
CH5

CH6

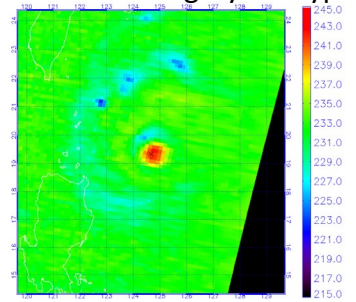
CH7

CH12 205 GHz

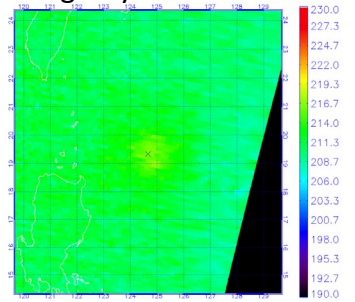
Tomorrow.io temperature sounder imagery for Typhoon Kong-Rey 2024



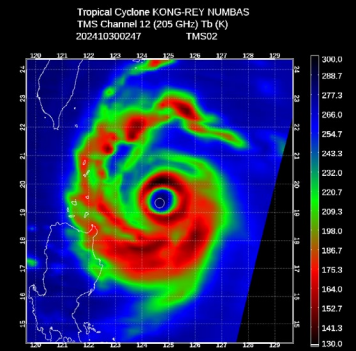
Max Tb (K): 242.5
Contour Interval = 1C
University of Wisconsin - CIMSS



Max Tb (K): 242.5
Contour Interval = 1C
University of Wisconsin - CIMSS



Max Tb (K): 216.8
Contour Interval = 1C
University of Wisconsin - CIMSS



Max Tb (K): 284.7
Contour Interval = 1C
University of Wisconsin - CIMSS



ADT / AiDT delivery to NOAA



- **ADT and AiDT currently running operationally at NOAA**
 - *<https://www.ospo.noaa.gov/products/ocean/tropical/aidt/>*
 - *ADT-Version 10 delivered Fall 2024 for and was implemented prior to 2025 northern hemisphere Tropical Cyclone seasons*
- **Current research activity is focusing on identifying the highest error situations**
 - *Pre-eye/CDO scene types and Eye scene types during rapid intensification are primary areas being investigated*
- **Leveraging DPRINT analysis (shap files) to identify possible added features to add to current AiDT machine learning model**
 - *Prior ADT history file entries (T-6 and T-12) are most likely candidates to be added to current model*
 - *Might investigate addition of short term intensity forecast to model output*



SATCON



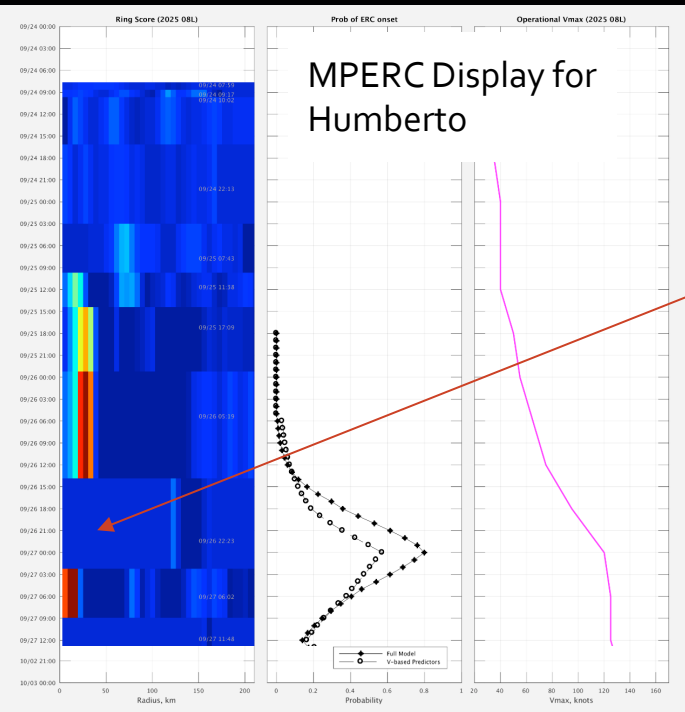
- Focus in 2026 will be on improving the AI member weighting structure and adding all AI members from D-MINT and D-MINT183, including cubesat members. Reassess bias corrections with the new weights.
- Addition of new sounder members from AWS and new MW Sounder missions
- Mitigation of largest error sources (tiny eyes) such as using improved eye detection tools
- Transition of code to NOAA NESDIS in 2026 starting with ATMS/ADT/AiDT member version then upgrading the code going forward to include D-MINT once that code is installed at NESDIS



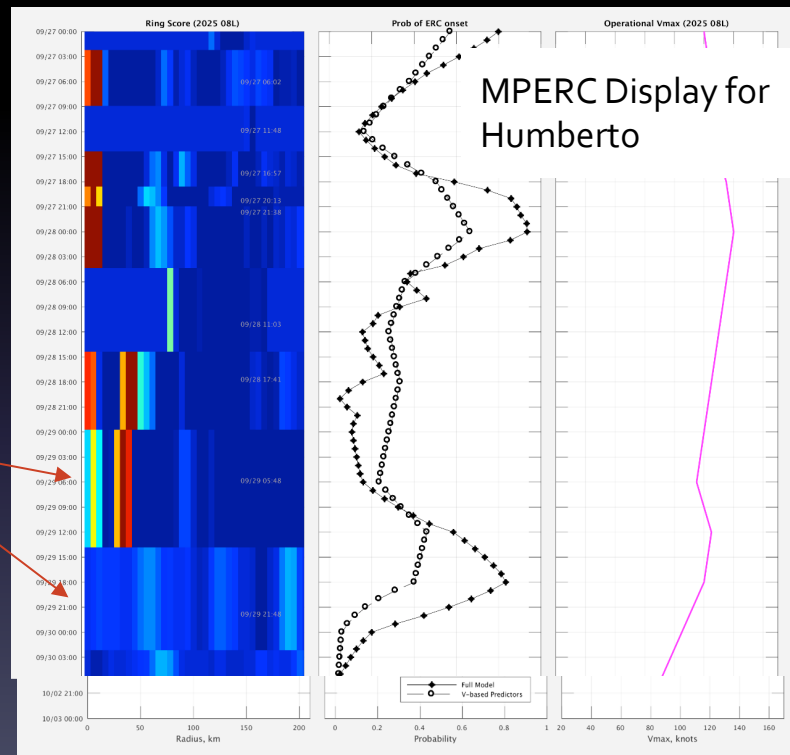
MPERC



- Leverage the high temporal resolution of the 183 GHz sensors to fill gaps in PMW coverage
- Develop a 183 GHz version of M-PERC



12 hour time gaps during Humberto's ERC events

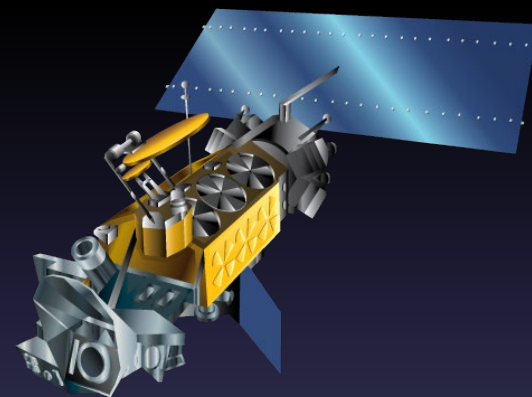




Risk Management for DMSP Loss



- DMSP is set to end in September 2026, though we are already mitigating for channel loss
- The loss of the SSMI/S instrument impacts most of our derived products that heavily depend on the 92 GHz band:
 - **ADT / ARCHER**
 - **M-PERC**
 - **SATCON**
 - **D-MINT**



- Current: *Used by CIMSS now, Planned: In development*

- *Losing DMSP means tipping the scales from 92-GHz to 183-GHz observations*

- *But work is needed to adapt to 183 GHz and to cross-track scanners*

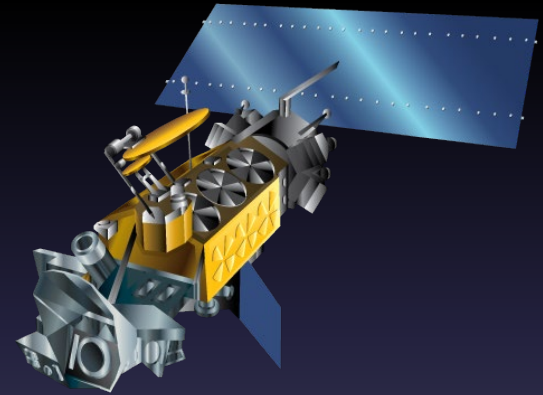
Satellite/Sensor	Channel(s), GHz	Current	Planned	Comments
DMSP F-16 SSMIS	91.7H	█		
DMSP F-17 SSMIS	91.7H	█		
DMSP F-18 SSMIS	91.7H	█		
GPM GMI	89-H	█	█	
GPM GMI	183+/-3 and/or -7		█	(Optional)
GCOM-W1 AMSR-2	89-H	█	█	
S-NPP ATMS	183+/-1, -3 and/or -7		█	
NOAA-20 ATMS	183+/-1, -3 and/or -7		█	
NOAA-21 ATMS	183+/-1, -3 and/or -7		█	Products will also apply to follow-ons
Tomorrow.io S2 - TMS	184.41 and/or 186.51		█	(Constellation changes, estimate 4+)
Tomorrow.io S3 - TMS	184.41 and/or 186.51		█	
Tomorrow.io S4 - TMS	184.41 and/or 186.51		█	
Tomorrow.io S5 - TMS	184.41 and/or 186.51		█	Products will also apply to follow-ons
WSF-M MWI	89-H		█	
GOSAT-GW AMSR-3	89-H		█	
GOSAT-GW AMSR-3	183+/-3 and/or -7		█	(Optional)
AWS MWR	89-V		█	(Possible, with examination)
AWS MWR	182.3-V		█	(Possible, with examination)



Risk Management for DMSP Loss



- Therefore, we are working with SAB to adapt our algorithms to use 183 GHz observations from cross-track scanners
- 183 GHz is different because it captures more water vapor, but our experience with D-MINT183 shows that it is just as relevant for TC properties as ~92 GHz



Questions?

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Positioning/Structure: ARCHER Meso-AMV M-PERC MIMIC-TC MIMIC-TPW SAL TC Diurnal Cycle

Tropical Outlook/Regional Websites: Atlantic East Pacific West Pacific Indian Ocean Australia/Fiji

Regional Real-Time Products

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-- click for Global Mosaics

Tropical Cyclone Image Gallery

CIMSS Satellite Blog coverage of Hurricane Melissa
CIMSS True Color loop of Melissa's landfall on Jamaica: 1 minute meso scale GOES-19 Imagery
Sunrise to sunset CIMSS True Color loop of Melissa: 28 October, 2025

We would like to acknowledge our research sponsors

NOAA NESDIS Naval Research Laboratory-Monterey, CA Office of Naval Research

Analyst Reference Guide: Objective Intensity Techniques

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tropic.ssec.wisc.edu

Extras

