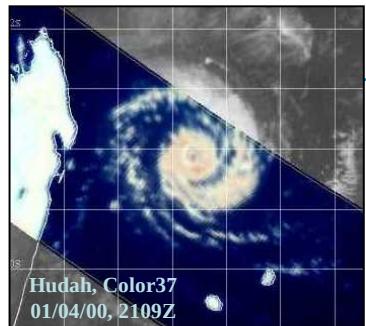


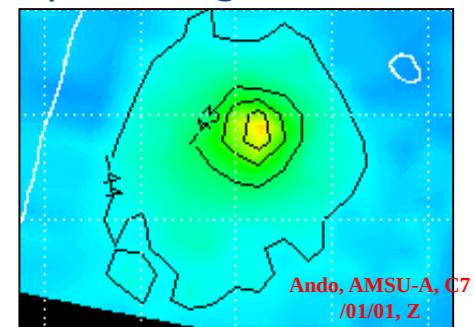
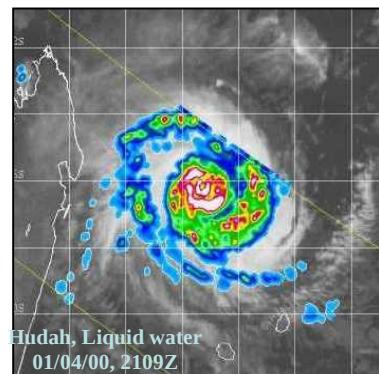
Satellite technology Applications to tropical cyclones

9th training course about tropical cyclones

WMO / Météo-France



Anne-Claire FONTAN
Thierry DUPONT
Sébastien LANGLADE
RSMC La Réunion



November 2019

Acknowledgements to COMET, NRL, CIMSS for many of the images shown here

OUTLINE

Synopsis on microwaves

Interpreting microwave data

Applications in TC analysis

TC Intensity estimate: objective guidances

Scatterometers / SAR

OUTLINE

Synopsis on microwaves

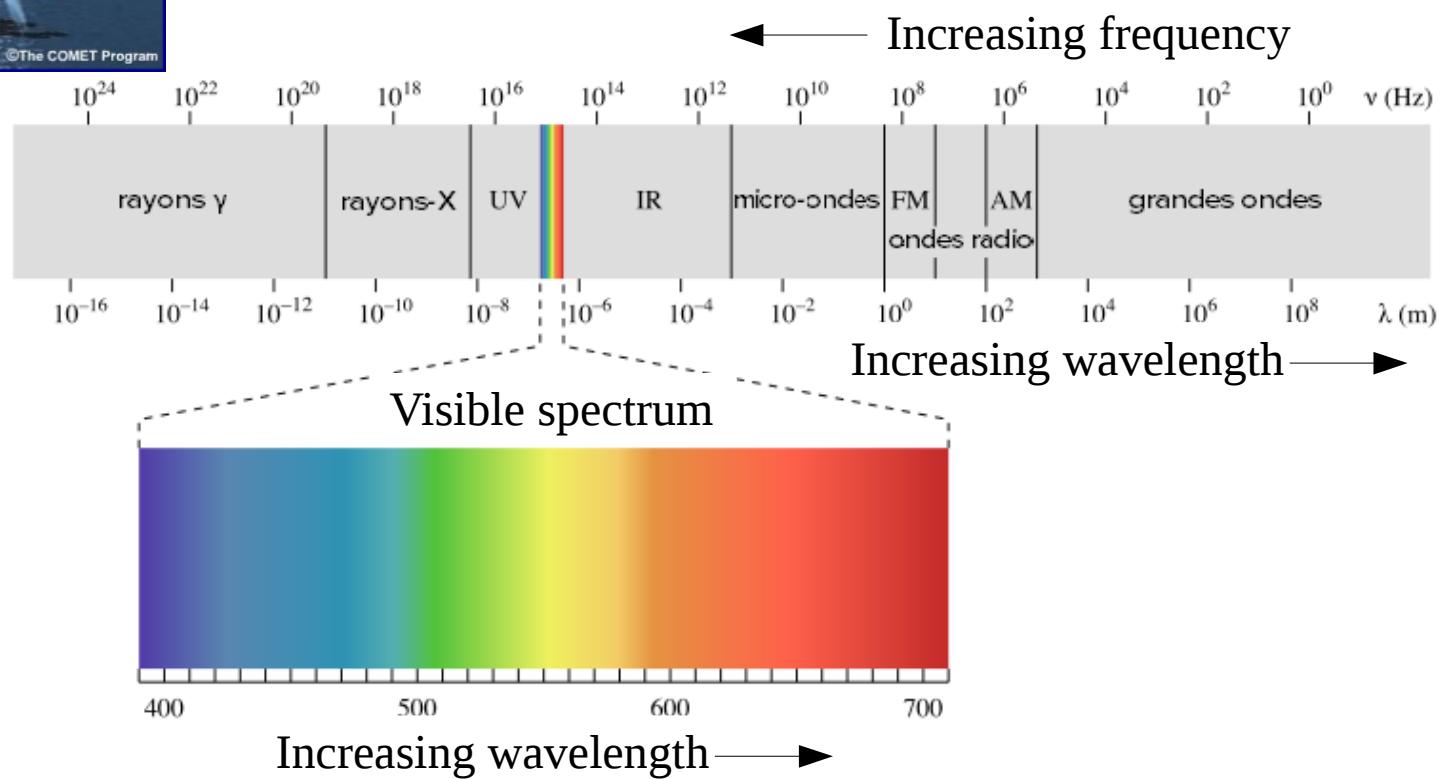
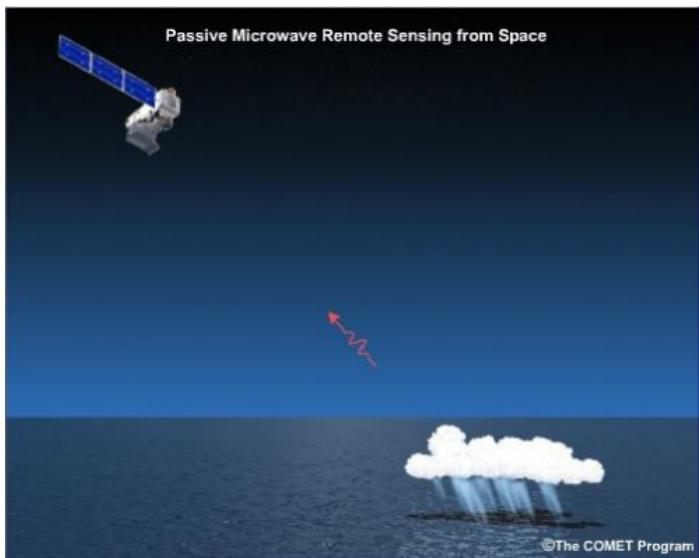
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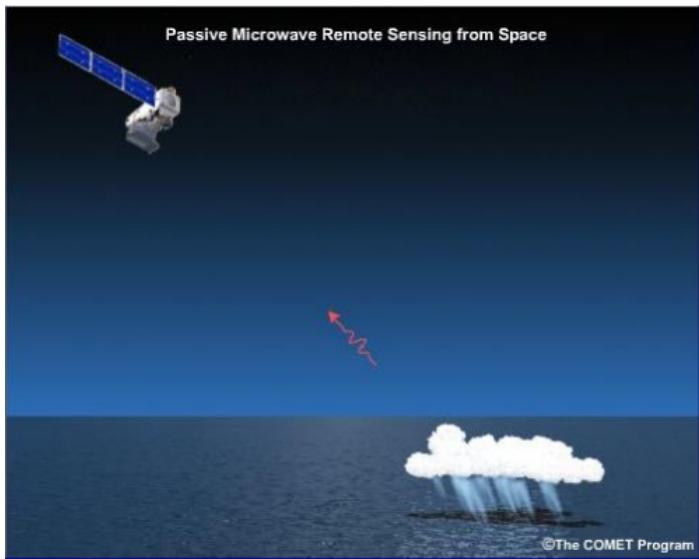
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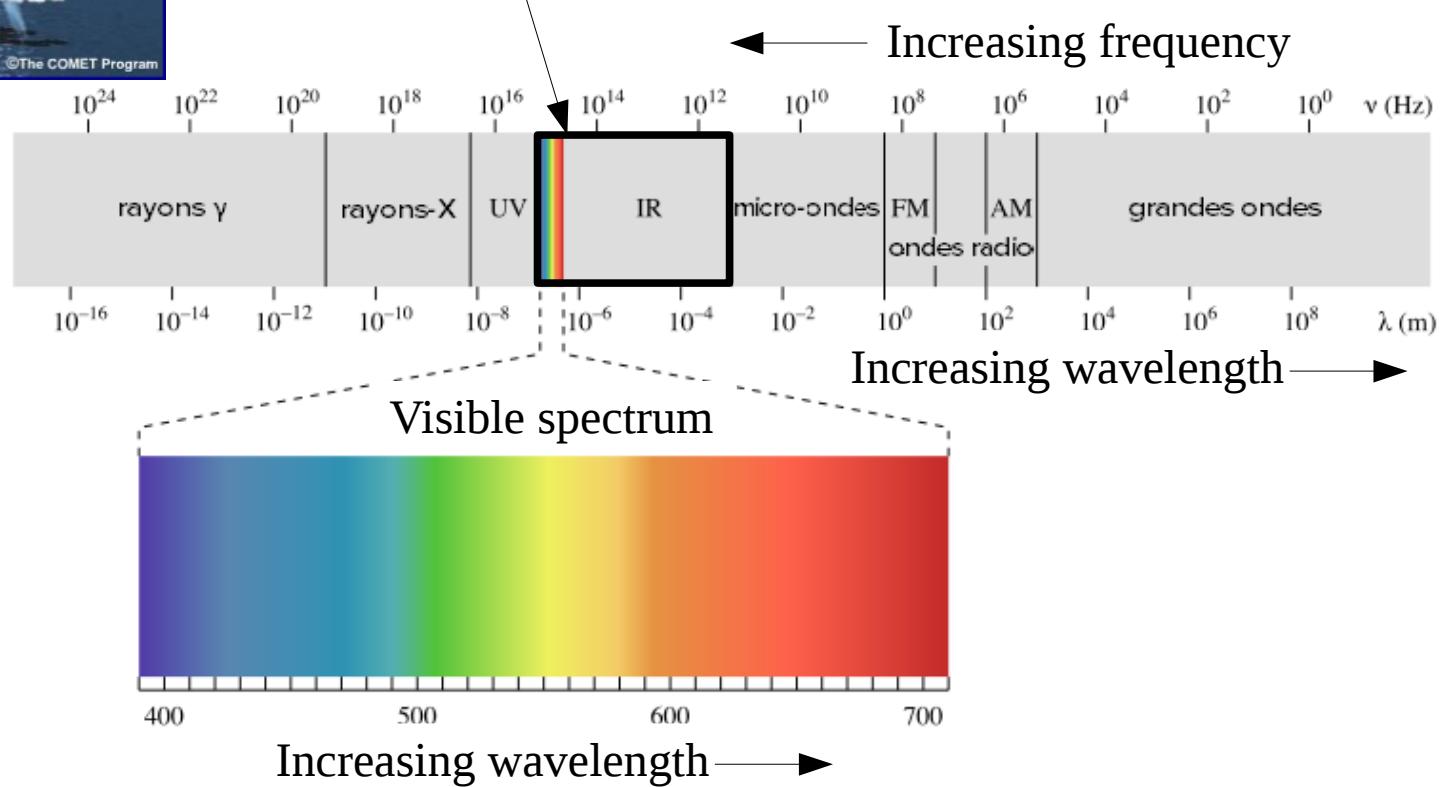
PASSIVE REMOTE SENSING FROM SPACE



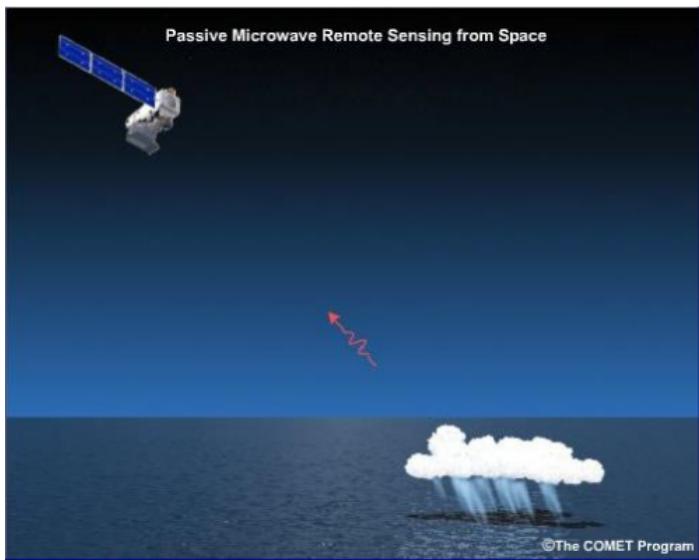
PASSIVE REMOTE SENSING FROM SPACE



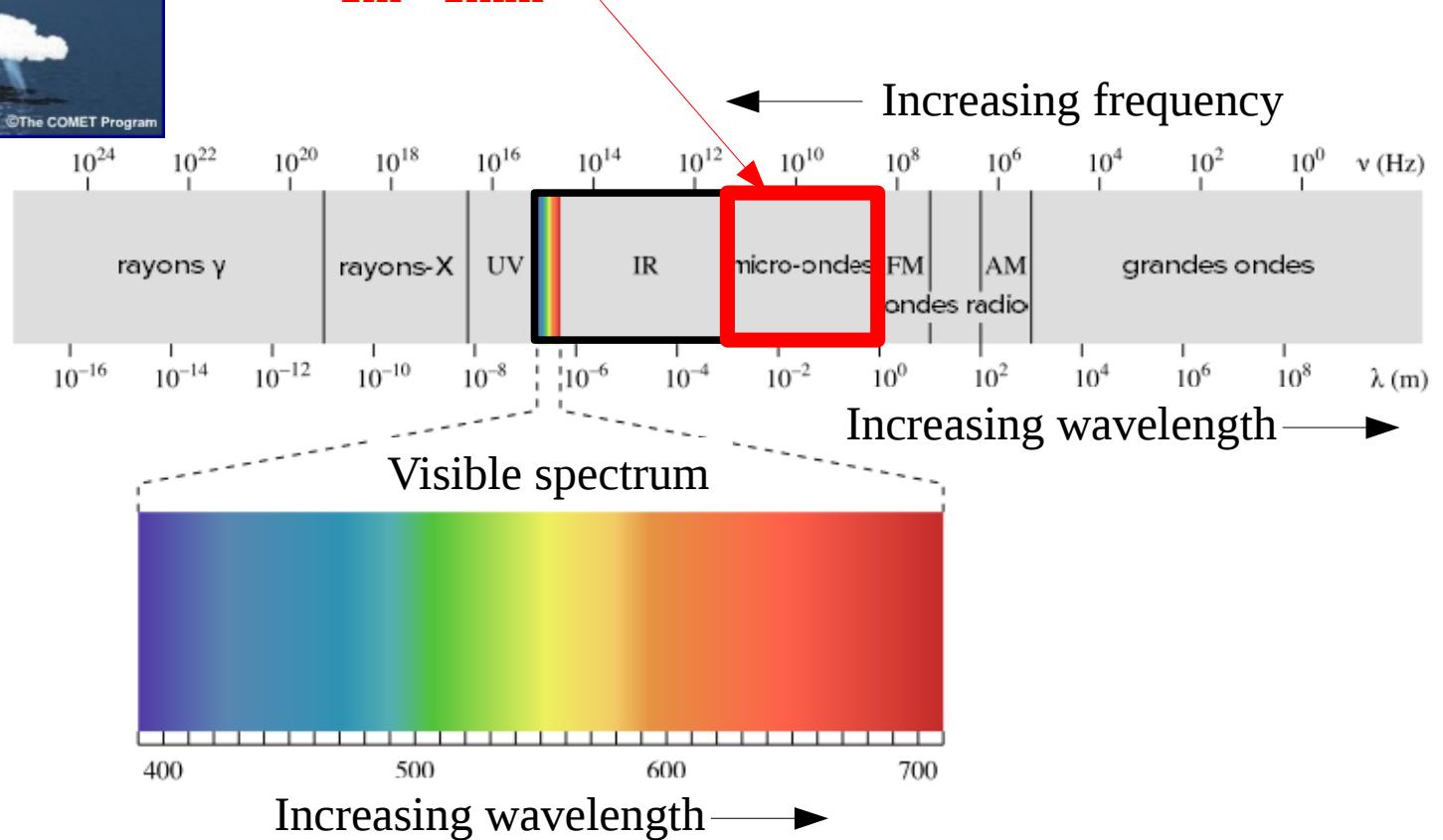
« Classical » imagery
Ex : Geostat MSG
VIS : 0.6-0.8 µm
IR : 4-13 µm



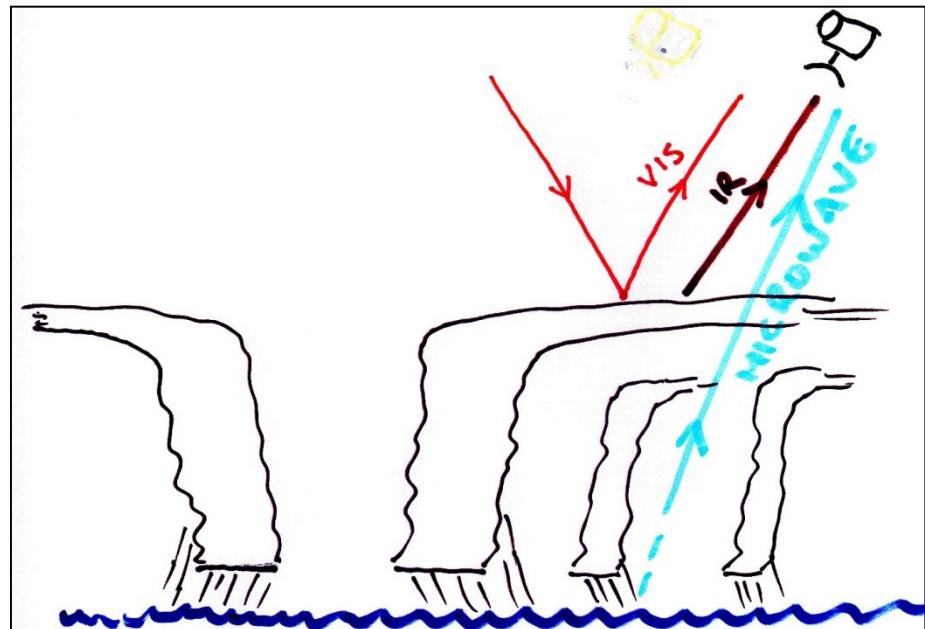
PASSIVE REMOTE SENSING FROM SPACE



Microwave spectrum :
300 MHz-300 GHz
1m - 1mm



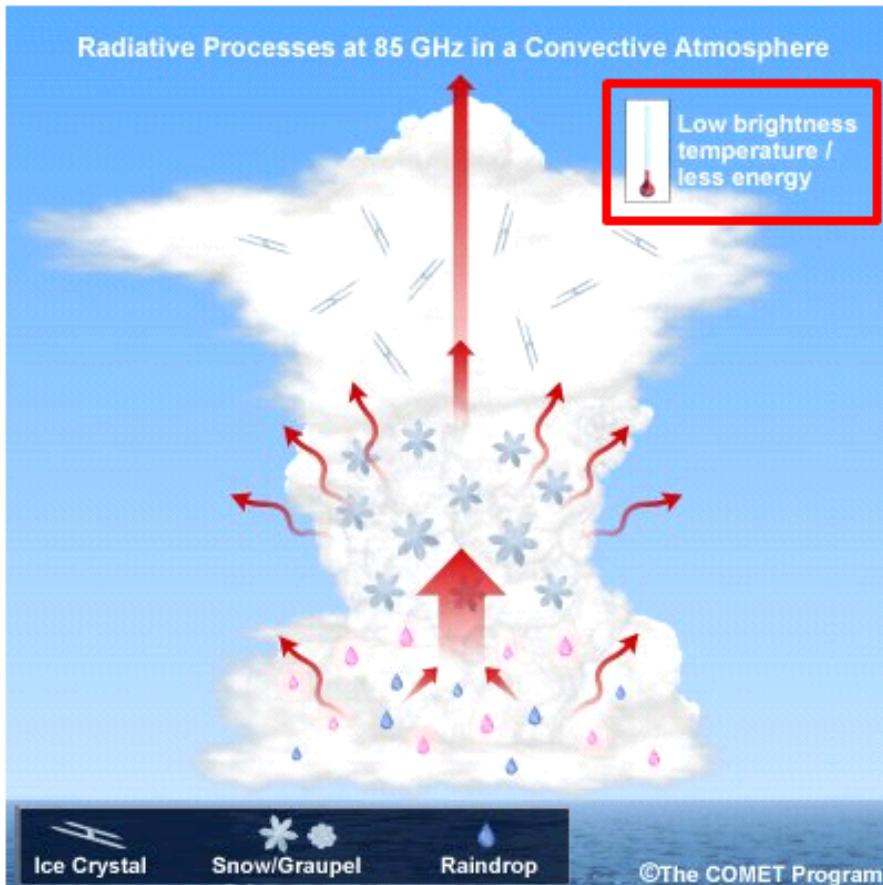
MICROWAVE PROPERTIES



- **Advantages**
 - See through cirrus
 - Sensing whatever the atmospheric conditions
- **Drawbacks**
 - Longer wavelength than VIS/IR so less energy and less horizontal resolution.
 - Only available on polar-orbiting satellites so less frequent coverage
 - Interpretation is more complex

- **Avantages**
 - voient à travers les cirrus
 - détection dans presque toutes les conditions atmosphériques
- **Inconvénients**
 - Une longueur d'onde plus longue que le VIS ou IR (moins d'énergie et une résolution horizontale moindre)
 - Disponibles seulement sur les défiliants donc une couverture moindre.
 - Interprétation plus complexe.

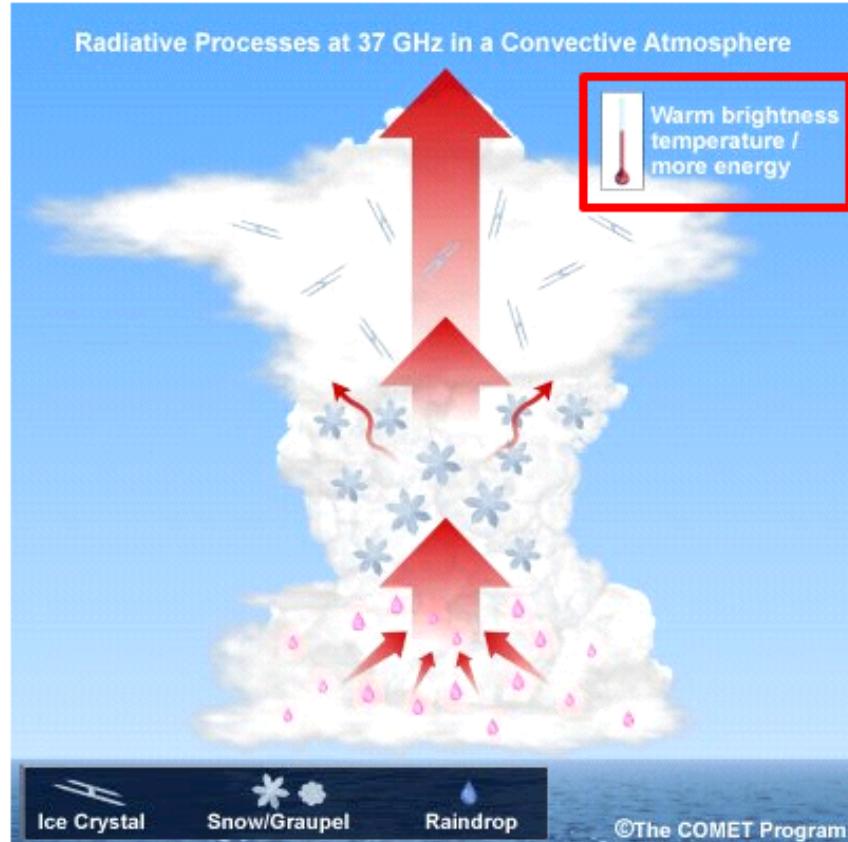
RADIATIVE PROCESS AT 85 GHz



- **85 GHz. Energie radiative :**
 - absorbée, réémise ou diffusée par les gouttes d'eau
 - Diffusée ensuite par les particules de glace
 - Peu d'effet des cirrus
- **Peu d'énergie parvient au sommet**
- **DONC : températures de brillance très basses captées au dessus de la convection profonde à 85 GHz**

- **85 GHz. Radiation :**
 - *Absorbed, re-emitted or scattered by raindrops*
 - *Scattered by precipitating ice particles*
 - *Cirrus have little effect*
- ***Radiation seriously depleted when reaching the top***
- ***SO : very low brightness temperatures are sensed above deep convection at 85 GHz***

RADIATIVE PROCESS AT 37 GHz



- **A 37 GHz : énergie**
 - absorbée par l'eau de pluie
 - Ré-émise par l'eau de pluie vers le niveau supérieur
 - Peu diffusée par les particules de glace précipitantes
 - Pas d'effet des cirrus
- **Energie abondante parvient au satellite**
DONC : hautes températures de brillance captées au sommet
- **At 37 GHz : radiation**
 - *Absorbed by rain water*
 - *Emitted from the rain water upwells further*
 - *Minor scattered by precipitation ice particles*
 - *Cirrus have no effect*
- **Abundant energy reaches the satellite**
SO : high britness temperatures

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TC Intensity estimate: objective guidances

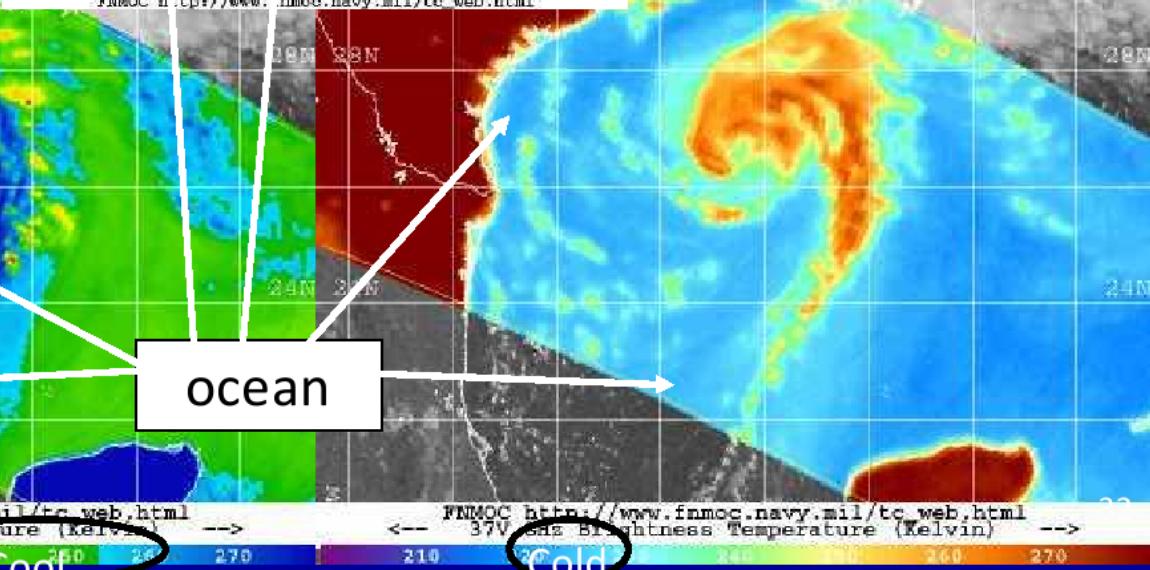
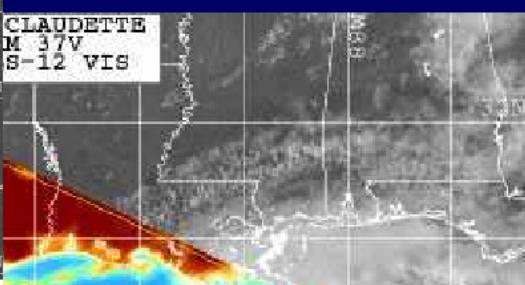
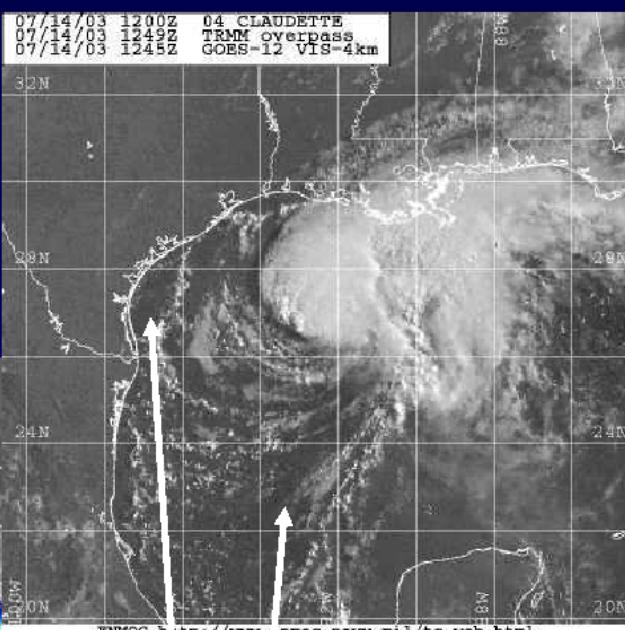
Scatterometers / SAR

IMAGERY EXAMPLES AT 37 AND 85 GHZ

Ocean regions
appear Cool in
85H

Ocean regions
appear Cold in 37V

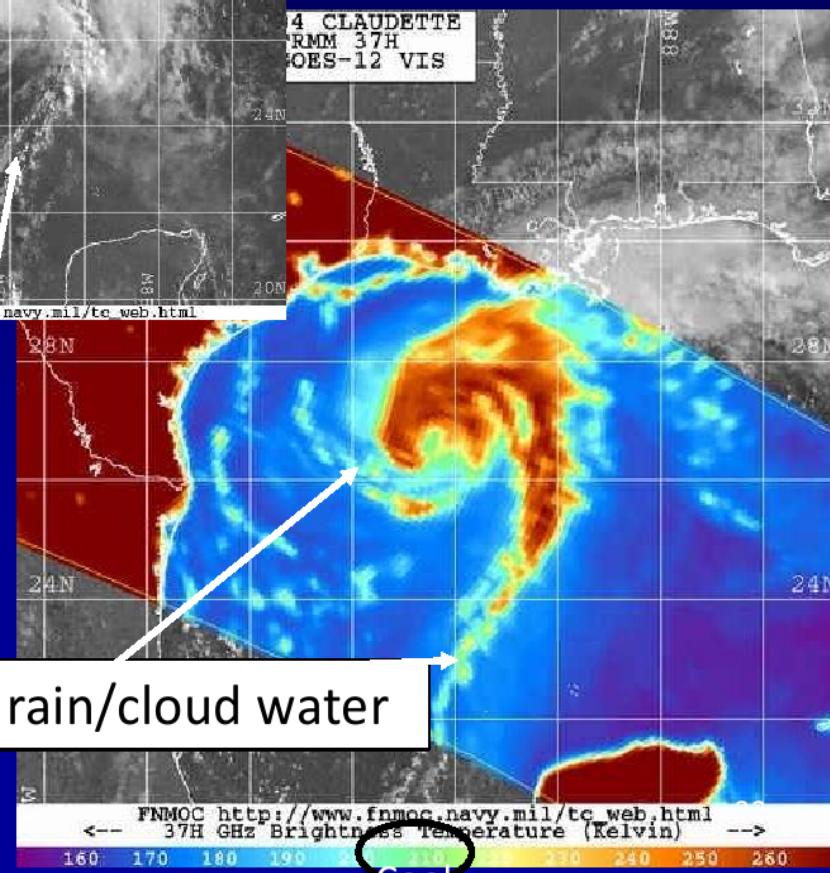
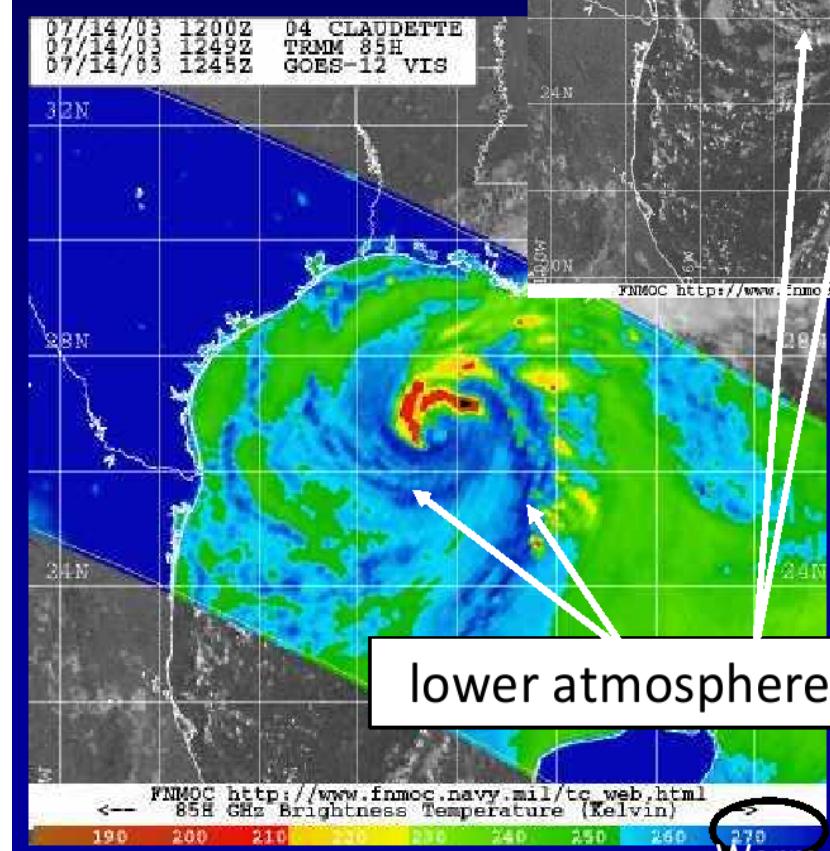
07/14/03 1200Z 04 CLAUDETTE
07/14/03 1249Z TRMM 85H
07/14/03 1245Z GOES-12 VIS



IMAGERY EXAMPLES AT 37 AND 85 GHZ

Rain appears
Warm in 85H

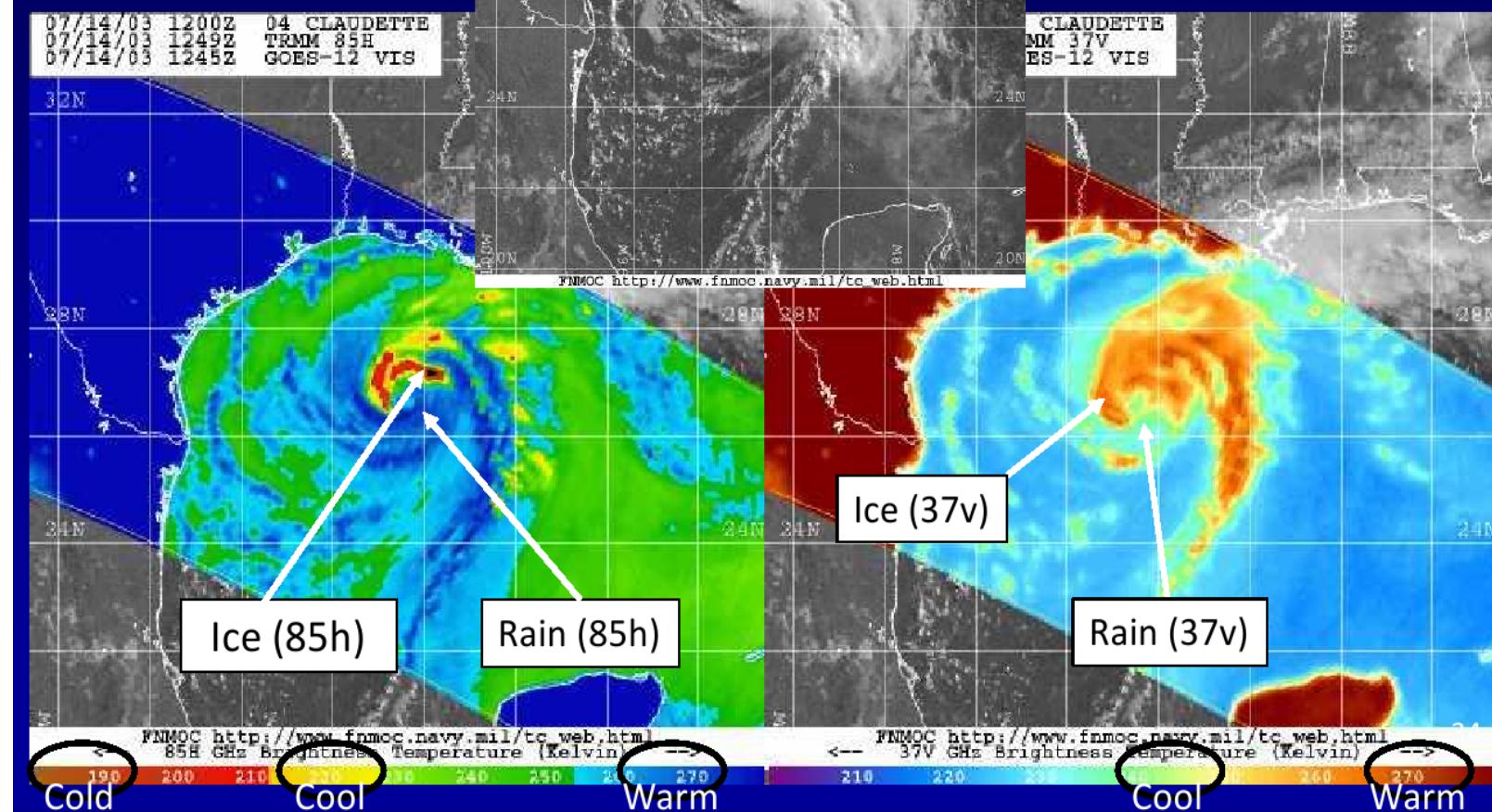
Lower-based Rain
appears Cool in 37H



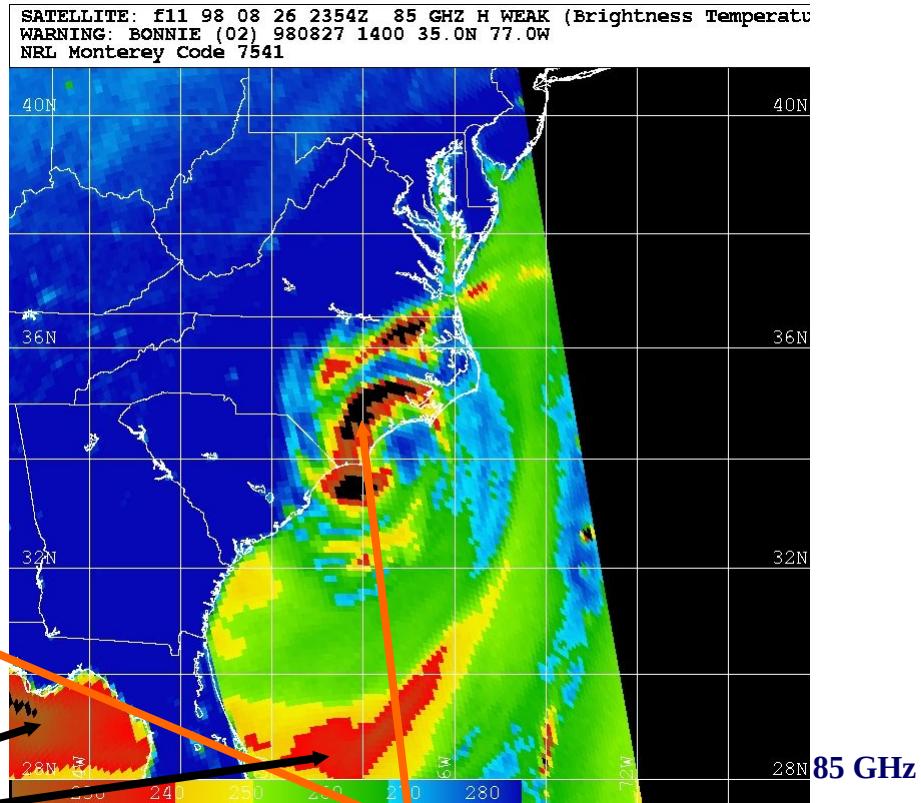
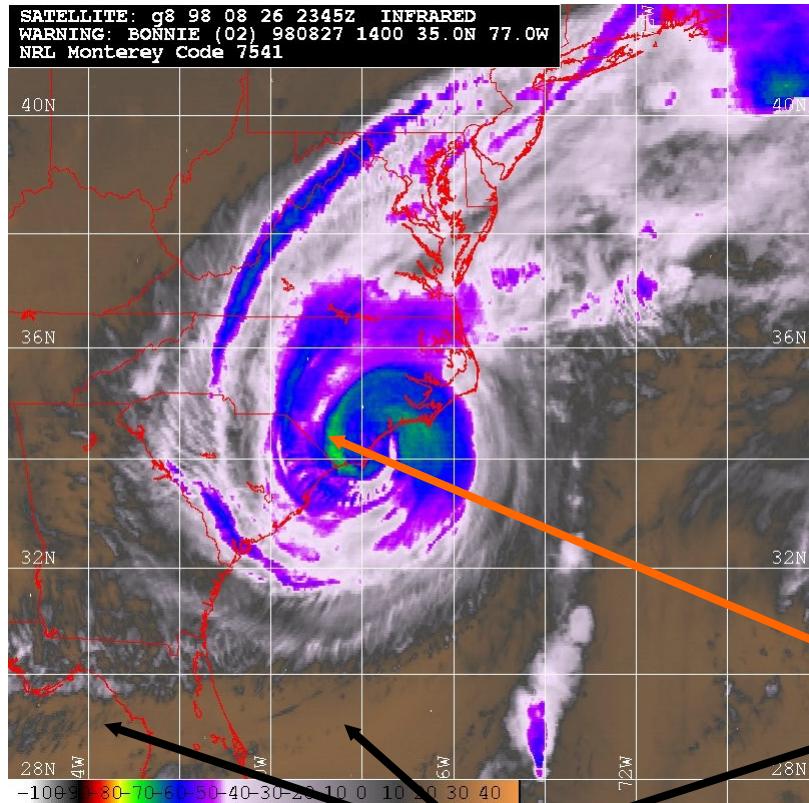
IMAGERY EXAMPLES AT 37 AND 85 GHZ

Ice appears Cool to Cold in 85H; rain is Warm

Rain appears Cool in 37V (less cold over water)
Dense ice looks Warm



INTERPRETATION ISSUES AT 85 GHZ



Air sec au dessus de la mer apparaît également froid en 85 Ghz, du fait de la faible émissivité.

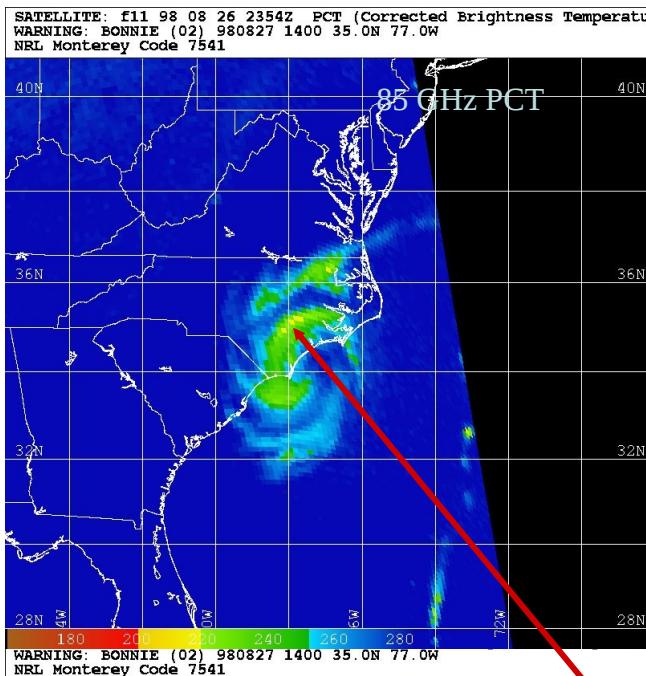
Dry air over sea also appears cold on 85 GHz image due to low emissivity

La convection du mur de l'œil apparaît froide en 85 Ghz, avec la diffusion de la glace.

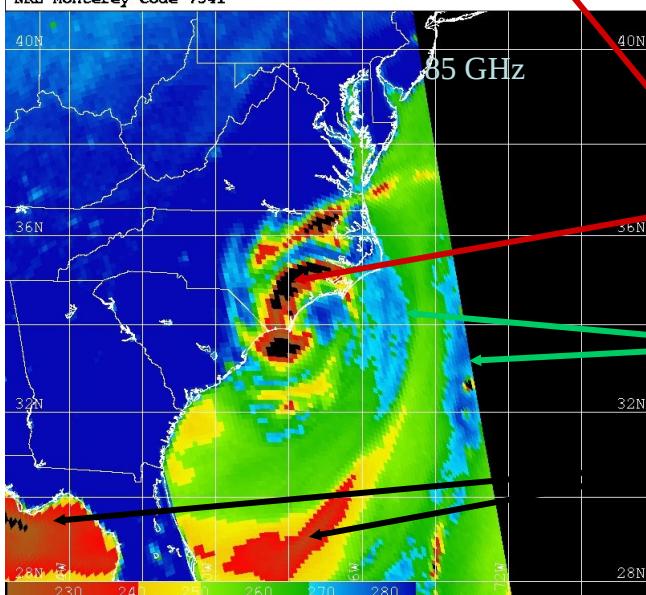
Eyewall convection appears cold on 85 GHz image due to ice scattering.

Images: NRL

INTERPRETATION ISSUES AT 85 GHZ



- Radiations émises de la mer polarisées, mais radiations diffusées par les grosses particules de glace non.
- Combinaison des polarisations verticale et horizontale : on s'affranchit des ambiguïtés.
- Appelé la PCT (Polarisation Corrected Temperature ou température corrigée de la polarisation)
- *Radiation from sea is polarised, while radiation scattered from large ice is not.*
- *By combining the H & V polarisations, we can get rid of the ambiguity.*
- *Called the PCT (polarisation corrected temperature).*



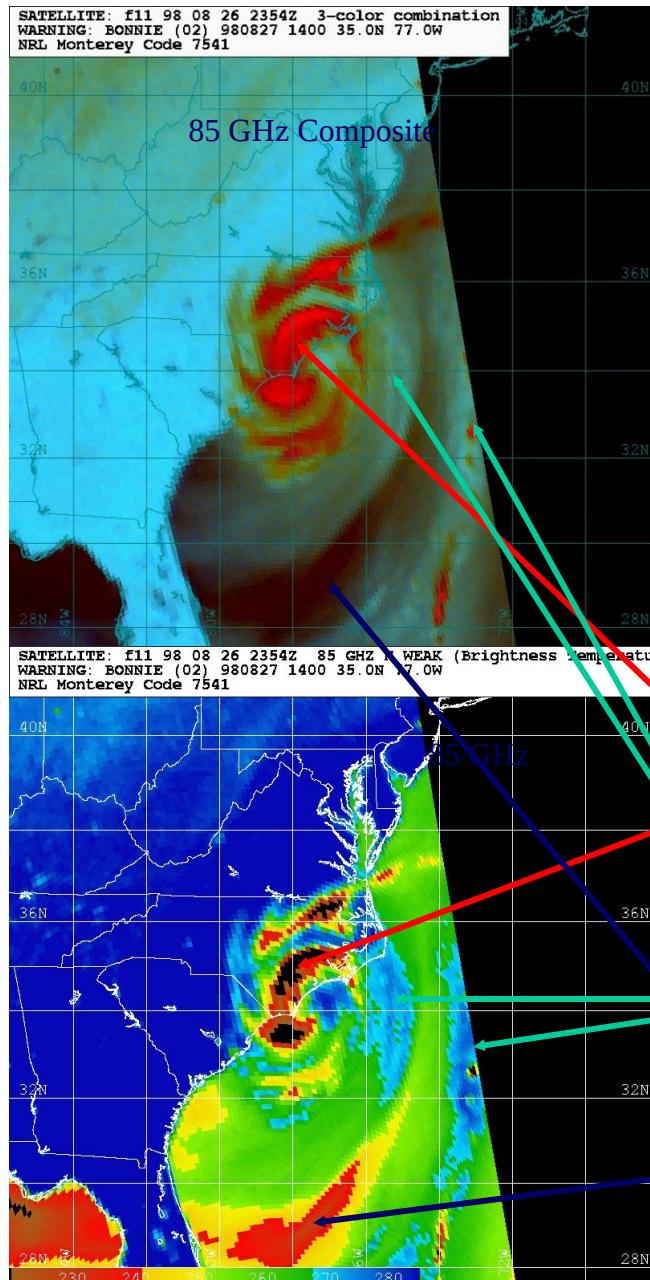
Eyewall convection appears cold on both images

Weak rainbands are washed out on PCT image

Dry air over sea not visible on PCT image

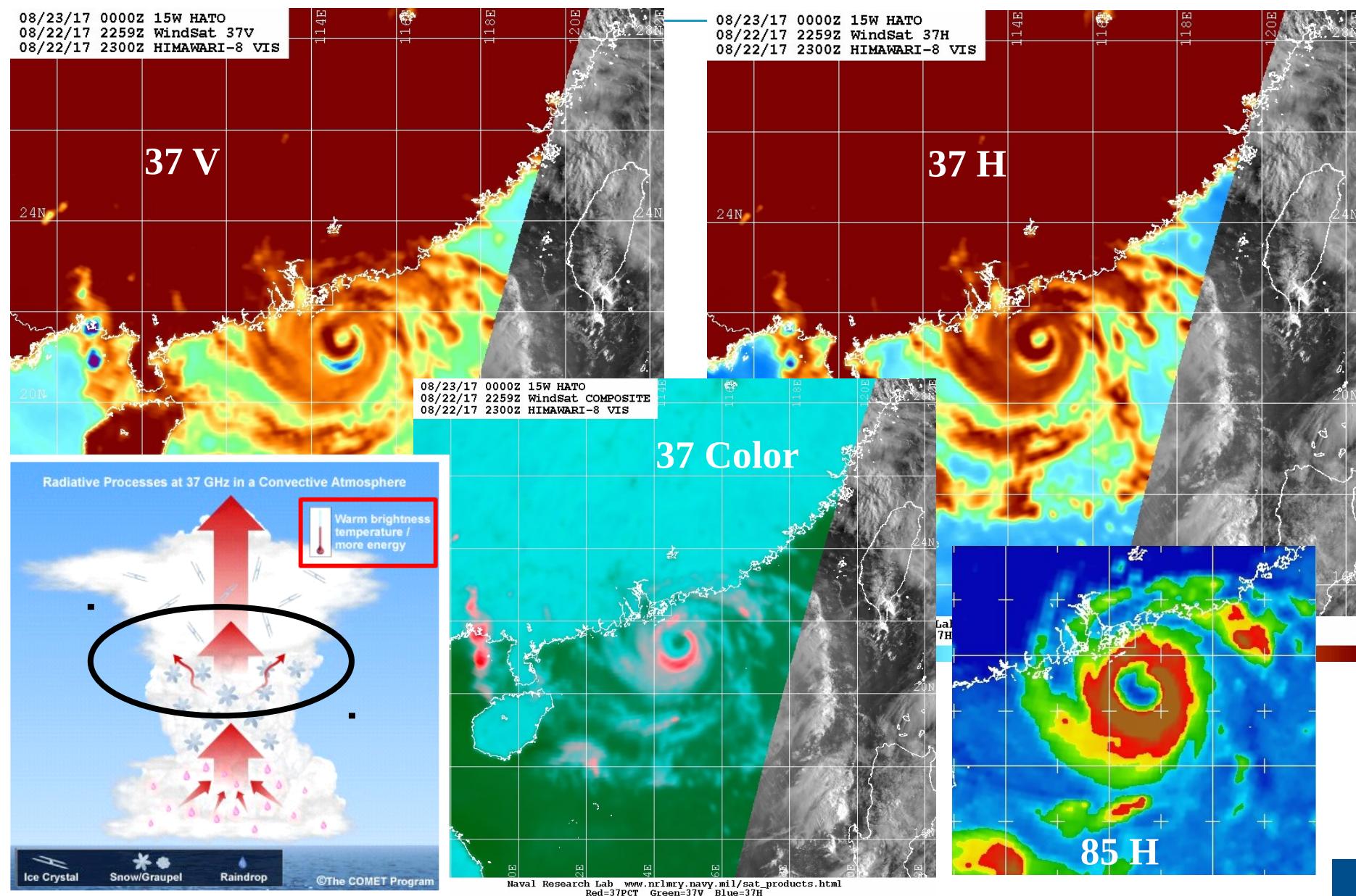
Images: NRL

INTERPRETATION ISSUES AT 85 GHz



- Image composite montre le PCT en rouge et les 85 GHz en bleu-vert.
 - *Composite image has PCT in red, 85GHz in blue-green, and captures both features.*
- Eyewall convection apparent on both images**
- Weak rainbands are green-blue on composite image.**
- Dry air over sea near-black on composite image.**

INTERPRETATION ISSUES AT 37 GHZ



OUTLINE

Synopsis on microwaves

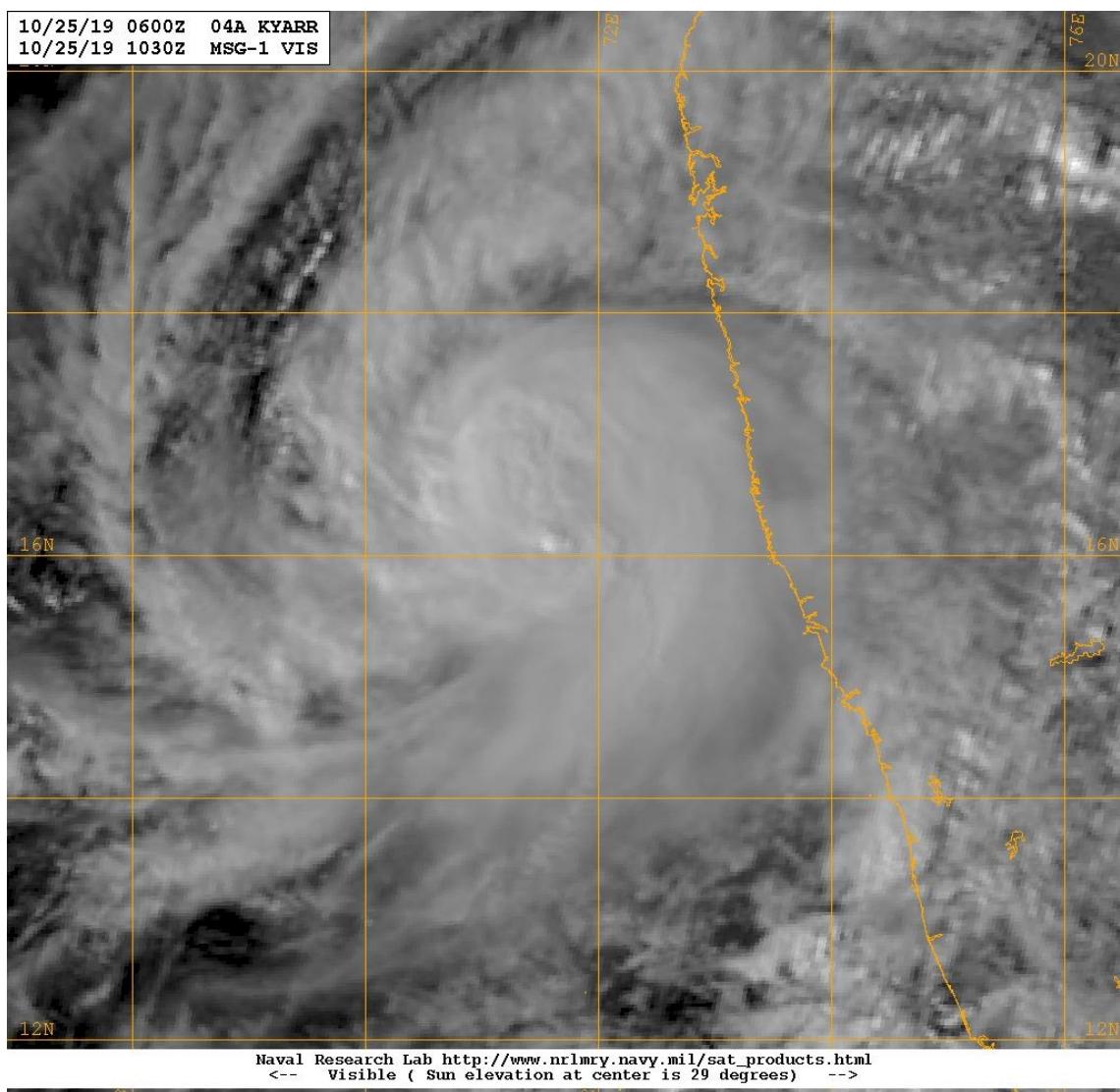
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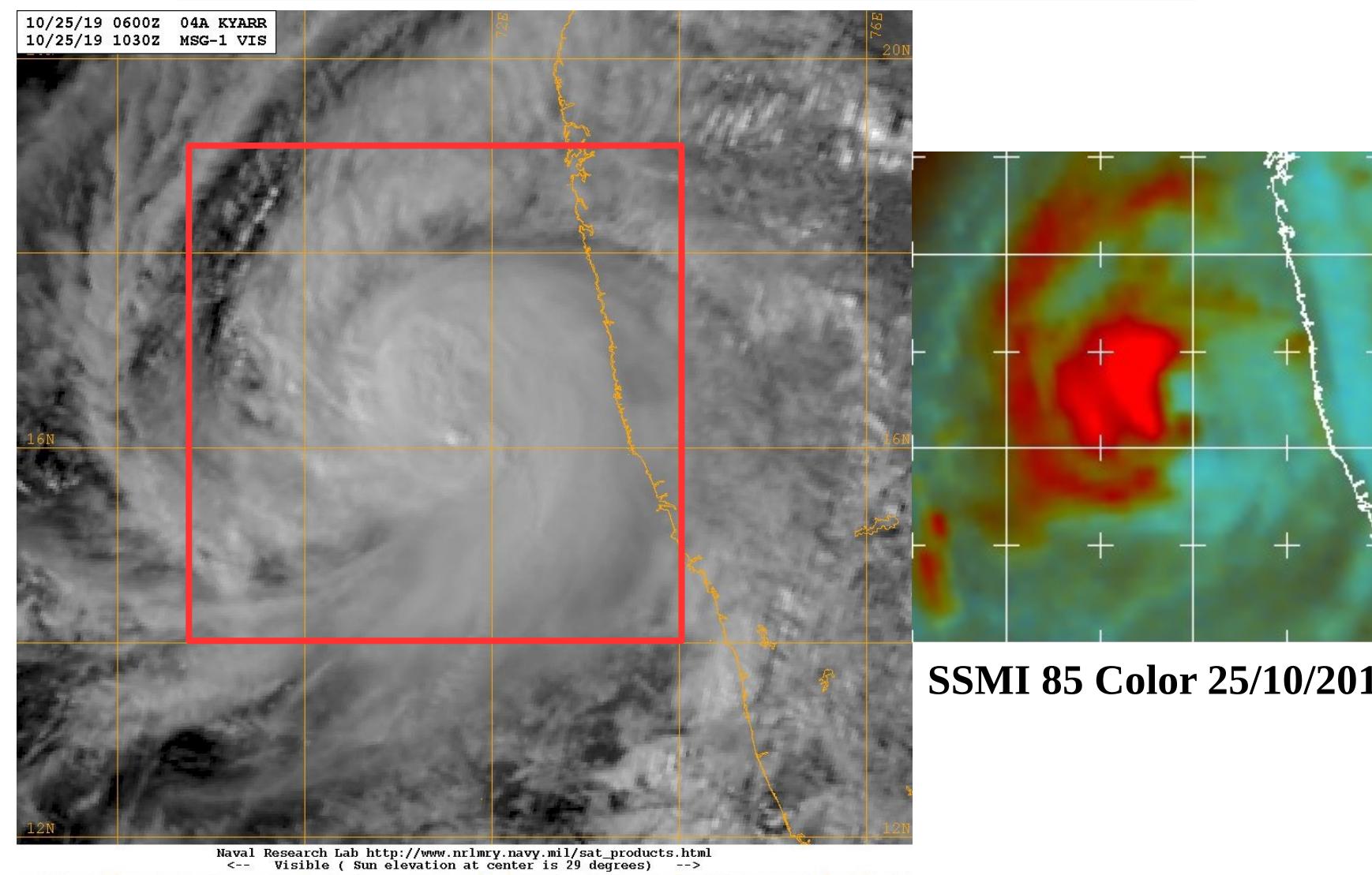
Scatterometers / SAR

LOCATE THE CENTER



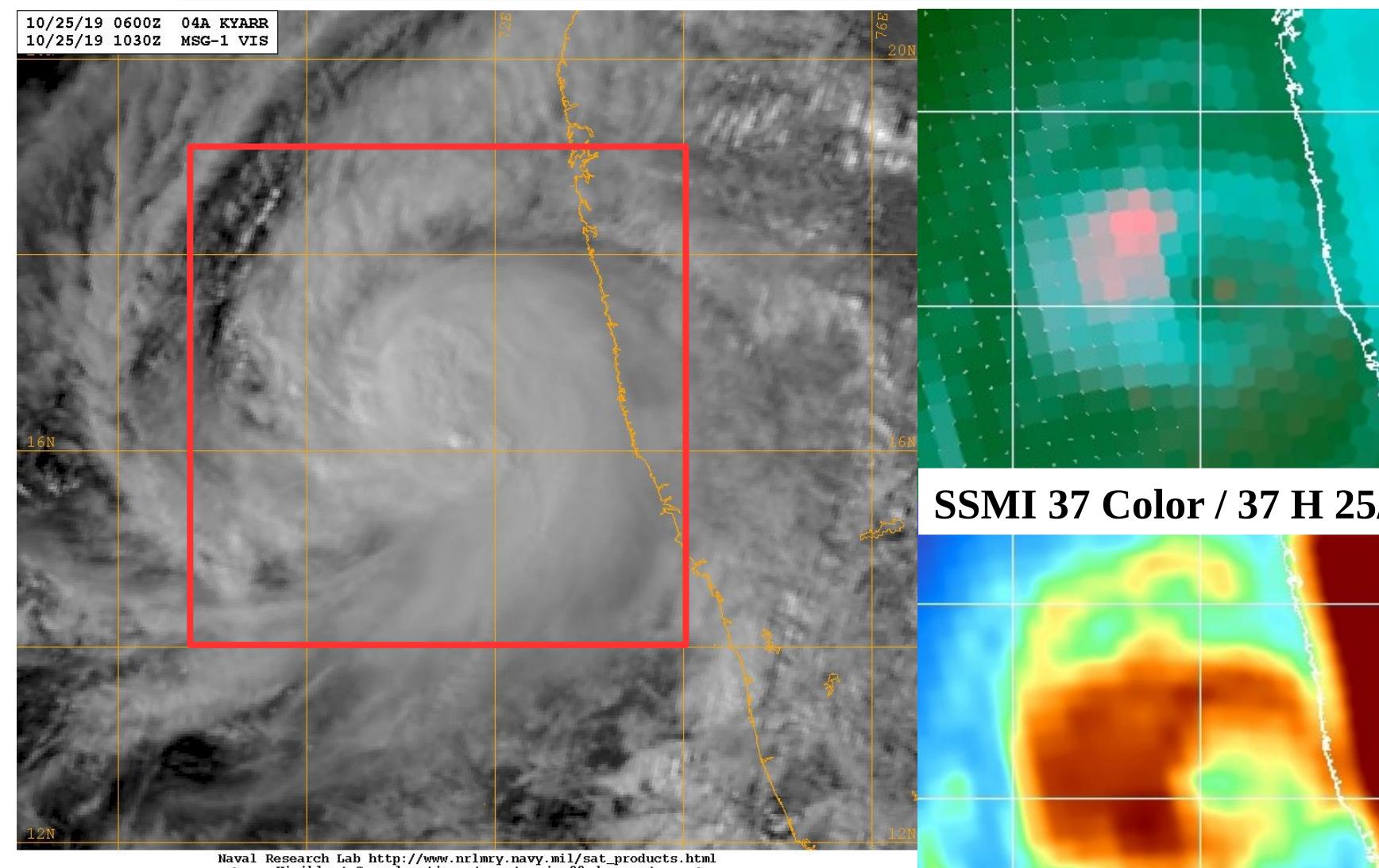
Tempête tropicale KYARR 2019 (NIND)
Tropical storm KYARR 2019 (NIND)

LOCATE THE CENTER



Tempête tropicale KYARR 2019 (NIND)
Tropical storm KYARR 2019 (NIND)

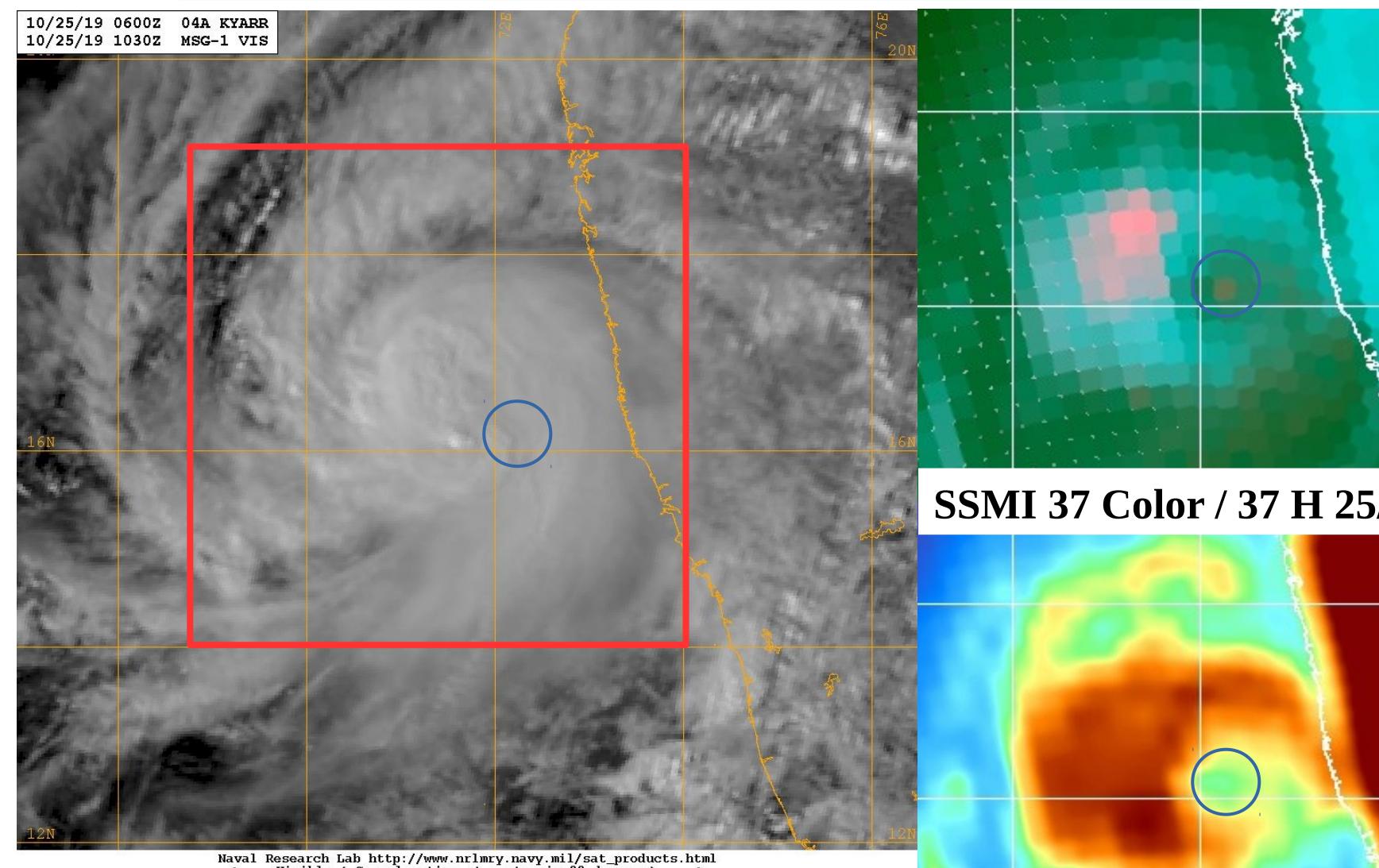
LOCATE THE CENTER



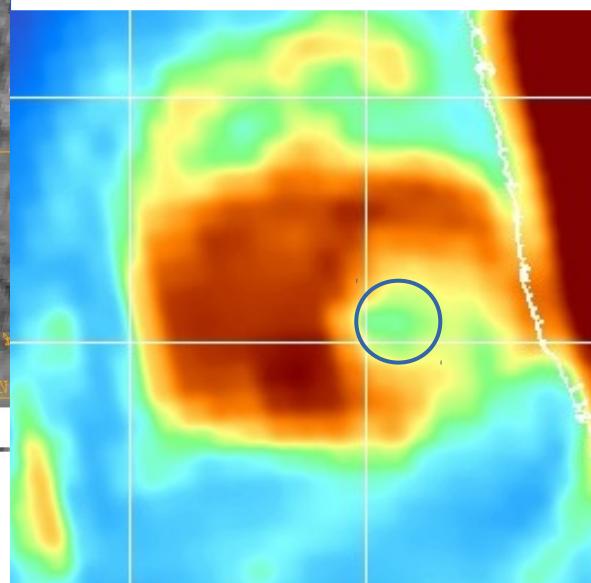
SSMI 37 Color / 37 H 25/10/2019 1027Z

Tempête tropicale KYARR 2019 (NIND)
Tropical storm KYARR 2019 (NIND)

LOCATE THE CENTER

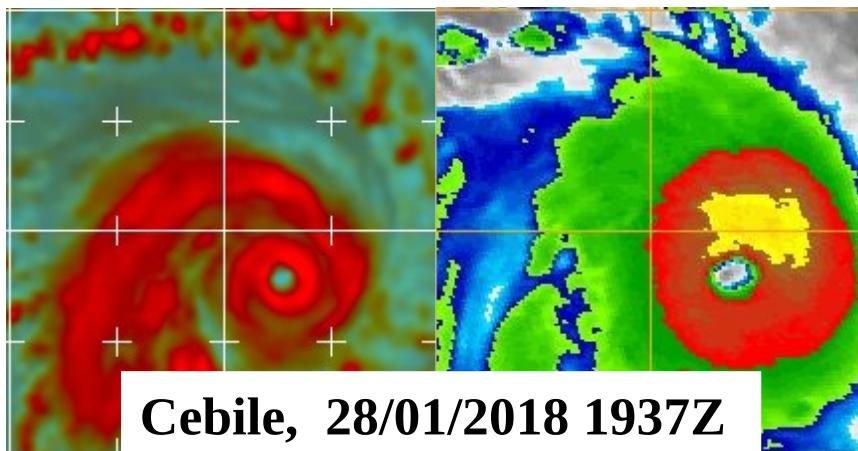


SSMI 37 Color / 37 H 25/10/2019 1027Z

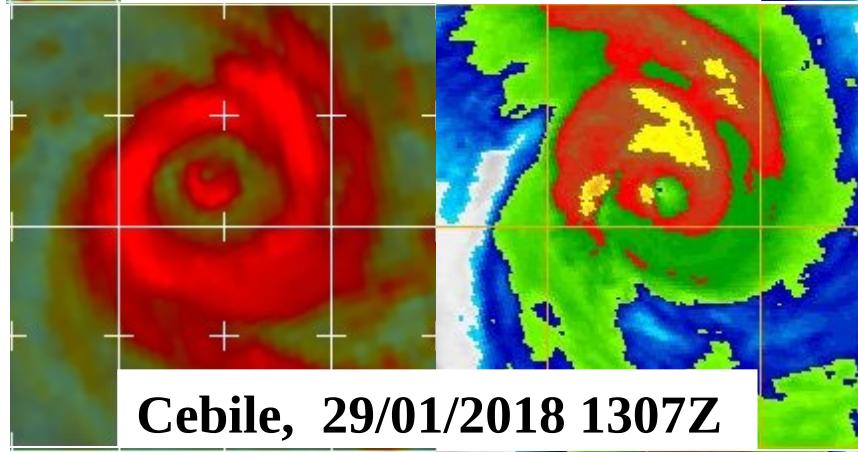


Tempête tropicale KYARR 2019 (NIND)
Tropical storm KYARR 2019 (NIND)

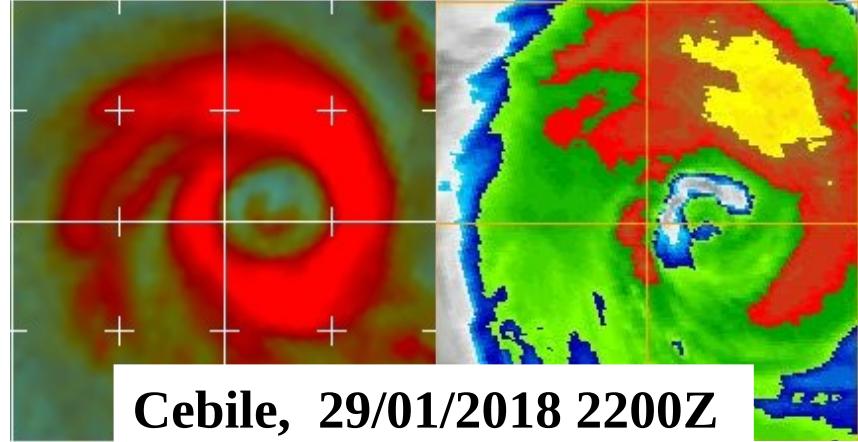
REVEAL EYEWALL REPLACEMENT CYCLE



Phase I: Intensification (début ERC)
Phase I: Intensification (ERC onset)

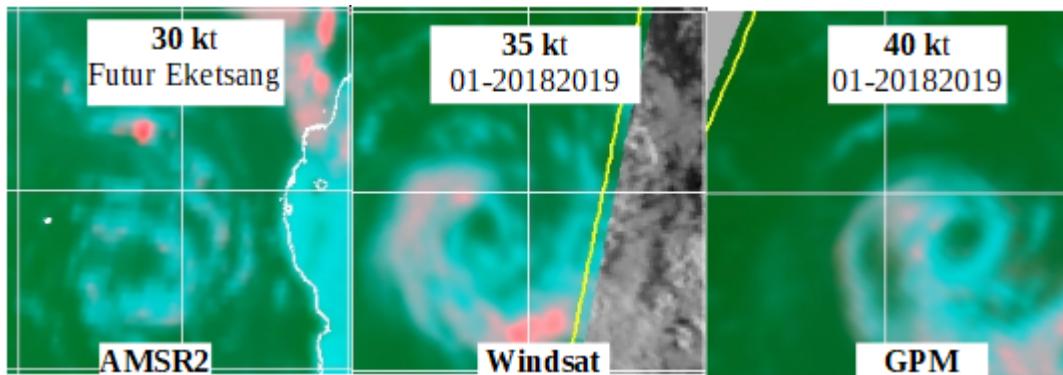


Phase II: Affaiblissement
Phase II: Weakening



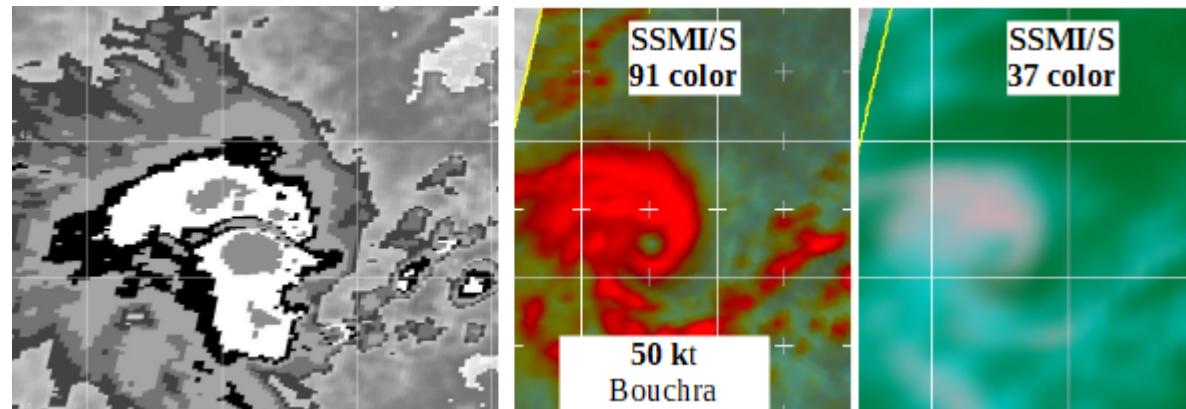
Phase III: Re-intensification
Phase III: Re-intensification

INTERNAL STRUCTURE & INTENSITY ASSESSMENT



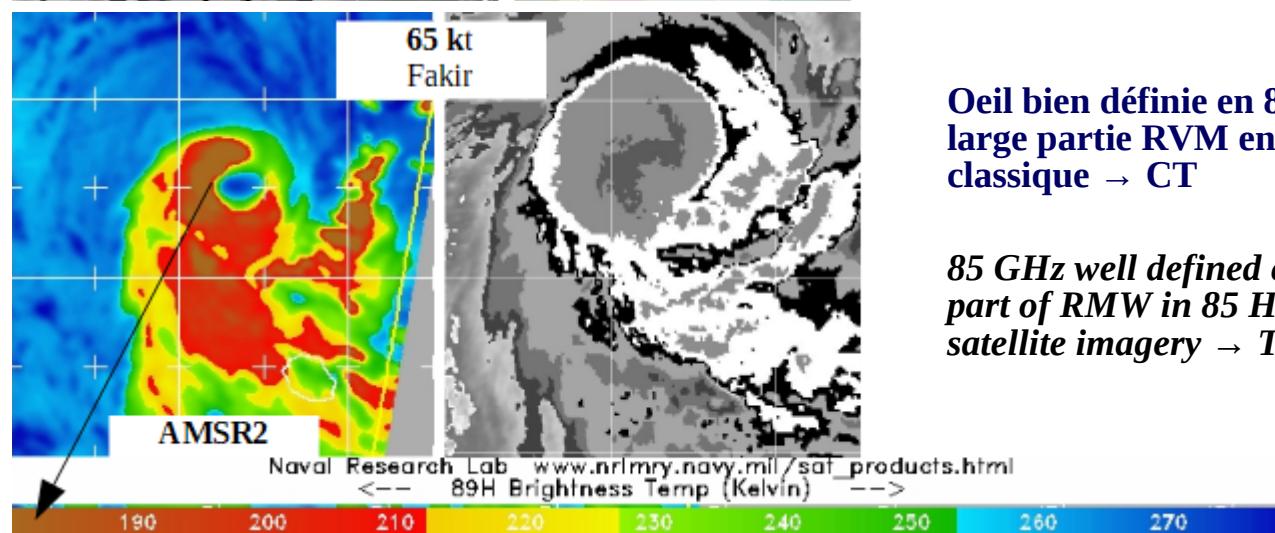
Oeil bien définie en 37 GHz / Pas d'oeil en 85 GHz / Pas d'oeil en imagerie classique → TTM

37 GHz well defined eye / no eye feature in 85 GHz nor with classical satellite imagery → Moderate Tropical Storm



Oeil bien définie en 85 GHz / alignement vertical / Pas d'oeil en imagerie classique → FTT

85 GHz well defined eye / no tilt / no eye feature with classical satellite imagery → Severe Tropical Storm

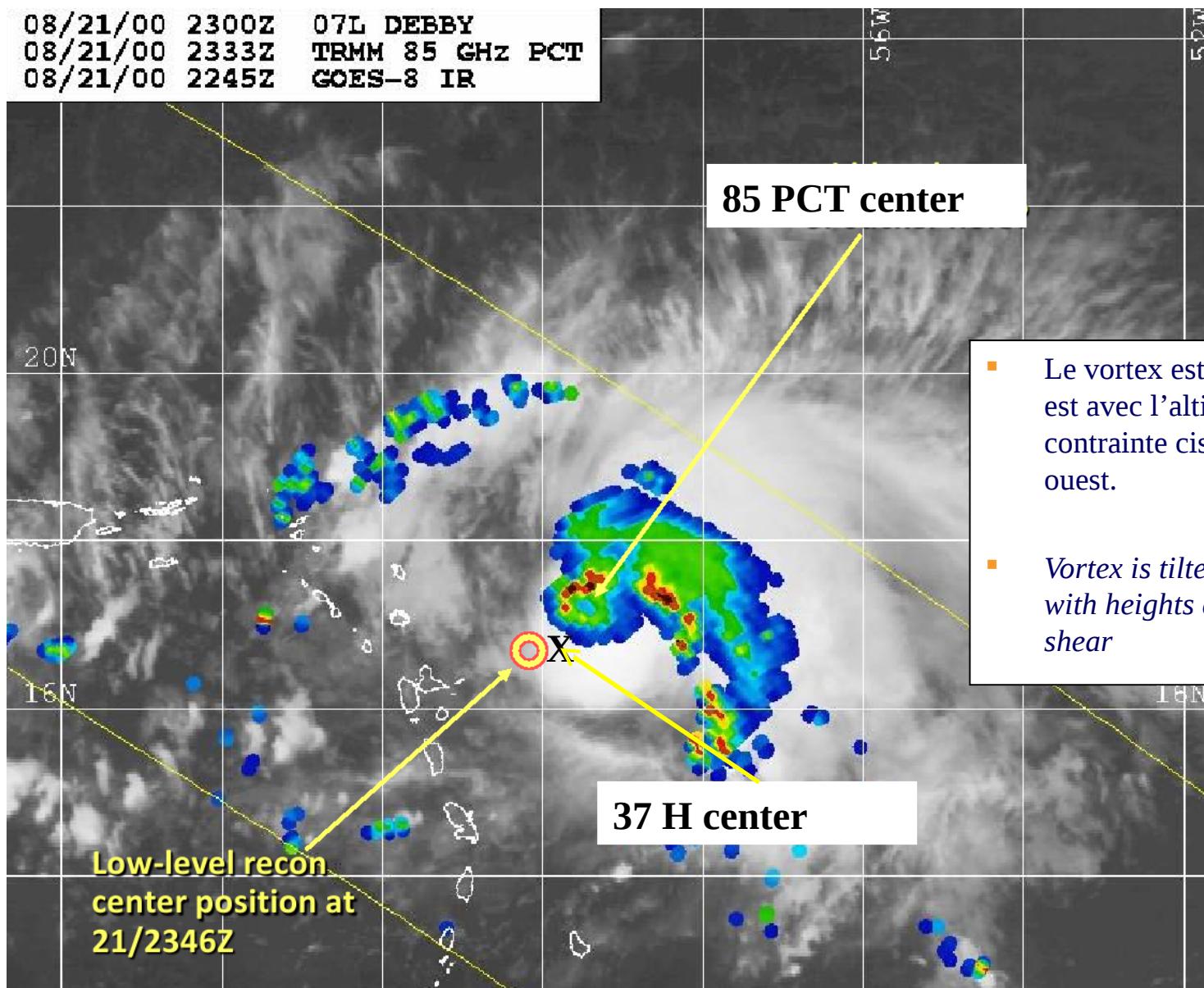


Oeil bien définie en 85 GHz / Tb très basses sur large partie RVM en 85 H / Pas d'oeil en imagerie classique → CT

85 GHz well defined eye / very low Tb over large part of RMW in 85 H/ no eye feature with classical satellite imagery → Tropical Cyclone

3D VIEW OF INTERNAL STRUCTURE

08/21/00 2300Z 07L DEBBY
08/21/00 2333Z TRMM 85 GHz PCT
08/21/00 2245Z GOES-8 IR

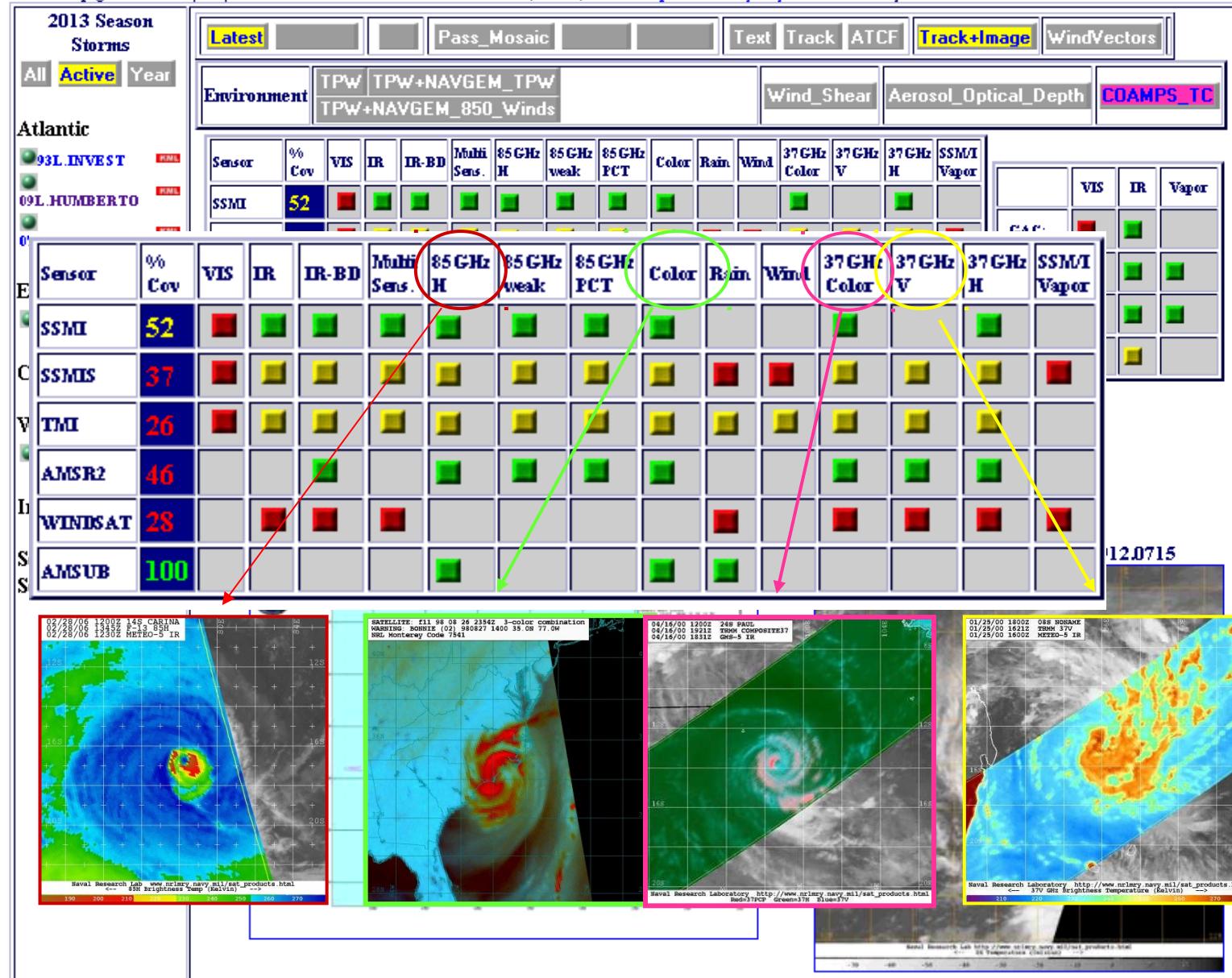


- Le vortex est incliné vers le nord-est avec l'altitude en raison d'une contrainte cisaillée de secteur sud-ouest.
- Vortex is tilted north-eastwards with heights due to south-westerly shear

NAVAL RESEARCH LABORATORY - TC PAGE

→ <https://www.nrlmry.navy.mil/TC.html>

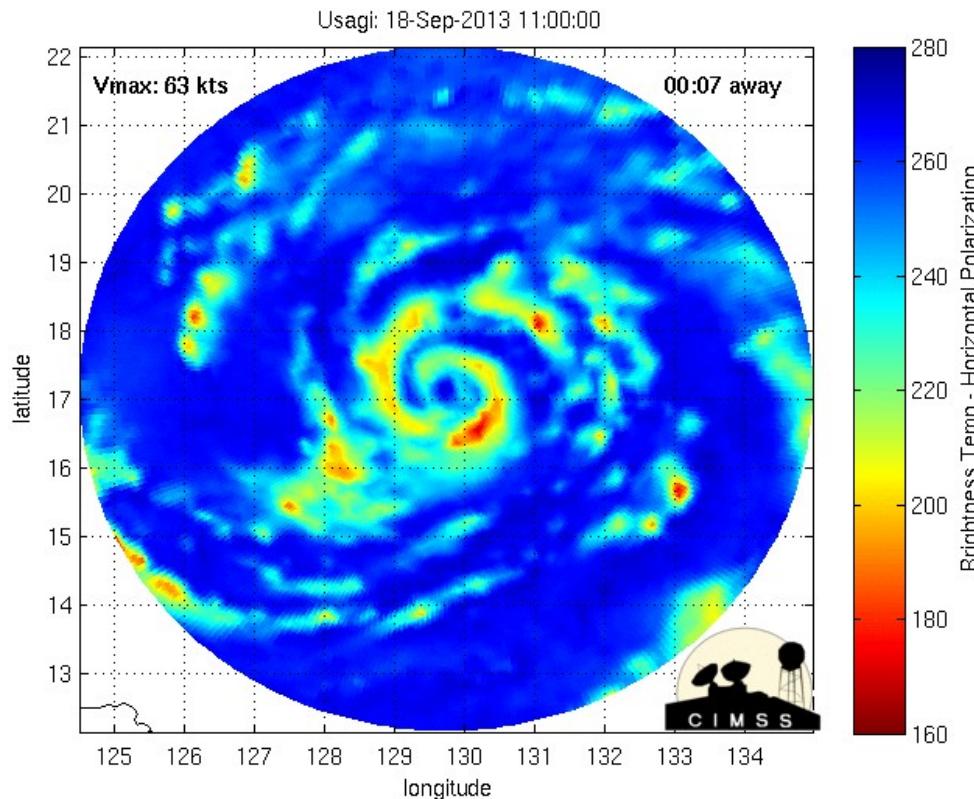
NOTE: this page is short lived (10 m). Please DO NOT bookmark it or save it to Favorites; instead, bookmark <http://www.nrlmry.navy.mil/TC.html> thank you.



CIMSS – MIMIC TC

<http://tropic.ssec.wisc.edu/real-time/mimtc/tc.shtml>

Morphed Integrated Microwave Imagery at CIMSS (MIMIC) Version 1



[- Return to main storm menu -](#)

OUTLINE

Synopsis on microwaves

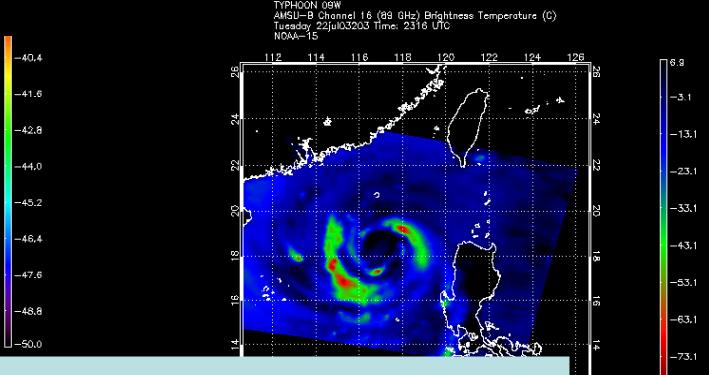
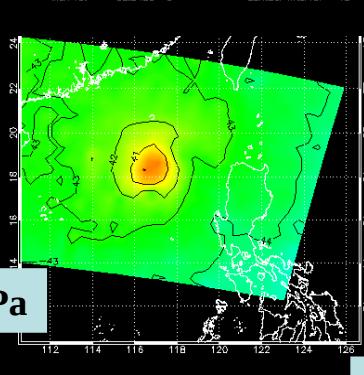
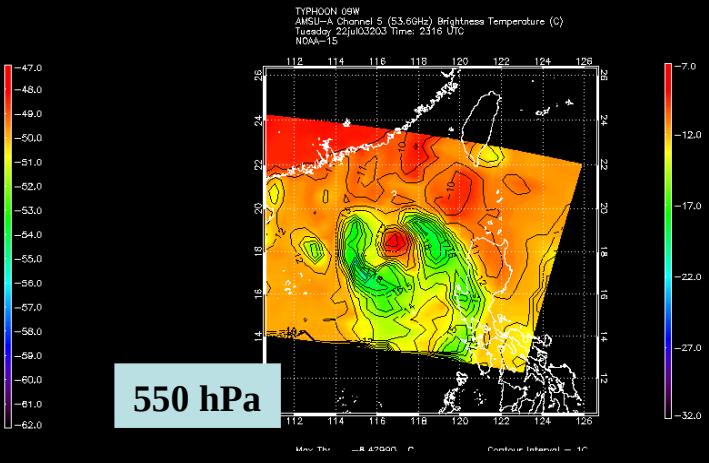
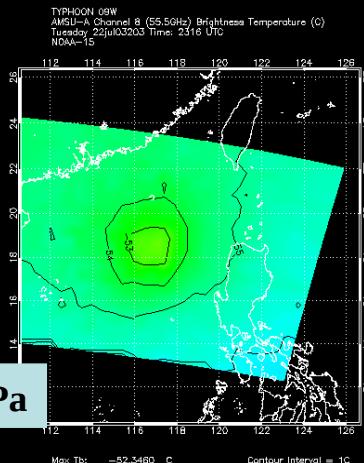
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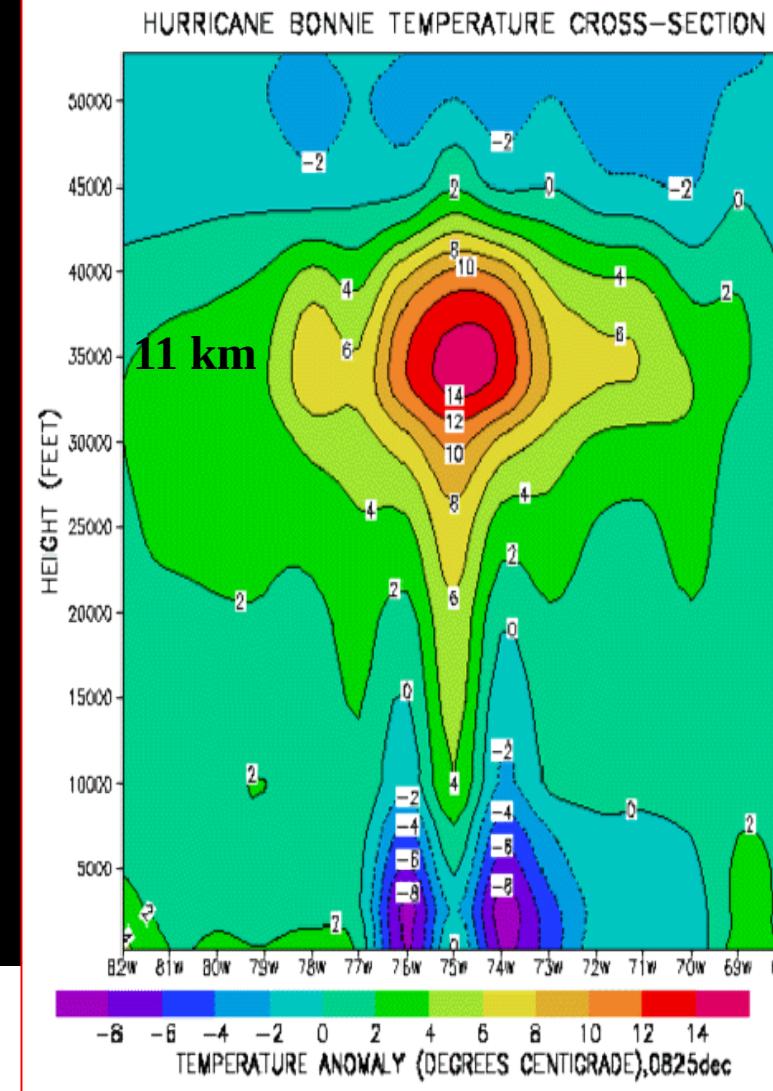
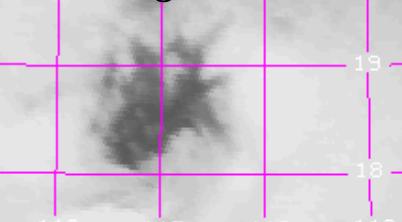
ADVANCED MW SOUNDING UNIT (AMSU)



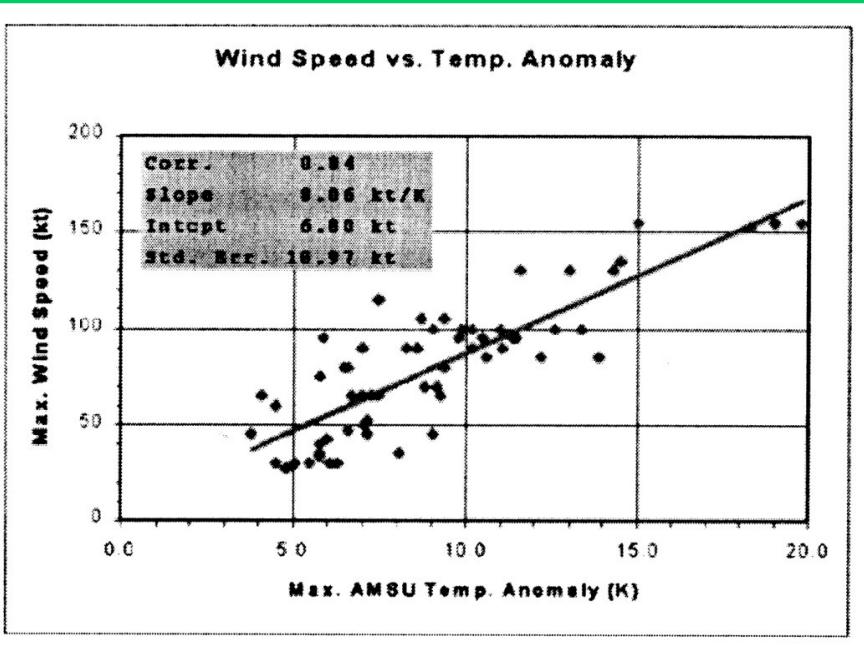
MW SOUNDER ABOARD NOAA-15

Typhoon IMBUDO, juillet 2003

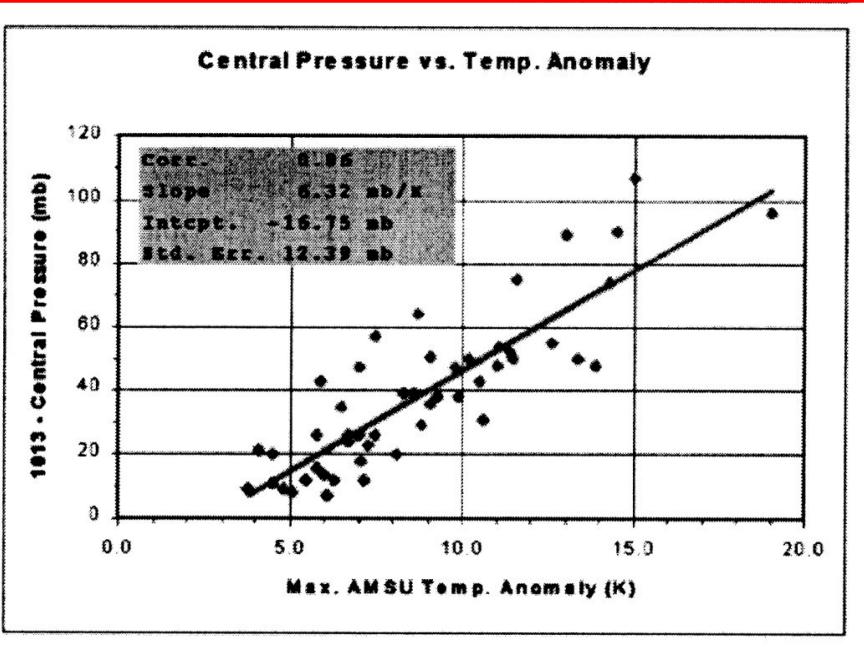
Images CIMSS



ADVANCED MW SOUNDING UNIT (AMSU)



- Les anomalies de température obtenues d'après AMSU-A permettent
 - d'estimer l'intensité du phénomène en obtenant
 - ▶ la vitesse du vent
 - ▶ la pression au centre.
- Via régression linéaire



- Temperature anomalies calculated thanks to AMSU-A allow
 - Intensity estimation by providing
 - Wind speed
 - Minimal pressure
- From linear regression

Source : Kidder et al (2000) :
Satellite analysis of tropical cyclone using the Advanced Microwave Sounding Unit (AMSU). *Bull. Amer. Met. Soc.*, 81, 1241-1259.

ADVANCED MW SOUNDING UNIT (AMSU)

<http://tropic.ssec.wisc.edu/real-time/amsu/>

Screenshot of the UW-CIMSS AMSU Tropical Cyclone Homepage:

The homepage features a banner with the Wisconsin Badger logo and the text "Cooperative Institute for Meteorological Satellite Studies University of Wisconsin-Madison" and "AMSU Tropical Cyclone Homepage".

Key sections include:

- Western North Pacific/Indian Ocean:** A dropdown menu showing storm names: 18W, 17W USAGI, 16W MAN-YI, 15W TUPAI, 14W KONG-REY, 13W, 12W TRAMI, 11W UTOR, 10W MANGKHUT, 09W JEBI, 08W CIMARON, 07W SOULIK, 06W RUMBIA, 05W BEBINCA, 04W LEEPI, 03W YAGI, 01B, 02W, 01W. The entry for 17W USAGI is highlighted.
- Eastern/Central Pacific Ocean:** A dropdown menu showing storm names: 18W, 17W USAGI, 16W MAN-YI, 15W TUPAI, 14W KONG-REY, 13W, 12W TRAMI, 11W UTOR, 10W MANGKHUT, 09W JEBI, 08W CIMARON, 07W SOULIK, 06W RUMBIA, 05W BEBINCA, 04W LEEPI, 03W YAGI, 01B, 02W, 01W. The entry for 17W USAGI is highlighted.
- Current Intensity:** A section showing brightness temperature anomalies for various AMSU channels (8, 7, 6, 5 at 100 hPa, 8, 7, 6, 5 at 200 hPa, 8, 7, 6, 5 at 300 hPa, 8, 7, 6, 5 at 500 hPa) and AMSU-B 89 GHz. The 17W USAGI storm is circled in red.
- AMSU algorithm change log:** A link to the algorithm change log.
- What is the CIMSS AMSU Tropical Cyclone Intensity Algorithm?** A link to the algorithm description.
- CIMSS/NESDIS-USAF/NRL AMSU TC Intensity Estimation:** Details for SUPER TYPHOON 17W on Thursday 19sep13 at 2052 UTC. Includes estimated MSLP (924 hPa), maximum sustained wind (124 kts), and confidence (Good). Storm position corresponds to AMSU-A FOV 9 [1<-->30].
- Storm is sub-sampled:** Bias correction applied is ~13 hPa.
- Channel 8 (~150 hPa) Tb Anomaly:** 4.71
- Channel 7 (~250 hPa) Tb Anomaly:** 4.71
- RNW:** 11 km
- RMW Source is:** MW
- Environmental Pressure:** 999 (Climo)
- Satellite:** NOAA-15
- ATCF data for Month:** 09 Day: 20 Time (UTC): 0000
- For imagery, go to:** <http://amsu.ssec.wisc.edu/nwpac32.html>
- For all comments and questions mailto:** chrisv@ssec.wisc.edu

A large red box highlights the "Current Intensity" section, and another red box highlights the AMSU-B 89 GHz cross-section plot. A red arrow points from the "Current Intensity" section to the AMSU-B 89 GHz cross-section plot.

Figure: 201317W MMDD: 0919 YEAR: 2013 Time(UTC): 2052 NOAA-15 AMSU-A Brightness Temperature Anomaly (Storm Center-Environment)
Vertical red line indicates approx location of TC/invert
Approx latitude of cross section is 18.80

Pressure (hPa) 1000 100 1000

Longitude -113.700 -117.200 -120.700 -124.200 -127.700 -131.200 -134.700

Contour Interval = 0.5K

ADVANCED DVORAK TECHNIQUE

- **Inconvénients de la technique de Dvorak manuelle :**
 - Subjectivité (position, choix de la configuration nuageuse, mesures ...)
 - Prend du temps à maîtriser pour un analyste.
 - Méthode empirique sur la base de relation statistique perfectible ...
- **ADT :**
 - « Dvorak automatique ou objectif » : détermination du centre, configuration nuageuse ...
 - Analyse statistique robuste basée sur plus de 10 ans de données avions dans l'Atlantique et le Pacifique
 - Initié par Dvorak lui-même dans les années 90.
 - Utilisation objective de l'imagerie micro-ondes dans les dernières versions
- ***Drawbacks of the manual Dvorak technique:***
 - *Subjectivity (position, cloud pattern choice, measures ...)*
 - *Take time to master*
 - *Empirical method without the aid of computer analysis and robust statistical relationships*
- **ADT:**
 - *« Automatic / objective Dvorak »: objective determination of the center, cloud pattern ...*
 - *Statistical analysis results from a 10+ year sample of North Atlantic and North Pacific storms*
 - *Work initiated by Dvorak in the 90's*
 - *Use of MW imagery in the latest version*

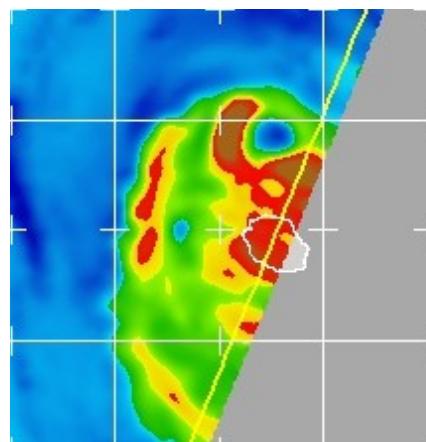
ADVANCED DVORAK TECHNIQUE

<http://tropic.ssec.wisc.edu/real-time/adt/adt.html>

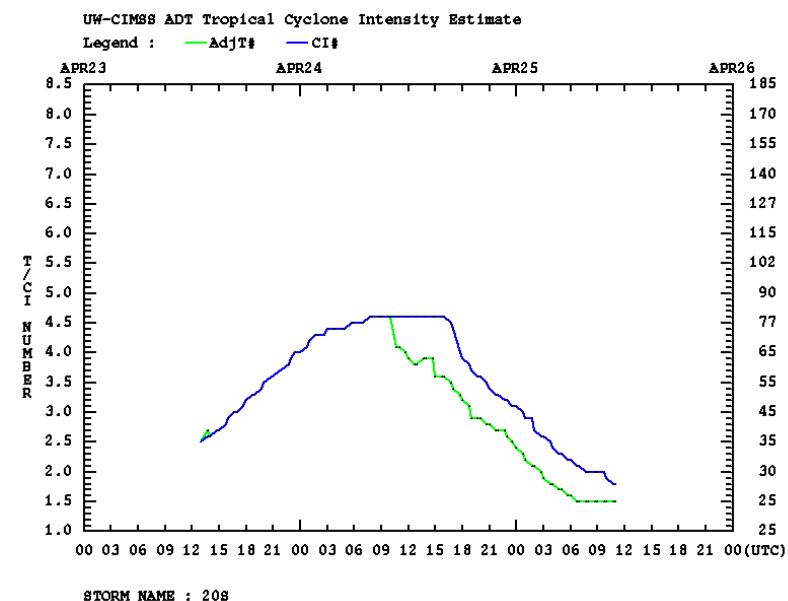
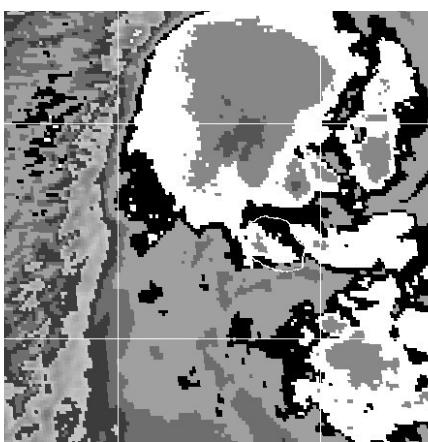
ADT821 LIST 20S.ODT CKZ=YES
 ===== ADT-Version 8.2.1 =====

indomain=0
 domainid_input=0

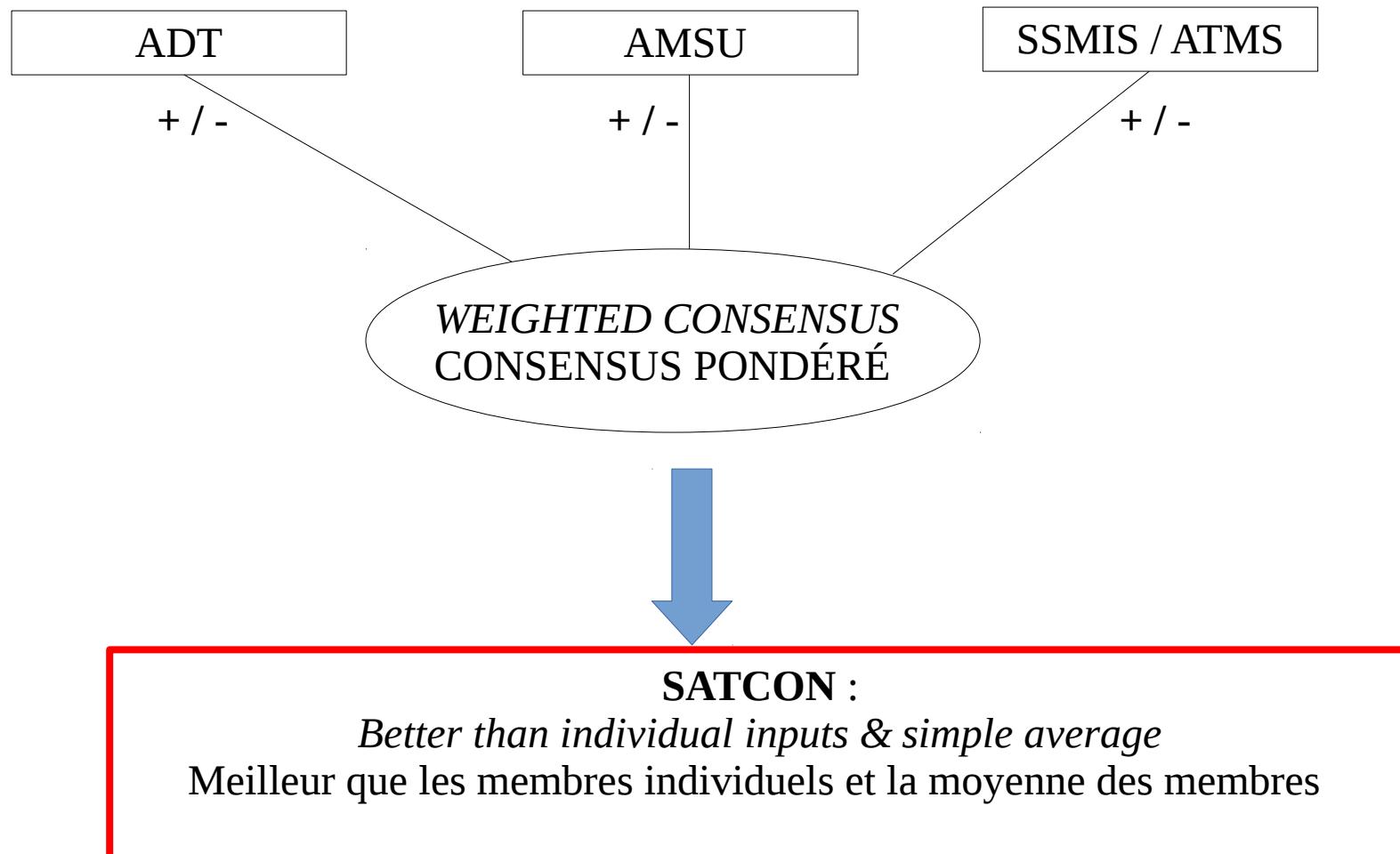
----Intensity----															-Tno Values--			---Tno/CI Rules---			-Temperature-								
Date	Time (UTC)	MSLP/Vmax	CI (CKZ) / (kts)	Tno	Raw	Raw	Limit	Flag	Wkng	Rpd	Cntr	Mean	Scene	EstrMW	MW	Storm	Location	Fix	Sat	VZA	Comments								
2018APR23	130000	2.5	1006.5	35.0	2.5	2.5	2.5	NO LIMIT	OFF	OFF	-77.21	-74.45	UNIFRM	N/A	N/A	-16.04	-52.99	FCST	MSG1	23.0									
2018APR23	134500	2.6	1005.3	37.0	2.6	2.7	3.1	0.2T/hour	OFF	OFF	-80.75	-77.42	UNIFRM	N/A	N/A	-16.21	-53.07	FCST	MSG1	23.2									
2018APR23	140000	2.6	1005.3	37.0	2.6	2.6	3.2	MW Adjst	OFF	OFF	-81.37	-77.74	UNIFRM	N/A	N/A	-16.27	-53.09	FCST	MSG1	23.3	MWinit=2.7/2.6/2.6								
2018APR23	144500	2.7	1004.0	39.0	2.7	2.7	3.3	MW Adjst	OFF	OFF	-80.75	-78.39	UNIFRM	N/A	-29.9	-16.44	-53.17	FCST	MSG1	23.5	MWinit=2.9/2.7/2.7								
2018APR23	150000	2.7	1004.0	39.0	2.7	2.7	3.4	MW Adjst	OFF	OFF	-81.37	-78.52	UNIFRM	N/A	-29.9	-16.50	-53.20	FCST	MSG1	23.6	MWinit=2.9/2.7/2.7								
2018APR23	154500	2.8	1002.7	41.0	2.8	2.8	3.5	MW Adjst	OFF	OFF	-80.14	-78.95	UNIFRM	N/A	-29.9	-16.67	-53.28	FCST	MSG1	23.8	MWinit=3.1/2.8/2.8								
2018APR23	160000	2.9	1001.5	43.0	2.9	2.9	3.6	MW Adjst	OFF	OFF	-78.94	-79.42	UNIFRM	N/A	-29.9	-16.73	-53.31	FCST	MSG1	23.8	MWinit=3.1/2.8/2.8								
2018APR23	164500	3.0	1000.2	45.0	3.0	3.0	3.6	MW Adjst	OFF	OFF	-78.36	-79.36	UNIFRM	N/A	-29.9	-16.90	-53.39	FCST	MSG1	24.1	MWinit=3.3/2.9/2.9								
2018APR23	170000	3.0	1000.1	45.0	3.0	3.0	3.7	MW Adjst	OFF	OFF	-76.10	-78.72	UNIFRM	N/A	-29.9	-16.96	-53.42	FCST	MSG1	24.1	MWinit=3.3/3.0/3.0								
2018APR23	174500	3.1	998.8	47.0	3.1	3.1	3.8	MW Adjst	OFF	OFF	-77.78	-75.90	UNIFRM	N/A	-29.9	-17.12	-53.51	FCST	MSG1	24.3	MWinit=3.5/3.1/3.1								
2018APR23	180000	3.2	997.5	49.0	3.2	3.2	3.7	MW Adjst	OFF	OFF	-77.21	-74.88	UNIFRM	N/A	-29.9	-17.18	-53.54	FCST	MSG1	24.4	MWinit=3.5/3.2/3.2								
2018APR23	184500	3.3	997.2	51.0	3.3	3.3	3.7	MW Adjst	OFF	OFF	-66.77	-72.62	UNIFRM	N/A	-29.9	-17.35	-53.63	FCST	MSG1	24.6	MWinit=3.7/3.3/3.3								
2018APR23	190000	3.3	997.2	51.0	3.3	3.3	3.7	MW Adjst	OFF	OFF	-78.36	-72.65	UNIFRM	N/A	-29.9	-17.40	-53.66	FCST	MSG1	24.7	MWinit=3.7/3.4/3.4								
2018APR23	194500	3.4	995.7	53.0	3.4	3.4	3.8	MW Adjst	OFF	OFF	-73.44	-73.91	UNIFRM	N/A	-29.9	-17.91	-54.33	FCST	MSG1	25.6	MWinit=3.3/3.4/3.4								
2018APR23	200000	3.5	994.3	55.0	3.5	3.5	3.8	MW Adjst	OFF	OFF	-71.92	-74.22	UNIFRM	N/A	-29.9	-17.97	-54.36	FCST	MSG1	25.7	MWinit=3.3/3.4/3.4								
2018APR23	224500	3.8	990.1	61.0	3.8	3.8	3.8	MW Adjst	OFF	OFF	-75.56	-76.48	UNIFRM	N/A	-49.6	-18.58	-54.72	FCST	MSG1	26.5	MWinit=3.6/3.4/3.4								
2018APR23	230000	3.9	988.7	63.0	3.9	3.9	3.8	MW Adjst	OFF	OFF	-73.96	-75.89	UNIFRM	N/A	-49.6	-18.64	-54.76	FCST	MSG1	26.6	MWinit=3.7/3.5/3.5								
2018APR23	233000	4.0	987.3	65.0	4.0	4.0	3.7	MW Adjst	OFF	OFF	-69.51	-73.57	UNIFRM	N/A	-49.6	-18.75	-54.83	FCST	MSG1	26.7	MWinit=3.7/3.6/3.6								
2018APR24	000000	4.0	987.3	65.0	4.0	4.0	3.7	MW Adjst	OFF	OFF	-65.46	-71.21	UNIFRM	N/A	-49.6	-18.87	-54.90	FCST	MSG1	26.9	MWinit=3.7/3.6/3.6								
2018APR24	004500	4.1	985.5	67.4	4.1	4.1	3.5	MW Adjst	OFF	OFF	-56.80	-67.33	UNIFRM	N/A	-40.0	-19.05	-55.01	FCST	MSG1	27.1	MWinit=3.5/3.6/3.6								
2018APR24	010000	4.2	983.9	69.8	4.2	4.2	3.4	MW Adjst	OFF	OFF	-72.42	-66.82	UNIFRM	N/A	-40.0	-19.11	-55.05	FCST	MSG1	27.2	MWinit=3.4/3.6/3.6								
2018APR24	014500	4.3	981.8	72.2	4.3	4.3	3.8	MW ON	OFF	OFF	-77.21	-74.92	UNIFRM	N/A	50.9	-19.91	-55.33	FCST	MSG1	28.1									



Fakir, 24/04/18 0156Z



SATellite CONsensus



SATellite CONsensus

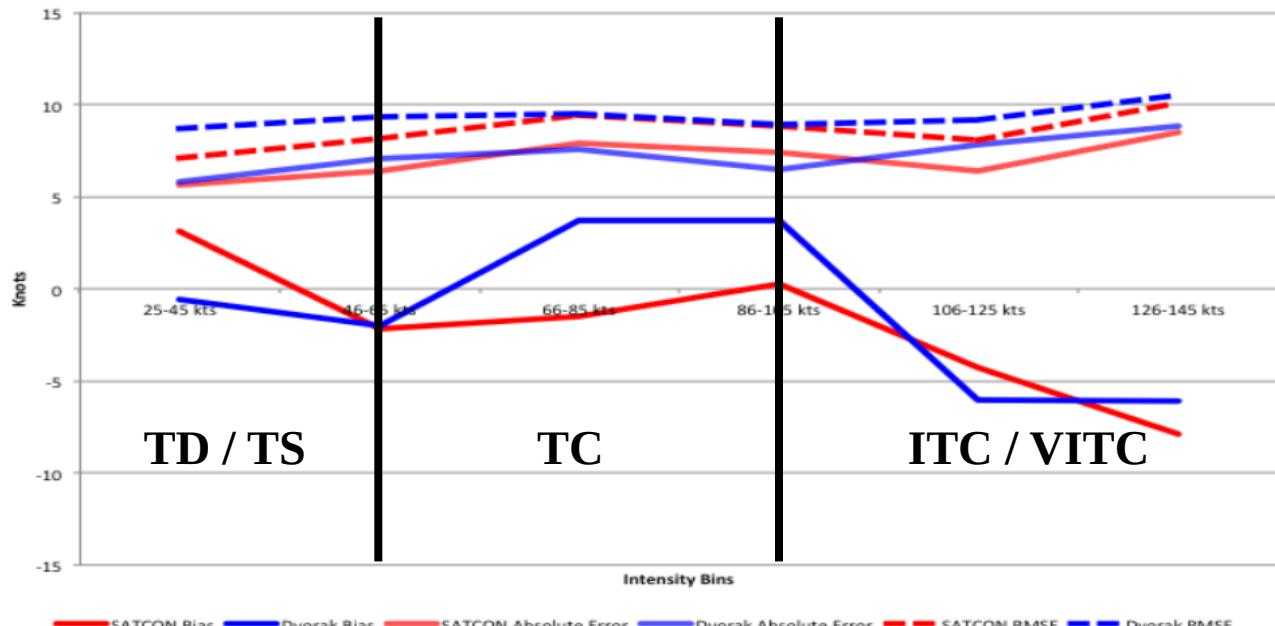
N = 4097	ADT	AMSU	SSMIS/ ATMS	SATCON Simple Avg	SATCON
BIAS	-1.6	-3.9	-2.2	-2.7	-0.2
ABS ERROR	10.0	9.7	8.6	7.3	7.2
RMSE	12.8	12.5	11.2	9.3	9.1

SATCON Vmax performance compared to individual members 2006-2015
 All values are in knots. SATCON Simple Avg is a straight average of all members

N = 4097	ADT	AMSU	SSMIS/ ATMS	SATCON Simple Avg	SATCON
BIAS	-0.8	-1.0	-1.5	-1.1	0.0
ABS ERROR	7.5	4.6	5.9	4.3	4.0
RMSE	10.3	6.3	8.0	5.8	5.3

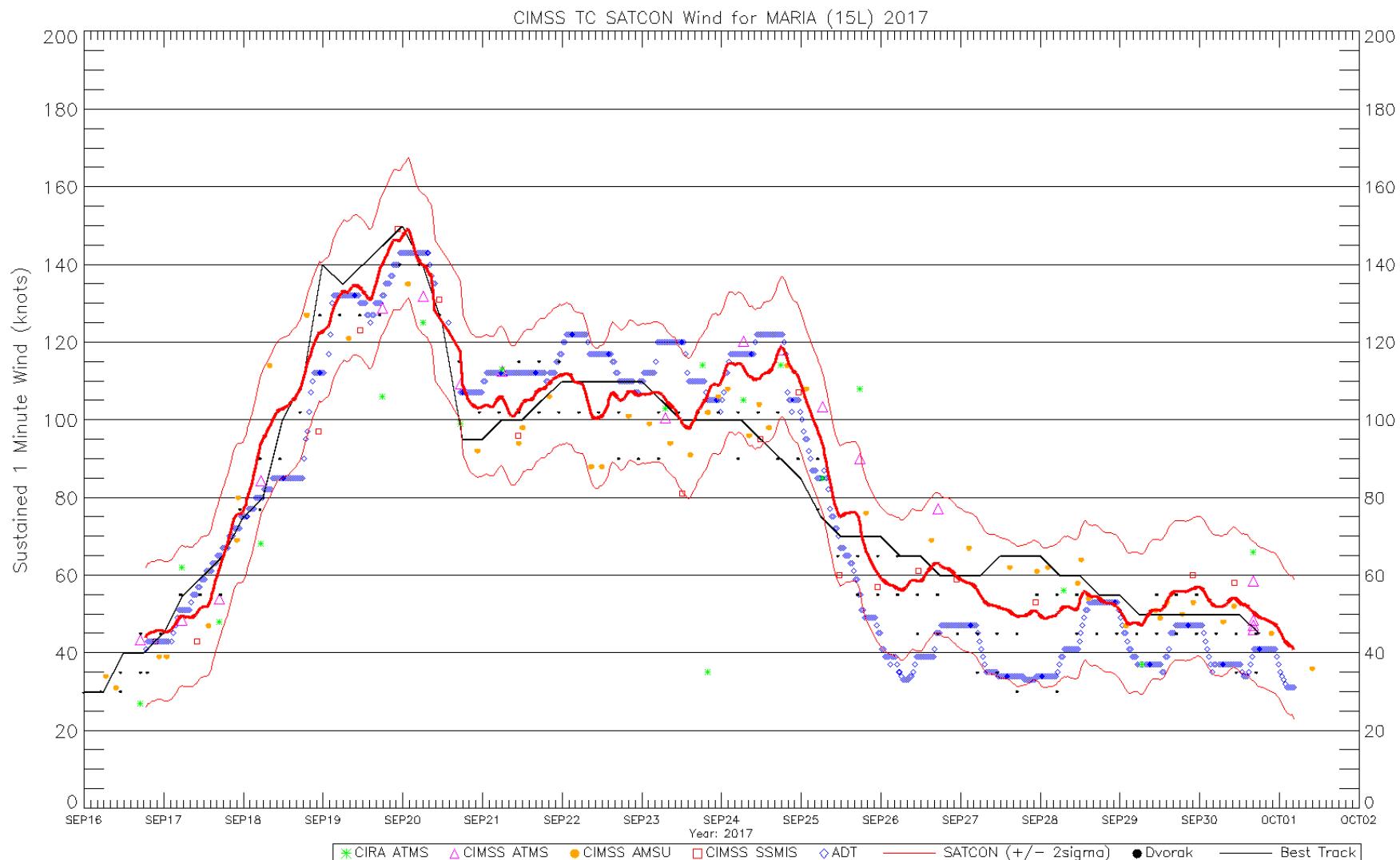
SATCON MSLP performance compared to individual members 2006-2015
 All values are in hPa. SATCON Simple Avg is a straight average of all members

SATCON Compared to Dvorak Binned by Intensity



SATellite CONsensus

<http://tropic.ssec.wisc.edu/real-time/satcon/>

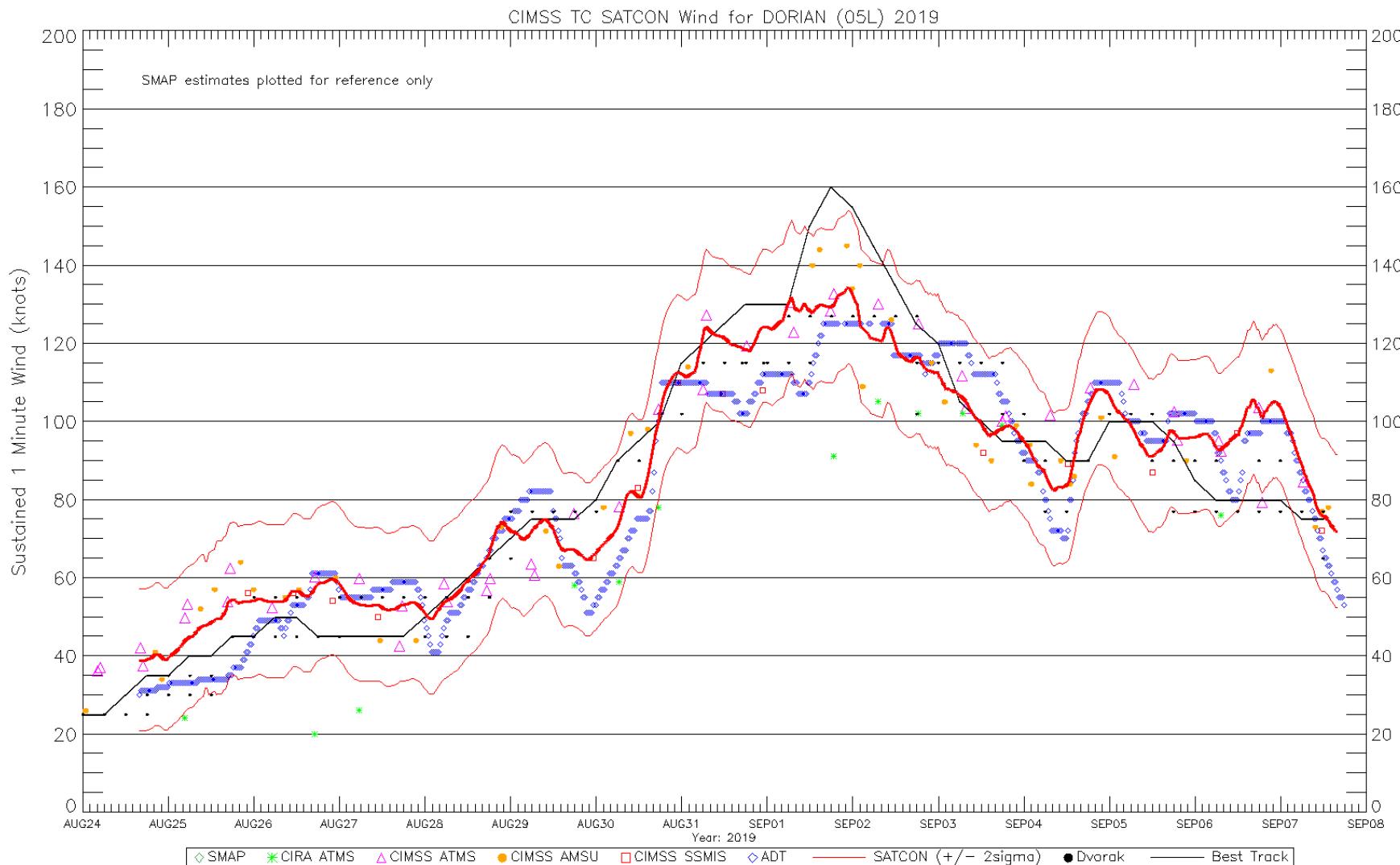


Ouragan MARIA 2017 (NATL) vu par SATCON
Hurricane MARIA 2017 (NATL) seen by SATCON



SATellite CONsensus

<http://tropic.ssec.wisc.edu/real-time/satcon/>



Ouragan DORIAN 2019 (NATL) vu par SATCON
Hurricane DORIAN 2019 (NATL) seen by SATCON



OUTLINE

Synopsis on microwaves

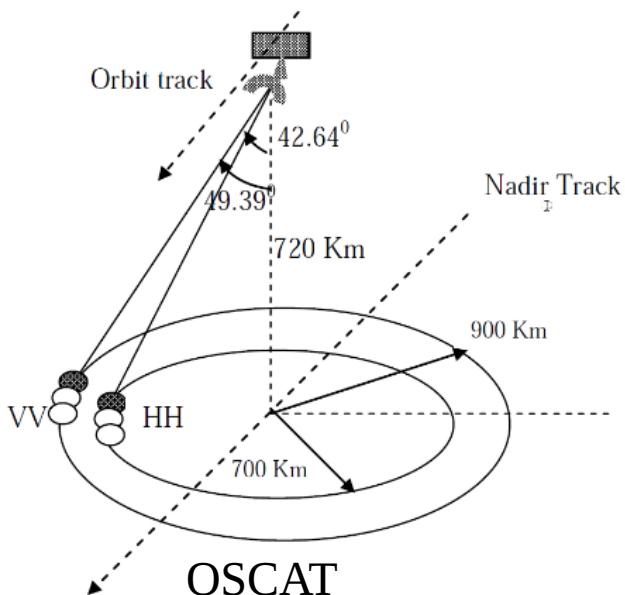
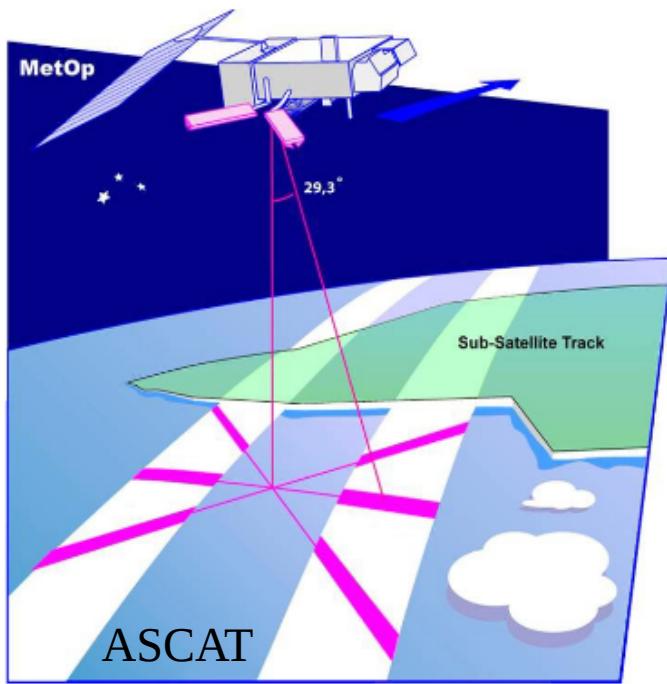
Interpreting microwave data

Applications in TC analysis

TC Intensity estimate: objective guidances

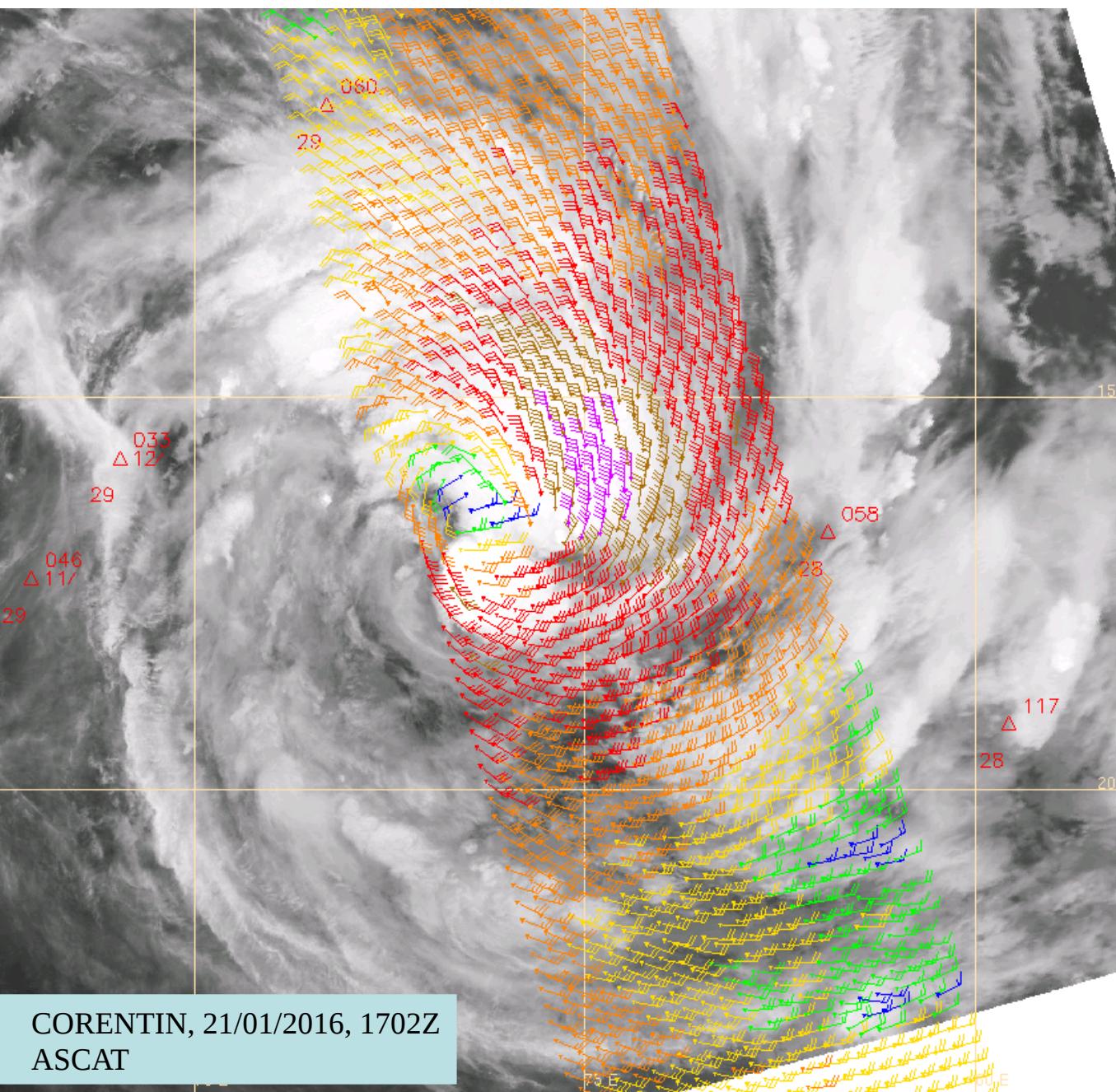
Scatterometers / SAR

HOW WORK SCATTEROMETERS ?



- Diffusiomètre : radar micro-ondes mesurant le signal rétro-diffusé par les ondes capillaires et de gravité à la surface de la mer
- L'analyse du signal retro-diffusé par une même surface océanique vue sous différents angles par le satellite permet de calculer la force et la direction du vent.
- La mesure est perturbée par tout phénomène qui détruit les ondes capillaires : la pluie, les vents très faibles ou très forts.
- Ambiguïté direction du vent : levée avec données modèles
 - *Scatterometers measure radar reflectivity due to Bragg scattering from capillary and short gravity waves.*
- *By viewing the same patch of ocean from several angles, it is possible to derive wind speed and direction.*
- *Measure can be incorrect due to any parameter destroying capillary waves : rain, very weak or very strong winds*
- *Wind direction ambiguity : use of NWP data*

OPERATIONAL SCATTEROMETERS (2019)



- ASCAT A, B et C (Metop – UE)
Meilleure résolution à 12.5 km

- OSCAT (ScatSat – IND)
Meilleure résolution à 25 km

- Passage ~06Z et ~18Z

Intérêts suivi cyclonique :

- Localisation du centre

- Intensité (gamme : 20 → 45 kt)

- Extensions vents forts (Grand-Frais, Coup de vent, ~ Tempête)

- ASCAT A, B et C (Metop – EU)
Best horizontal resolution 12.5 km

- OSCAT (ScatSat – IND)
Best horizontal resolution 25 km

- Swath ~06Z and ~18Z

Advantage for TC monitoring :

- Locate the center

- TC intensity (maxwinds :
20 → 45 kt)

- Winds radii (Near Gale,
Gale, ~Storm force winds)

SCATT PRODUCTS : DATA ACCESS

→NOAA :

ASCAT-A : <https://manati.star.nesdis.noaa.gov/datasets/ASCATData.php>

ASCAT-B : <https://manati.star.nesdis.noaa.gov/datasets/ASCATBData.php>

ASCAT-C : <https://manati.star.nesdis.noaa.gov/datasets/ASCATCData.php>

→KNMI (EUMETSAT OSI SAF) :

ASCAT-A : http://projects.knmi.nl/scatterometer/ascat_osi_co_prod/ascat_app.cgi

ASCAT-B : http://projects.knmi.nl/scatterometer/ascat_b_osi_co_prod/ascat_app.cgi

ASCAT-C : http://projects.knmi.nl/scatterometer/ascat_c_osi_co_prod/ascat_app.cgi

OSCAT : http://projects.knmi.nl/scatterometer/scasa_25_prod/scasa_app.cgi

→NRL TC PAGE :

The screenshot shows the NRL TC PAGE interface. At the top, there is a menu bar with buttons for Latest, Previous, Full, Pass_Mosaic, Mosaic, Loop, Text, Track, ATCF, Track+Image, Environment, TPW, TPW+NAVGEM_TPW, TPW+NAVGEM_850_Winds, Wind Shear, and Scat. Ambiguities over IR Backgrnd. A red circle highlights a dropdown menu that includes options like Scat Wind Vectors, Scatterometer + 37 GHz color, Scatter. Ambiguities over IR Backgrnd, Scatterometer over Blank Backgrnd, Scatt. Amb. over Blank Backgrnd, ScatSat-1 OSCAT, and SMAP Wind. Below the menu is a grid of sensor status for SSMI, SSMIS, GMI, AMSR2, WINDSAT, and AMSUB. The grid columns include Sensor, % Cov, VIS, IR, IR-BD, Multi Sens., 85GHz H, 85GHz weak, 85GHz PCT, Color, Rain, Wind, 37GHz Color, 37GHz PCT, and Vapo. To the right of the grid are sections for GEO:, MODIS:, VIIRS:, and OLS:. At the bottom left, it says 04A.KYARR, IR, 27 OCT 2019 1630Z. At the bottom center, it says Tutorials: COMET. At the bottom right, it says Overview. At the very bottom, it says Full-Sized image (326 KB). Click to return to thumbnail.

04A.KYARR, IR, 27 OCT 2019 1630Z

Tutorials: COMET

Overview

Full-Sized image (326 KB). Click to return to thumbnail.

Previous | 20191027.1630.msg1.ir.BD.04AKYARR.135kts-923mb.jpg |

10/27/19 1200Z 04A KYARR

10/27/19 1630Z MSG1 IR

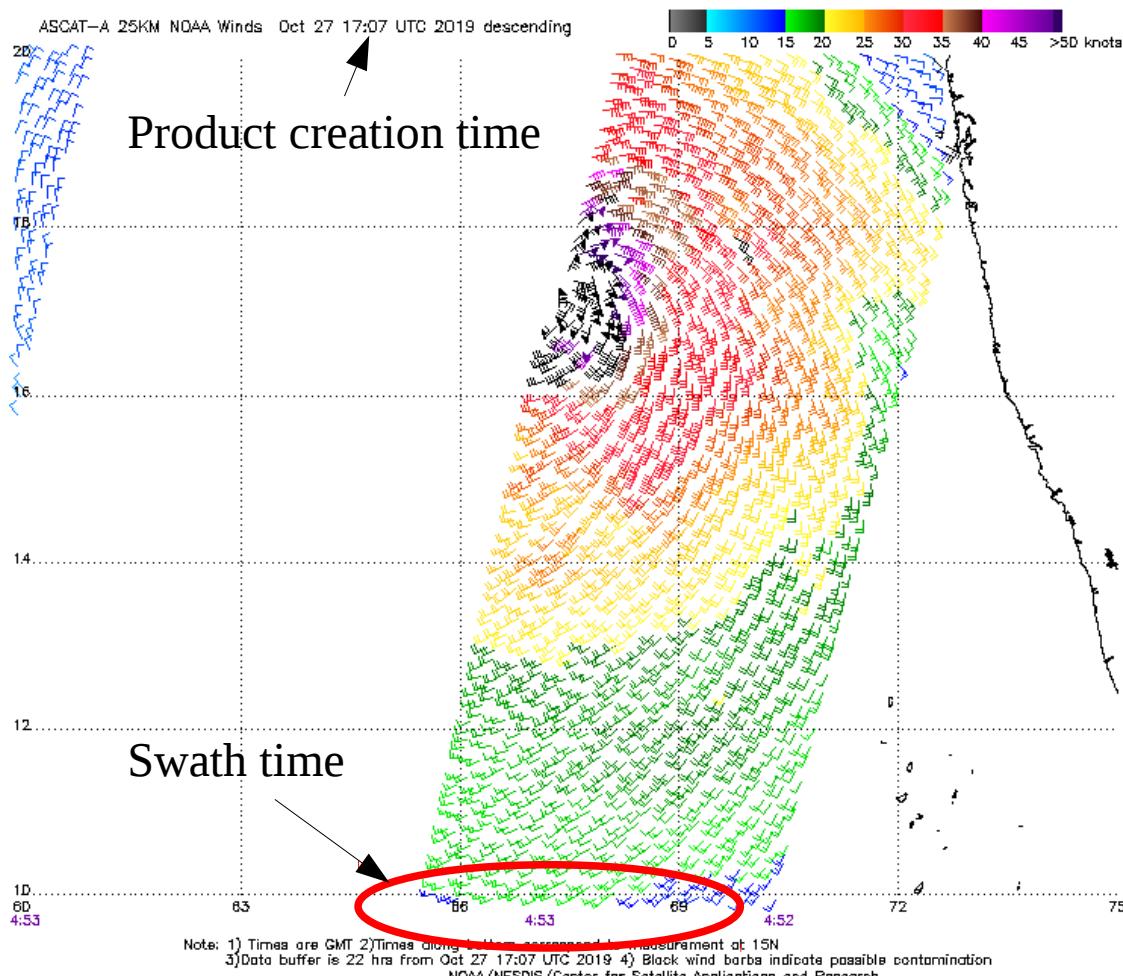
SCATT PRODUCTS : DATA ACCESS

→NOAA :

ASCAT-A : <https://manati.star.nesdis.noaa.gov/datasets/ASCATData.php>

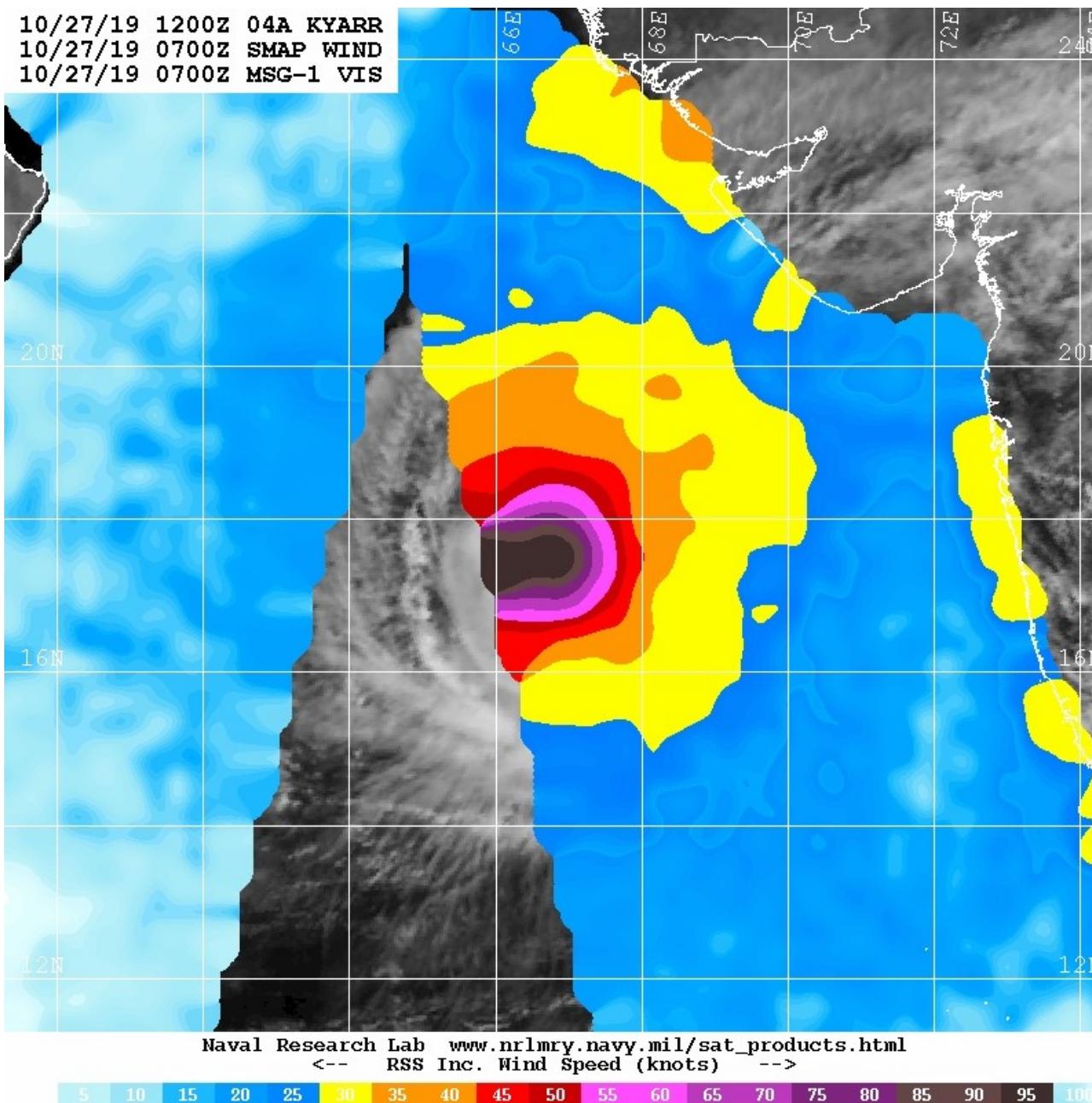
ASCAT-B : <https://manati.star.nesdis.noaa.gov/datasets/ASCATBData.php>

ASCAT-C : <https://manati.star.nesdis.noaa.gov/datasets/ASCATCData.php>



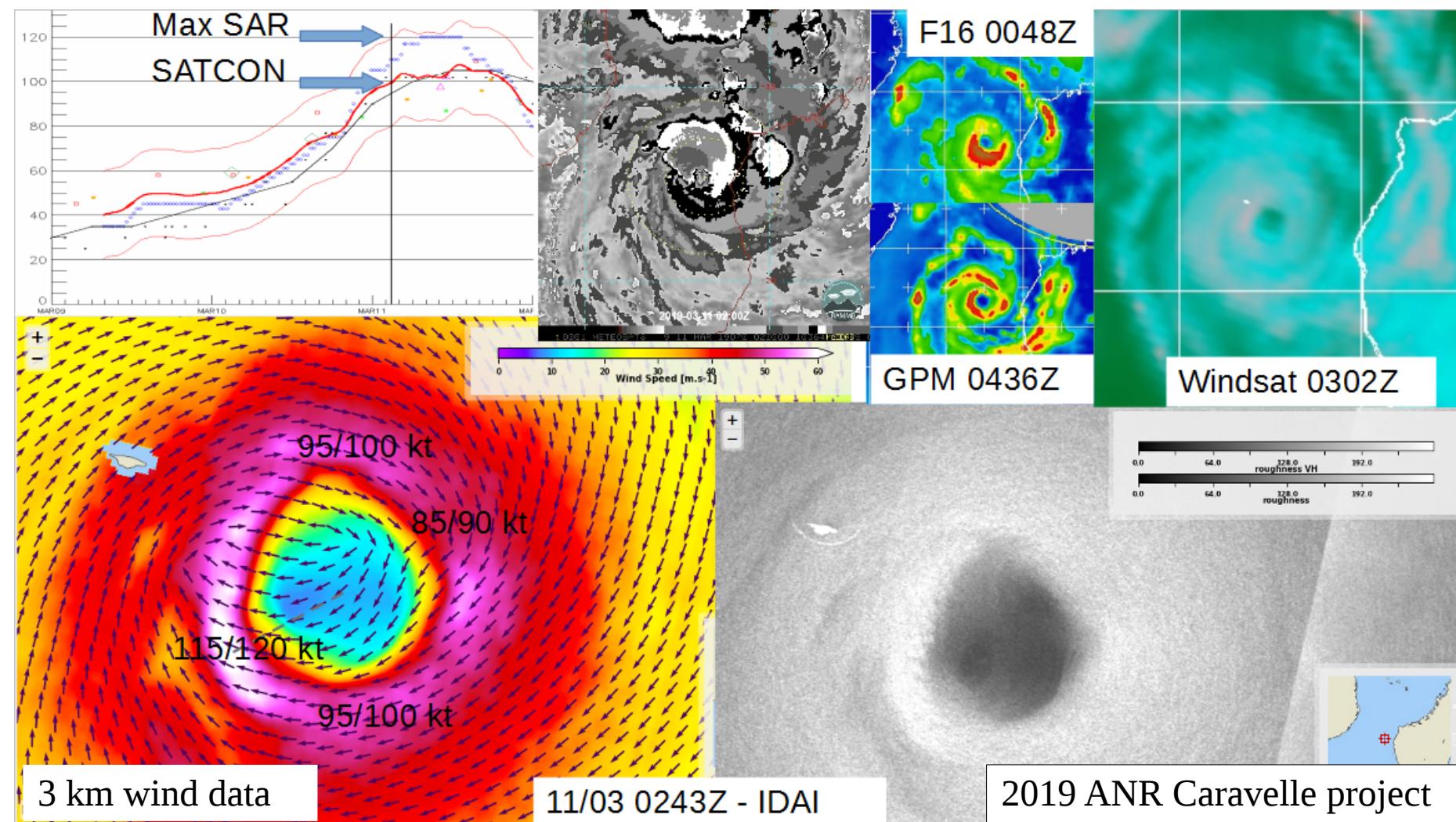
REMOTE MEASUREMENT OF HIGH WIND SPEED

Soil Moisture Active Passive



- Passive radiometer sensitive to high wind speed and less sensitive to rain
- Allowing estimate intensity and strong winds radii despite coarse resolution (~40 km)
- NRT access on Manati (<https://manati.star.nesdis.noaa.gov/datasets/SMAPData.php>), NRL and RMSS (http://images.remss.com/smap/sm_ap_data_daily.html)

REMOTE MEASUREMENT OF HIGH WIND SPEED Synthetic Aperture Radar (SAR)



The only spaceborn instrument able to probe at very high resolution the sea surface under extreme weather conditions

- Current mission with Sentinel 1 A-B, Radarsat 2
- Still not operationnal ... but work in progress to do so ...

CONCLUSION :

TC analysis is a blending of several inputs

