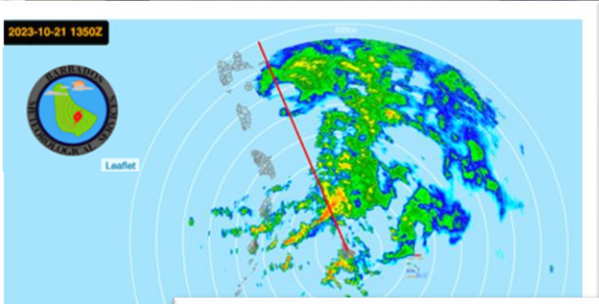
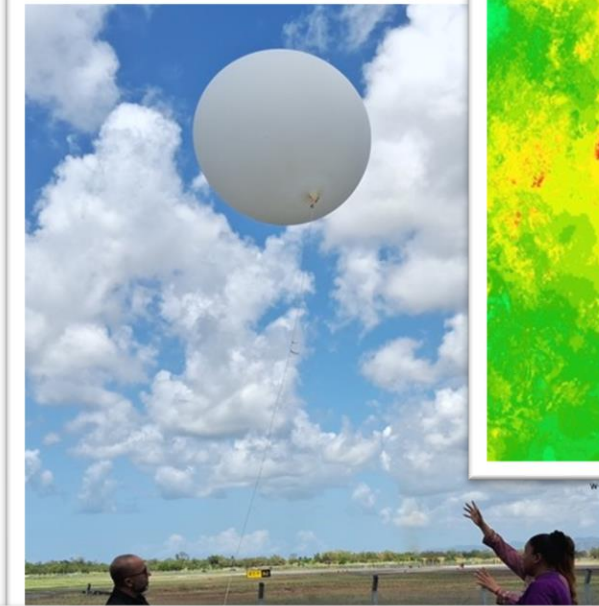
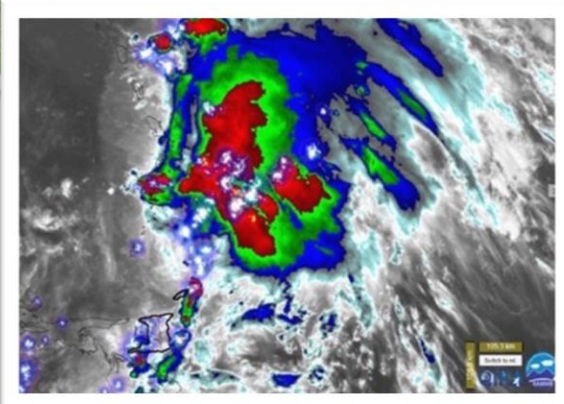
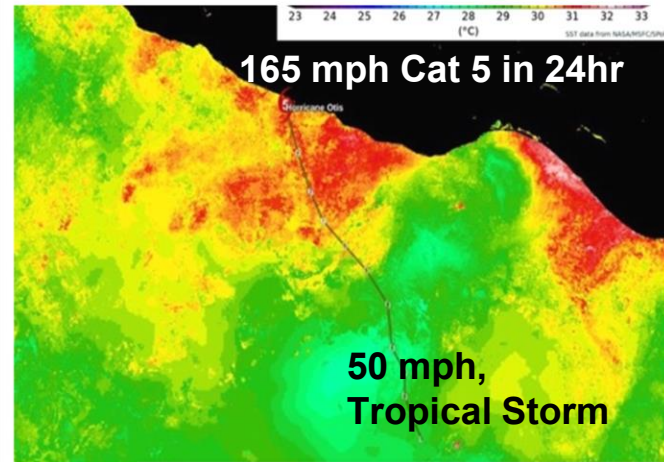


Advocating for the protection of meteorological applications and the safety of the people in the Caribbean

Arlene Laing

Caribbean Meteorological Organization

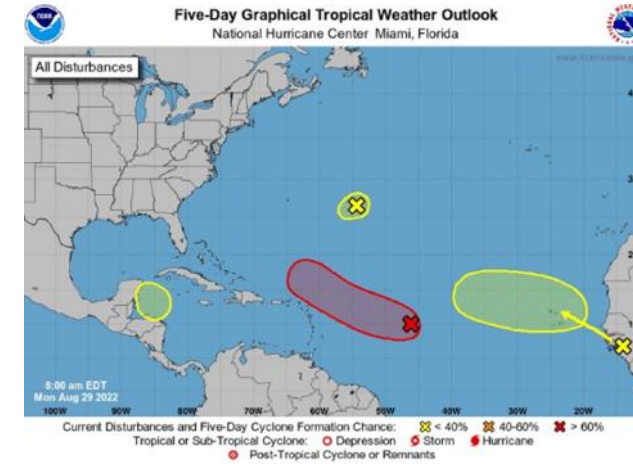


Caribbean Multi-Hazard EWS Underpinned by Radio Frequency

For the Caribbean, weather, climate and water hazards are monitored primarily from space and through radio-based systems

Timeliness, adequacy and effectiveness of early warning systems in Caribbean rely on Radio Frequency:

- Well-developed **warning and forecasting systems** for hurricanes and tropical storms, other severe weather & geohazard EWS in testing phase (Pillar 2)
- Supported by network of **monitoring, communication tools**, with RF playing a key role (Pillars 2 & 3)
- **Data transmission and alerts**: Via mobile networks, Cell Broadcast and emergency communications and *Smart Seas Project*

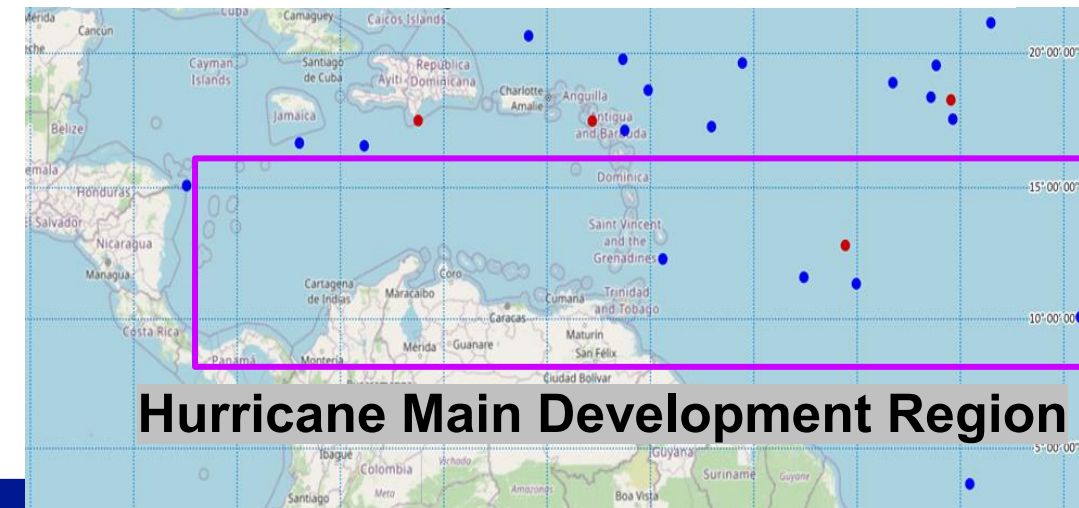
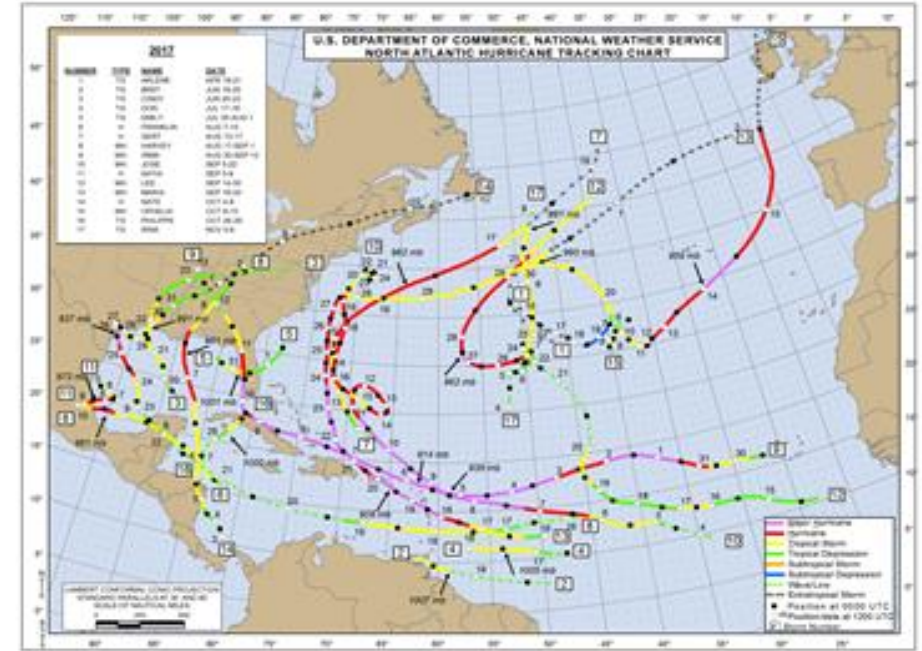


RF ensuring resilience to multiple hazards in the Caribbean



Few ocean observation stations in the Caribbean

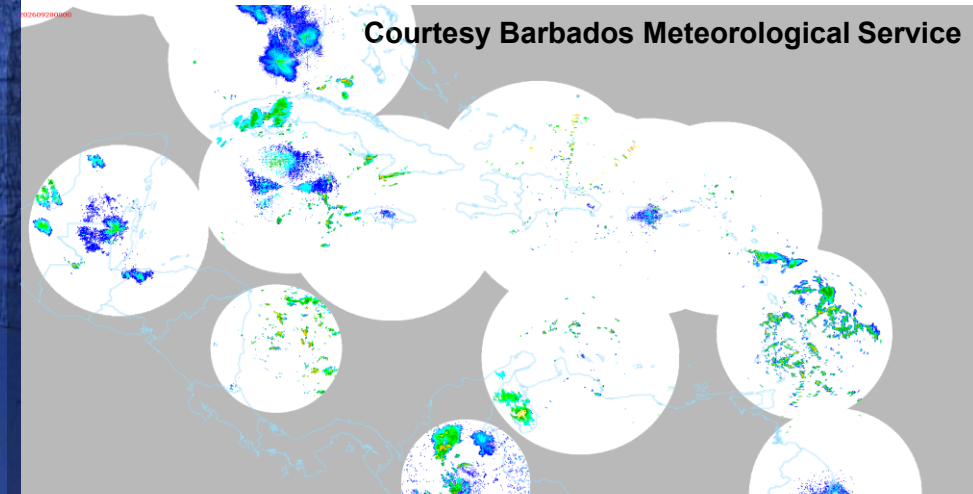
1. Caribbean islands have experienced **catastrophic impact of tropical cyclones**
2. **Air–sea interface is key gateway** in detecting, and forecasting tropical cyclones
3. **Greatest limitation to hurricane forecasts and warnings accuracy, and timeliness, is scarcity of observations**
4. **Caribbean needs remotely-sensing information**



Caribbean Radars



Caribbean Weather Radar Reflectivity Mosaic Expanding into South America



Satellite Observation: Ocean Temperature

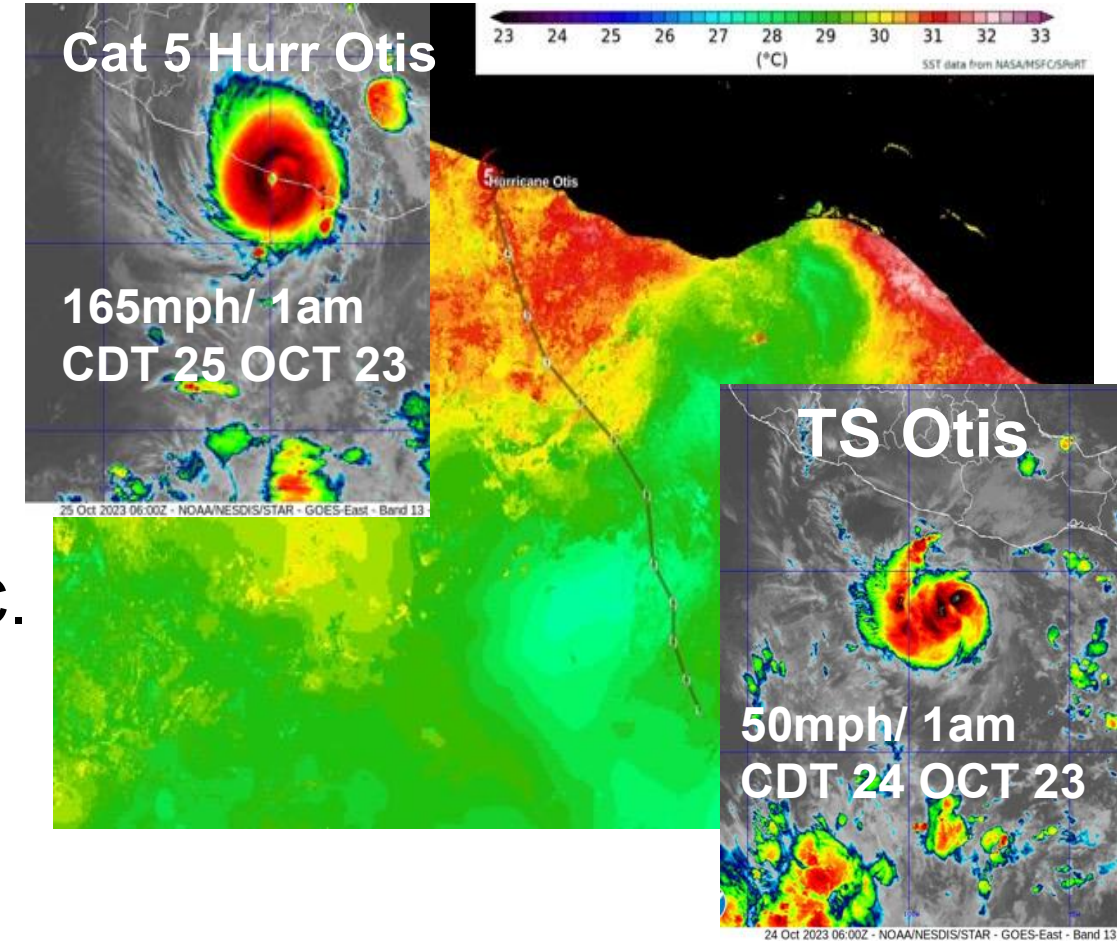
Passive Bands

6425–7125 MHz

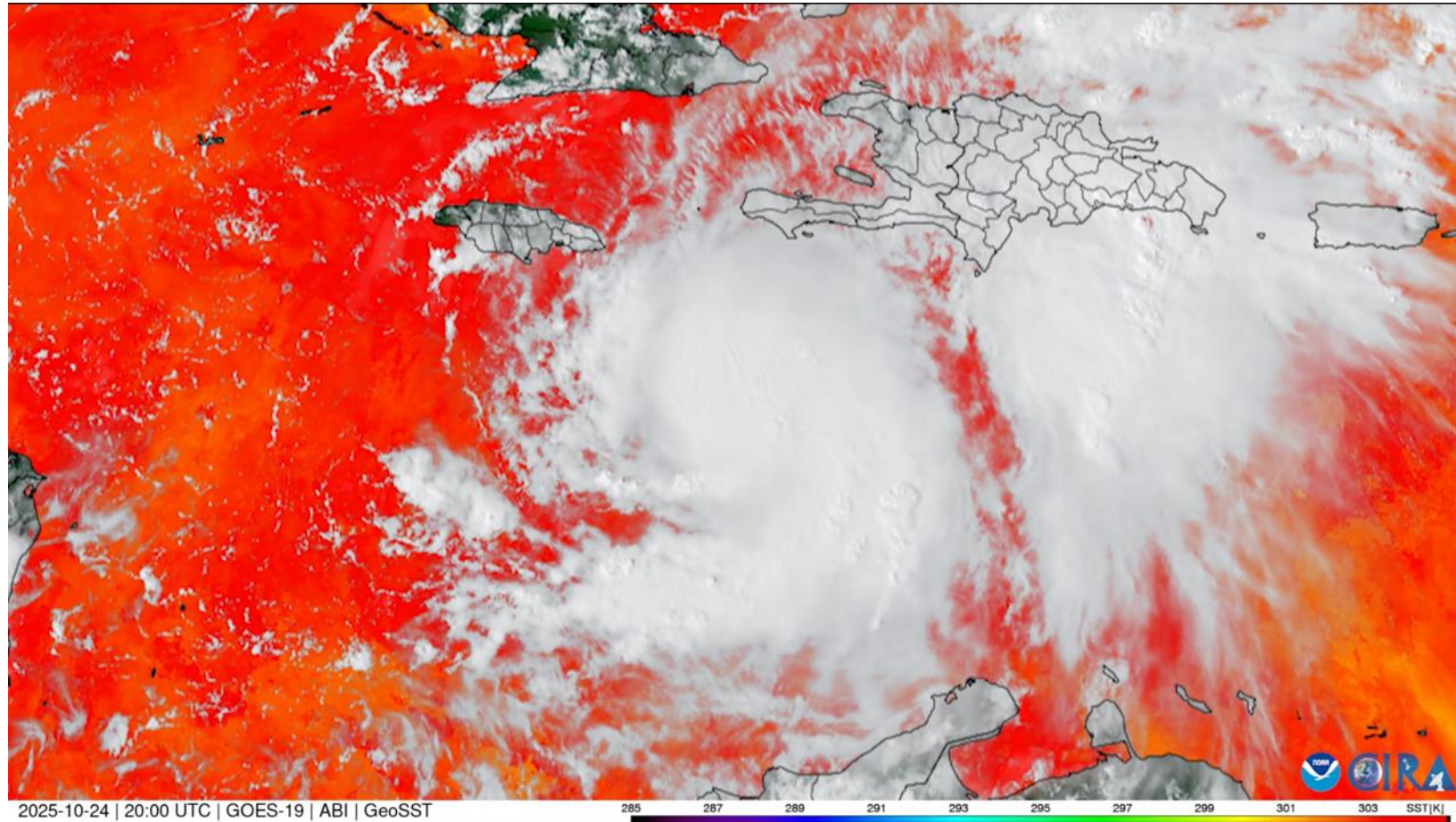
Impact on **sea-surface temperature** measurements if new spectrum allocation for future IMT development is decided

Sea surface temperature monitoring vital to saving lives in the Caribbean

- **Tropical cyclones** form when SST $\geq 26^{\circ}\text{C}$.
- **Rapid intensification** observed when storms pass over warm eddies and currents.



Hurricane Melissa intensifying over high Sea Surface Temperature



Regional Telecommunications

- **Primary:** FTPS via the Internet to Regional Telecommunication Hub (RTH) Washington;
- **1st Secondary:** Via satellite through the Emergency Managers Weather Information Network (receive only); **Broadcast frequency 1694.1 MHz**
- **2nd Secondary:** Via GeonetCAST- Americas broadcast (2-way System). **Broadcast frequency 4080.0 MHz**



1st WMO Radio Frequency Training in the Caribbean

Port of Spain, 19 and 23
February 2024

WMO training workshop on
RF spectrum management,
hosted by Caribbean
Meteorological Organization
(CMO) with support of
Caribbean
Telecommunications Union



Motivated by threats to earth observation frequencies and need to coordinate on RF for monitoring, data transmission and emergency alerts, etc...



Caribbean RF Training Outcomes

- Enhanced capabilities of NMHSs and other institutions with RF mandates to better understand meteorology RF-related issues
- Fostered closer relationship between NMHSs and respective National Regulatory Authorities (NRA) experts
- Promoted improved understanding of NMHS and WMO RF needs among NRA experts
- Ensured knowledge transfer, laid foundation for new national and regional RF experts in Members NMHSs



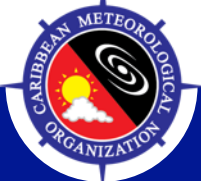
Regional Engagement with Caribbean Telecommunications Union (CTU) on Spectrum Management

- Briefings to CTU on WMO and CMO positions following 18th WMO Congress (2019) and 19th WMO Congress (2023)
- CMO invited to present to Regional ITU Seminars 2020 and 2022
- Invited to join CTU Spectrum Management Task Force, since February 2024
- Contributing to working group on preparation for WRC-27
- Invited to present at 2nd Caribbean Spectrum Management Conference
- Contributed to Smart Seas Project
- Review of updated handbook by Task Force members, who provided valuable comments
- Requested ICAO to present to Task Force on their WRC-27 positions
- Presented WMO & CMO WRC-27 positions to the Task Force, August 2026



Regional Discussions

- Chair, CTU Spectrum Management Task Force - Shared information received from CMO with ICT Industry Forecast Watch Meeting, 14 September 2026
- Working Group on WRC-27 Preparation and Harmonization – Deep dive on 1.7 and 1.14
- CITEL-PCC.II status, preliminary proposal by Brazil, identified 7 125 -8 400 MHz; debate is how far above 7 125 MHz to go while protecting government and MetSat use
- Administrators asked to inventory incumbents now





Maria Myers-Hamilton

“Melissa and Beryl were forecast as major hurricanes because microwave SST data was available – data with no formal protection today”

WMO/CMO: meteorological spectrum at WRC-27

1.1 / 1.3	Adjacent passive temperature-sounding bands	Mandatory emission limits; Res. 750
1.7	MetSat downlinks and sea-surface temperature – irreversible once deployed	Protect MetSat/EESS conditions in the chosen method
1.13	2.7–2.9 GHz meteorological radars	protect adjacent-band operations
1.18 / 1.19	Passive sensing above 85 GHz; SST bands	Secure new formal protection

Asks of every NRA

- Include met services in WRC-27 consultations and delegations
- Register radars, radiosondes and receivers in the MIFR
- Appoint WMO national focal points
- Speak with one regional voice via CITEL

Melissa and Beryl were forecast as major hurricanes because microwave SST data was available – data with no formal protection today.

CTU Spectrum Management Task Force | 12–13 Aug 2026 | 5

Caribbean Meteorological Council (Ministerial-level)

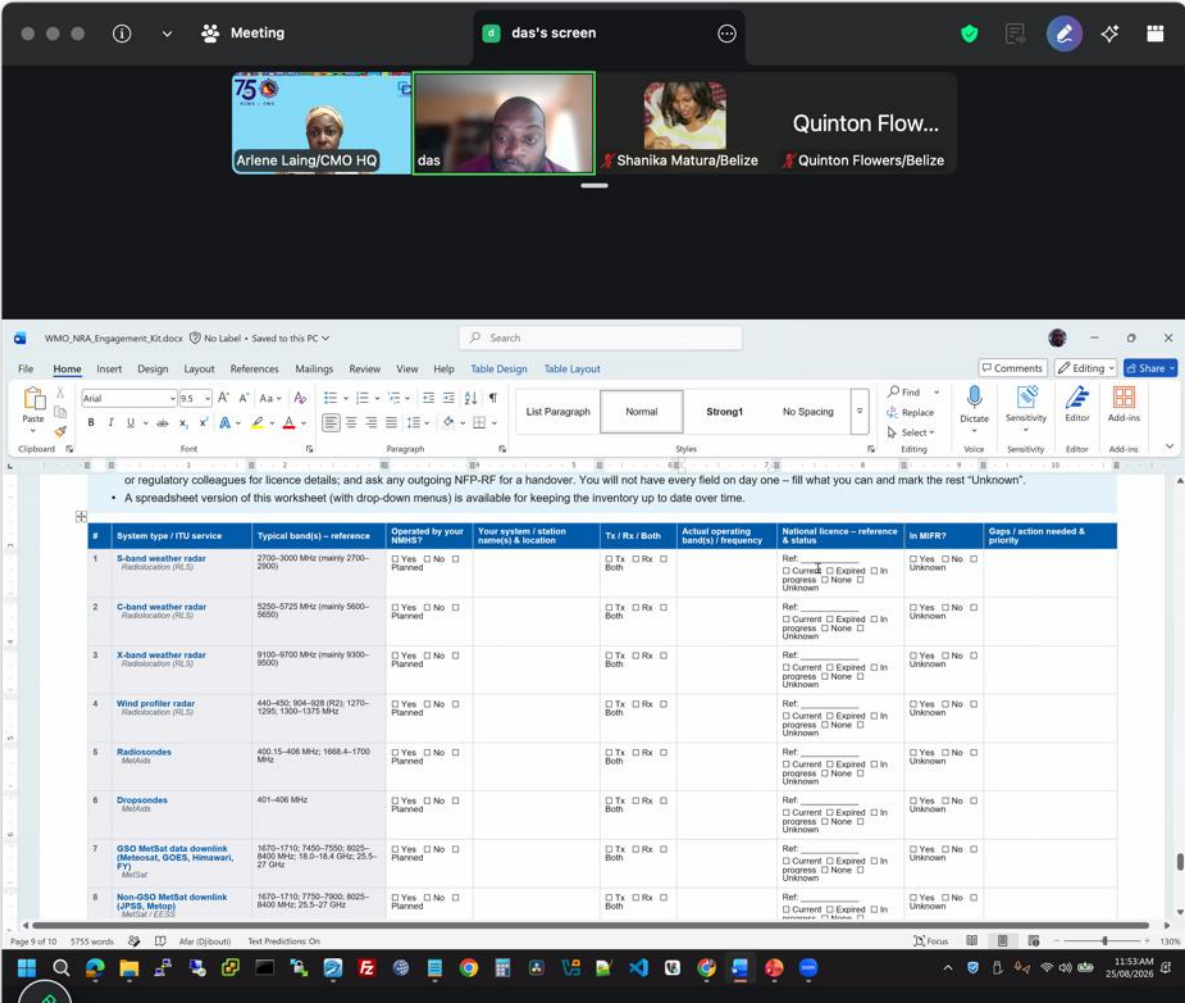
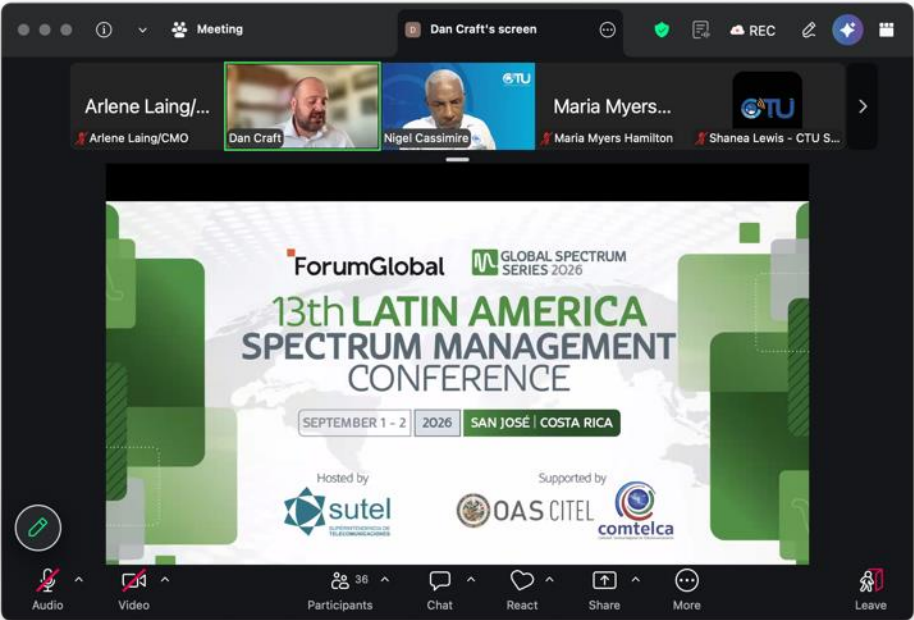
- Presented information on WRCs and radio frequency protection to the Council sessions since 2019
- Some Ministries responsible for both Meteorology and Telecommunications
 - E.g., Ministry in Saint Lucia requested further information following annual Council session in 2024, including the updated Handbook for meteorological applications
 - EWS and Data transmission: ECTEL Countries to pilot Cell Broadcast for emergency alert. CMO is supporting.



CMO supporting NMHS National Focal Points for RF

Belize

August 2026: Supported NMS engagement and advocacy with National Regulator in advance of 13th Latin America Spectrum Management Conference in Costa Rica (1-2 Sep 2026)

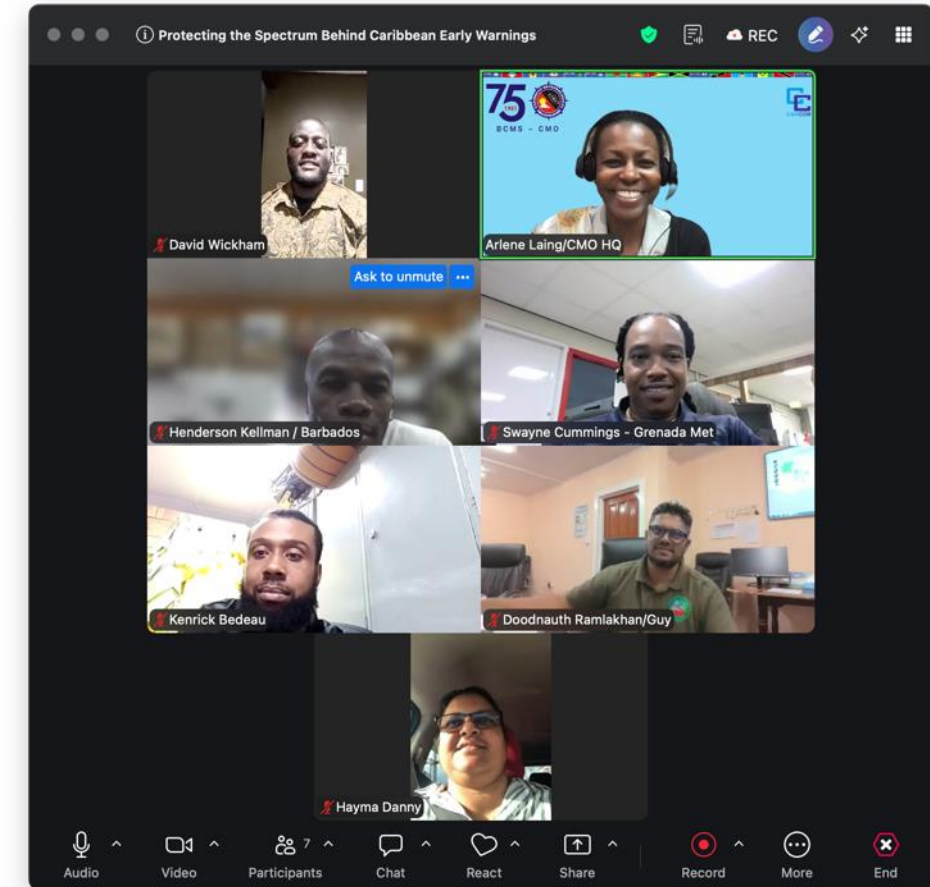


CMO supporting NMHS National Focal Points for RF

Barbados, Grenada, Guyana, Trinidad and Tobago

September 2026: Training on engagement and advocacy with National Regulatory Authorities

Actions: Focal points to register meteorological sensors and frequencies



Trinidad & Tobago Radio Frequency Coordination

David Wickham, TT Met Service

- The [Trinidad and Tobago Meteorological Service \(TTMS\)](#) continues to work closely with its national telecommunications authority, the [Telecommunications Authority of Trinidad and Tobago \(TATT\)](#).
- [All major meteorological equipment is currently protected and licensed to operate on respective frequencies](#). These include S-Band RADAR, X-band RADAR(Tobago), Rawinsonde System, and AWOS systems
- This year, there was a lengthy delay for final approval for Automatic Weather Observing System (AWOS) at Trinidad to be renewed to operate at 465Mhz for 'point-to-multipoint '.
- License to operate was granted in past years, but this time, TATT sought clarity on an administrative issue, where registration identifiers for the AWOS station at Tobago and the AWOS stations at Trinidad were mixed up.
- Administrative details were eventually cleared up, and the renewal was granted.



Trinidad & Tobago Radio Frequency Coordination

David Wickham, TT Met Service

Important updates:

- Trinidad and Tobago Government procured another Radar to operate on X-band. TTMS requested a license from TATT, which was approved. TTMS to operate the radar from PIARCO Airport office location.
 - Follow-up action: TATT to conduct an RF survey in X-band to determine if there is significant interference before Radar fine-tuning during the installation.
- As part of TTMS continued collaboration with TATT, information was shared in April 2026 from the findings and recommendations of a recent meeting the CMO Operational Radar Group (CORG). Presentations and discussions focused on Radar operations and the growing impact of radio frequency interference on Radar operations. Presentation slides and interference details as identified by Barbados operators were well received and documented by TATT officials.



Radio Frequency Interference: A Growing Threat to Radar Operations

Radio Frequency interference is a top Caribbean priority, due to significant impacts on Caribbean radar performance

Weather-radar frequency bands are increasingly crowded by **commercial, governmental, and personal communication systems**, including **5G/IMT**, mobile networks, satellites, and Wi-Fi

Caribbean islands' **small land areas** increase RF signal scattering from buildings, mountains, and reflective surfaces, reducing radar accuracy

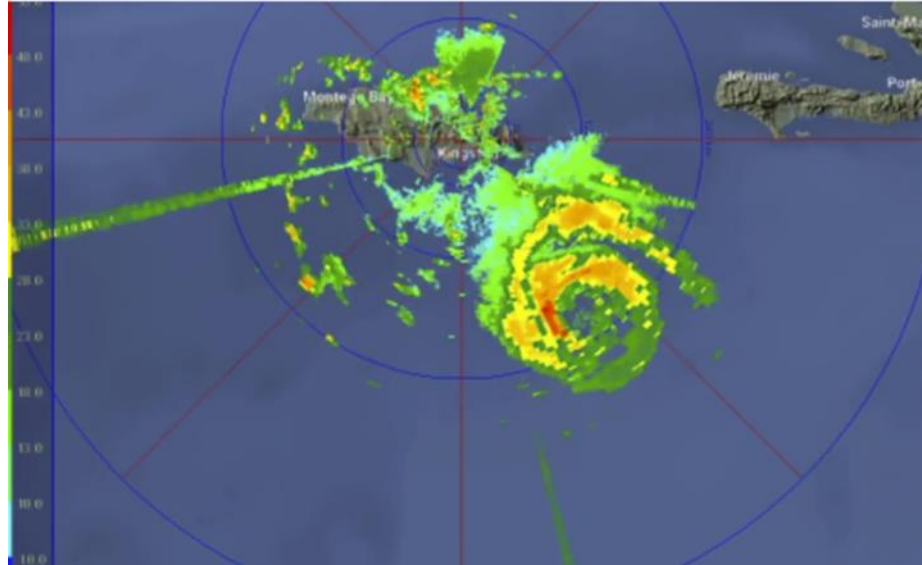
Limited local RF expertise and monitoring capacity makes identifying and mitigating interference difficult

Cross-island signal spillover further complicates the RF environment



Radio Frequency Interference on Caribbean Weather Radars

Jamaica



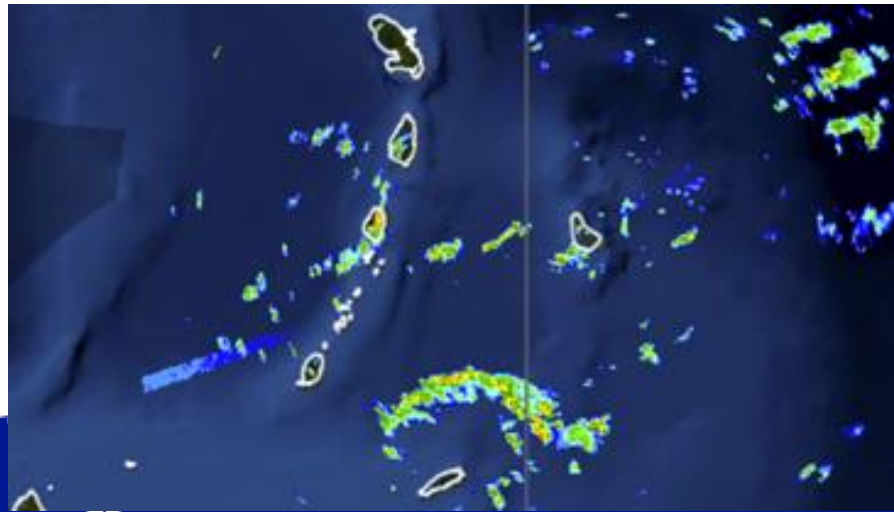
Trinidad



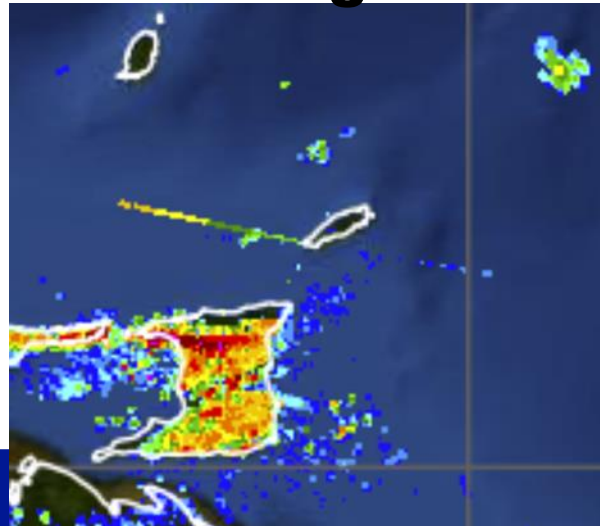
Dominican Republic



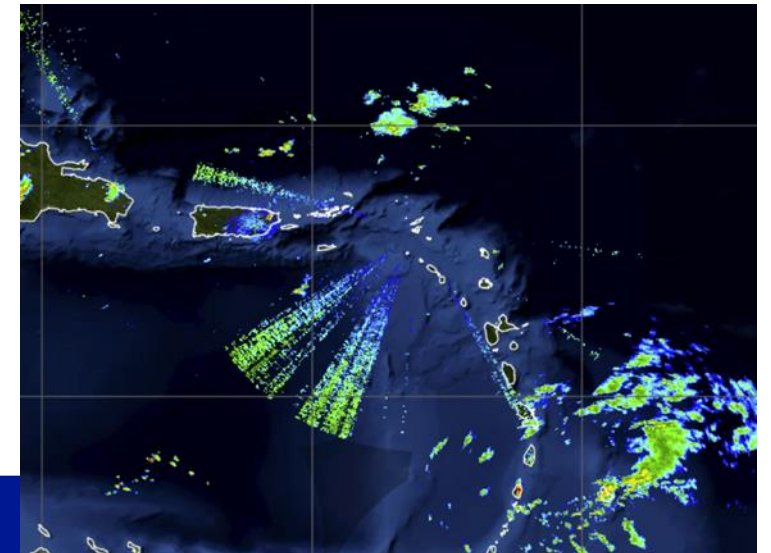
Barbados



Tobago



Sint Maarten/St Martin



What Caribbean Met-related Hazards Depend On

Caribbean hazard	What 2025 and 2026 (so far) showed	Observing system — and the spectrum — it depends on
Tropical cyclones & rapid intensification	Melissa struck Jamaica with 298 km/h winds and 892 hPa – matching-most intense Atlantic landfall on record. Its slow approach gave warning lead time; rapid intensification to Category 5 was a challenging forecasting.	Microwave and infrared soundings from passive satellite sensors detect intensification before landfall, and the data must then reach forecasters. AI 1.7 protects the MetSat/EESS satellite downlinks that distribute this data; AI 1.1, 1.3, 1.8 and 1.18 protect the EESS (passive) sounding bands that take the measurement.
Warming seas	Record-high sea-surface temperatures in the Caribbean Sea and Gulf of Mexico, with the highest category of extreme marine heatwaves.	Sea-surface temperature is measured from space; with clouds blocking infrared >60% of the time, microwave SST bands (AI 1.7, 1.19) are irreplaceable.
Storm surge & coastal flooding	Sea level is rising faster than the global average (4.5-5.5 mm/yr at the coast vs 3.6 mm/yr globally), compounding surge and coastal-flood risk for every low-lying island State.	Satellite altimetry and the passive bands that calibrate it are the only way to track sea-level rise basin-wide and model surge.
Drought & water security	Severe water shortages affected parts of the Caribbean in 2025 and 2026; drought has driven water rationing that strained agriculture, infrastructure and power supply.	Drought monitoring relies on satellite precipitation, soil-moisture and vegetation products – including the 1.4 GHz soil-moisture band, where ground interference already degrades data.



RF Needed for Transmission of Data and Alert

- Common Alerting Protocol (CAP) / Cell Broadcast being piloted in ECTEL countries
- *Smart Seas Toolkit for Disaster Resilience Project*
- Caribbean RF usage for Transmission:

Sensor data → NMHS / Data Centre

VHF/UHF radio

Cellular networks

Microwave links

Satellite communications

Other telemetry networks

- ***Reliable spectrum is essential for timely, continuous data transmission. RF interference can result in missing observations or delayed warnings***



The line-of-sight range between a Small Fishing Vessel using a handheld VHF with a typical antenna height 1m above sea level and a Coast Station with an antenna 50m above sea level is approximately 20 nautical miles.



VHF communication is limited to antenna line-of-sight.

A typical line-of-sight range between two Small Fishing Vessels using handheld VHF's with their antennas 1m above the sea surface is approximately 5 nautical miles.



Summary

- Effectiveness of early warning systems in Caribbean rely on Radio Frequency Spectrum (observations and data transmission)
- Need to protect frequencies for meteorological application (e.g., reducing interference with radar)
- **Safeguarding Caribbean lives depends on satellite observations, the primary and vital sources for observations across the Caribbean Sea and Atlantic Ocean**



Thank you for your kind attention



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