



Multi-Hazard Early Warning Systems, Hurricane Contingency Planning and Civil Aviation

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Multi-Hazard Early Warning System



- Caribbean one of the world's most hazard-prone regions, exposed to:
 - Tropical cyclones , Heavy Rainfall, Flash floods, Severe thunderstorms, High winds, Heat events, Drought, Volcanic Ash, Reduced Visibility, Wind Shear
- These hazards affect critical infrastructure
- **Multi-Hazard Early Warning System (MHEWS):** Integrated frameworks designed to monitor, forecast, and provide advance notice for multiple connected hazards—such as tropical cyclones, floods, and heatwaves—to protect lives, critical infrastructure, essential services and reduce community loss

Common Objective



Both MHEWS and aviation meteorological services have the same ultimate objective:

- To protect lives, property, critical infrastructure, and ensure the continuity of essential services through timely, accurate, and actionable meteorological information

Difference lies in who uses the information

National Meteorological Service provides both types of services using many of the same observations, forecasts, and warning products

Airports & Air Navigation Systems: Critical National Infrastructure



- Airport is not simply a physical infrastructure for aircraft operation—it is a **critical national asset** that supports:
 - **Air Navigation Systems (services & systems enabling safe aircraft operations)**

Failure of either have **cascading impacts** on:

- Safety, Emergency Response, Medical Evacuations, Humanitarian Assistance, Disaster Relief Operations, National Resilience
- Both are **enablers of disaster preparedness, response, and recovery**
- Both must be fully integrated into national **MHEWS**

Why This Matters ?



- **Why this matters in the Caribbean?** Airports and aviation are the primary means of rapid access, making the continuity of air navigation services especially important
- **Why This Matters for Multi-Hazard Early Warning Systems**

Four pillars of a Multi-Hazard Early Warning System:

1. Risk knowledge
2. Monitoring and forecasting
3. Warning dissemination
4. Preparedness and response

Air Navigation Services Intersect with All Four



MHEWS Component	Air Navigation Connection
Risk knowledge	Airport flood maps, runway wind limits, volcanic ash risk, cyclone exposure
Detection, Monitoring & Forecasting	Aviation forecasts, METAR, TAF, SIGMET, tropical cyclone advisories
Warning Dissemination & Communication	Airport operations centers, Air Traffic Control, airlines receive warnings
Preparedness & Response Capability	Supports evacuations, relief flights, medical flights, post-disaster recovery



Air Navigation Depends on Meteorological Infrastructure

Meteorological infrastructure supporting national warnings also supports aviation

Examples include: Weather radar, Automatic Weather Observing Systems (AWOS), Surface meteorological stations, Upper-air observations, Lightning detection networks, Satellite reception systems, Operational Forecast Offices

If these systems fail, consequences extend beyond public weather warnings—they also **affect aviation operations**

Interdependency During a Hurricane



Consider a Category 4 hurricane approaching a Caribbean island

NMHS provides:

- Tropical cyclone warnings
- Impact-based warnings
- CAP alerts
- TAFs
- METARs
- SIGMETs
- Wind and rainfall forecasts

Air Navigation Service Provider uses this information to:

- Plan airspace restrictions
- Coordinate flight diversions
- Protect communications and surveillance equipment
- Implement contingency procedures
- Coordinate with airlines and airport operators

Airport Operator uses it to:

- Suspend operations when required
- Secure aircraft and ground equipment
- Protect navigation aids and facilities
- Activate emergency operations
- Plan post-event reopening

Hurricane Contingency Planning

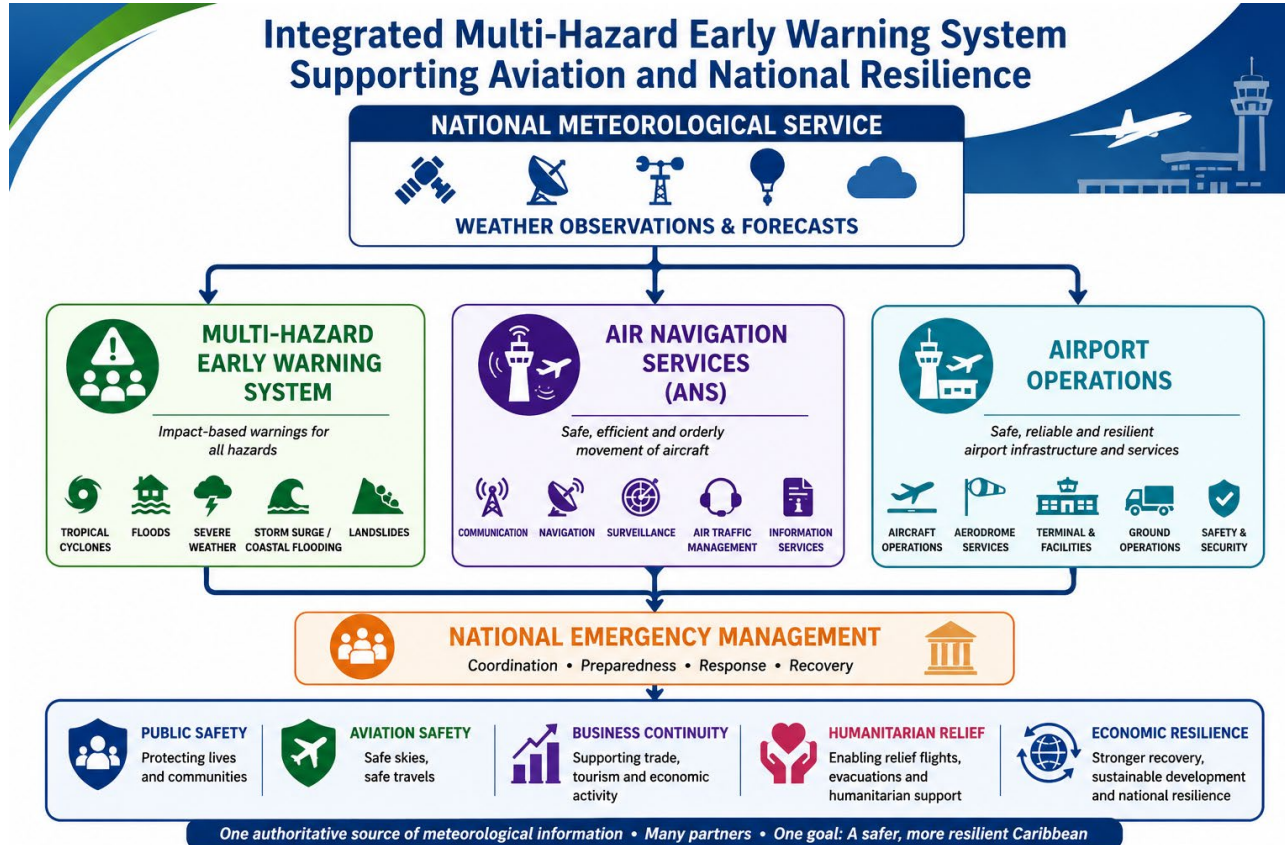


- Hurricane contingency plan defines how agencies prepare for, respond to, and recover from a hurricane

NMHS's involved:

- **Before the Event-** Enhanced monitoring, Forecast briefings, Coordination with disaster agencies, Issuing watches and warnings
- **During the Event:** Continuous forecasting, Impact updates, CAP alerts, Aviation advisories, Coordination with emergency operations centers
- **After the Event:** Damage assessments, Weather support for recovery operations, Verification and lessons learned

How Multi-Hazard Early Warning Systems Support Hurricane Contingency Planning for Air Navigation?



CMO's Perspective



- CMO promotes **strengthening NMHS** because they are **foundational to** both public safety and the **continuity of critical infrastructure, including air navigation**
- Same authoritative observations, forecasts, and warnings that protect communities also enable aviation stakeholders to activate hurricane contingency plans, protect critical systems, manage airport operations, and maintain essential air services
- Integrated approach reflects international frameworks promoted by **WMO, ICAO, and the United Nations Early Warnings for All initiative**, where meteorological services support not only the protection of communities but also the resilience of critical sectors

CMO Building National Operational Capability for MHEWS



Our Key Message: **Building the foundations for operational readiness**

CMO Contributions:

- Strengthened institutional and technical capacity of Caribbean NMHSs (**QMS & Internal Auditors certification**)
- Provided regional training on **Impact-Based Forecasting and Warning Services** to support people & sector centred warnings
- Development of **Communities of Practices** for knowledge sharing/peer support



CMO Contributions:

- Capacity building on the Common Alerting Protocol (CAP) for standardized, interoperable warning dissemination
- Support for operational procedures and governance aligned with WMO standards and EW4All initiative (**NMHS, NDRMO, Media Workshop**)

Operational readiness begins with capable institutions, skilled personnel, and harmonized procedures



Modernizing Operational Warning Infrastructure



CMO Operational Support

- Deployment of the **WMO CAP Composer** for creating standardized CAP alerts
- Integration of **RSS feeds**, and **automated dissemination of warnings** to multiple communication channels

CMO CAP Alerts Homepage



CAP Alerts Antigua and Barbuda



CAP Alerts Bahamas



CAP Alerts British Virgin Islands



CAP Alerts Cayman Islands



CAP Alerts Dominica



CAP Alerts Grenada



CAP Alerts Saint Lucia



CAP Alerts Sint Maarten



CAP Alerts St. Kitts and Nevis



CAP Alerts St. Vincent and the Grenadines



Home

[CMO CAP ALERTS HOMEPAGE](#) / [CAP ALERTS SAINT LUCIA](#) / [HEAVY RAINFALL WARNINGS FOR EAST COAST \(YELLOW LEVEL\)](#)

CAP ALERT - ACTUAL

Heavy rainfall warnings for east coast (Yellow Level)

[CAP XML](#) [PNG](#) [PDF](#) [Facebook](#) [X](#) [LinkedIn](#) [WhatsApp](#) [Telegram](#)

Expired: Heavy Rain
Moderate severity

● Urgency
▲ Severity
○ Certainty
● Category
● Language

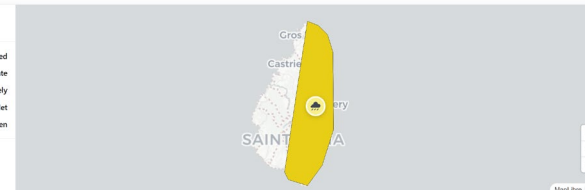
Expected
Moderate
Likely
Met
en

TIME PERIOD

Issued: 25 May 2026 01:17
Effective: 24 May 2026 21:00
Onset: 24 May 2026 21:00
Expires: 25 May 2026 12:00

SEVERITY

● Extreme
● Severe
● Moderate
● Minor



● Heavy Rain (en)

A Low Level Trough System Expected To Bring Heavy Rainfall to St. Lucia.

AREA

Eastern Saint Lucia

EVENT DESCRIPTION

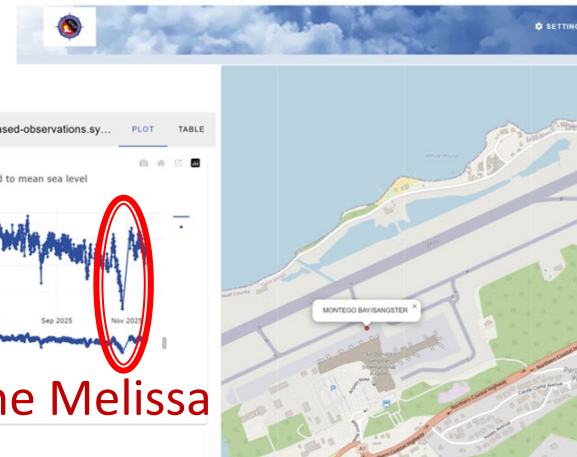
Heavy rainfall is expected due to the passage of a low level trough system as well as an approaching tropical wave. Frequent heavy rain may result in flash flooding especially in the Dennery area and areas Nearby. Motorways will be impacted with water levels rising rapidly as well as fallen rocks affecting driving conditions. Visibility will also be affected.

Modernizing Operational Warning Infrastructure



CMO Operational Support

- Establishment of the **CMO Regional WIS 2.0 Node (WIS2-in-a-Box)** to support real-time publication and exchange of weather and warning information
- Regional **WIS 2.0 implementation workshops** and hands-on technical training



MONTEGO BAY/SANGSTER

0-20000-0-78388

Observations in json format for urn:wmo:md:jm-msj:cce.surface-based-observations.sy...

Observed Property

Non coordinate pressure

Pressure reduced to mean sea level

24 hour pressure change

Air temperature

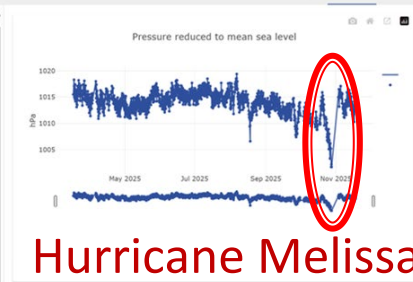
Dewpoint temperature

Relative humidity

Horizontal visibility

Cloud cover total

Cloud amount



Hurricane Melissa

CMO Radar upgrade: Improve Aviation Services



- Dual polarized radar directly detect supercooled liquid water above freezing level allows improved aircraft icing detection and warnings.
- Enhance monitoring of aviation hazards for maintaining watch of hazardous meteorological conditions that could adversely affect aircraft and flight operations.
- Improved discrimination of volcanic eruption particles and ash cloud tracking - operationally beneficial, particularly for enroute aircraft.

Empowering Operational Readiness Across the Caribbean for MHEWS



Regional Outcomes

- ✓ **NMHSs better equipped** to deliver Impact-Based Forecasts and Warnings
- ✓ **Standardized warning** creation using CAP
- ✓ **Faster dissemination** through WIS 2.0 and automated information sharing
- ✓ **Improved coordination** between NMHSs, Disaster Management Agencies, Civil Aviation Authorities, Airport Operators, and other stakeholders

Enhanced readiness to support:

- **Multi-Hazard Early Warning Systems**
- **Hurricane contingency planning**
- **Aviation safety**

Summary



- In the Caribbean, every weather observation has multiple purposes
- Same observation that supports a hurricane warning for a community also supports a pilot's flight planning, an airport's hurricane contingency plan, an air navigation provider's operational decisions, and a government's emergency response
- This is the power of an integrated Multi-Hazard Early Warning **System—one authoritative source of meteorological information serving many sectors**, one coordinated response, and one shared goal: **protecting lives and critical infrastructure**, while building a safer and more resilient Caribbean



Thank you!

CMO Headquarters Unit, www.cmo.org.tt