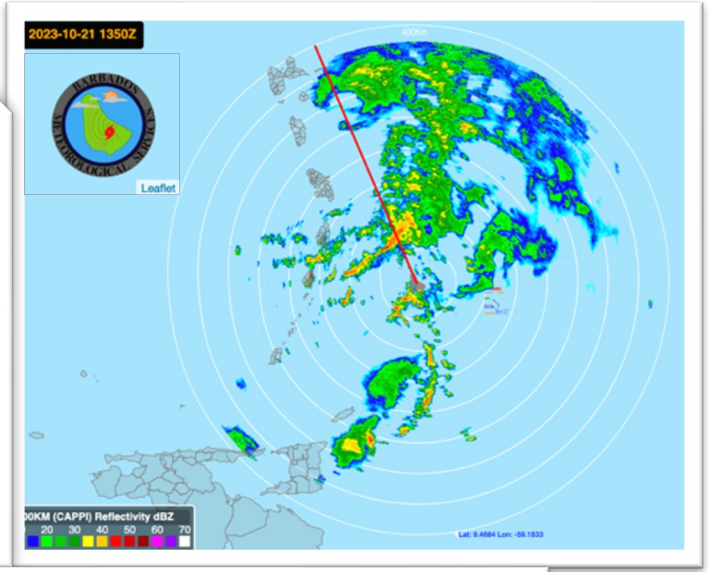
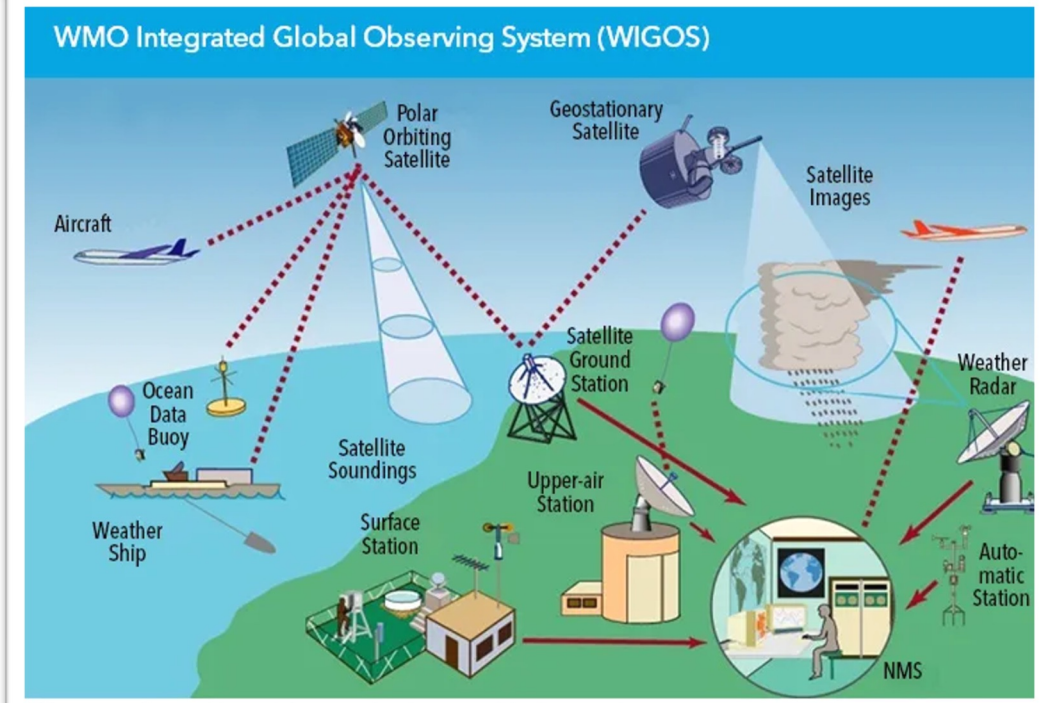




Observations, Data Transmission and Information Communication rely on Radio Frequency

Source: World Meteorological Organization

2nd Small Island Developing States (SIDS) Internet Governance Forum (IGF)

Enhancing Digital Resilience for Environmental Sustainability - a Hydro-Met Perspective

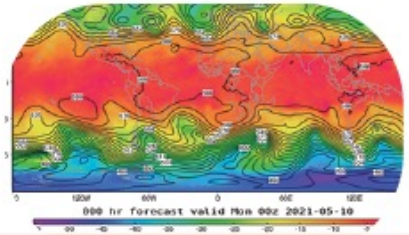
Dr Arlene Laing
Caribbean Meteorological Organization

1973-2023
ORIGINATED IN 1951 AS THE BRITISH CARIBBEAN METEOROLOGICAL SERVICE

Weather & Climate Value Chain

Observations from the entire globe

International exchange of observations



Global Numerical Weather Prediction

Weather and climate-related infrastructure - **must be designed and managed globally**

Last-mile activities undertaken **primarily at regional, national and local level**

Effective decision-making and action

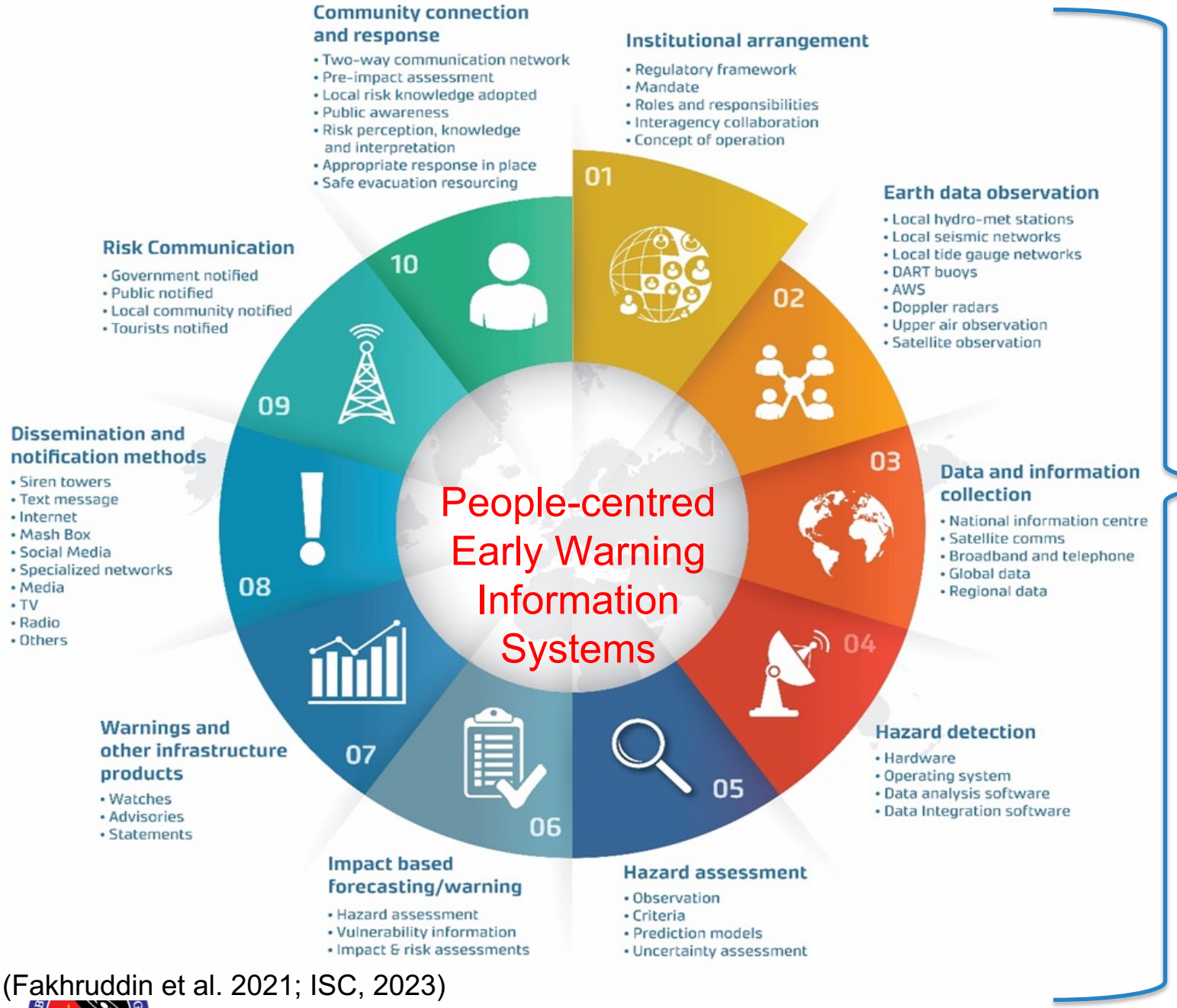
Delivery of weather and climate services

Local data processing, forecast, warning and advisory products

WMO, 2021

- Information for the benefit of society
- International data exchange in real-time (24/7)
- **WMO Unified Data Policy**
- **Requires reliable, secure, robust information & communication technology (ICT) systems**

Multi-Hazard Early Warning Systems



(Fakhruddin et al. 2021; ISC, 2023)

Governance & Institutional arrangements

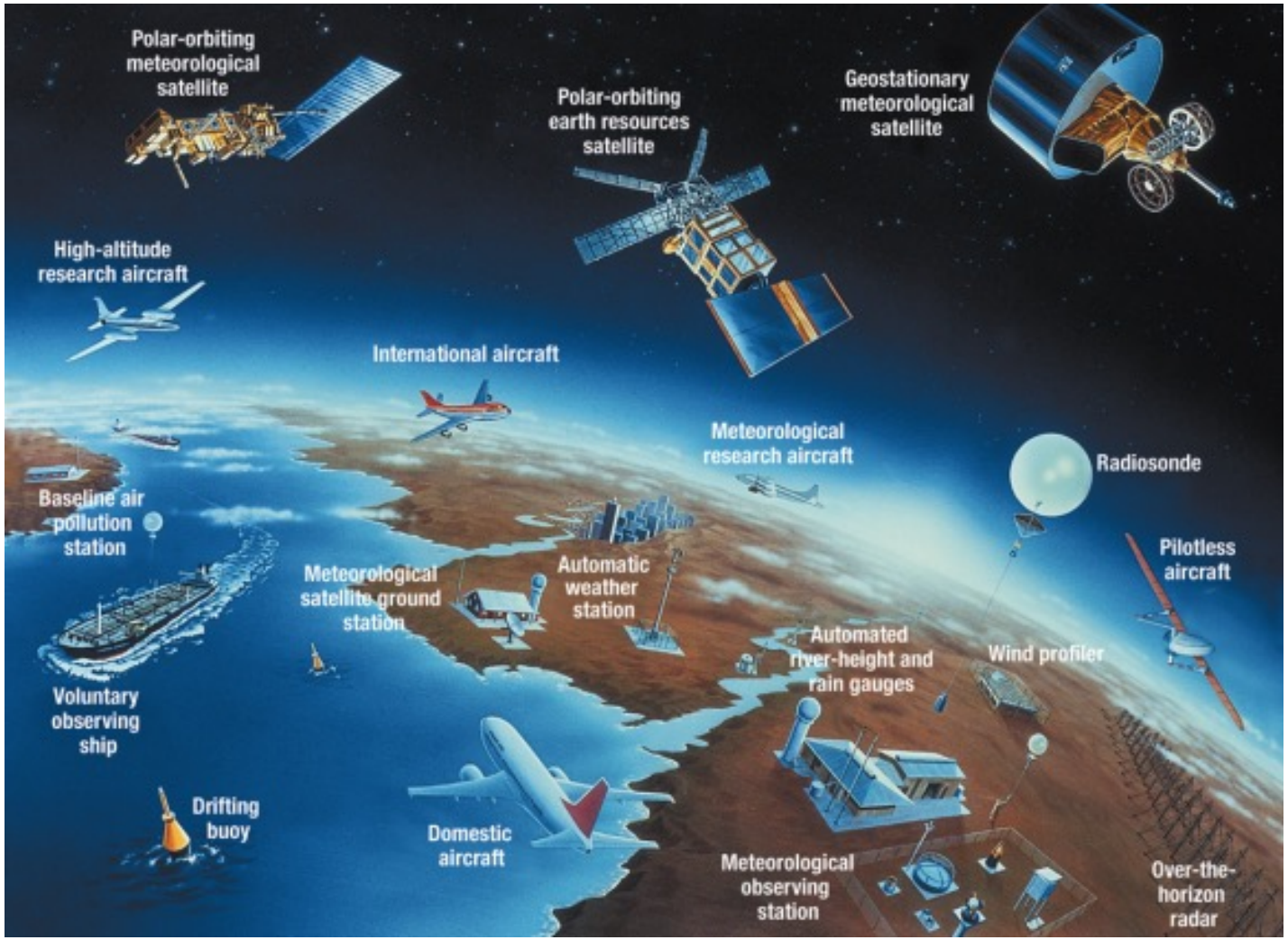
Digital Resilience

Target D of Sendai Framework - reducing disaster risk through better critical infrastructure, including national weather, water and climate service infrastructure

1. Enhancing Resilience of Observations

- Standardization of network - ease of calibration and maintenance (e.g., via WMO Regional Instrument Centre at CIMH)
- Backup data in geographically dispersed locations (CIMH climate data also on servers at CMO HQ and CCCCC)
- Severe weather case database, hosted at CIMH, mirrored at CMO HQ

WMO Integrated Global Observing System (WIGOS)

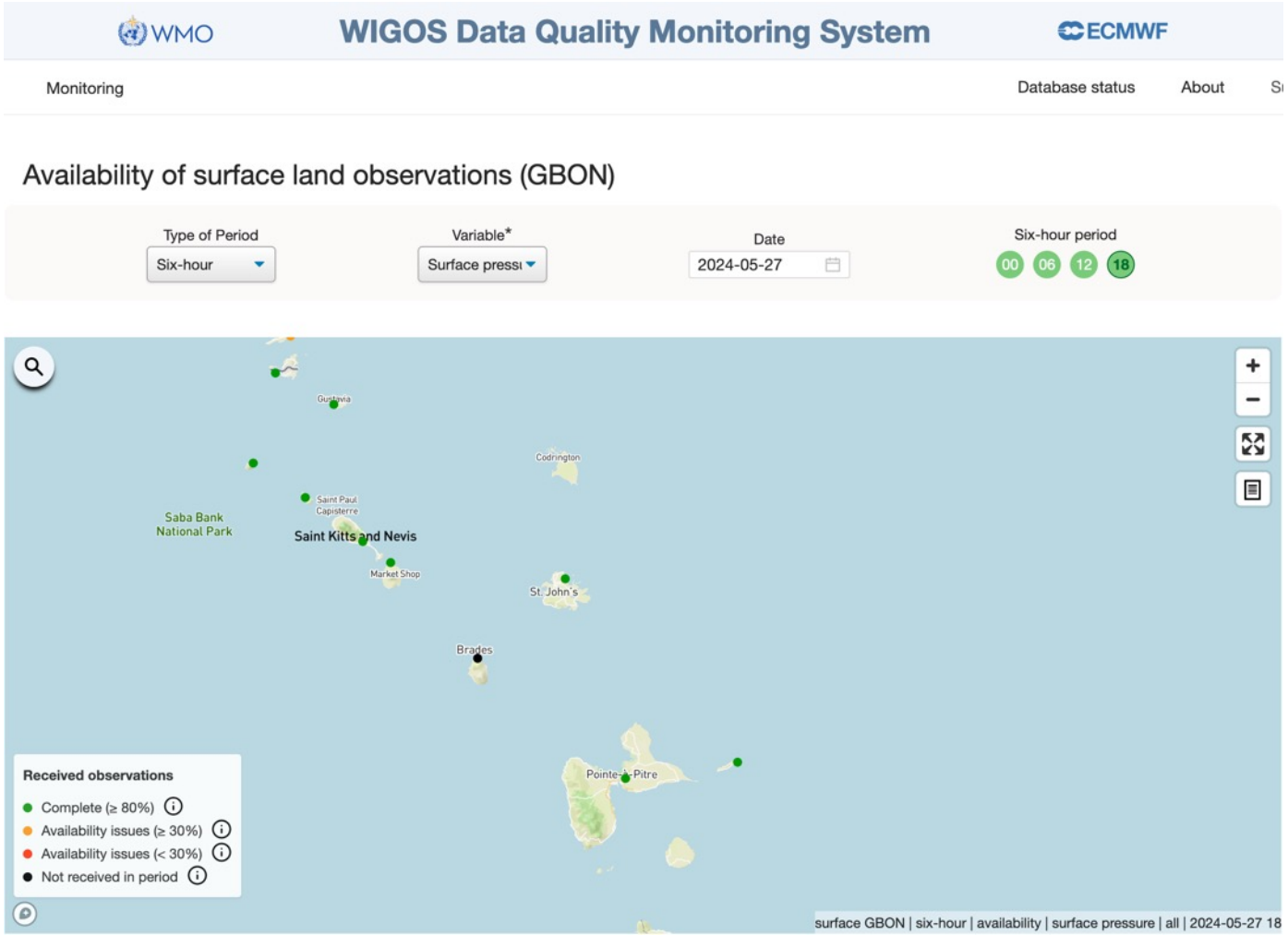


Enhancing Resilience of Observations

Global Basic Observation Network (GBON)

Systematic Observations Financing Facility (SOFF)

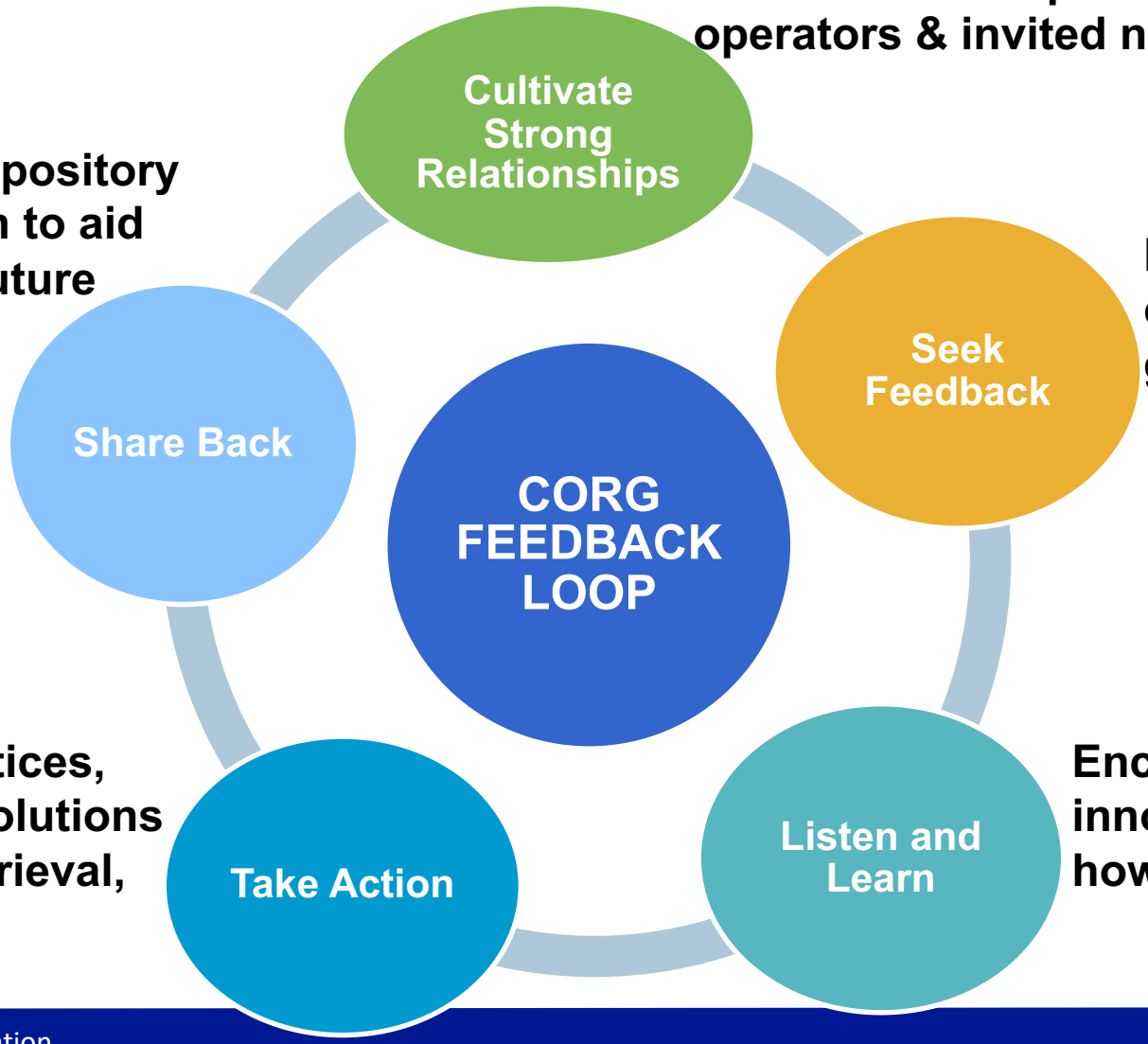
- Sustain basic network for the public good
- Data Quality Management – ***Regional WIGOS Centre*** (US, Canada, CMO HQ & Trinidad & Tobago Met Service, Costa Rica)
- Organs of CMO are supporting SOFF implementation



Enhancing Resilience of Observations: CMO Operational Radar Group (CORG)

Built trust & cooperation among CMO radar operators & invited neighbouring operators

Created centralized online repository to access shared information to aid capacity building & similar future projects



Focused dialogue on common problems to generate feedback

Documented best practices, lessons learned, and solutions e.g., data archiving, retrieval, dissemination

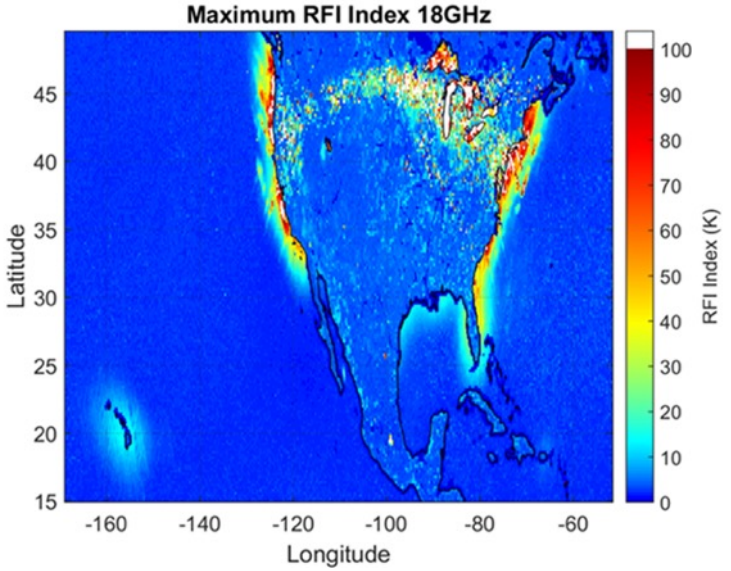
Encouraged sharing of innovative solutions, know-how, best practices adopted

Courtesy, K Kerr)

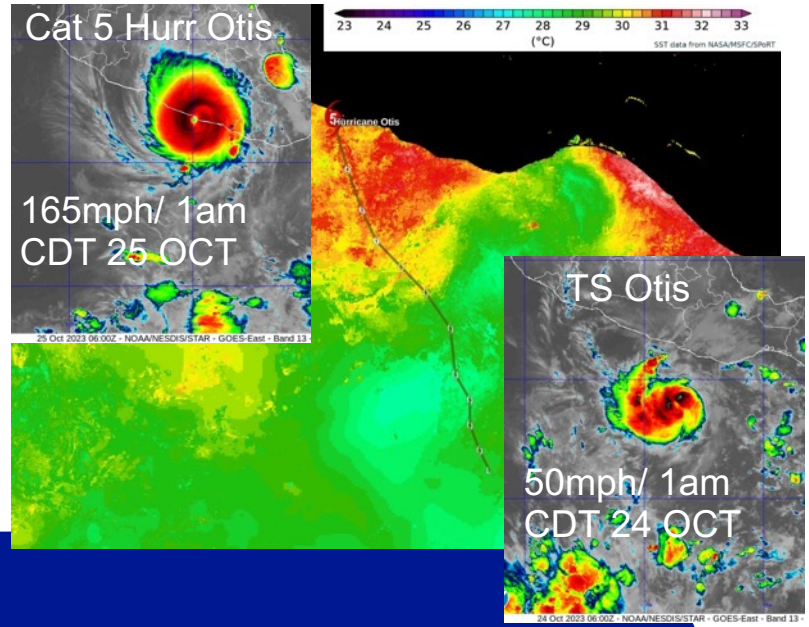
Enhancing Resilience of Observations: Addressing Challenges to Satellite Earth Observations

Passive Bands

- International mobile telecommunications (IMT) groups examining radio frequency spectrum above 6 GHz as part of 5G growth. **Degradation in ability to use passive bands is a growing concern for remote sensing.**
- **Sea-surface temperature (SST)** measurements at risk. **Sea surface temperature monitoring vital to saving lives** (e.g., tropical cyclones form when SST ≥ 26°C).

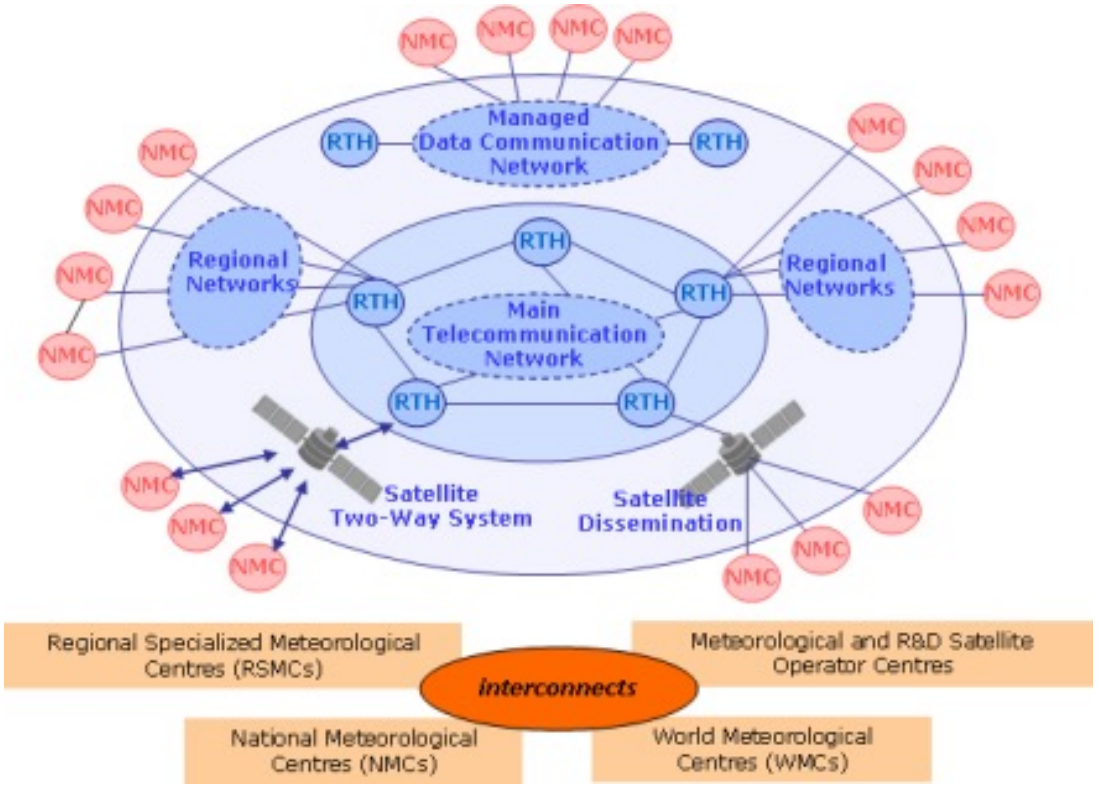


Innovation: 1st ever WMO **training workshop on radio frequency spectrum management,** (Regulators, Met Services, UWI, civil defense, other stakeholders), hosted by CMO with support of the Caribbean Telecommunications Union (CTU), February 2024



2. Enhancing International Data Exchange

Regional Meteorological Telecom Network



Special component carries meteorological data for aviation

Supports multi-hazard, multipurpose early warning systems, e.g., tsunamis

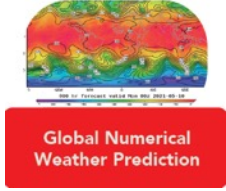
- Reliable, secure ICT systems are fundamental to global weather and climate enterprise, which requires real-time (24/7) international data exchange to safeguard lives and property.
- **WMO Unified Data Policy** (free exchange of core and recommended data)
- Observation networks and dissemination of data and information via the internet are susceptible to cyberattacks. A radar was hacked last year.

Transitioning International Data Exchange to WMO Information System (WIS 2.0)

- WMO WIS 2.0 Training Workshop hosted by CMO HQ, June 2023
- Belize, T&T, Cayman – led piloting of WIS2.0 after workshop
- **CMO WIS2.0 Node established Oct 2023, with cloud services from WMO, pioneering with 12 Members.**

https://community.wmo.int/en/news/wis-news-2023-06-the-2nd-wis2-training-workshop-trinidad-and-tobago

3. Global & Regional Numerical Weather Prediction & Climate Prediction (seamless approach)



WMO Integrated Processing and Prediction System (WIPPS)

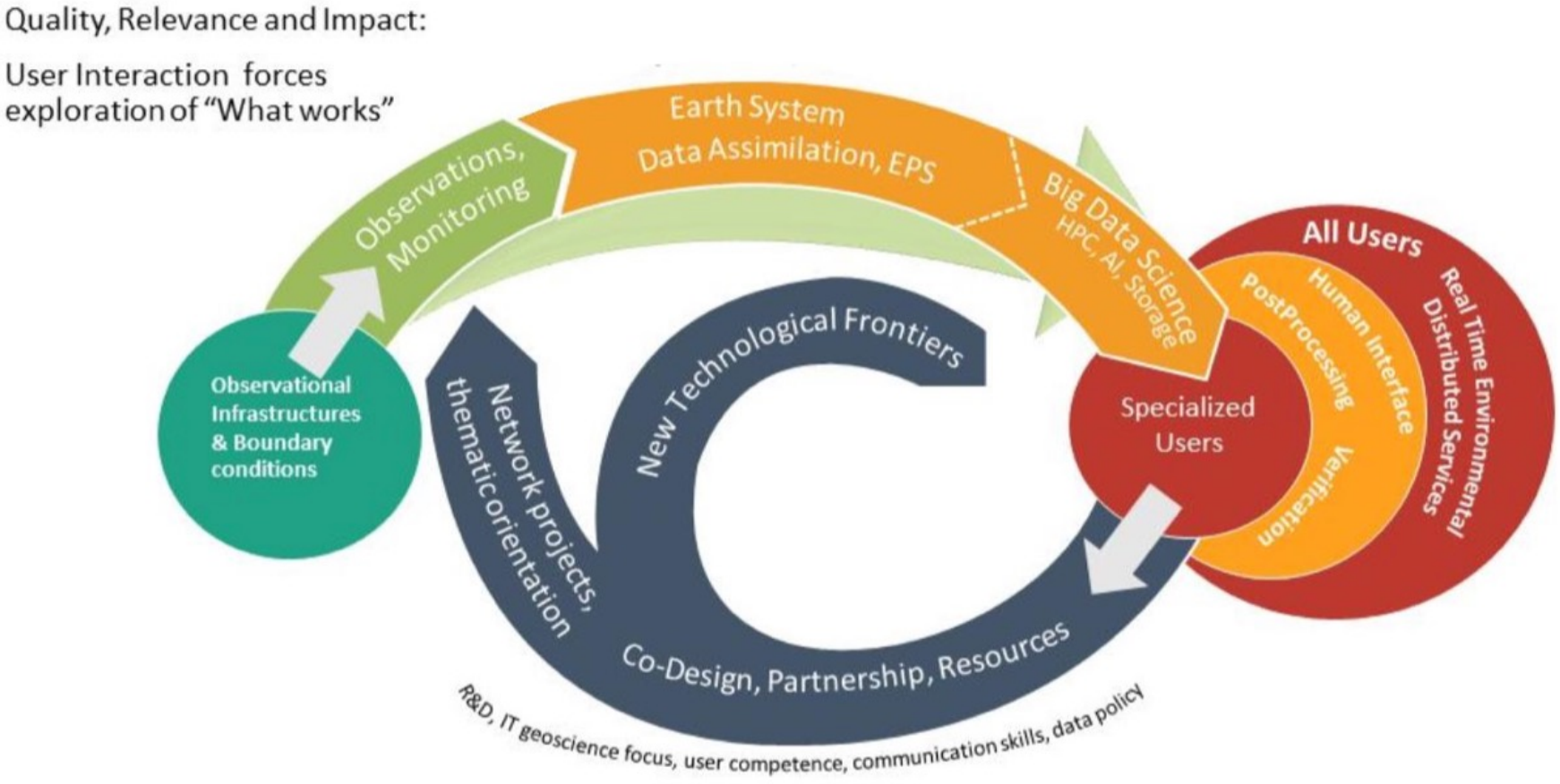
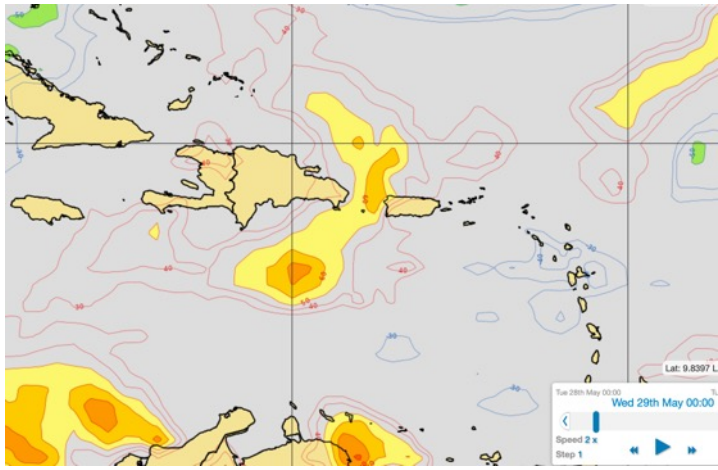


Figure 5. A value cycle approach encompasses the whole value chain from observations (green components), through production of forecasts and products (orange component), to the engagement of users (red components) and calls for a co-designed approach, featured through a feedback loop (grey components) to achieve scientific breakthroughs that serve society. From Ruti et al. (BAMS, 2019).

EPS ECMWF: Extreme Forecast Index for Rainfall



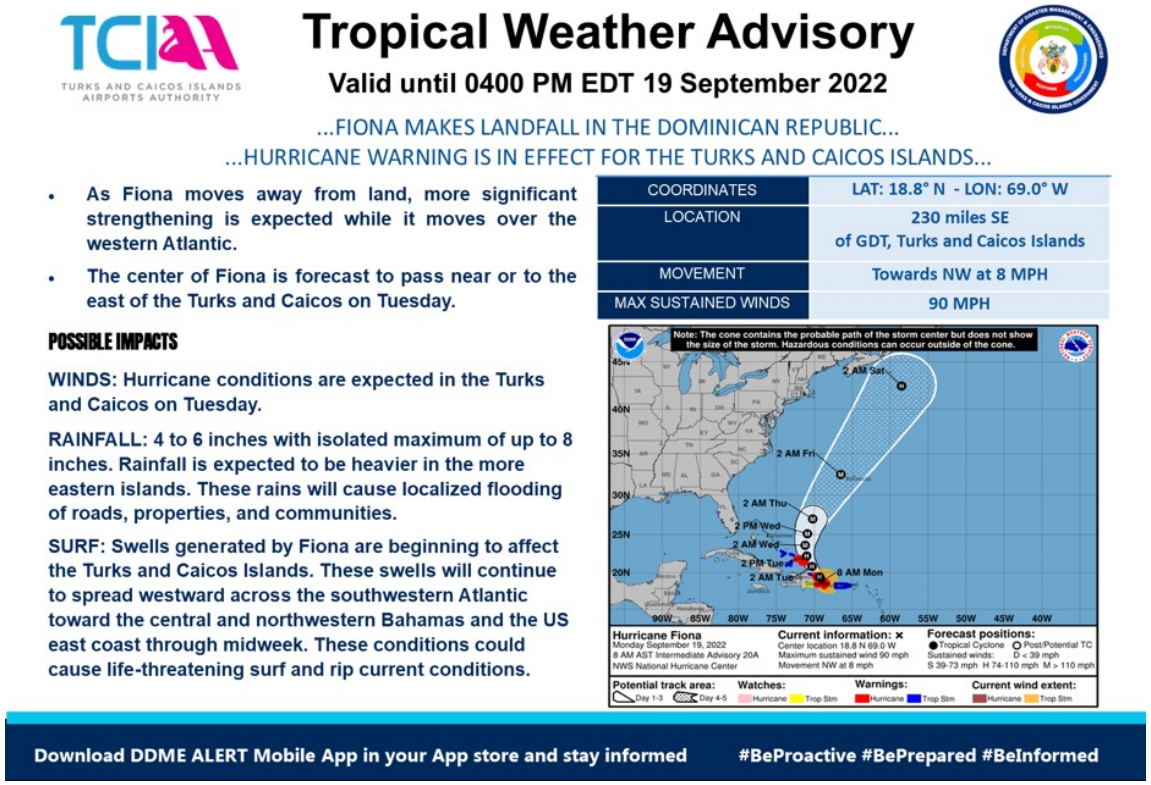
4. Local Data Processing, forecast, warning, & advisory products

National Framework for Weather, Water, and Climate & Ocean Services

- **National Institutionalized mechanism** to coordinate elements pertaining to entire value chain for the **production, delivery and application of weather, water, and climate services** (e.g., National Climate Outlook Forum, Hurricane Alerts, Drought Bulletins, etc.…)

- **Engage all national stakeholders** – in co-production, tailoring, communication and utilization of weather, water, and climate services in a national dialogue

Met Service & Disaster Office co-production, co-design, co-delivery



5. Delivery of Weather and Climate Services

Common Alerting Protocol (CAP)

Mobile Cell Broadcast – key technology for public alerting with potential for geographic targeting of alert delivery

Volume: 10 Issue: 1 | January 2022

AGROMET BULLETIN

METEOROLOGICAL SERVICE JAMAICA

HIGHLIGHTS FOR JANUARY

- Stations in all thirteen (13) parishes received below-normal rainfall.
- No parish experienced meteorological drought conditions.
- Near-normal to above-normal rainfall is forecast for February to April 2022.
- Near-normal temperatures are expected for the next three months.

What Happened: November 2021 – January 2022

Based on analysis (image to the right) very dry conditions were noted in sections of Trelawny, St. Ann, St. Mary, St. Thomas, St. Catherine and Clarendon. Sections of St. James, St. Elizabeth and Portland were experiencing mild levels of wetness.

The below-normal rainfall received across the island, during the early months the dry season (December, January) has resulted in continued dry conditions in many farming communities especially in central parishes.

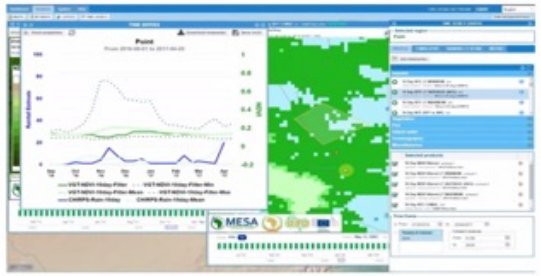
Wet and Dry Conditions, November 2021 – January 2022

Delivery of Climate Services: Climate Services and Related Applications (ClimSA)

- Intra-ACP Climate Services and Related Applications Programme (ClimSA): Four-year project funded through European Union (EU) African, Caribbean, Pacific (ACP) Secretariat and **being implemented by CIMH on behalf of CMO**. *Period extended*.
- Advancing climate services value chains in the:
  - **health** sector of **Dominica**,
  - **water** sector of **Jamaica** and
  - **agriculture and food security** sector of **Guyana**

ClimSA
INTRA-ACP CLIMATE SERVICES AND RELATED APPLICATIONS PROGRAMME

C-Station GUI – Analysis and IMPACT



Interactive Map view windows

Mapping a range of climate impacts

Courtesy, CIMH RCC

Hydro-Met Services, Environmental Sustainability and Digital Resilience - Interconnected

- Desire for the Caribbean to become resilient to extreme weather and climate events
- Requires high quality **weather, climate, water and related environmental information, effectively applied**
- **Weather and climate services built on ICT**
- Extreme **weather and climate intelligence can also inform cybersecurity matters**, .e.g., understanding impact of hazardous weather on ICT system integrity

Thank you!

http://www.cmo.org.tt