United Nations Educational, Scientific and Cultural Organization

Intergovernmental Oceanographic Commission

Update on CARIBE-EWS and Status of Sea level Stations and Data Availability in the Caribbean and Adjacent Regions

Christa von Hillebrandt-Andrade – on behalf of the UNESCO/IOC ICG CARIBE-EWS

International Tsunami Information Center – Caribbean Office

Marine Science Conference – IOCARIBE-GOOS

May 8, 2023

UNESCO/IOC ICG CARIBE –EWS XVII Session

April 24-28, 2023,Costa Rica

United Nations Educational, Scientific and Cultural Organization

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Restructuring, around the ODTP

4 Working Groups:

- Risk Knowledge
- Detection and Forecasting – sub groups on source detection, tsunami detection (sea level) and Forecasting
- Warning Dissemination and Communication
- Preparedness, Response and Mitigation – subgroups on Preparedness and Response, Mitigation and Tsunami Ready

CARIBE WAVE Task Team

New Officers: Regina Browne (US/USVI, Vice Chair), Anthony Murillo (Costa Rica, Vice Chair), Gerard Metayer (Haiti, Chair). Marie Noelle Raveau (France/Martinique, Vice Chair)

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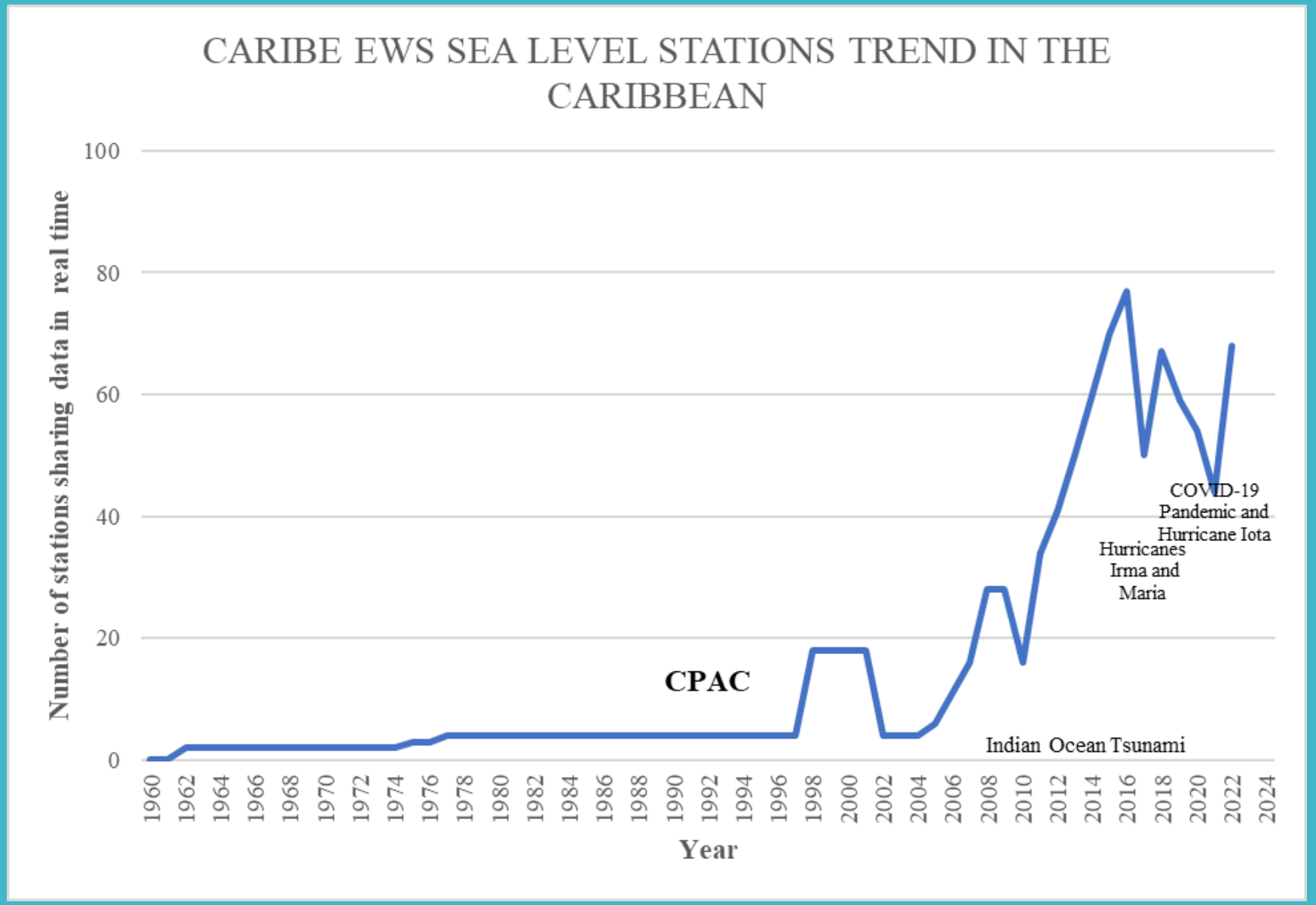

Sea level network status

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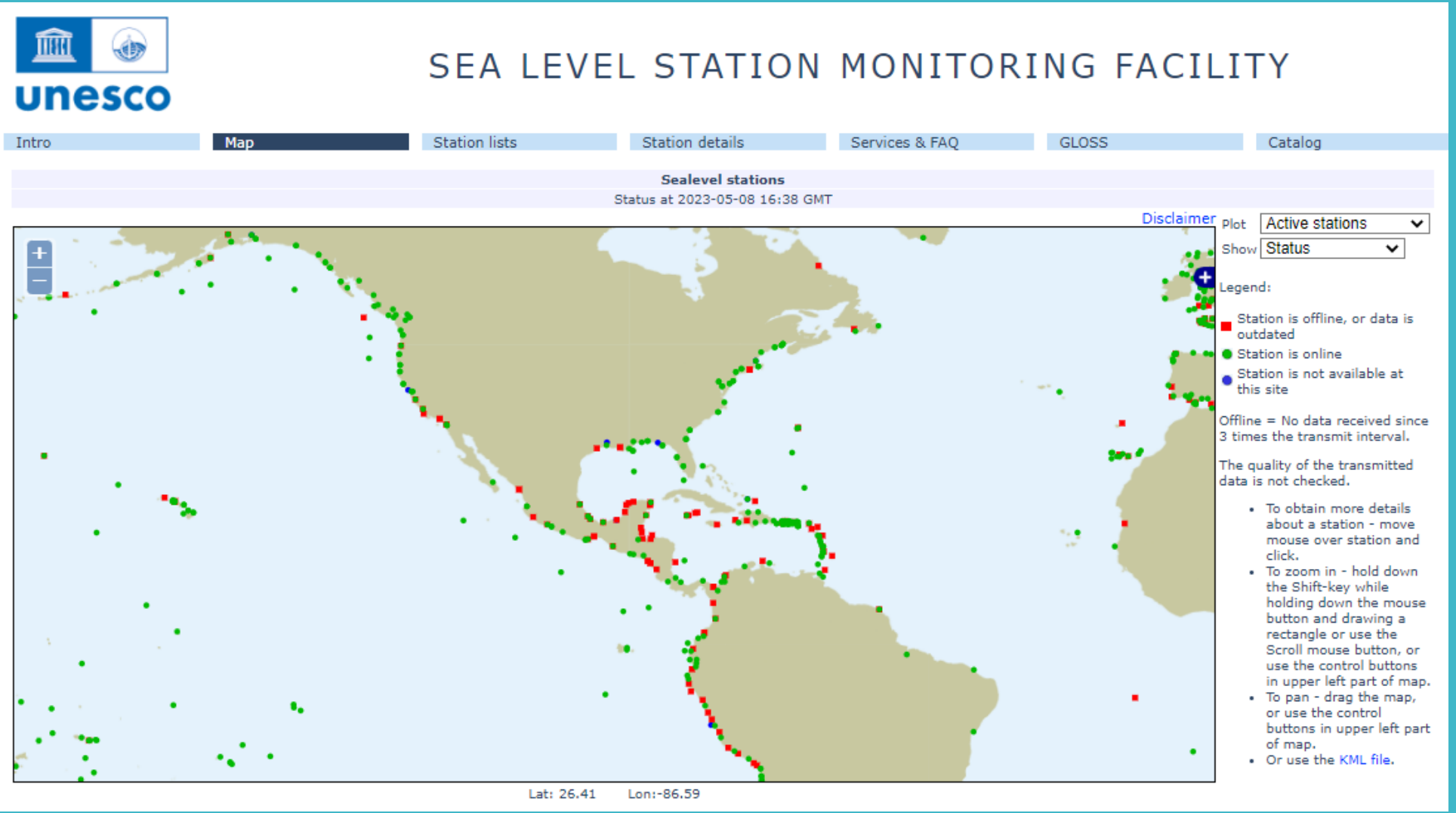

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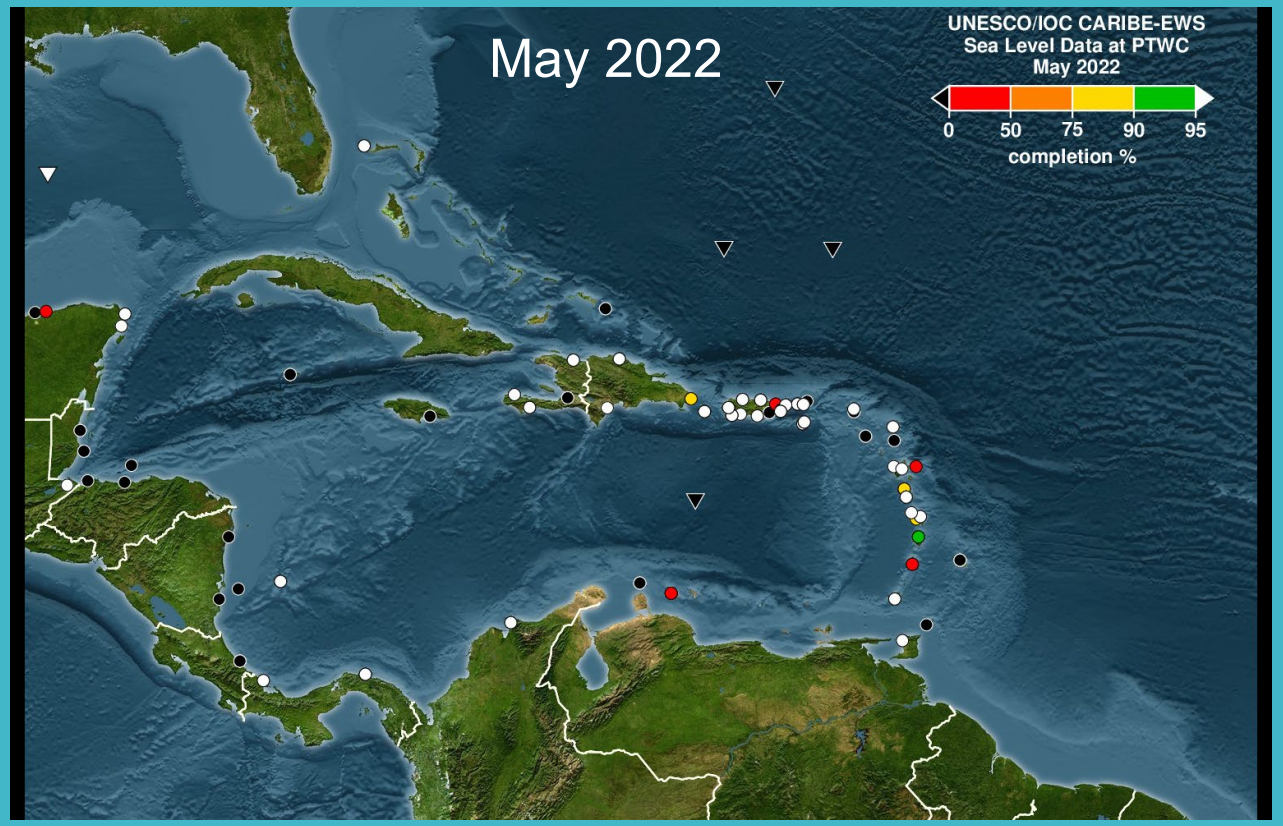
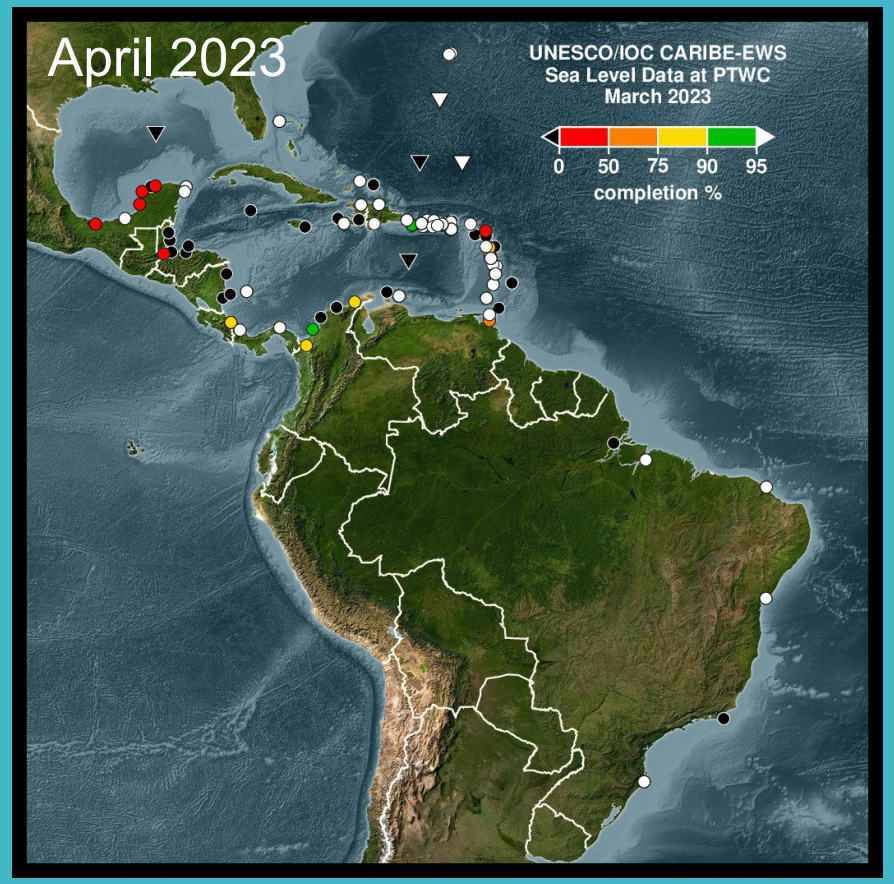


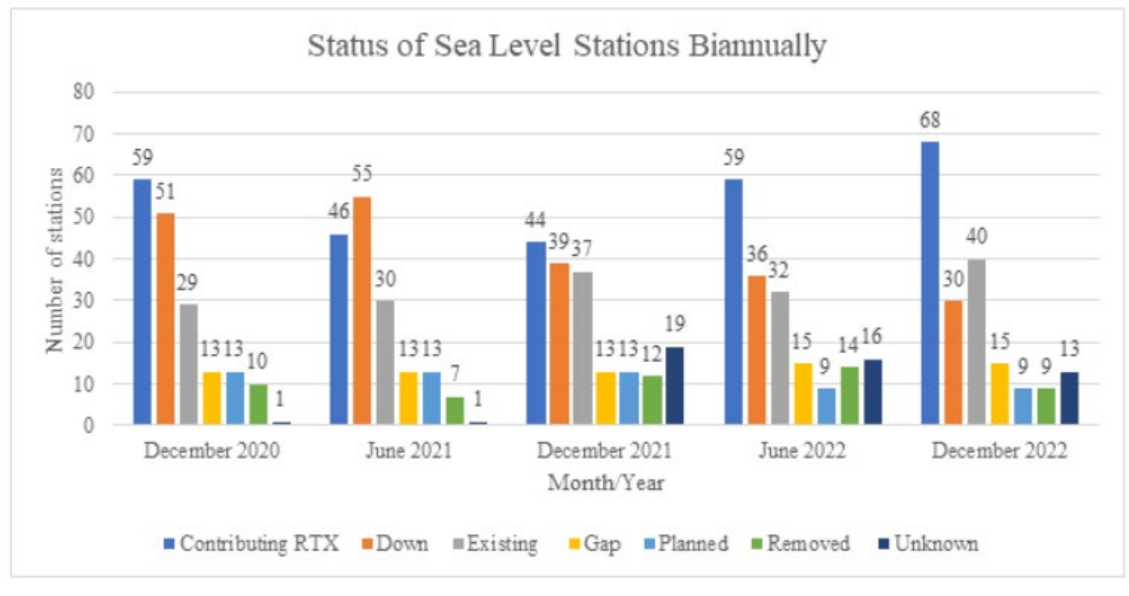


- Caption

PTWC monthly maps of sea-level station data availability.

used for WG1 monthly email discussions with station operators.

Sea-level network status



The number of stations has increased in 2022,
however the overall number is down from pre-COVID era and
not all new stations are currently operational in SLMF and Tide Tool

New stations installed in 2022

Chateau Belair (St. Vincent), Cayman,
Colombia, Puerto Rico

Two NOAA DARTs back online

Sea-level station outages have increased significantly over the past few years.

Caribbean coast in Central America

Haiti, Jamaica, St Martin and Barbados

UK NOC produced a maintenance manual for tide gauge operators

OCEAN DECADE TSUNAMI PROGRAMME:
Seeking Major Advances in SCIENCE and PREPAREDNESS

New observational and analysis technologies to move from a **high-uncertainty** assumption-based capability to a **low-uncertainty** dynamic-based capability

RESILIENCE!

Communities respond to tsunami threats by combining accurate

1. real-time impact forecasts with

2. deep community preparedness.

Tsunami disaster impacts are minimized, enabling rapid restoration of critical infrastructure and services

Comprehensive institutional & community preparedness and capacity building efforts aimed at achieving **IOC Tsunami Ready** designation across all socio-economic categories

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Tsunami Ready

SMART Repeaters on Subsea Cables

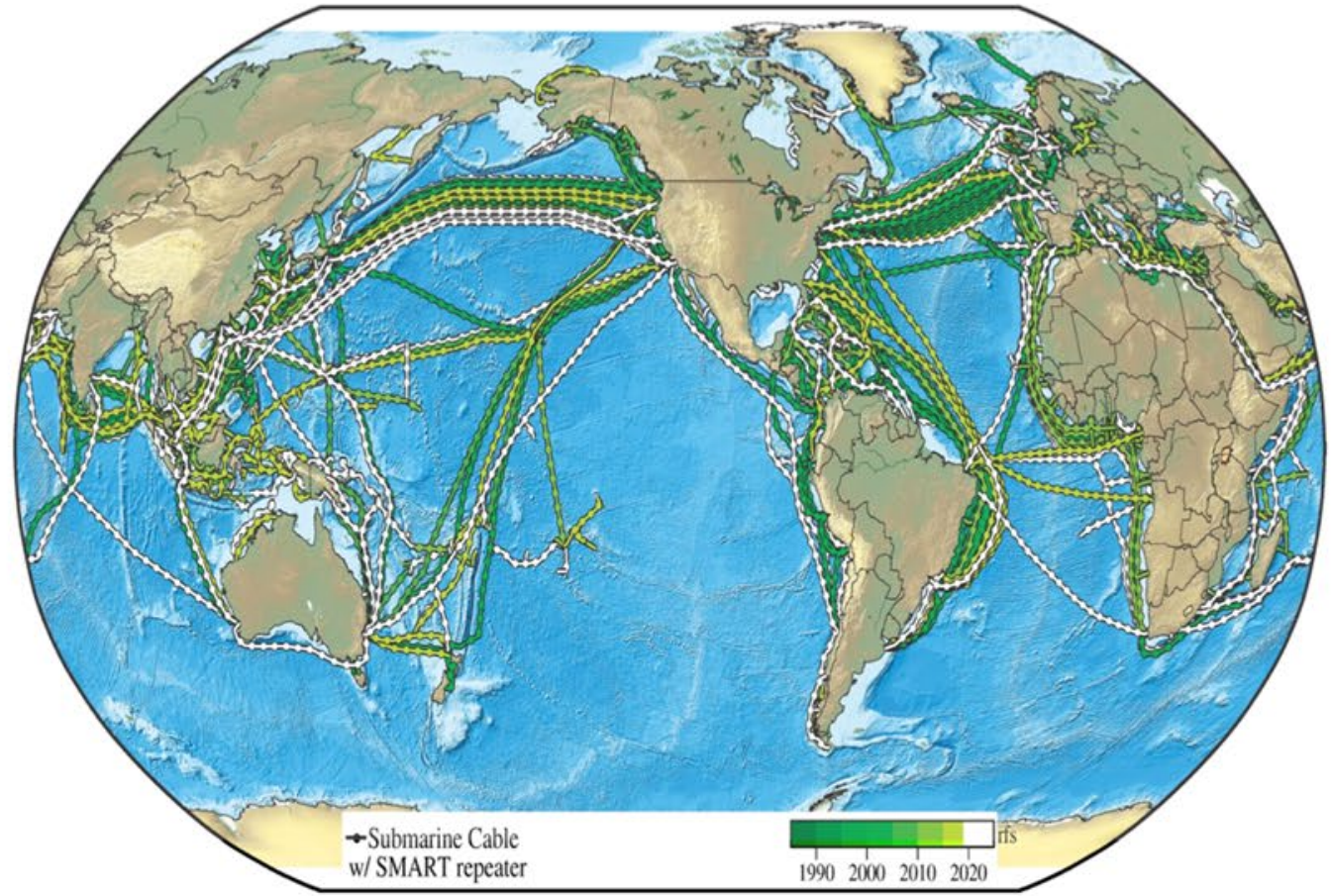
SMART = **S**cience **M**onitoring **A**nd **R**eliable **T**elecommunications

- Subsea fiber comprises 95% of international Internet traffic
- 1.3M+ km total cable length
- Repeaters (amplifiers) located every 60-100 km along the cable (~20,000 at present)
- Virtually untapped for science and monitoring capabilities

SMART Cables: leverage commercial cable infrastructure

- Sensors (**pressure, temperature, seismic**) on some/all cable amplifiers (repeaters)
- Power & communications provided over cable
- Engineering / replenishment lifespan of ~25 years
- U.N. multi-agency Joint Task Force leading adoption push
- Hardware development underway by Subsea Data Systems
- Adoption by fiber cable suppliers required

Key opportunity to leverage commercial infrastructure for CARIBE-EWS earthquake and tsunami early warning

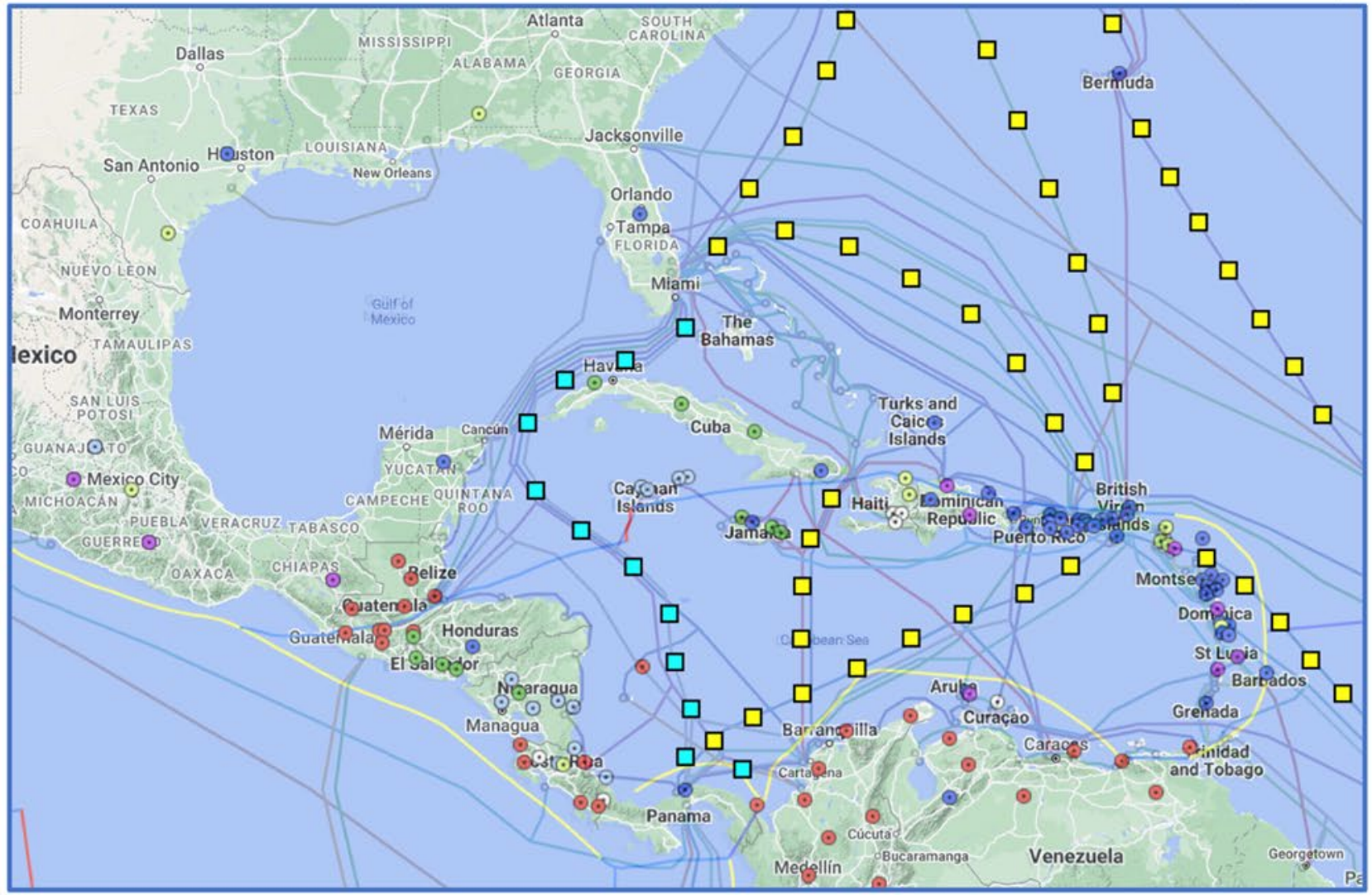


Submarine fiber optic cable network age progression
(Courtesy JTF SMART Cables)

EXAMPLE CARIBE SMART CABLE CONCEPTS

(Courtesy Matt Fouch, Subsea Data Systems)

- Older cables in CARIBE-EWS region scheduled for replacement in next 2-7 years
- Prime opportunity to include SMART repeaters in region
- Enhance current CARIBE seismic and tsunami detection capabilities
- Improve societal resilience
- Protect / harden telecom infrastructure

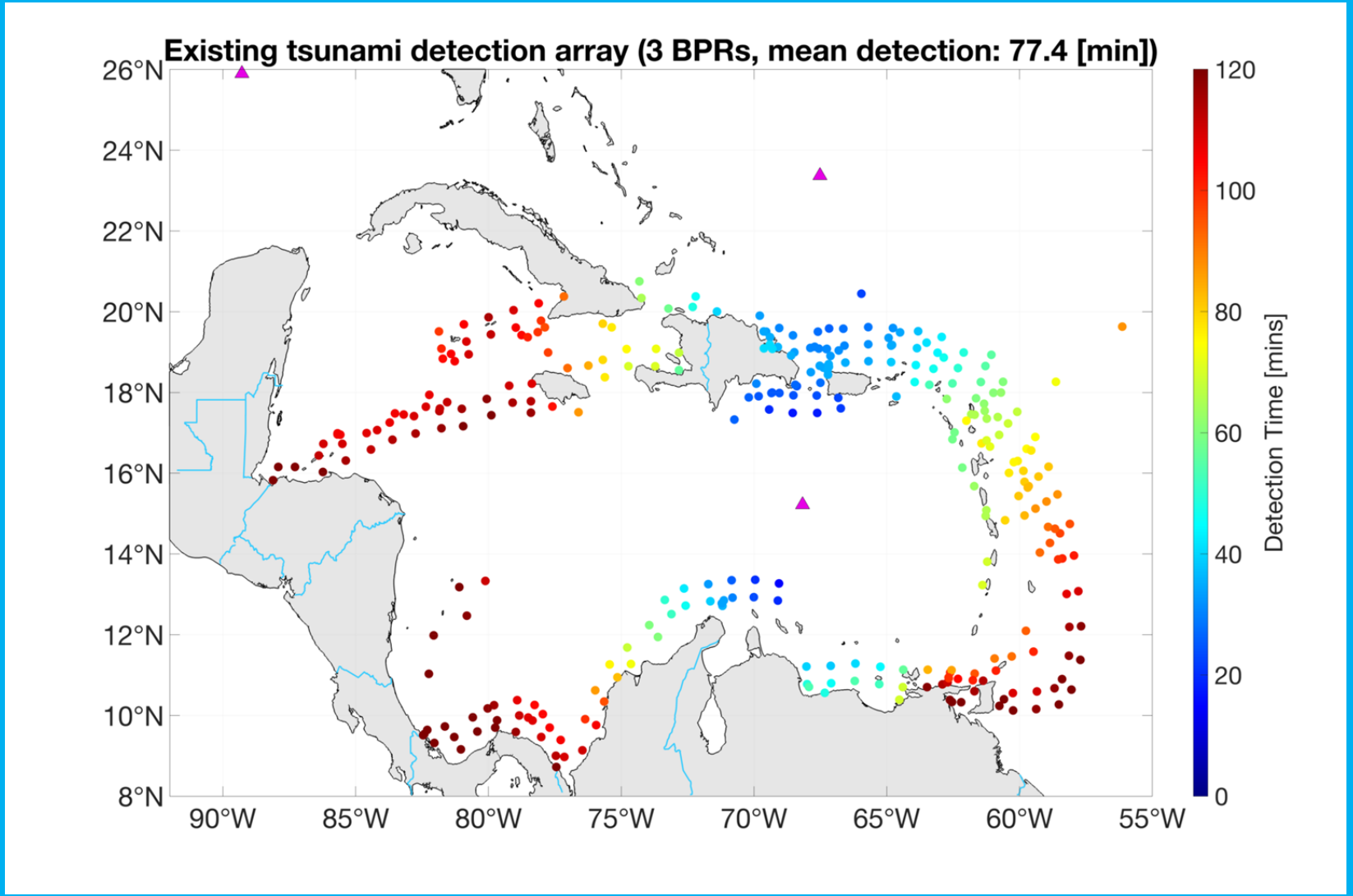


Circles: Existing CARIBE-EWS seismic stations
Squares: Notional SMART Cable sensor-enabled repeaters

Tsunami Detection, Sensor Placement Strategy

Detection and measurement

- **Tsunameters/BPRs**
  - Deep-water measurement necessary
  - Current Buoy coverage minimal
  - Events from historical and fault catalog
- **Optimized Sensor Placement**
  - 10-minute detection goal
  - 2nd sensor needed for good source characterization
- **Other Sensors can Offset**
  - Cable-based deep-water sensors
  - GNSS sensors on land
  - HF Radar, Ionosphere, etc



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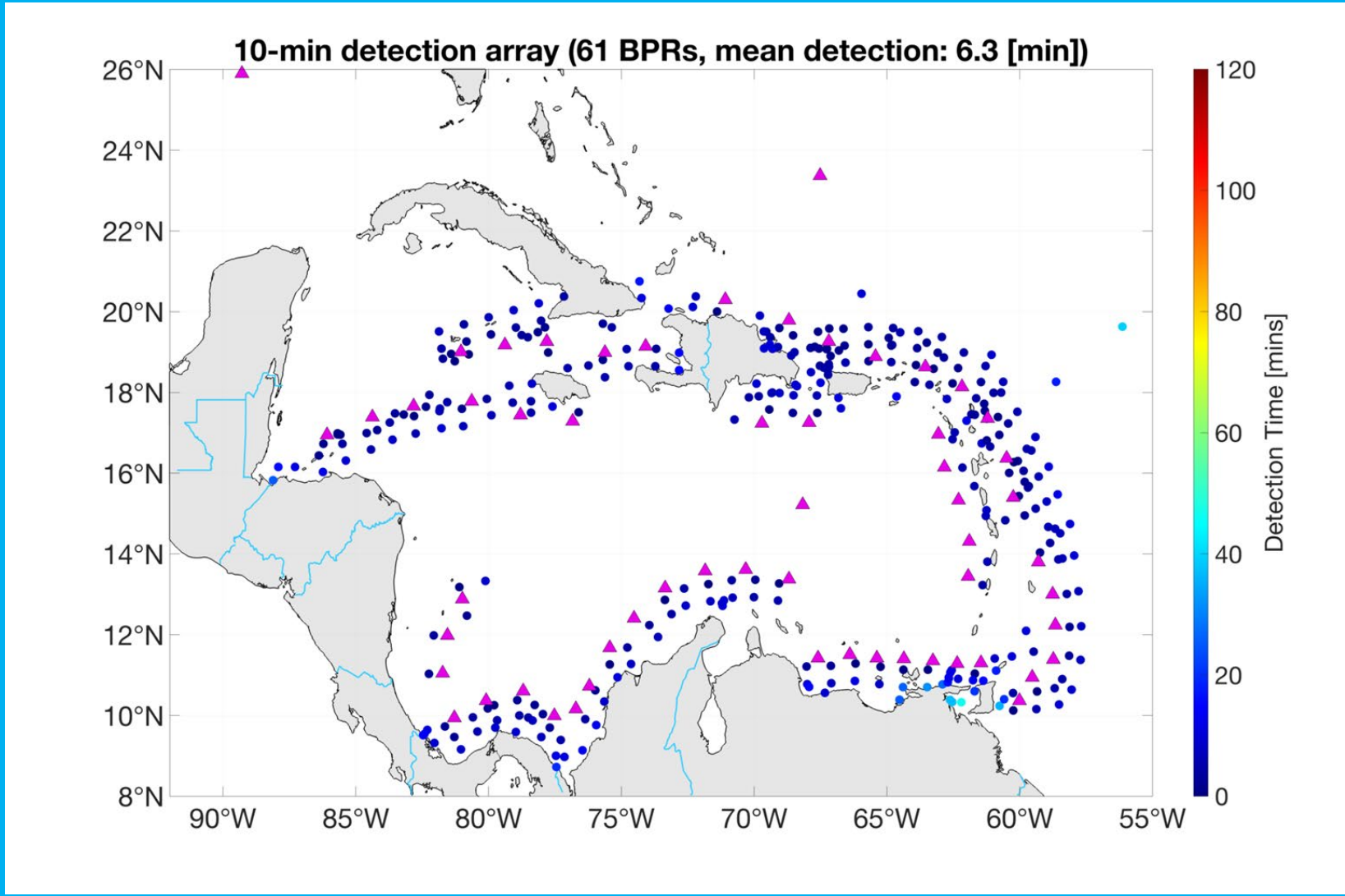

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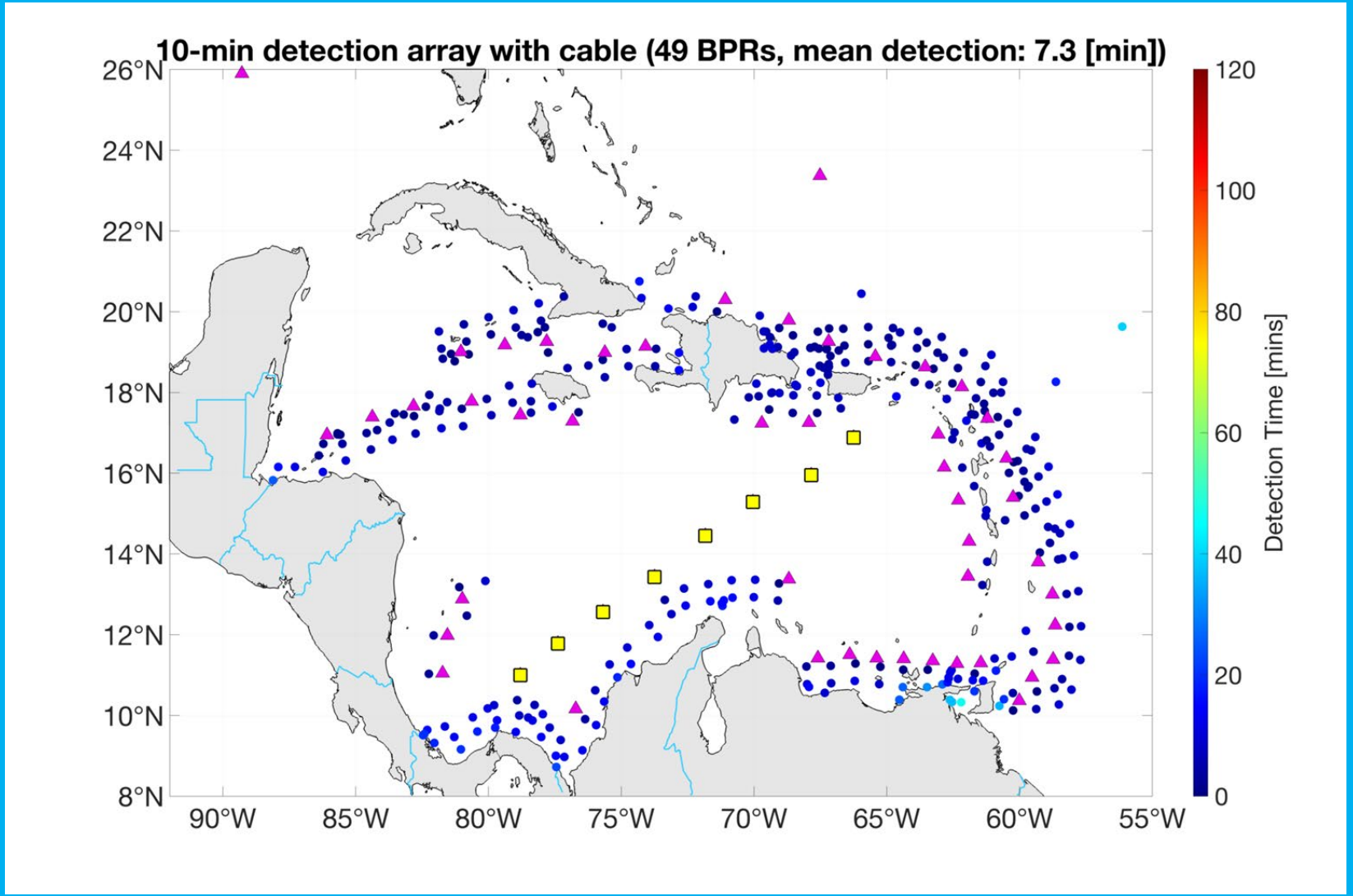

UN OCEAN DECADE TSUNAMI PROGRAMME:
100% AT-RISK COMMUNITIES TSUNAMI READY

	TSUNAMI READY INDICATORS
I	**ASSESSMENT (ASSESS)**
1	**ASSESS-1**. Tsunami hazard zones are mapped and designated.
2	**ASSESS-2**. The number of people at risk in the tsunami hazard zone is estimated.
3	**ASSESS-3**. Economic, infrastructural, political, and social resources are identified.
II	**PREPAREDNESS (PREP)**
4	**PREP-1**. Easily understood tsunami evacuation maps are approved.
5	**PREP-2**. Tsunami information including signage is publicly displayed.
6	**PREP-3**. Outreach and public awareness and education resources are available and distributed.
7	**PREP-4**. Outreach or educational activities are held at least three times a year.
8	**PREP-5**: A community tsunami exercise is conducted at least every two years.
III	**RESPONSE (RESP)**
9	**RESP-1**. A community tsunami emergency response plan is approved.
10	**RESP-2**. The capacity to manage emergency response operations during a tsunami is in place.
11	**RESP-3**. Redundant and reliable means to timely receive 24-hour official tsunami alerts are in place.
12	**RESP-4**. Redundant and reliable means to timely disseminate 24-hour official tsunami alerts to the public are in place.

- **STRATEGY:**
  Be Aware, Be Prepared
- **FRAMEWORK:**
  - Harmonized global guidelines UNESCO IOC Tsunami Ready
  - Performance-based Community Recognition
- **ACTION:**
  - National programs empower Communities,
  - Communities demand national actions
- **GLOBAL MEASURE**

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Standard Guidelines for the Tsunami Ready Recognition Program, UNESCO IOC TS 74

RECOMMENDATIONS

- Noting the possibility of densifying sea level observations with new sea-floor cable technologies (SMART);
- Noting the importance of Member States and operators of sea level stations to maintain their sea-level stations in an operational status and regularly review and update the status of its stations, including the IOC Sea Level Monitoring Facility, and inform on plans for repair
- Noting the ICG CARIBE EWS recommendation for a survey of sea-level network operator status survey with the goal of improving the uptime of sea-level network,
- Welcomes the CARIBE EWS, IHO and MACHC Spanish language Sea Level network operators workshop to be hosted by Costa Rica later in November 2023
- Recommends IOCARIBE Secretariat and IOCARIBE GOOS to enhance collaboration and coordination with the CARIBE EWS on sea level and other relevant ocean observation initiatives and actions.