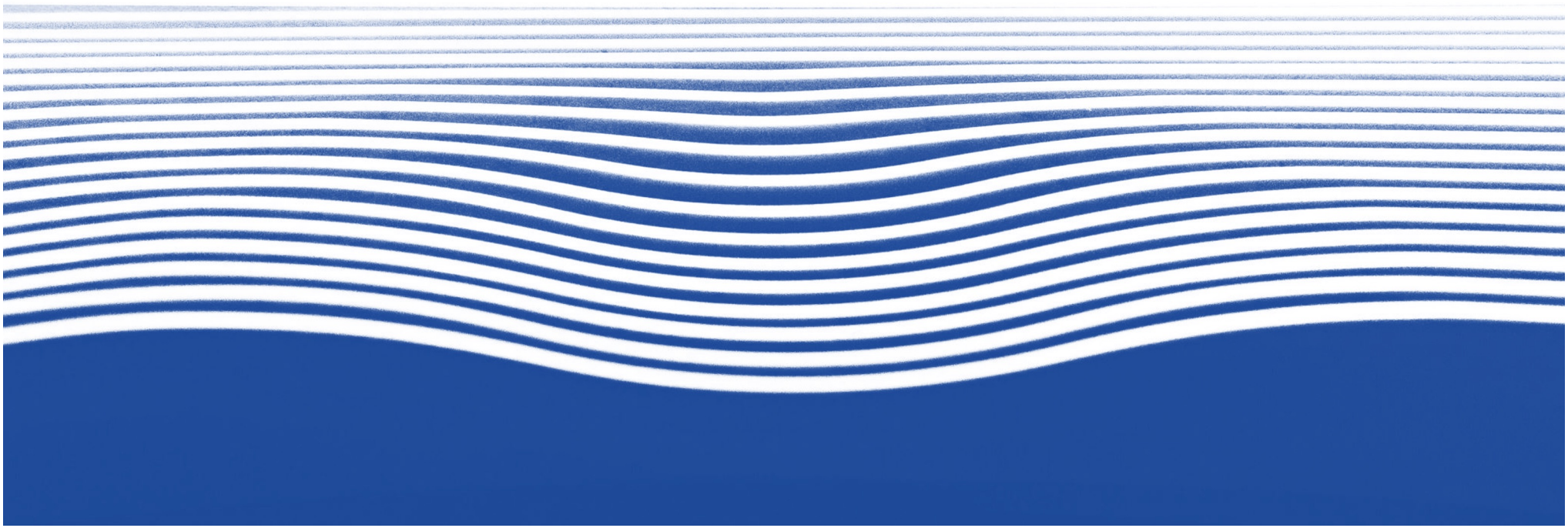
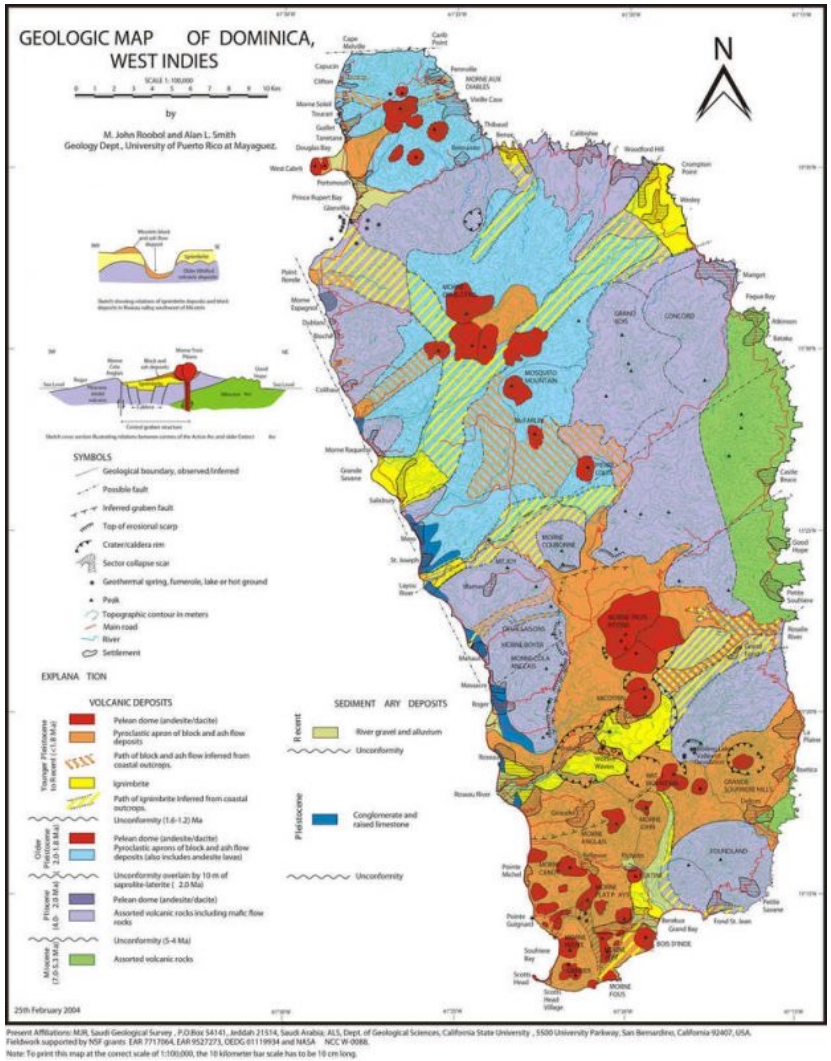
TSUNAMI READINESS IN DOMINICA

By Station Officer: Grenfel Defoe

Dominica Fire & Ambulance Services



Context

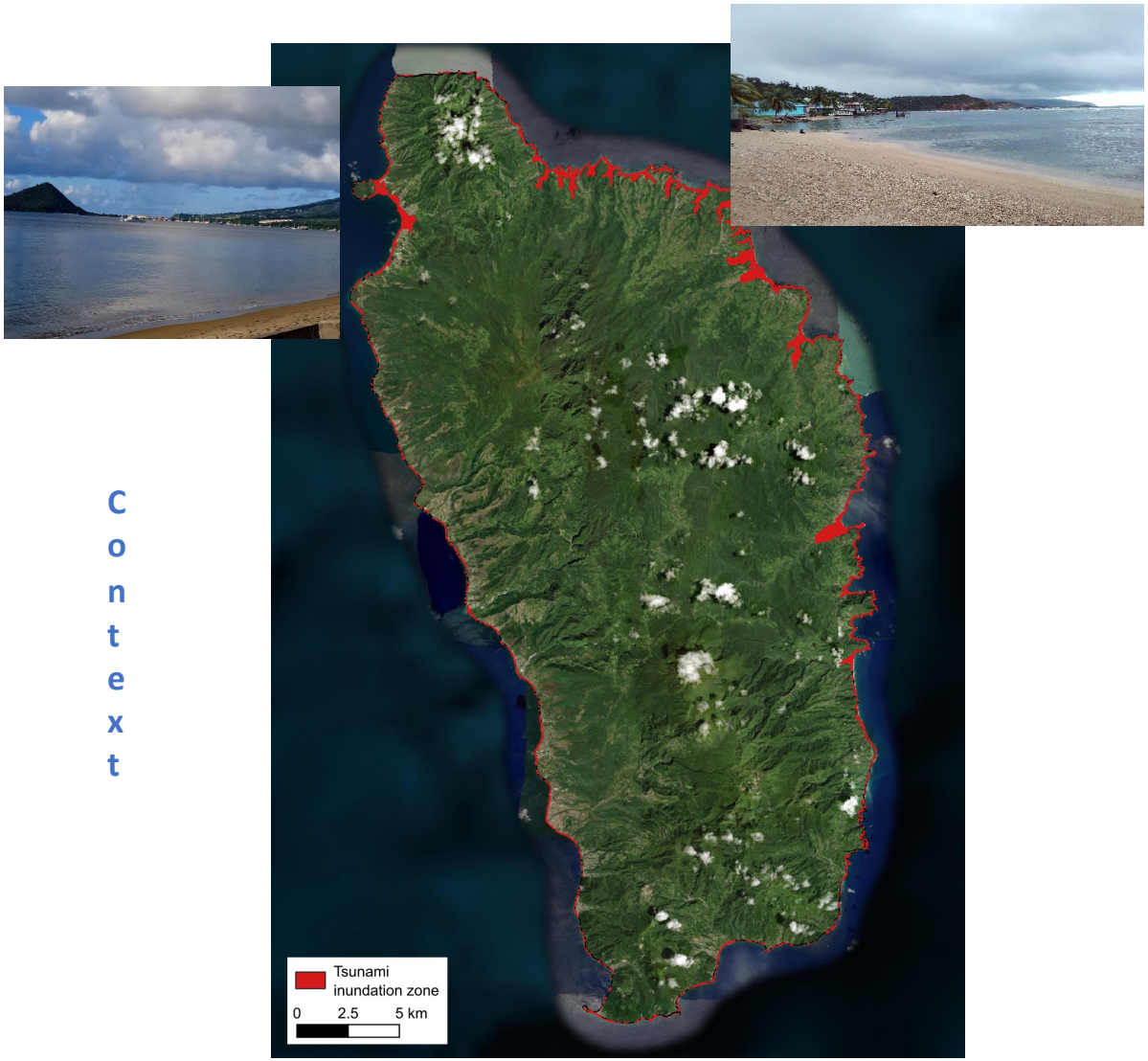


The Commonwealth of Dominica is centered in the Eastern Caribbean island chain between Guadeloupe and Martinique and.

The country is highly vulnerable to natural hazards including meteorological hazards (e.g., hurricanes and extreme storms) and geophysical hazards (e.g., earthquakes, volcanoes, and tsunamis) due to its fragile geography and steep topography.

- It is nestled approximately 50 miles near the crumbling fault line of the Caribbean and Atlantic plates;
- It has one of the highest concentrations of live volcanoes (9) in the world;
- Has the second largest boiling lake in the world;
- The capital, Roseau, sits on a pyroclastic flow flan;
- There are many areas with Sulphur deposits and hot springs ;
- It also ranks among the wettest islands in the Eastern Caribbean;
- The majority of the population is settled along coastal areas

Context



The SINAMOT Universidad Nacional (Costa Rica) conducted a scientific study and developed a "Technical Report: Tsunami Inundation Map for Dominica" in early 2003:

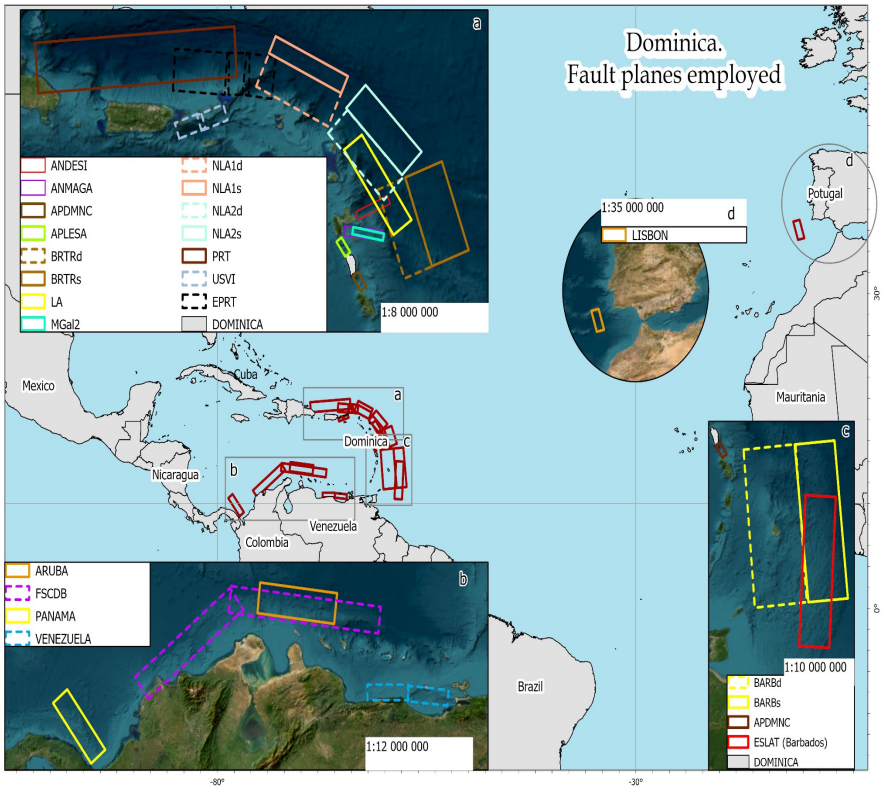
Findings include:

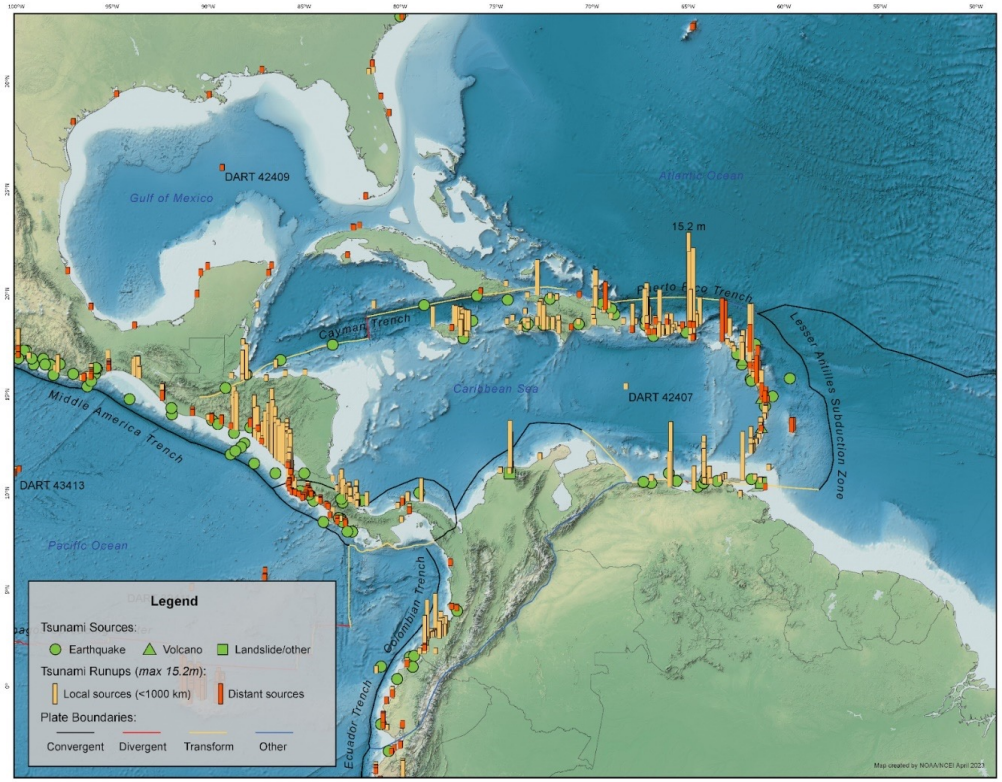
- Dominica has experienced a few tsunami events in the past 4 centuries; "six tsunamis have arrived at Dominica since 1755 (NOAA/NCEI, 2022), five of them originated by earthquakes and one of them originated by the volcanic eruption of the Hunga Tonga – Hunga Ha'apai in January 2022 (Sostre-Cortes et al., 2022). The highest wave heights reported were 3.7 m for the 1755 Lisbon tsunami at Portsmouth and 3 m for the 1867 U.S. Virgin Islands tsunami at Prince Rupert's Bay (Table 1)."
- Dominica's northeastern coastline spanning to the center of the eastern coast as well as the northwestern coastline – more specifically the town of Portsmouth - are most vulnerable to tsunamis;

Context

- The west coast of the island presented the smallest tsunami heights and inundation areas;
- “The largest tsunami threat from seismic sources for Dominica comes from near-field sources. The scenarios that caused the largest inundation areas, tsunami heights and flow depths were the ones located between Barracuda Trench and Tiburon Trench (BRTR scenarios) (Table 5 in the report);”
- “Arrival times can be as early as 4 minutes to the shore and can increase to more than 60 minutes inland;”

Further details including the report’s limitations can be sought in the official report.





“The Caribbean Sea and the Atlantic Ocean have many potential sources for tsunami generation including earthquakes, sub-aerial, submarine landslides and underwater volcanic explosions;”

- “Since 1900, there have been five tsunamis which resulted in deaths in the Caribbean Region (National Geophysical Data Center, 2023). Four of them were caused by earthquakes, while one was generated by meteorological condition (meteotsunamis).
- The most destructive tsunami in the Caribbean (occurred in 1946 in the Greater Antilles and was triggered by a magnitude 8.1 earthquake in the Dominican Republic) killing around 1,800 people (Science News, 2005).
- Further, in 1918, in Puerto Rico there was a magnitude 7.5 earthquake that triggered a tsunami with waves measured at approximately 5.5 meters (20 feet).
- The 2010 Haiti earthquake resulted in a tsunami which caused at least three fatalities.
- According to the NCEI/WDS Global Historical Tsunami Database (2023) since 1498 there have been 65 confirmed (validity 3+) tsunami events observed in the Caribbean Sea and adjacent (i.e. Gulf of Mexico, South Carolina/Florida Atlantic coast), causing 4,492 deaths.
- Most of these tsunamis were associated with underwater, or what are called submarine earthquakes, although the Caribbean Sea region has all of the potential tsunami-generating sources: submarine earthquakes, subaerial or submarine landslides and volcanic activity…” (National SOPs)

History of Tsunami Preparedness in Dominica

01

Tsunami Preparedness Pre - 2019

02

National Tsunami SOPs 2019-2020

03

Tsunami Ready Recognition Program 2023-2024

Tsunami Preparedness Pre - 2019

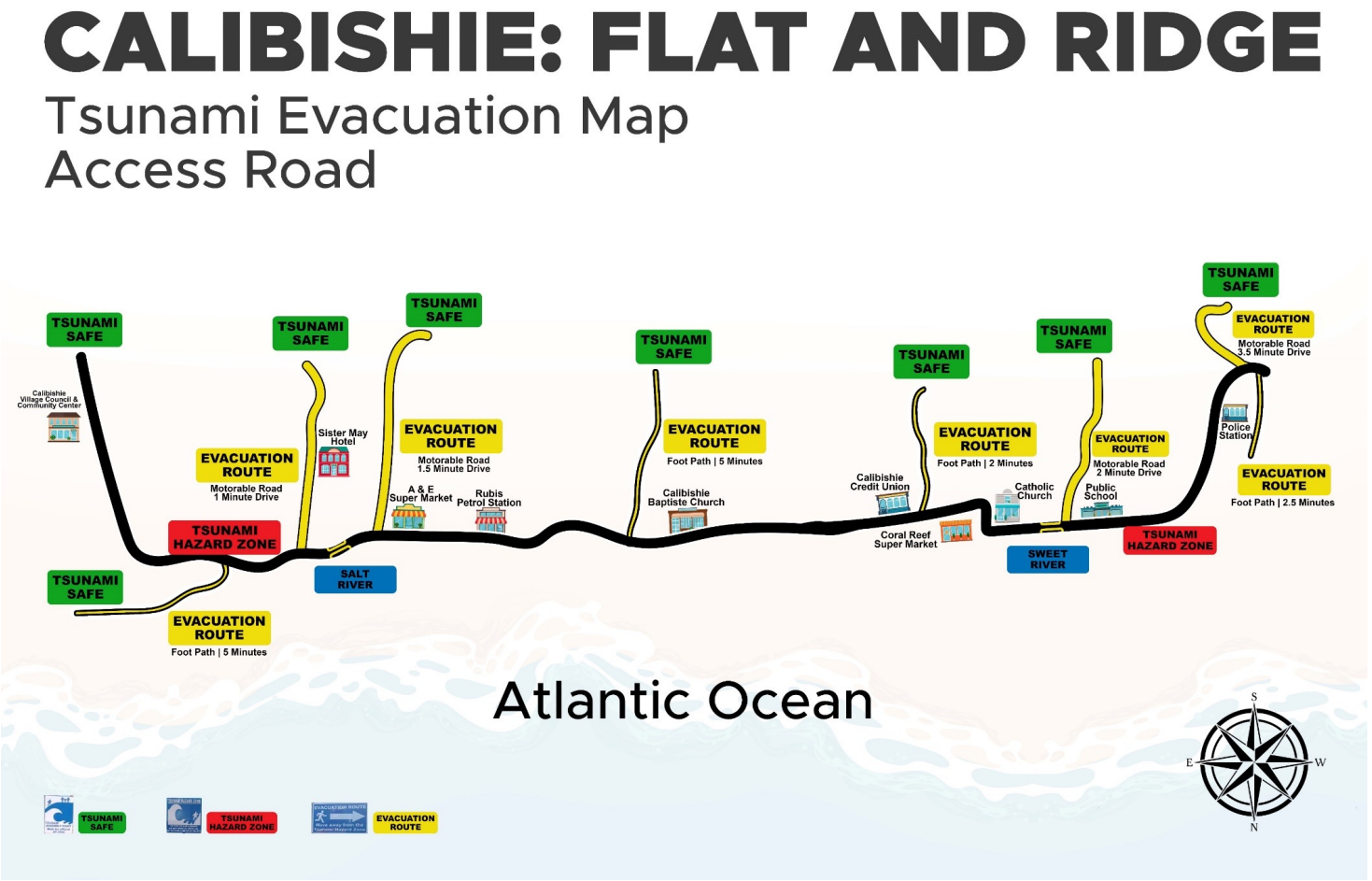
In 2019 an evacuation map was sketched and some tsunami signage was replaced in the Calibishie community on the northeast coast – through steel frame signage and wall painting by a local artist; there was also the drafting of their tsunami SOPs; and a tsunami simulation involving the community with 50+ stakeholders from various relevant agencies like first responders, the Dominica Red Cross, the Village Council, Disaster Management Committee, UNDP reps, government officials, etc. Tsunami awareness sessions were also held with key community agencies as well as with the general public and the Primary (Elementary) School in the area.

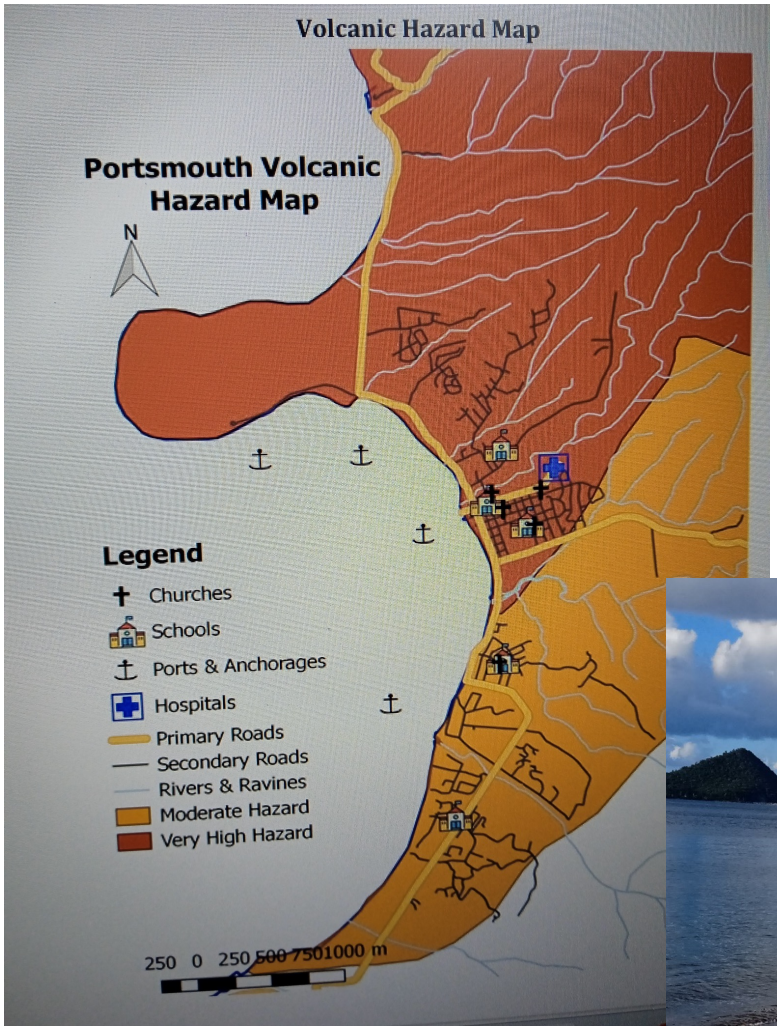
Lessons learned were documented and have been applied to tsunami preparedness since then.

The Calibishie tsunami evacuation map was developed using simply the 10 meter counter line (30 ft above sea level) to demarcate the evacuation zone as compared to the new maps (Portsmouth – shown later) which have made use of a more scientific process.

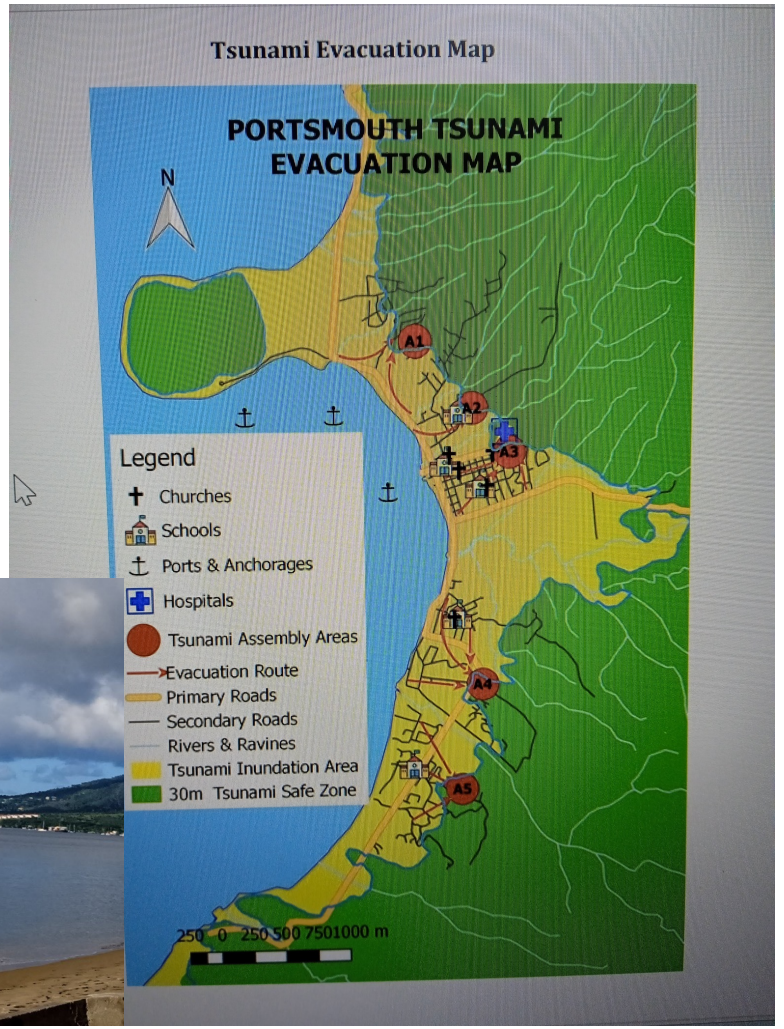
The Calibishie map primarily focused on exit locations and routes including assembly points without specifically indicating the parameters of the flooding / inundation that would take place.

All future maps will be more scientific.





This former map of Portsmouth pre-2020 is also an example of the tsunami evacuation maps that were developed without the more sophisticated technology and process used today.



Community leaders and stakeholders in Calibishie were engaged in several days of learning, mapping and planning.

Primary School students and staff conducted tsunami drills at the same time with members of the community.

The Office of Disaster Management (ODM) sometimes partners with the Ministry of Education during the annual regional Caribe Wave to conduct tsunami drills in various districts on the island.

National Tsunami SOPs 2019-2020

Dominica's National Tsunami Protocol & Standard Operating Procedures (Version 2.0, December 2023)

Sets the framework and context for the management of Tsunami preparedness, warning and response.

Defines the interaction of key actors internationally, regionally and nationally who are responsible for Tsunami events.

Outlines the standard operating procedures to be implemented if a local, regional or distant tsunami were to impact the Commonwealth of Dominica.

Parallel to the experience in Calibishie, the UNDP and other partners supported the development of the National SOPs for Dominica.

Tsunami Protocol Outlines:

- The initiation of threat messages from the Pacific Tsunami Warning Centre (PTWC) up to the "All Clear" interpreted and disseminated to the public by the Dominica Tsunami Warning Focal Point – which is the Office of Disaster Management (ODM) - and warning center staff through alert and notification mechanisms;

- The Tsunami decision making criteria tables, alert levels and the warning products disseminated by the Pacific Tsunami Warning Centre;

- The main actors and their responsibilities regarding the alert, warning and response systems nationally and at the community level;

- The checklist procedures for evacuation and post impact of local, regional and distant tsunamis;

- The templates for local messaging around alert levels for quick and concise notifications to the public; and Glossary;

The National Tsunami Warning Focal Point - ODM

"At the national level, the Office of Disaster Management (ODM) will act as the National Tsunami Warning Focal Point (NTWFP) and National Tsunami Warning Center (NTWC) and the Control Agency for the response to a tsunami event. The National Disaster Coordinator will serve as the contact point for the ODM. Other agencies will support operations as detailed further in this document.

The NTWFP is on the special country Tsunami Focal Points list of the PTWC and is responsible for quickly and accurately translating the message, while the NTWC is responsible for disseminating Warnings, Advisories and other notifications to the public and other key stakeholders. The NTWFP and the NTWC will authorize the activation of alerts and warning systems and will be at central command at the National Emergency Operations Center (NEOC) during a Tsunami event.

The Office of Disaster Management embraces a culture of shared and individual responsibility within the country's national disaster management programming. Comprehensive tsunami preparation in Dominica requires the collaboration and input of national and community stakeholders to ensure the following:

- Undertaking risk assessments to gain an appreciation of tsunami risk;
- Engaging with communities regarding tsunami risk;
- Working with communities to plan how to prepare for and respond to the tsunami risk;"

- “Providing emergency information and tsunami warnings including identification of tsunami inundation zones, evacuation routes and assembly areas;
- Installing Tsunami signage;
- Ensuring an effective, well-coordinated response during a tsunami event;
- Helping communities to recover from and embrace learning following a tsunami event as a means of building their resilience to future events;

It is agreed that if the proper stakeholders are not identified or do not work together, the public will not receive a timely warning and the End-to-End system will fail to deliver alerts and messages to individuals in threatened communities.

Existing institutions within communities, Village Councils, Disaster Committees, Police and Fire Stations, schools and health centers, will be guided by their integrated protocols to respond effectively and efficiently after receiving Tsunami alerts from the ODM.” – (National SOPs)

Tsunami Alert Levels for Dominica are detailed next.

Tsunami Alert Levels for Dominica

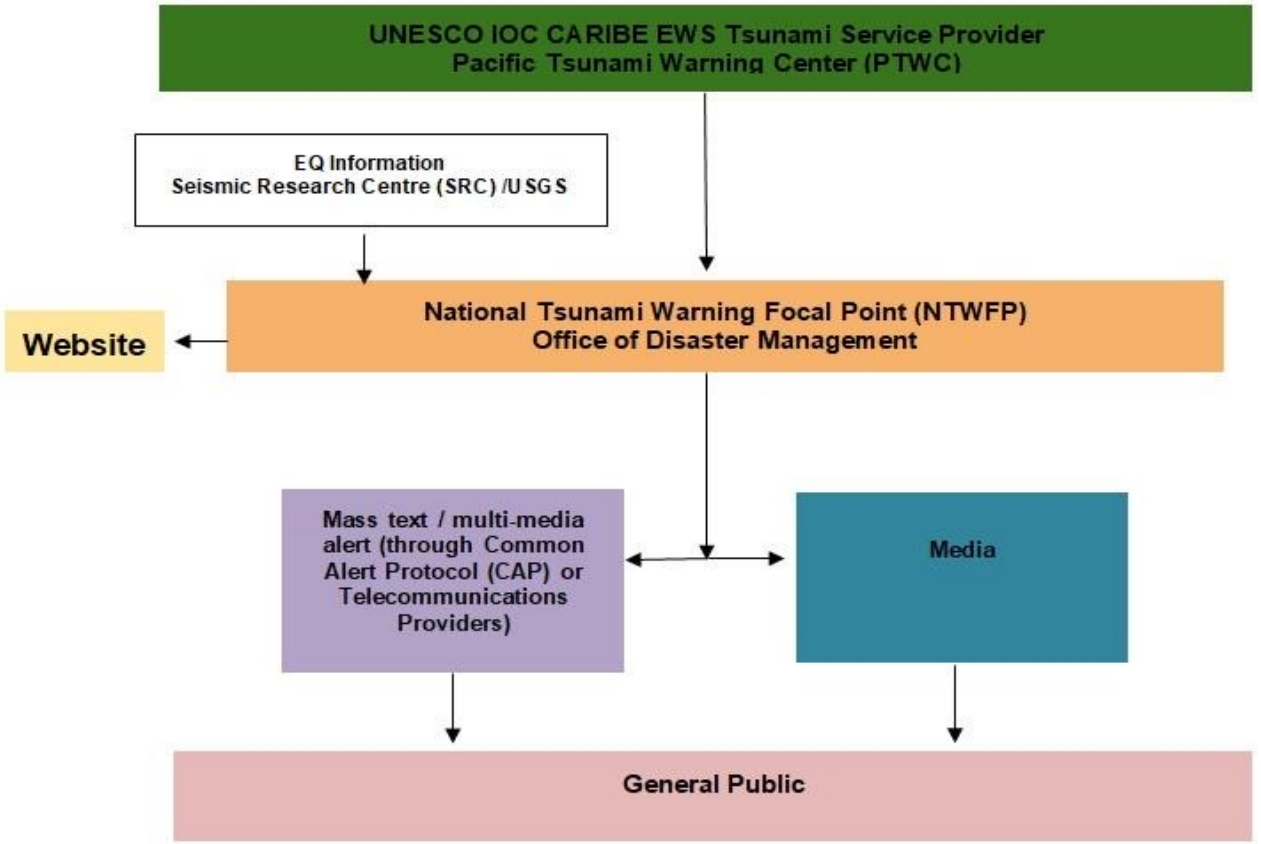
Alert Level	Color Code	Description	Recommended Action
Warning	**RED**	Issued when there is imminent danger of coastal flooding from tsunamis within three hours.	**Evacuate; Move quickly/ run to higher ground**.
Advisory	**ORANGE**	Issued when there is imminent possibility of dangerous currents from tsunamis (no flooding).	**Move out of the water, off the beaches and out of harbors and marinas**
Watch	**YELLOW**	Is issued when there is a distant earthquake and if a tsunami were to be generated and impact Dominica, it would take at least 3 hours and the local threat is under evaluation.	People will be instructed to **stay tuned for further official information**.
Tsunami Bulletin	**GREEN**	Issued in the case of a small or distant event with no local threat. It is issued for information only.	NONE – issued for information only
Cancellation	**WHITE**	If a Tsunami Warning, Advisory or Watch is issued, once the threat has passed or the evaluation yields there is no threat to Dominica, a Cancellation will be issued.	This only indicates that there is no longer a tsunami threat, but if there has been tsunami impact people will have to wait for an **All Clear** to be issued by ODM indicating it is safe to return.

The Office of Disaster Management (ODM) acting as the National Tsunami Warning Center (NTWC) and the National Disaster Coordinator serving as the National Tsunami Warning Focal Point (NTWFP) will receive the initial products from the PTWC.

If the product is a Tsunami Threat Message, the NTWFP will quickly and accurately explain the Threat Message and disseminating Warnings, Advisories and other notifications to the public and other key stakeholders through mass SMS (cell phone texts) through the CAP system [if functioning] or the telecommunications companies, and or simultaneously disseminate through the mass media to the general public.

The NTWFP and the NTWC will authorize the activation of alerts and warning systems and will be at central command at the National Emergency Operations Center (NEOC) during a Tsunami event.

FIGURE 1. DOMINICA ADAPTED TSUNAMI MASS WARNING PROTOCOL

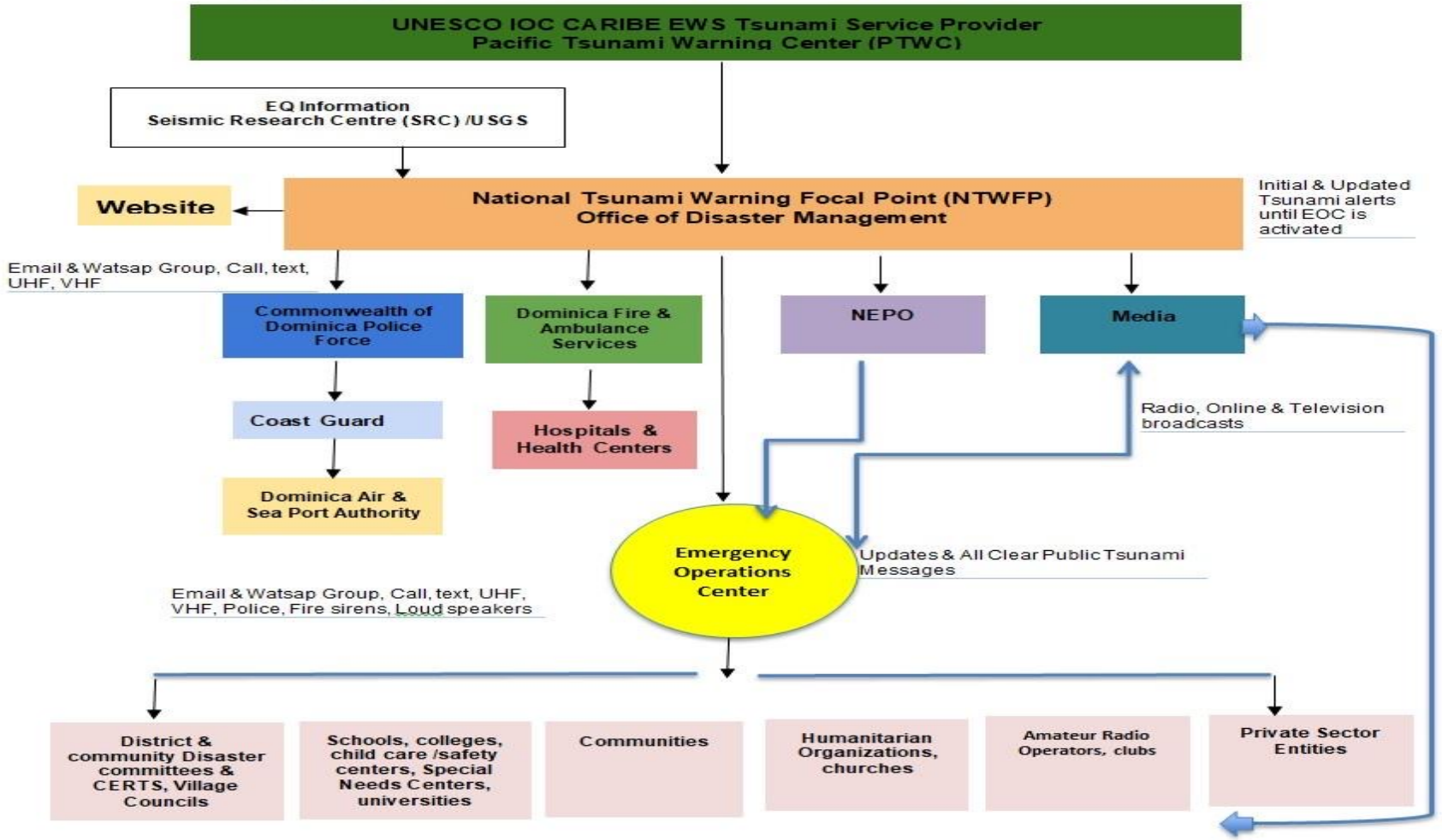


Dominica's Adapted Tsunami Response Protocol

- "There may be multiple cascading events that result from an earthquake generating are tsunami and these could include fires, collapsed buildings, hazardous material spills, flooding etc. The National Emergency Operations Center will be activated to manage these events (stakeholders to refer to SOP-EOC v1.4). Acknowledgement of warning and alert messages will be the standard practice to ensure effective end-to-end systems."

- The response protocol is depicted as follows:

FIGURE 2. DOMINICA ADAPTED TSUNAMI RESPONSE PROTOCOL



Tsunami Alert and Notification Tools for Dominica

TOOL
Emails
Text
Common Alerting protocol (CAP)
WhatsApp Groups
Telephones (landlines)
Sirens of Police Station vehicles and Fire Station & ambulance vehicles
Radio & television Interrupt
Static Road/Beach Signs
Mobile Loudspeakers
Amateur Radio
Church Bells
Computer pop-ups
Selected Indoor alerting/warning systems
Door-to-Door alerting and warning
Town criers / Loud hailers

Challenges related to Tsunami warning are mainly due to inadequacy and variety of modernized mass warning tools adaptable to any circumstance (electricity/no electricity), and the usual staffing limitations.

Tsunami Ready Recognition Program 2023-2024

The town of Portsmouth was selected to participate in the Tsunami Ready Recognition Program for various reasons:

there is historical risk to the Portsmouth area, Portsmouth has experienced major earthquakes in the past, and has previously conducted some activities related to Tsunamis, but more so it has the essential structures such as local authority, disaster committee, Police, Health, Fire services and others that are critical for preparedness and response.

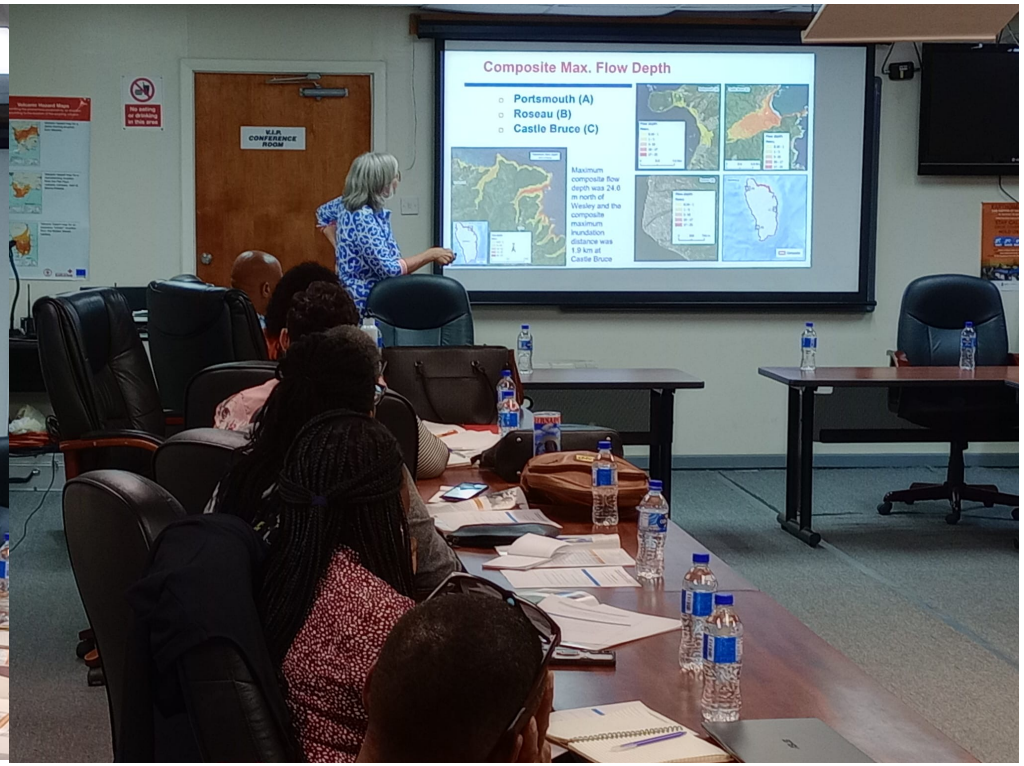
Catholic Church building in Portsmouth destroyed by 2004 earthquake of 6.3 magnitude is now fully rebuilt and operational.

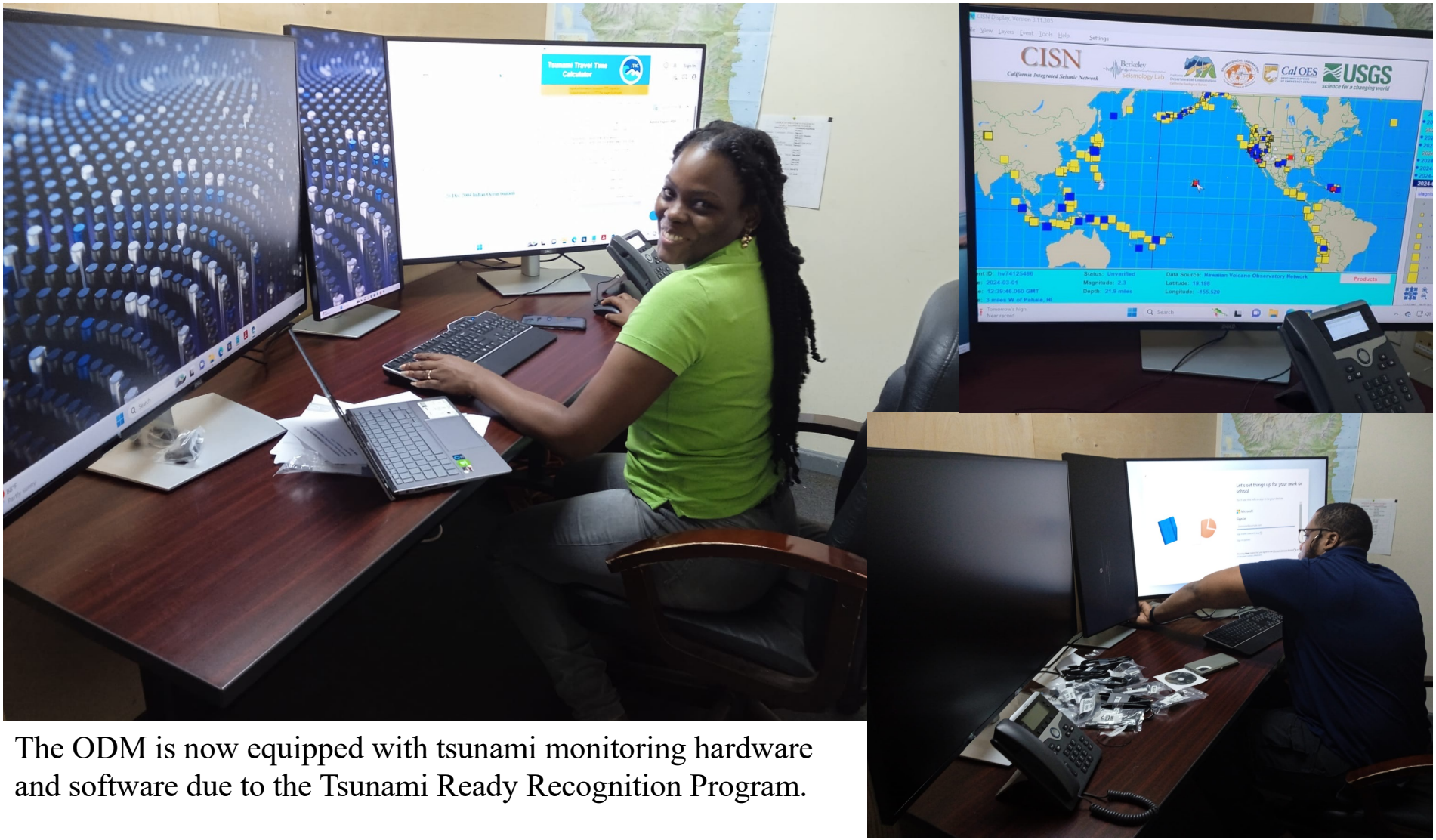
Output deliverables of program implementation in Portsmouth over the last year include:

1. A scientific tsunami hazard assessment for Dominica [includes a tsunami hazard map for all of Dominica – SINAMOT report]
2. A national tsunami ready board
3. An updated /revised national tsunami plan & SOPs
4. Tsunami Ready SOPs for the town of Portsmouth
5. An evacuation map for Portsmouth
6. A tsunami community exercise that tested warning & evacuation
7. 15 tsunami signage installed in Portsmouth
8. 15 megaphones distributed to key first responder & other institutions
9. Community awareness and education outreach
10. And finally, the official recognition ceremony (tabled for late September 2024)

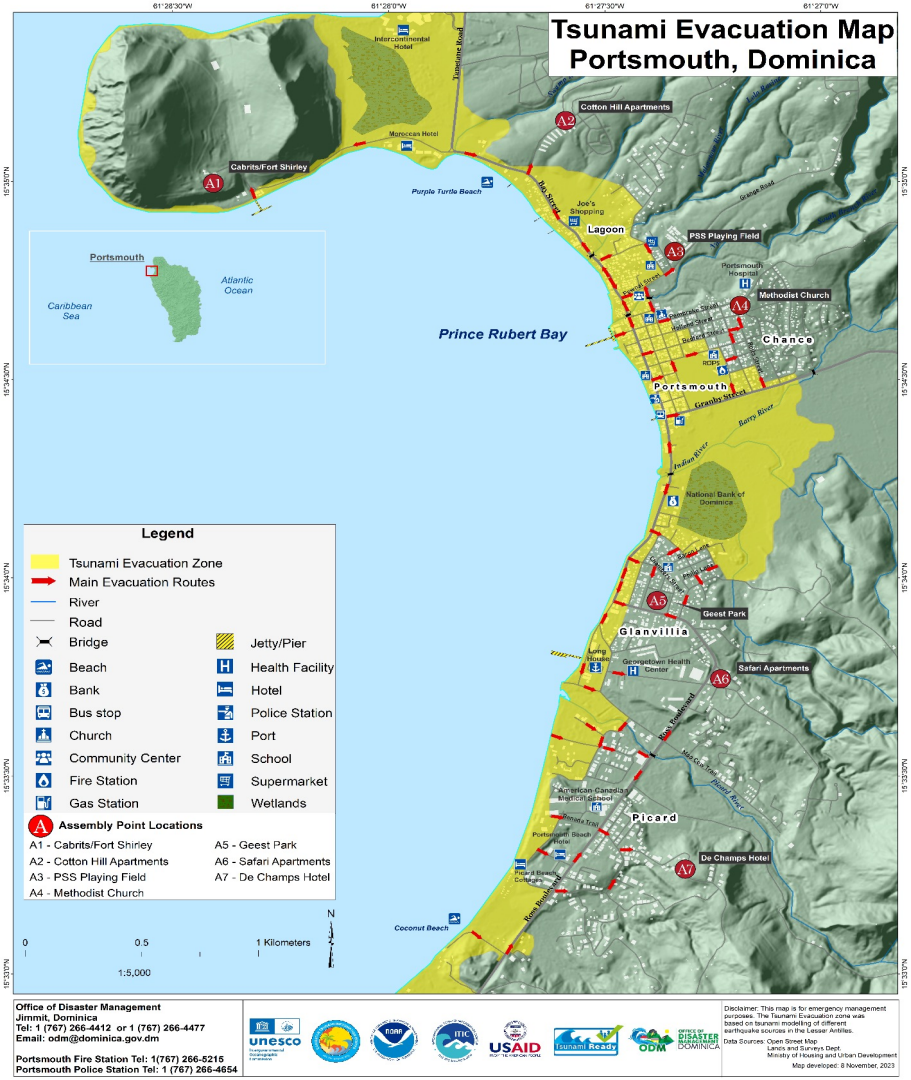
The Tsunami Ready Recognition Program is initiated internationally by UNESCO's Intergovernmental Oceanographic Commission - UNESCO/IOC and regionally, by the International Tsunami Information Centre, Caribbean Office UNESCO/IOC.

Activities and products such as signage etc. during these last several months have been funded by the USAID through the University Corporation for Atmospheric Research (UCAR). – *Much appreciation to all*



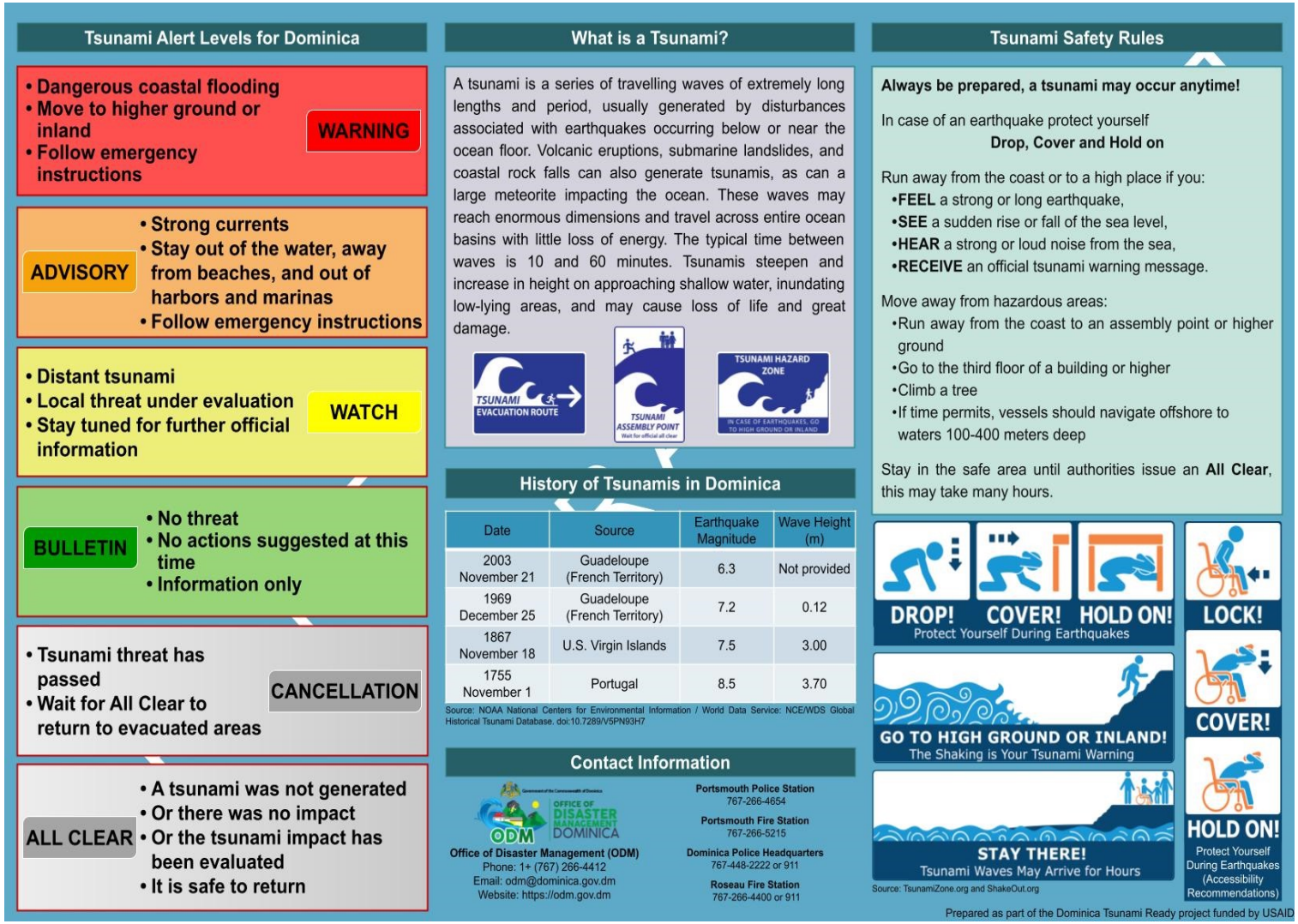


The ODM is now equipped with tsunami monitoring hardware and software due to the Tsunami Ready Recognition Program.



Key leaders and stakeholders from the town of Portsmouth contributed to the development of the tsunami evacuation map for Portsmouth and the publication of it was done by staff of the Physical Planning Division with support from the Lands and Surveys Division and ITIC staff in Puerto Rico.

Portsmouth's map was developed using bathymetry survey in addition to digital elevation model that shows the topography of the land and is much more accurate and the DEM was generated from the lidar survey that was done between 2017 & 2018.



Portsmouth residents, businesses and institutions were given printed maps with safety information on the reverse side of the tsunami evacuation map.

“people located on land less than 30 meters in height need to be consistently educated on how to prepare and respond to tsunamis. Their communities and cities should also have the requisite tsunami mapping and signage for evacuation routes, safe zones / assembly sites, and this could include the demarcation of strong steel reinforced buildings / structures that would facilitate elevated evacuations,”(National SOPs).

Areas selected by the Town Council for signage had to be approved by the Physical Planning Division.

Various Tsunami signage were developed locally and installed throughout the town of Portsmouth.

The signage process took the longest as some sites had to be re-evaluated and even changed due to various planning rues.

Handover of megaphones to first responder agencies, schools and community groups to assist with early warning and mobilizing the evacuation out of the hazard zone…

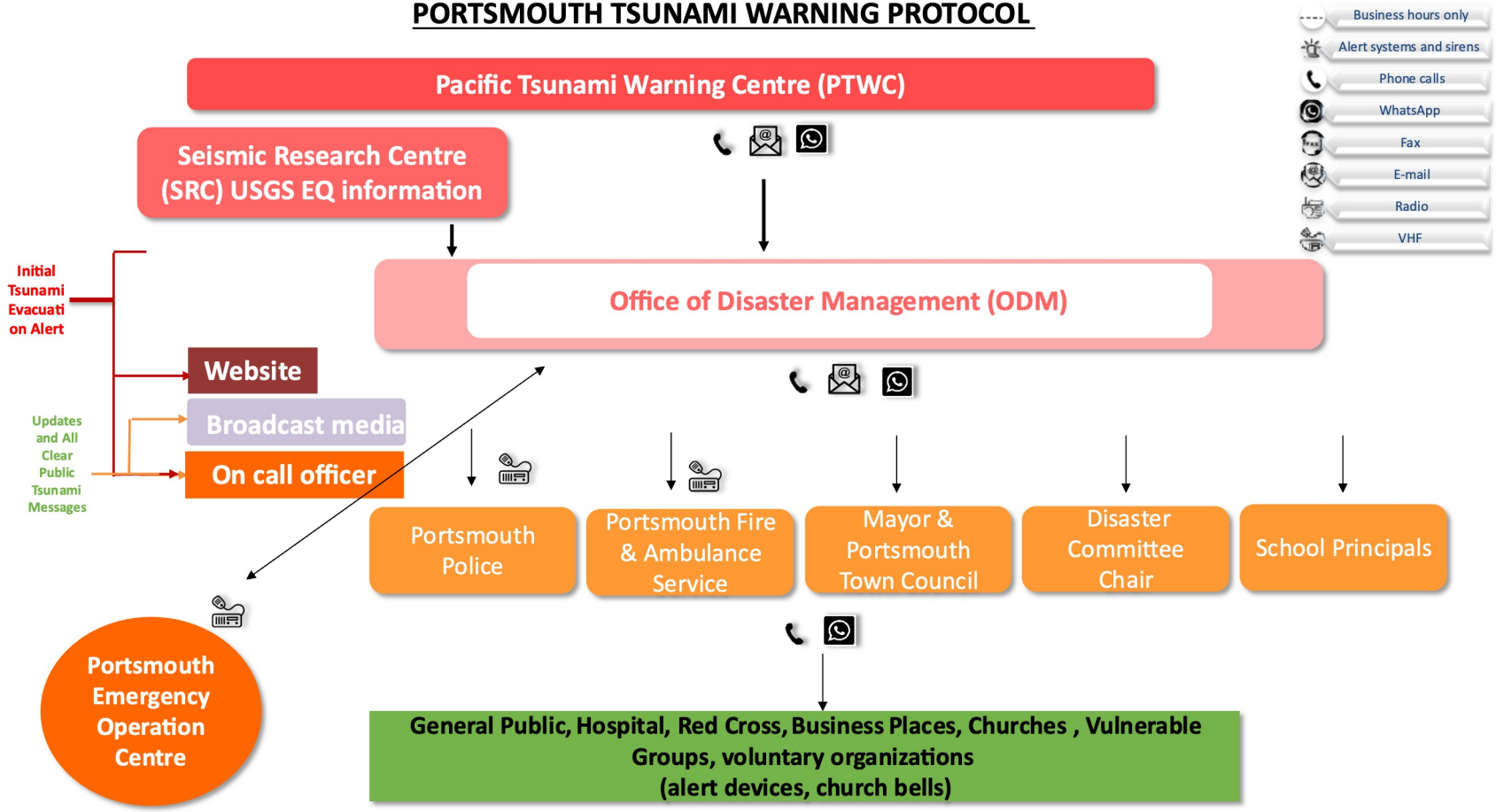
Tsunami awareness sessions with schools in Portsmouth (right)

National Disaster Coordinator, Fitzroy Pascal, and ITIC – CAR Manager, Christa G. von Hillebrandt-Andrade, at one of the three, new ‘Regional Emergency Shelters’ on the West Coast near the ODM.

The Town of Portsmouth now has a Tsunami SOPs and Warning Protocol which was developed with the input of the leaders and residents of the community. It reflects similar content categories / sections to the National SOPs.

The Tsunami Warning Protocol for Portsmouth is depicted in the following diagram.

PORTSMOUTH TSUNAMI WARNING PROTOCOL



The National Disaster Coordinator with the Mayor of the Town of Portsmouth with some of the town's Police Officers, Fire Officers, staff of the ODM, first responders, volunteers of the Disaster Management Committee and others at the Emergency Operations Centre building in Portsmouth post the After Action Review which completed the tsunami exercise.

Mayor of the Town of Portsmouth (2nd from the left), Ms. Kerry Prince represented Dominica at the 2024 Ocean Decade Conference; Spain: back in April to share the Portsmouth experience .

Overall, the intention is to continue to prepare as many communities in Dominica as possible to be tsunami ready.

THANK YOU!