Caribbean and Adjacent Regions Tsunami Sources and Models (CATSAM) Map Viewer

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Introduction

The Intergovernmental Coordination Group for the Tsunami and other Coastal Hazards Warning System for the Caribbean and Adjacent Regions (ICG/CARIBE EWS) was established in 2005 as a subsidiary body of the Intergovernmental Oceanographic Commission of UNESCO (IOC-UNESCO) with the purpose of providing efficient assistance on tsunami risk reduction to Member States in the Caribbean region. Since 2011, CARIBE-EWS has benefited from IOC-UNESCO Experts Meetings and CaribeWave exercises that have produced a variety of credible tsunami scenarios that would impact the Caribbean and adjacent regions.

CaribeWave exercises are intended to improve Tsunami Warning System effectiveness along the Caribbean coasts. The exercises construct plausible tsunami sources, which provide an opportunity for emergency management organizations throughout the region to test response procedures. The Expert Meetings are multidisciplinary efforts to help identify earthquake and tsunami sources.

Working Group 2 (Hazard Assessment) of the CARIBE-EWS facilitated the developement of the Caribbean and Adjacent Regions Tsunami Sources and Models (CATSAM) Map Viewer. Universidad Nacional, Costa Rica (UNA), and NOAA National Centers for Environmental Information (NCEI), and World Data Service (WDS) for Geophysics developed CATSAM, a geospatial presentation of selected tsunami sources and scenarios for the Caribbean. CATSAM is not intended to identify all tsunami sources in the region, just those identified by experts at CARIBE-EWS led efforts as well as those in the NCEI/WDS Global Historical Tsunami Database.

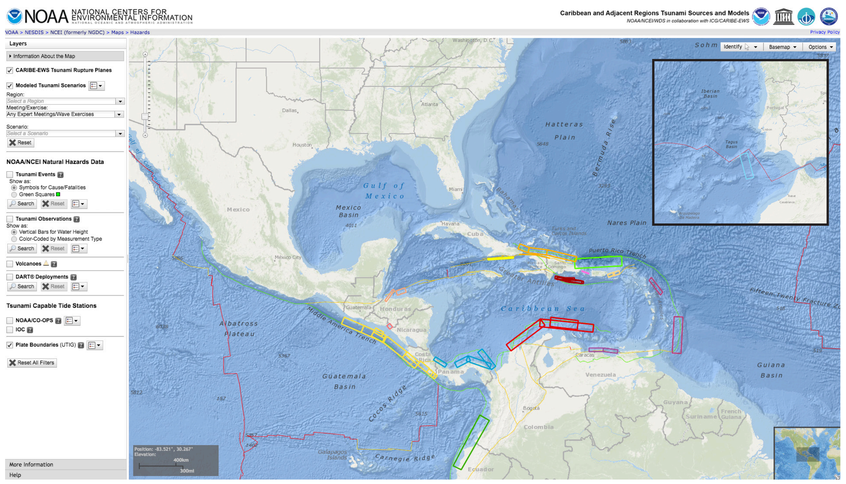

Figure 1. CATSAM currently has 41 defined rupture planes divided into 15 subregions

Initial Concept

In 2016, UNA began the process of making tsunami sources and scenarios derived from CaribeWave exercises and Expert Meetings readily available to potential users such as tsunami researchers and regional decision makers. UNA began to normalize the data to display on an interactive map, via the ArcGIS Online platform. The data displayed included spatial representations of rupture zones and seismic parameters. At the 12th Session of the ICG/CARIBE-EWS in May 2017, the CARIBE-EWS Member States endorsed this effort and a formal recommendation was made to expand the effort by partnering with NCEI/WDS.

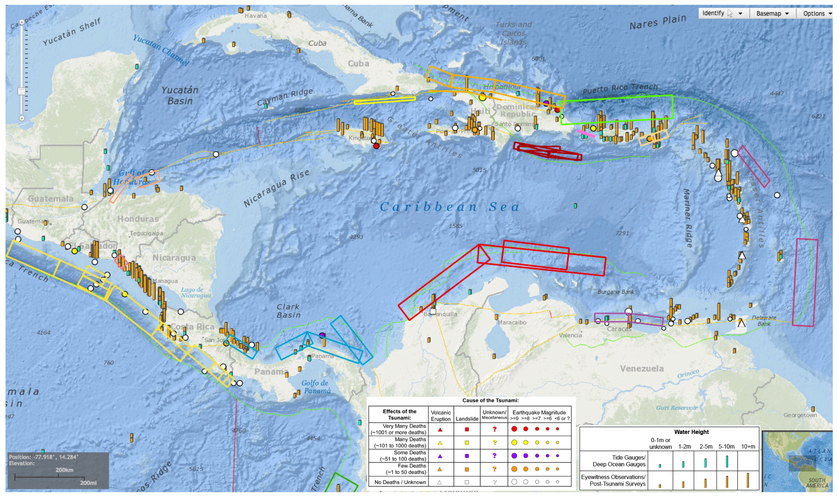

Figure 2. A total of 50 confirmed tsunami source events and over 300 runups are displayed in the Caribbean Sea.

NCEI/WDS Transition Makes More Data Available

During the 13th Session of the ICG/CARIBE-EWS in April 2018, CATSAM was presented to Member States (Fig. 1). A variety of tsunami data was added to the initial effort in 2016. A significant addition is the data from NCEI/WDS Global Historical Tsunami Database (Fig. 2). Most noticeably, tsunami offshore wave amplitude plots (sometimes referred to as tsunami energy plots) are displayed with their associated rupture planes. This enhancement facilitates the capability to compare modeled versus historical events (Fig. 3).

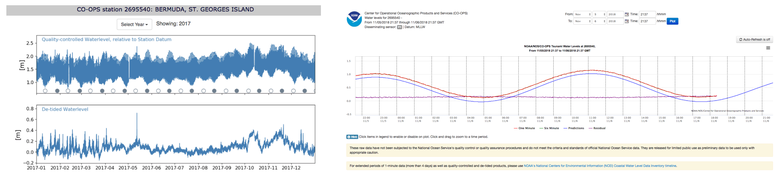

Figure 4. NOAA operated 1-minute tide gauges and DART® bpr in Caribbean Sea with access to quality controlled retrospective data are available through CATSAM (left image example). Access is also provided to the National Data Buoy Center (NDBC) and Center for Operational Oceanographic Products and Services (CO-OPS) websites for the latest real-time data (right image example).

Development on NCEI Platform

CATSAM development was based on the ArcGIS JavaScript API, common JavaScript components, and ArcGIS Server map services hosted at NCEI.

Advantages for hosting CATSAM at NCEI/WDS include:

- URL
  - Hosting on a U.S. government website provides more of a permanent URL. Moreover the URL is easier to remember, instead of the ArcGIS Online URLs with random characters
- Customization
  - Tsunami offshore wave amplitudes service could only be hosted by a local ArcGIS Server (dynamic map/image services are not supported in ArcGIS Online)
  - Filters/searches can be customizable (i.e. search dialogs, drop-down menus, etc.)
  - IOC tide gauge layer required custom code

Summary of Data Available in CATSAM

CATSAM currently has 41 defined rupture planes, divided into 15 subregions (Fig. 1). A total of 23 IOC Expert Meetings and CaribeWave modeled scenarios (with deep-ocean tsunami amplitudes) are currently available.

The following seismic parameters are available for the rupture planes: Depth, Dip, Moment Magnitude, Rake, Rupture Plane dimensions, Slip, Strike.

CATSAM's additional data include:

- NCEI/WDS historical tsunami data
  - Event source info: location, cause (e.g. earthquake), maximum water height, socio-economic data, references
  - Runup info: location, wave arrival time, water height, socio-economic data, references
- Tide gauge and DART® stations
  - NOAA-operated 1-minute tide gauges (14) & DART® Bottom Pressure Recorder (1) in Caribbean. Provides access to quality controlled restrospective data (Fig. 4)
  - IOC tide gauge stations
- Volcano locations

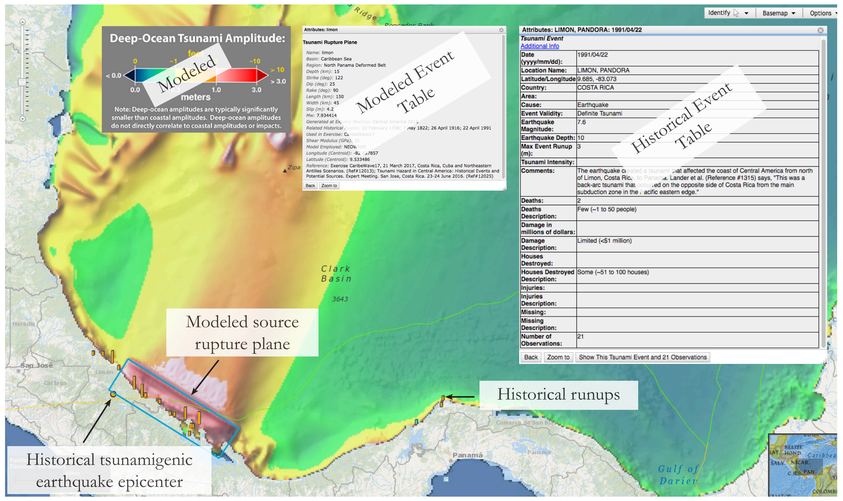

Figure 3. CATSAM facilitates comparisons of modeled versus historical tsunami events.

Moving Forward to Meet Users' Needs

IOC Expert Meetings and CaribeWave exercises help define and characterize hypothetical tsunami sources for Caribbean coastlines that are vulnerable to tsunami hazards. As tsunami modelers, emergency management officials, and other decision makers in the region consider tsunami sources, CATSAM will evolve to meet their needs. For instance, a group of tsunami experts requested a filter/toggle to more easily differentiate between Experts Meetings and CaribeWave scenarios. This new feature has been implemented to facilitate decision-making.

Additional Information, References, and Resources

For more information, visit website below or scan QR code with your smartphone.

https://maps.ngdc.noaa.gov/viewers/CATSAM/