

WORLD TSUNAMI AWARENESS 5 NOVEMBER 2016 DAY

COMMEMORATION IN THE CARIBBEAN

20 OCTOBER 2016, PORT-OF-SPAIN, TRINIDAD AND TOBAGO



Tsunami risk caused by seismic activity in the Caribbean

Dr. Joan L. Latchman – Seismic Research Centre

October 20, 2016



UWI



SEISMIC RESEARCH CENTRE

BE TSUNAMI SMART, KNOW THE NATURAL SIGNS



UWI SEISMIC RESEARCH CENTRE



FEEL → **RUN**
a very strong earthquake?

SEE → **RUN**
the water withdraw an unusual distance?

HEAR → **RUN**
a strange roar?

RUN to high ground or inland
if **ANY** of these signs occur

Presenter: Dr. Joan L. Latchman – Seismic Research Centre

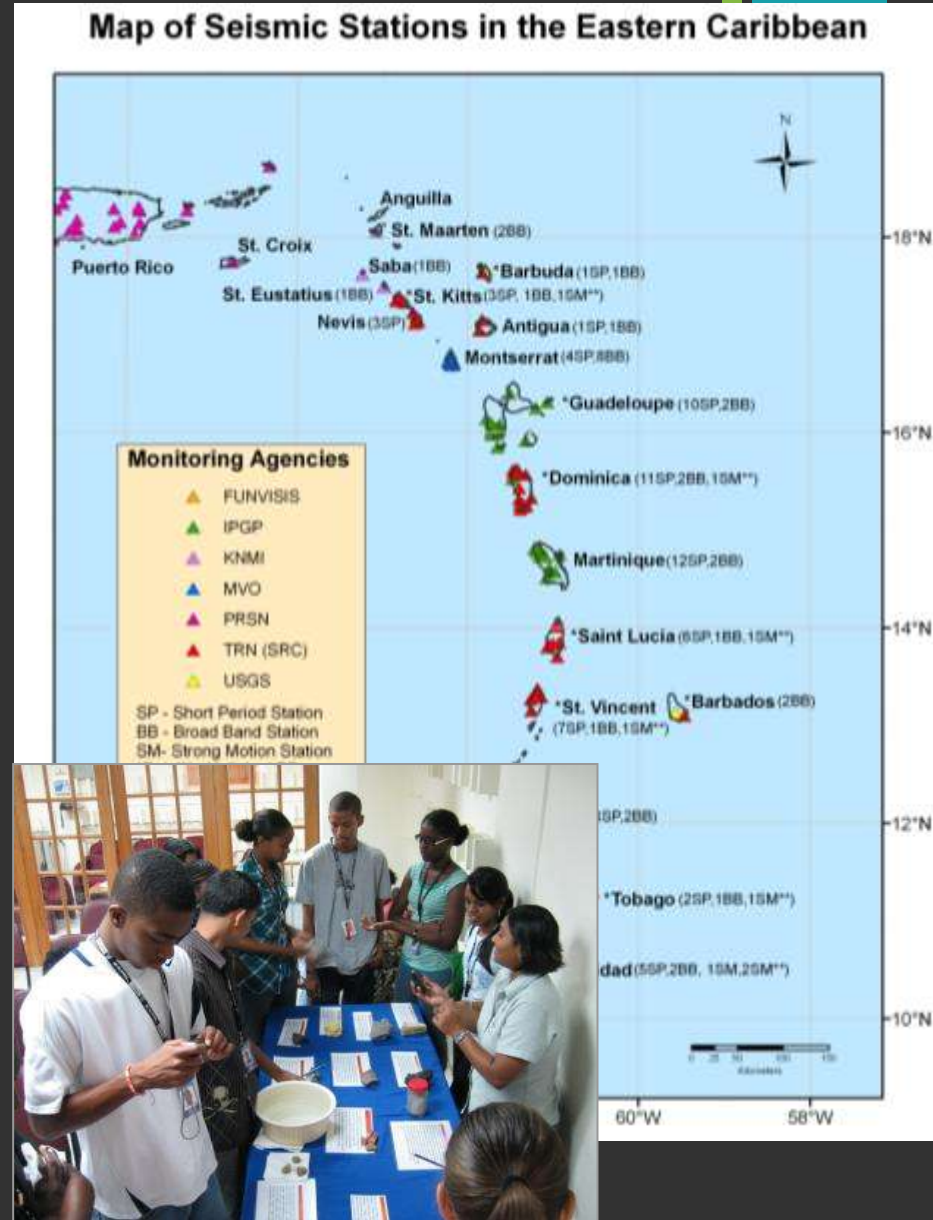
Venue: ACS Headquarters Port of Spain Date: 2016 October 20

WORLD TSUNAMI AWARENESS DAY



About the SRC

- Today, with a network of over 60 stations, and access to about 100, the SRC remains the authoritative source for information on the status of earthquake and volcanic activity in the English-speaking Eastern Caribbean.
- The SRC provides contributing governments with maps and info on geological hazards and also supports disaster management agencies with Education & Outreach efforts.





Tsunami Programme

RSNO Workshop April 2006



The SRC has been supporting tsunami awareness for more than a decade. In recent years, Earth Science is being marked in one or other of our territories of responsibility with outreach to schools and various interest groups to build awareness of the geological hazards, including tsunamis.



RSNO2 Workshop February 2008



Technology Upgrade - 2007



Monitoring and research help us to better understand earthquake patterns in the region and support the tsunami warning effort.



Network Expansion – 2013-2014



Saint Lucia installation April 2013

TSUAREG Project: Tsunami Alert Regional; funded by European Commission; in collaboration with IPGP, Paris through Observatories in Martinique and Guadeloupe.
Four new stations in Antigua, Carriacou, Dominica and Saint Lucia.



Antigua installation October 2013



Carriacou installation March 2014



Tsunami E & O

Barbados Tsunami Smart Campaign
March 2014



Earth Science Week is being marked annually in one or other of our territories of responsibility with outreach to schools and various interest groups to build awareness of the geological hazards, including tsunamis.

St. Kitts Tsunami and Earthquake
Smart Campaign September 2014



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- **RUN** to high ground or inland if **ANY** of these signs occur.
- Do not wait for an official tsunami warning as there may not be sufficient time.



What causes Earthquakes?

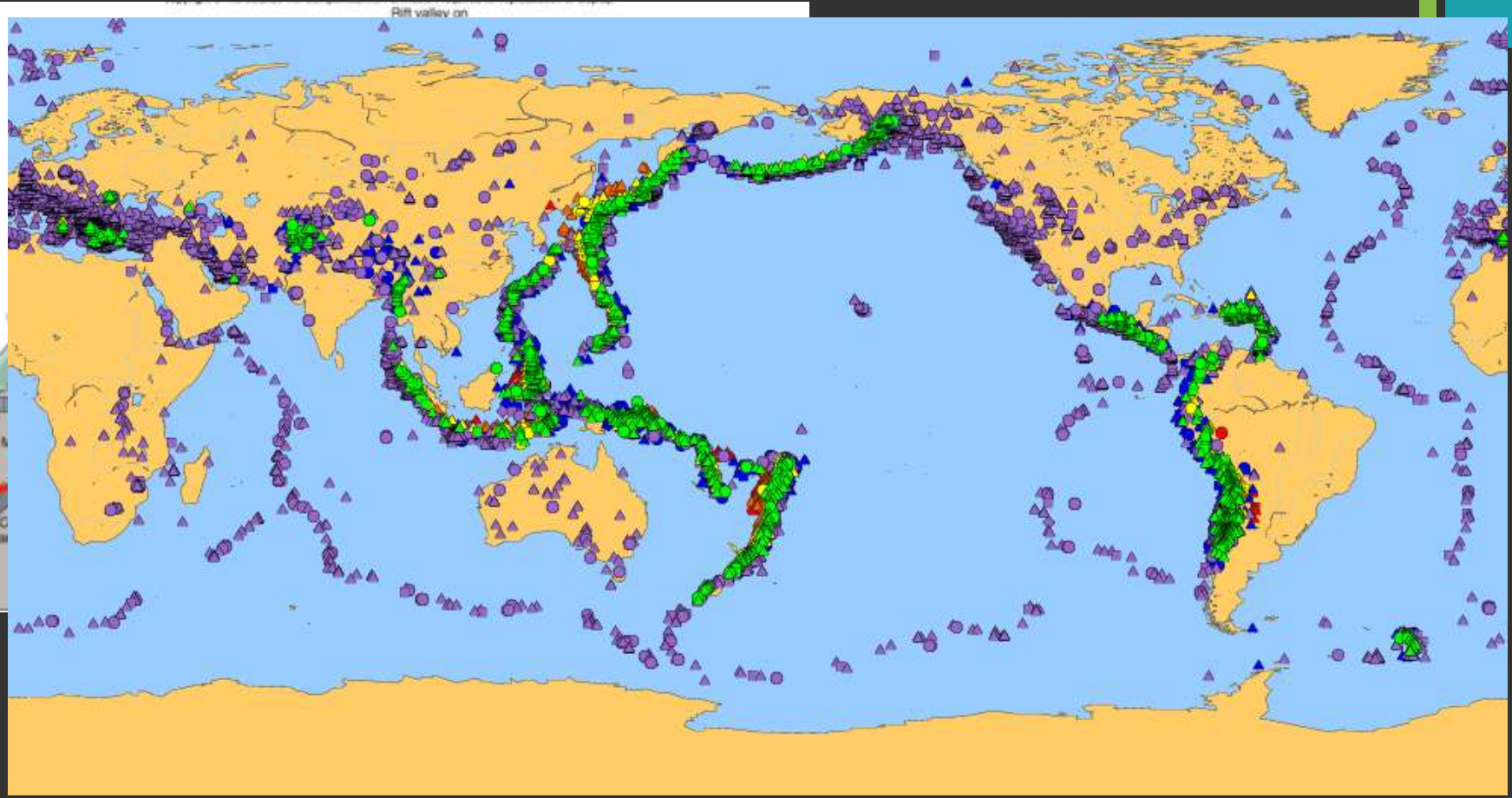


What causes Earthquakes?





What causes Earthquakes?

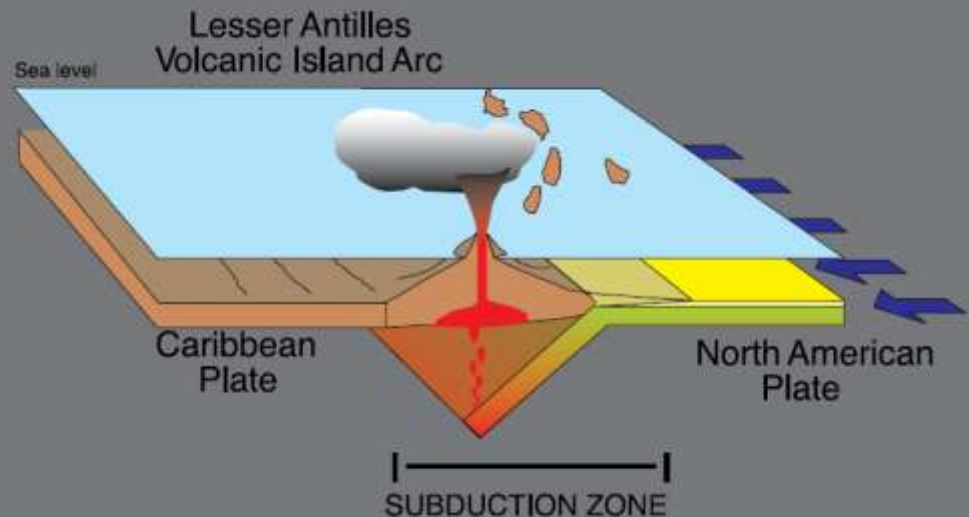
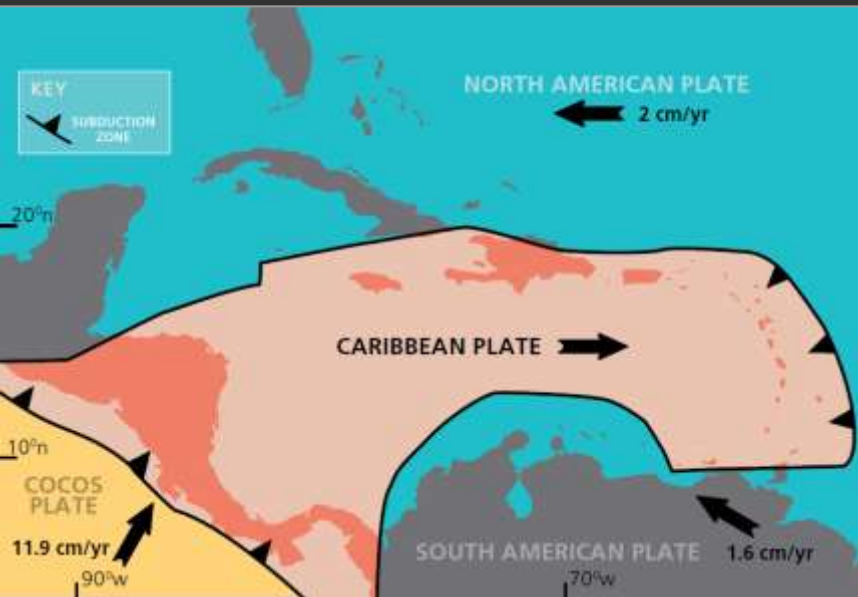




Regional Context



- North American Plate dips beneath the Caribbean Plate.
- Friction causes strain energy to accumulate which is then released in the form of seismic waves or earthquakes.





What causes a tsunami?



- Earthquakes

- How earthquakes generate tsunamis
- Earthquake generated tsunamis in the Caribbean
- Tele-tsunamis

- Volcanoes

- Tsunamis generated by Volcanic eruptions in the Caribbean
- Submarine volcanoes

- Submarine landslides

- Other possible causes – Asteroids/Meteorites



Eastern Caribbean Earthquake facts



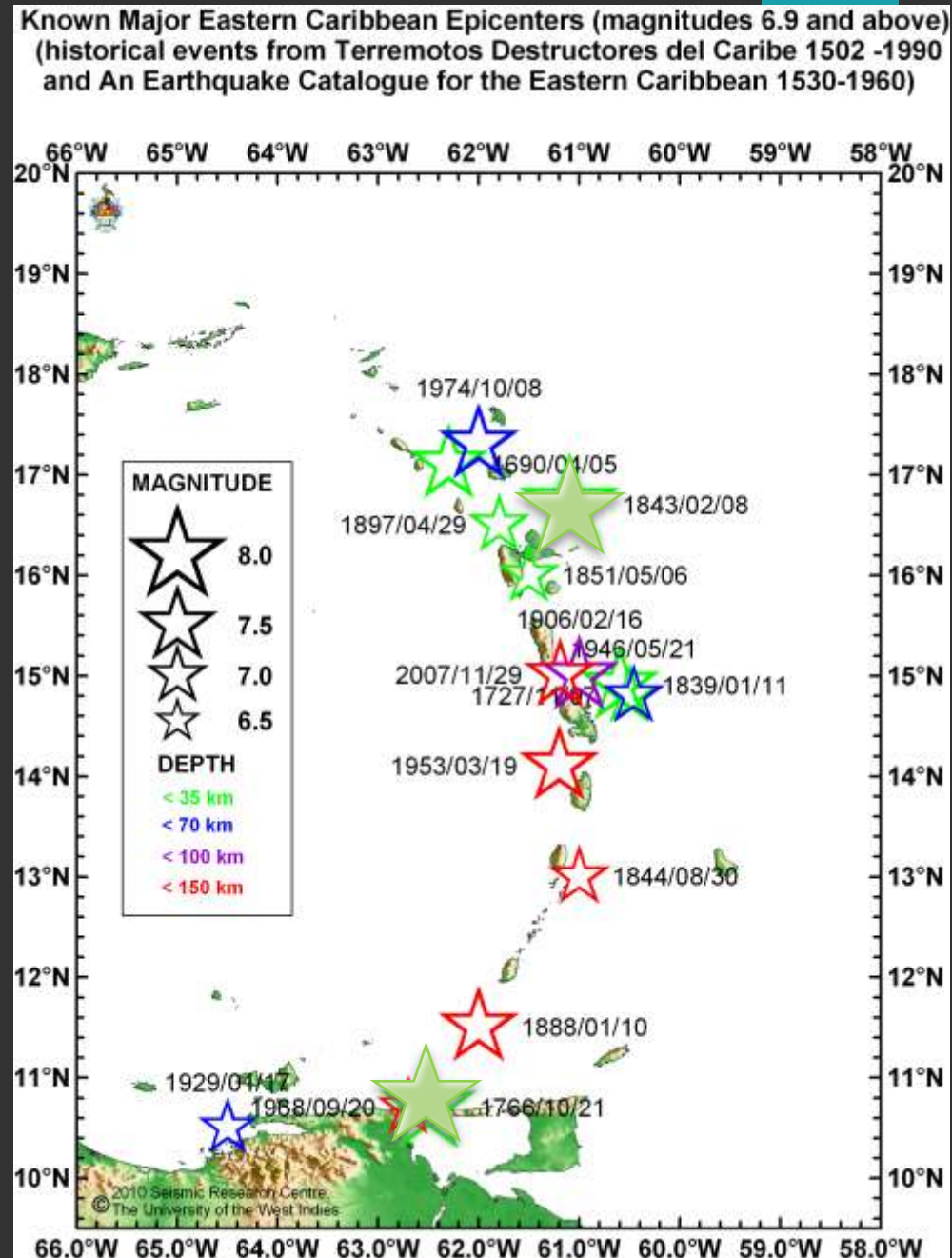
- ~ 2200 earthquakes greater than magnitude 2.0 are recorded annually.
- ~ 3 earthquakes greater than magnitude 5.0 expected each year.
- An earthquake in the magnitude 6 range will occur every 3-5 years.
- In the last 200 years there has been on average an earthquake in the magnitude 7 range every 20-30 years.
- Research suggests the region should generate an earthquake in the magnitude 8 range every 100 years.



Major Earthquakes 1530 - 2007

Events prior to the 1950's were gleaned from historical accounts. Magnitudes derived from felt observations.

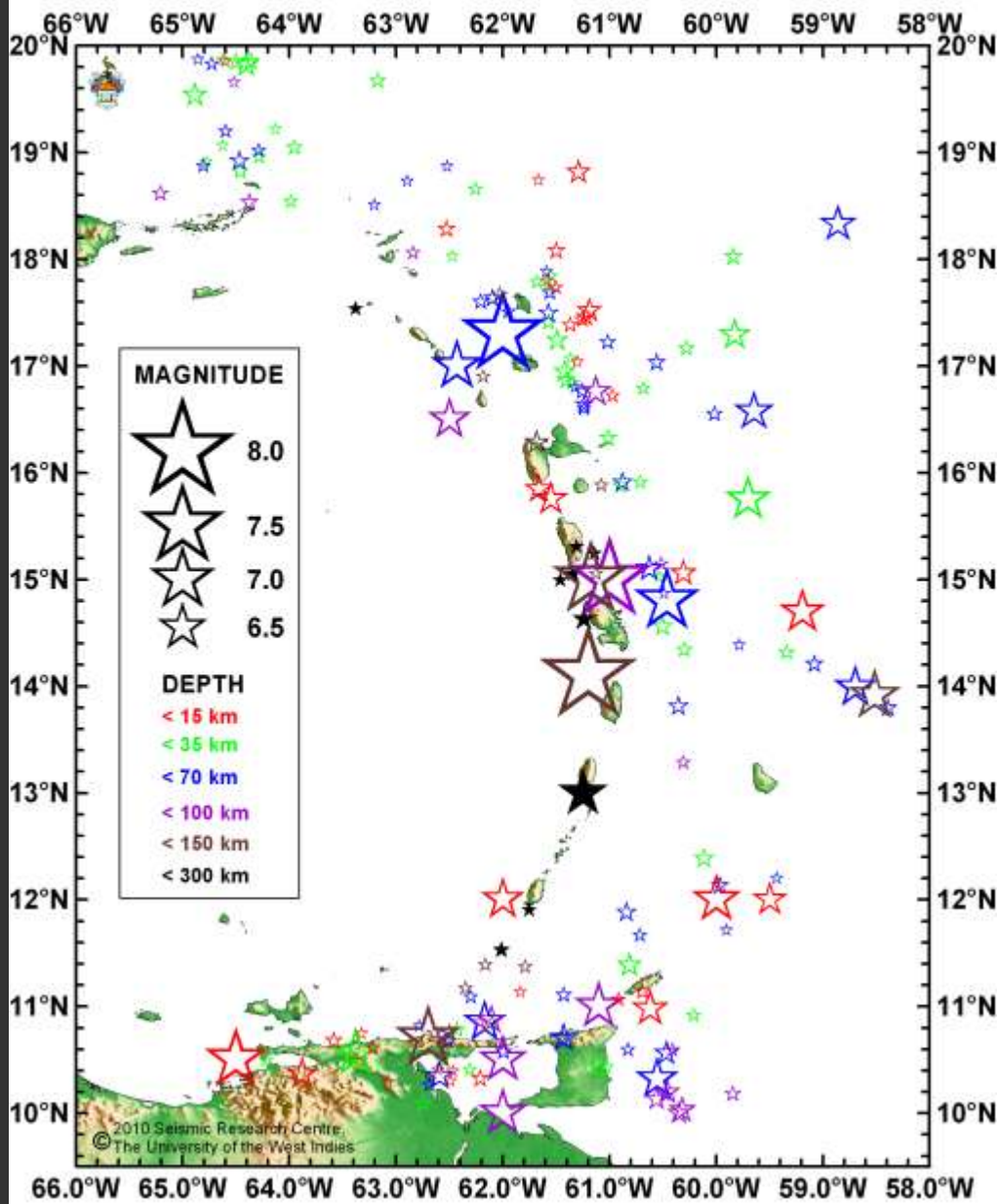
Largest occurred in 1843 and was located between Guadeloupe and Antigua





Eastern Caribbean Seismicity Magnitude 5.0+ 1900-2016

Eastern Caribbean Epicenters 1900-2016 (magnitudes 5.0 and larger)





Volcanic Tsunamis in Eastern Caribbean

- 1761 – Azores Earthquake
 - Origin: Azores fracture zone (near Portugal)
 - Travel time: approx 7 hrs
 - Wave height: unknown
- 1902– Soufrière Eruption
 - Origin: La Soufrière, St. Vincent
 - Travel time: approx 1 hr
 - Wave height: 2-3 meters



Volcanic Tsunamis in Eastern Caribbean



- 1939 – Kick ‘em Jenny Eruption
 - **Origin:** Kick -‘em-Jenny Submarine volcano 9km
 - north – west of Grenada
 - **Travel time:** approx 1 hr
 - **Wave height:** 2 meters
-
- 1997 Boxing Day – Soufrière Hills Eruption
 - **Origin:** Montserrat
 - **Travel time:** less than 30 mins
 - **Wave height:** unknown
 - **Affected:** Montserrat, Guadeloupe



Landslide Tsunamis in Eastern Caribbean

- 1690 –Earthquake
- **Origin:** Near Nevis
- **Event:** liquefaction induced landslips generated tsunamis that affected Charlestown, the capital city.
- **Travel time:** two minutes
- **Wave height:** unknown



REMEMBER

The Eastern Caribbean possess all the features necessary for the generation of significant tsunami:

- Earthquakes
- Volcanic discharge into the sea
- High volume precariously balanced material
- We must continue to push for preparedness at all levels



Thank You For Listening!



Tel: +1 (868) 662-4659 Fax: +1 (868) 663-9293
Email: uwiseismic@uwiseismic.com

www.uwiseismic.com



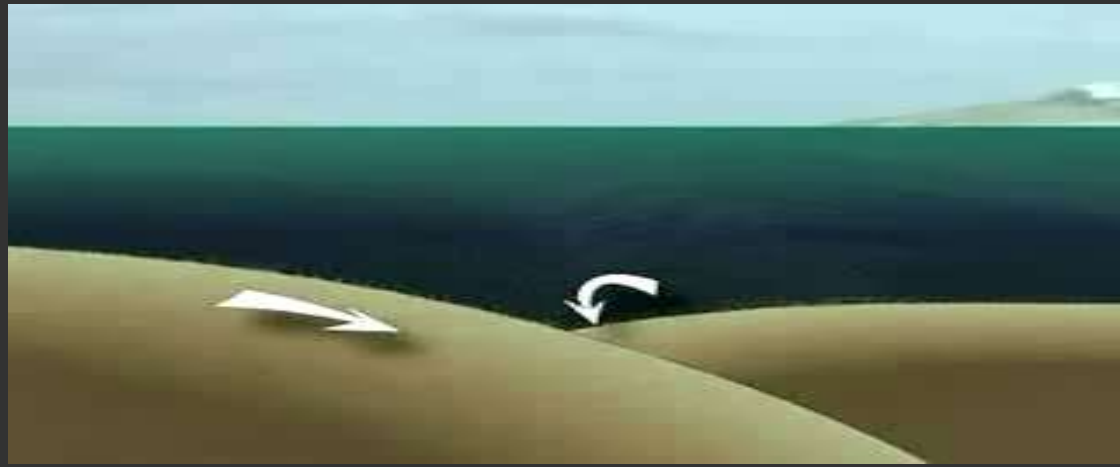
Tsunamis



- Derived from 2 Japanese words
- tsu (**harbour**) + nami (**wave**).

津波

- A series of ocean waves caused by an abrupt **disturbance of the ocean floor** that displaces a large mass of water.
- Waves that radiate outward in all directions from the disturbance and can propagate across **entire ocean basins**.





What a tsunami is NOT!

- Tsunamis have been erroneously called “tidal waves”
- However, it should be understood that these waves have nothing to do with the attraction of the Moon or the Sun
- Tsunamis are mainly caused by earthquakes, landslides and volcanic eruptions





Animation showing Tsunami inundation

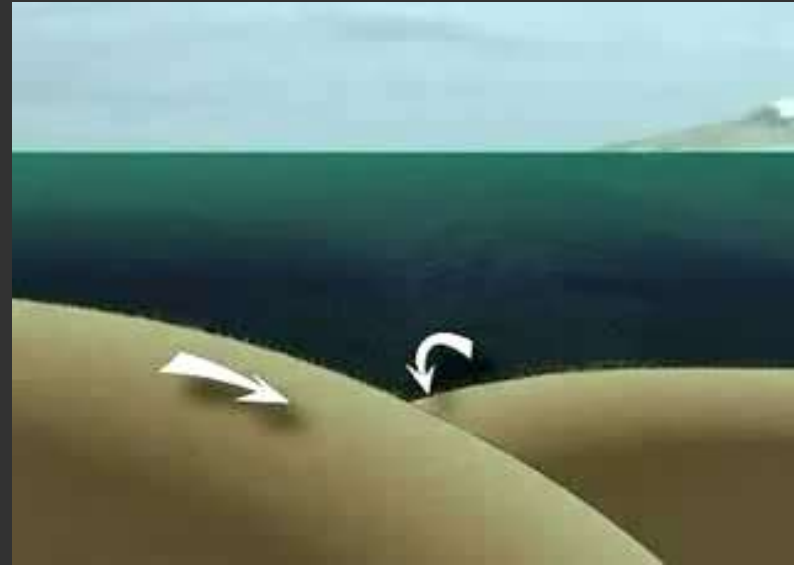




Do all earthquakes generate tsunamis?



- To generate a tsunami:
 - The fault where the earthquake occurs must be underneath or near the ocean.
- But more importantly:
 - A vertical movement (up to several metres) of the sea floor over a large area (up to 100,000km²) must be created.
 - Shallow focus earthquakes (**depth <70km**) of **magnitude >6.5** along subduction zones are responsible for most destructive tsunamis.

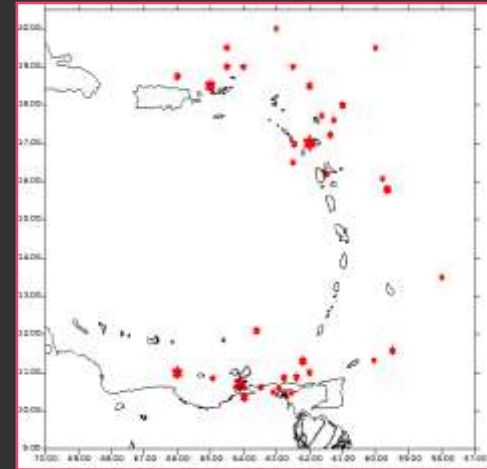




Source of tsunami threats in the Caribbean

- **Local tsunamis:**

- Generated nearby, within the Caribbean region
- Strikes shore quickly (in minutes)
- **NO TIME** for official evacuation

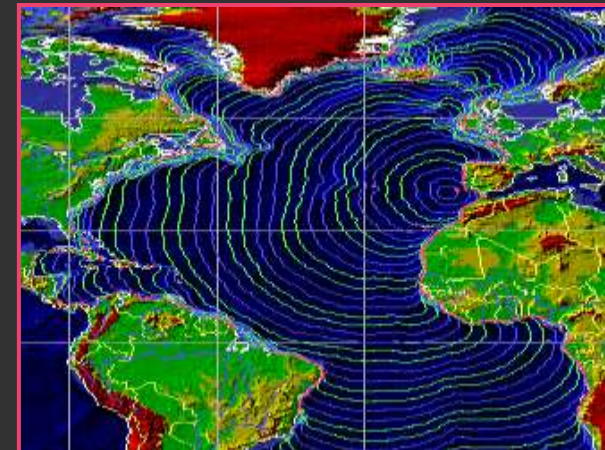


Earthquakes with the potential to generate tsunamis in the Caribbean

- **Tele-tsunamis:**

- Generated far away, and crosses wide open basins, such as the Atlantic Ocean
- Strikes shore later (2+ hours)
- Sufficient **TIME** for official warnings

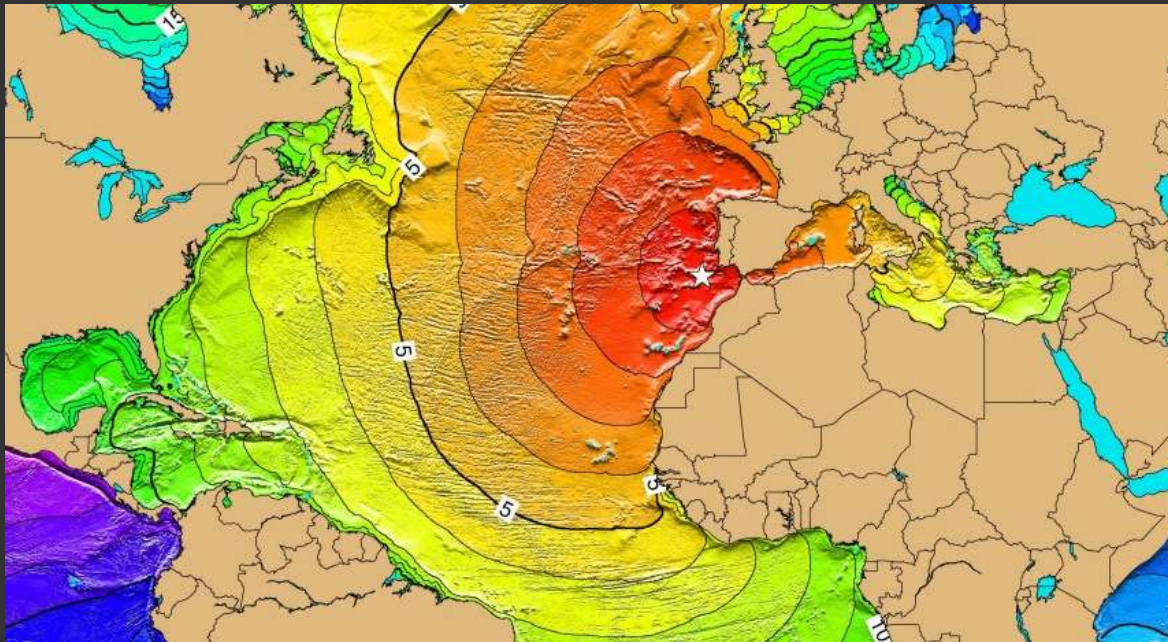
Time travel chart - great Lisbon earthquake generated tsunami of 1755





Tsunamis that affected Eastern Caribbean

- 1755 – Lisbon Earthquake
 - Origin: Lisbon Portugal
 - Travel time: approx 7 hrs
 - Wave height: 2 meters





Tsunamis are powerful forces



BEFORE

Lhoknga, Sumatra January 2003



AFTER

Lhoknga, Sumatra December 2004





Before a tsunami

- Know how far you are from the coast
- Learn the quickest route to get to high ground
- Ensure that you and your family know how to detect tsunami signs
- Have an emergency plan and emergency supplies





Sensing a tsunami

- What to expect?
- Often the first sign is an **Earthquake**
- Followed by a **withdrawal** of the sea.



Sri Lanka, 26th December 2004

Image shows “drawback” or withdrawal of water exposing ~150 meters of temporary beach. Photo: www.digitalglobe.com



Then it returns like a wall of water

- **Never** go to the beach to wait and watch for a tsunami.
- If you can **see** the wave, you are already **too close** to outrun it.
- Remember there are **many** waves and the first wave may **NOT** be the last or largest.





'Preserving our geo-heritage for future generations'

- Geo-heritage sites are an important part of Saint Lucia's history, economy and future.
- Sites that may be susceptible to damage from an oncoming tsunami should be noted and procedures be put in place to limit damage where possible.
- Stakeholders that utilize these sites should be knowledgeable of the potential tsunami hazard and safety tips (natural warning signs).
- It is the responsibility of all to share the information learnt so loss of life and property can be reduced.