

### What are potential sources of tsunamis that may affect Montserrat?

A tsunami is a series of ocean waves caused by an abrupt disturbance of the sea floor. Montserrat and the other islands of the Eastern Caribbean lie in a tectonic setting where the North American plate is sinking beneath the Caribbean plate giving rise to earthquakes and volcanic activity. In this setting underwater earthquakes that rupture the crust may generate tsunamis. Volcanic eruptions and landslides following earthquakes (coastal or beneath the ocean) may also generate tsunamis. Consequently, the entire arc may be considered a potential source for tsunami generation capable of affecting every island.

### Can tsunamis be predicted?

Current understanding does not allow the date, time, magnitude and precise location of a future earthquake to be specified and so scientists cannot predict when an earthquake or landslide-generated tsunami might occur. However, once an earthquake occurs, parameters can be assessed for tsunami generating potential and data from sea level instruments can confirm tsunami status. Further, tsunamis that are triggered by volcanic activity (e.g. underwater volcanic eruptions or pyroclastic flows) may be forecast if the volcano is carefully monitored as is the case with volcanoes in the Eastern Caribbean.

### Why are locally generated tsunamis so dangerous and how can I protect myself?

A local tsunami affects shores that are relatively close (<100 km) to the source of the tsunami. Generally, local tsunamis may reach the shores of nearby islands in less than ten minutes, which may be insufficient time for local authorities to receive and issue an official warning. This short time between generation and arrival of the first wave requires critical life saving decisions to be made rapidly and emphasizes the importance of being able to recognize the natural warning signs of a tsunami



and knowing the appropriate response.

### Have tsunamis ever affected Montserrat?

A dome collapse at the Soufrière Hills volcano on 1997/12/26 produced large waves onshore at Old Road Bay. Deposits near Old Road jetty suggest that a 1 m high wave moved boats onshore and carried debris 80 m along the road towards Old Towne. Another major collapse culminating late in the evening (11:35 PM local time) on 2003/07/12 (03:35 UTC) generated a tsunami, which was recorded in Montserrat 2-4 km from the generating area and Guadeloupe, 50 km from Montserrat. Results of field surveys, for this tsunami, suggest that wave height, in Montserrat, may have been about 4 m according to the location of a strandline of charred trees and other floating objects at Spanish Point on the east coast of the island. Tsunami may have occurred prior to European settlement, however, there is no known record. In the past, there have been large regional earthquakes, which generated tsunamis (e.g. 1867/11/18 Virgin Is. and 1918/10/11 Puerto Rico magnitude 7.5 earthquakes generated tsunamis. The former affected nine territories, while the latter was limited to the near vicinity). Given the right conditions, tsunamis from similar future events might impact Montserrat.

### Can an earthquake from outside of the Caribbean region generate a tsunami?

Yes, a tsunami may be generated from earthquakes occurring both within and outside of the region. In 1755 the Great Lisbon earthquake, magnitude estimated in the range 8-9, near Portugal caused a tsunami “as high as the upper storey’s of houses” on the east coast of Martinique. Waves 2m high were also observed at the east coast of Barbados. Tsunamis generated from sources outside of the region are called ‘tele-tsunamis’.

### Do all earthquakes cause tsunamis?

No, all earthquakes do not cause tsunamis. Four factors promote the generation of a tsunami by an earthquake: (1)The earthquake occurs at shallow depth, less than 70 km, (2)The earthquake magnitude is 6.5 or larger, (3) The fault is submarine and ruptures the Earth’s surface or causes material to collapse into the ocean and (4) The earthquake causes vertical movement of the fault and sea floor.

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*Can an eruption from the Kick 'em Jenny submarine volcano generate a tsunami?*

Although relatively infrequent, violent underwater volcanic eruptions may displace a large volume of water and generate tsunami waves in the immediate source area. In this case, waves may be generated by the sudden displacement of water caused by large volumes of volcanic material displacing the ocean. Kick-'em-Jenny is a submarine (underwater) volcano located 9 km northwest of Grenada. Currently, scientists consider that there is a very small chance that an eruption of the volcano would trigger a tsunami. Any tsunamis triggered by underwater eruptions are a potential hazard for islands nearby.

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*If a tsunami is detected by scientists how long would it take for a warning to be issued?*

Following an earthquake, scientists need 5 – 20 minutes before a tsunami warning can be issued. However, if you live in Montserrat and a local tsunami is generated by an earthquake near Grenada, waves could impact your island in less than 15 minutes with little or no time for an official warning. This means that coastal residents must be able to recognise a tsunami's natural warning signs. Alternatively, if an earthquake were to occur off the west coast of Africa, a tsunami generated by that earthquake (tele-tsunami) would take several hours before reaching the Caribbean, allowing ample time to issue an official warning.

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*Is there a tsunami early warning system for Montserrat?*

Seismic monitoring and government agencies in the Caribbean, Central and South America are developing a tsunami warning system for the region, including Montserrat. Meanwhile, if an earthquake occurs that can or has triggered a tsunami that may affect the Caribbean, the Pacific Tsunami Warning Centre (PTWC) will send a warning to specific government agencies in the Caribbean. The Disaster Management Coordination Agency (DMCA) would then alert the population.

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*Which areas in Montserrat are most vulnerable to tsunamis?*

All low lying areas such as coastal villages and towns are at greatest risk from coastal flooding events like tsunamis. While evacuation may be afforded by high ground such as hills near to the coast, great care still needs to be taken.

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*Are there any natural solutions to reducing the impacts of tsunamis?*

Many studies following the 2004 Indian Ocean tsunami, suggest that mangroves and coastal tree plantations reduced tsunami wave heights and protected shorelines against damage when compared to those without vegetated buffer zones. Coastal ecosystems such as sand dunes, coastal forest and coral reefs are also cited as serving the same protective role against these destructive waves. The preservation of coastal ecosystems is fundamental to reducing the impact of tsunamis in the face of development. While tsunamis do not occur frequently, implementing risk reduction measures should be encouraged as tsunamis are very high impact events that can set back development for many years.

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*Can I be safe surfing a tsunami wave?*

Absolutely not! Tsunami waves should not be surfed as they possess tremendous destructive power from BOTH the strength and size of the waves. The large amount of seafloor material (mud and sediment) caught up in the wave makes them very dangerous for surfing.

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*Where can I find more information on tsunamis in Montserrat?*

The Disaster Management Coordination Agency (DMCA) – (664) 491-7166

UWI Seismic Research Centre - [www.uwiseismic.com](http://www.uwiseismic.com)

