

NATURAL DISASTER(TSUNAMI)

INTRODUCTION

The word tsunami is a Japanese word, represented by two characters: tsu, meaning, 'harbour', and name meaning, 'wave'. Tsunami is a set of ocean waves caused by any large, abrupt disturbance on the sea- surface. If the disturbance is close to the coastline, local tsunamis can demolish coastal communities within minutes. A very large disturbance can cause local devastation and export tsunami destruction thousands of miles away.

Tsunamis rank high on the scale of natural disasters. Since 1850 alone, tsunamis have been responsible for the loss of over 420,000 lives and billions of dollars of damage to coastal structures and habitats. Most of these casualties were caused by local tsunamis that occur about once per year somewhere in the world.



MEANING OF TSUNAMI

The phenomenon we call tsunami is a series of large waves of extremely long wavelength and period usually generated by a violent, impulsive undersea disturbance or activity near the coast or in the ocean. When a sudden displacement of a large volume of water occurs, or if the sea floor is suddenly raised or dropped by an earthquake, big tsunami waves can be formed by forces of gravity.

The waves travel out of the area of origin and can be extremely dangerous and damaging when they reach the shore. The word tsunami (pronounced tsoo-nah'-mee) is composed of the Japanese words 'tsu' (which means harbour) and 'nami' (which means 'wave').

Often the term, 'seismic or tidal sea wave' is used to describe the same phenomenon, however the terms are misleading, because tsunami waves can be generated by other non-seismic disturbances such as volcanic eruptions or underwater landslides, and have physical characteristics different from tidal waves.

The tsunami waves are completely unrelated to the astronomical tides—which are caused by the extra-terrestrial, gravitational influences of the moon, sun, and the planets. Thus, the Japanese word 'tsunami', meaning 'harbour wave' is correct, official and all-inclusive term. It has been internationally adopted because it covers all forms of impulsive wave generation.



CHARACTERISTICS OF TSUNAMI

Tsunami in the deep ocean may have very long wave length of hundreds of kilometre and travels at about 800 km per hour, but an amplitude of only about 1 km. It remains undetected by ships in the deep sea. However, when it approaches the coast its wavelength diminishes but amplitude grows enormously, and it takes very little time to reach its full height.

Computer model can provide tsunami arrival, usually within minutes of the arrival time. Tsunamis have great erosion potential, stripping beaches of sand, coastal vegetation and dissipating its energy through the destruction of houses and coastal structures.

In the open ocean, tsunamis would not be felt by ships because the wavelength would be hundreds of miles long, with an amplitude of only a few feet. This would also make them unnoticeable from the air. As the waves approach the coast, their speed decreases and their amplitude increases. Unusual wave heights have been known to be over 100 feet high. However, waves that are 10 to 20 feet high can be very destructive and may cause many deaths or injuries.

From an initial tsunami generating source area, waves travel outward in all the directions much like the ripples caused by throwing a rock into a pond. As these waves approach coastal areas, the time between successive wave crests varies from 5 to 90 minutes. The first wave is usually not the largest in the series of waves, nor it is the most significant.

Furthermore, one coastal community may experience no damaging waves while the other, located not that far away, may experience destructive deadly waves. Depending on a number of factors, some low-lying areas could experience severe inland inundation of water and debris of more than 1,000 feet.

PREDICTION OF TSUNAMI

There is no historic record of a tsunami in the Indian Ocean: the only earlier reference to a tsunami was in relation to the 1941 Andaman Island earthquake and prior to that in 1880s. That too is not documented. Tsunami is most infrequent and it is almost impossible to predict as compared to a normal earthquake.

Since this phenomenon has been experienced mostly in the Pacific Ocean region stretching from Chile in Latin America to Japan in far East-Asia. The international group for the Tsunami warning system does not extend to Indian Ocean.

The area of Sumatra where the earthquake occurred, was considered to lie in an endangered zone by many geologists and other experts, even though the exact date and time of catastrophe could not be forecast. The strength of the quake could not have been predicted nor its location below the ocean. No one had thought that such a dangerous tsunami would result as it happened in December, 2004.

Early warning can be made about the presence and advance of a tsunami. But this can be practical only for those who are some distance away from ground zero. These waves could be detected by specially designed synchronous satellites mandated to keep a watch. A more reliable method might be to locate several pressure sensors at the bottom of the ocean.

These sensors would detect the periodic changes in pressure produced by the variations of the water column height above caused by the passing waves. They would send the information up to the floating buoys using ultrasound chirp signal.

The buoys could be equipped to communicate through satellite communication with control, analysis and operational centres, which could then issue appropriate warnings to the people in potential impact zones. Although prediction of Tsunamis is an uphill task, however, disaster mitigation centres can be established in those areas, where there is an urgent need to provide relief and rehabilitation facilities.

CAUSES OF TSUNAMI

A tsunami is a large ocean wave that is caused by sudden motion on the ocean floor. This sudden motion could be an earthquake, a powerful volcanic eruption, or an underwater landslide. The impact of a large meteorite can also cause a tsunami. Tsunamis travel across the open ocean at great speeds and convert into large deadly waves in the shallow water of a shoreline.

(i) Subduction Zones are Potential Tsunami Locations:

Most tsunamis are caused by earthquakes generated in a subduction zone, an area where an oceanic plate is being forced down into the mantle by tectonic plate forces. The friction between the subducting plate and the overriding plate is enormous. This friction prevents a slow and steady rate of subduction and instead the two plates become 'stuck'.

(ii) Accumulated Seismic Energy:

As the stuck plate continues to descend into the mantle the motion causes a slow distortion of the overriding plate. The result is an accumulation of energy very similar to the energy stored in a compressed spring. Energy can accumulate in the overriding plate over a long period of time—decades or even centuries.

(iii) Earthquake Causes Tsunami:

Energy accumulates in the overriding plate until it exceeds the frictional forces between the two stuck plates. When this happens, the overriding plate snaps back into an unrestrained position. This sudden motion is the cause of the tsunami—because it gives an enormous shove to the overlying water. At the same time, inland areas of the overriding plate are suddenly lowered.

(iv) Tsunami Races away from the Epicentre:

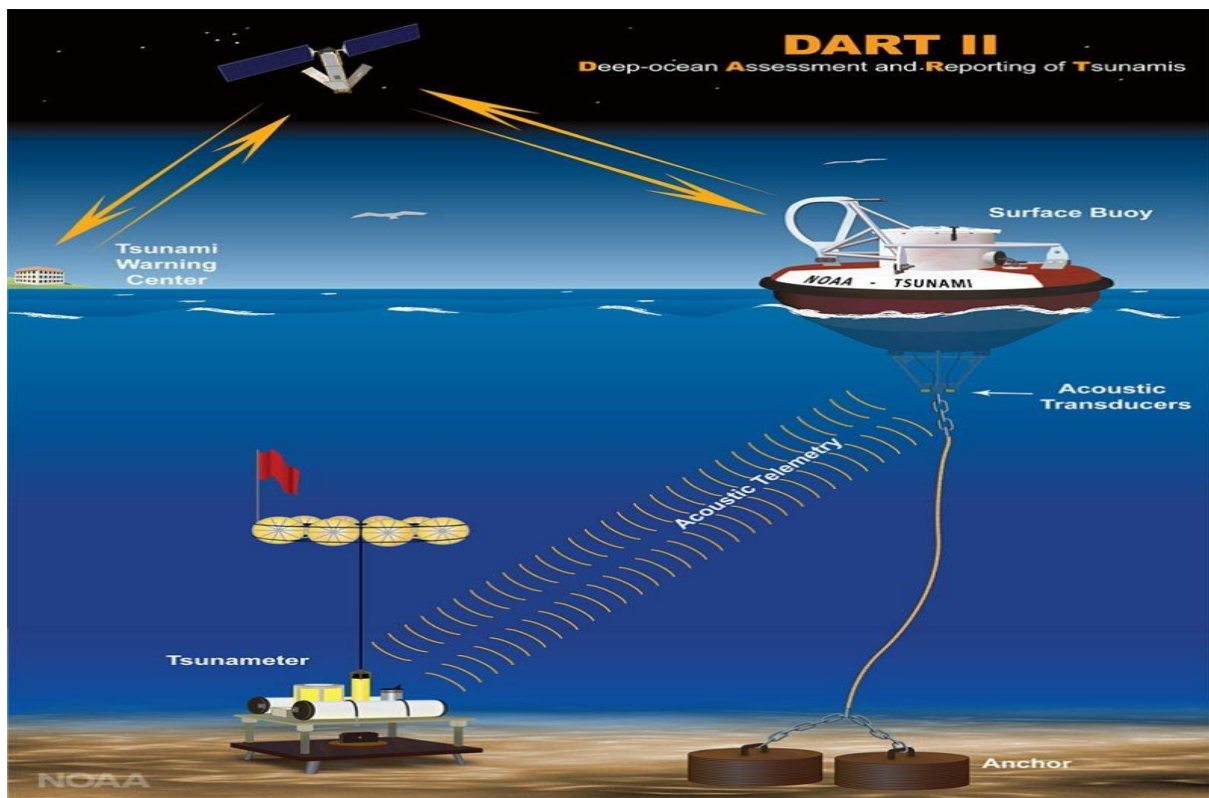
The moving wave begins travelling out from where the earthquake has occurred. Some of the water travels out across the ocean basin, and, at the same time, water rushes towards the land to flood the recently lowered shoreline.

WARNING SYSTEMS

Since 1946, the tsunami warning system has provided warnings of potential tsunami danger in the Pacific basin by monitoring earthquake activity and the passage of tsunami waves at tide gauges. However, neither seismometers nor coastal tide gauges provide data that allow accurate prediction of the impact of a tsunami at a particular coastal location.

Monitoring earthquakes gives a good estimate of the potential for tsunami generation, based on earthquake size and location, but gives no direct information about the tsunami itself. Tide gauges in harbors provide direct measurements of the tsunami, but the tsunami is significantly altered by local bathymetry and harbour shapes, which severely limits their use in forecasting tsunami impact at other locations.

Partly because of these data limitations, 15 of 20 tsunami warnings issued since 1946 were considered false alarms because the tsunami that arrived was too weak to cause damage.



RISK ASSESSMENT OF TSUNAMI

A preliminary risk assessment has been done for the Indian coast w.r.t. tsunamis taking into account the seismo-tectonic setting, historical seismicity and past-tsunami events.

The east and west coasts of India and the island regions are likely to be affected by Tsunamis generated mainly by subduction zone related earthquakes from the two potential source regions, viz., the Andaman- Nicobar-Sumatra Island Arc and the Makran subduction zone north of Arabian Sea.

Depending upon the location of the earthquake, the response time for evacuation of coastal population could range between 10 minutes to few hours. Tsunami modelling studies indicate that the least response time available is for the Andaman & Nicobar Islands which are situated right on the subduction zone capable of triggering tsunami earthquakes.

Considering that a credibly worst earthquake of 7.5 or higher occurs near Nicobar, the travel time to the nearest coast in Nicobar would be approximately 20-30 minutes and for the Indian mainland about 2-3 hours.

CAPACITY BUILDING FOR TSUNAMI

UNDP describes 'capacity-building' as the creation of an enabling environment with appropriate policy and legal frameworks, institutional development, including community participation (of women in particular), human resource development and strengthening of managerial systems. It adds that capacity-building is a long-term, continuing process, in which all stakeholders participate (ministries, local authorities, non-governmental organizations, and water user associations, professional associations, academics and others).

Capacity may include physical, institutional, social or economic means as well as skilled personal or collective attributes such as leadership and management. Capacity may also be described as capability.

PREPAREDNESS FOR TSUNAMI-WHAT TO DO?

The United Nations has been engaged for fifteen years in a process of creating awareness and promoting the development of policies to diminish the loss of life and property from natural and man-made disasters. This was first done through efforts during the International Decade for Natural Disaster Reduction and then through the International Strategy for Disaster Reduction that followed, as well as by the establishment of the UN Disaster Task Force, in which UNESCO and IOC participate.

Awareness-raising and policy-development issues in disaster reduction were raised to a higher level at the World Conference on Disaster Reduction held in Kobe, Japan, in January 2005 in which more than 6,000 delegates from 155 countries, and numerous inter-governmental and non-governmental agencies, United Nations, and other specialized organizations participated.

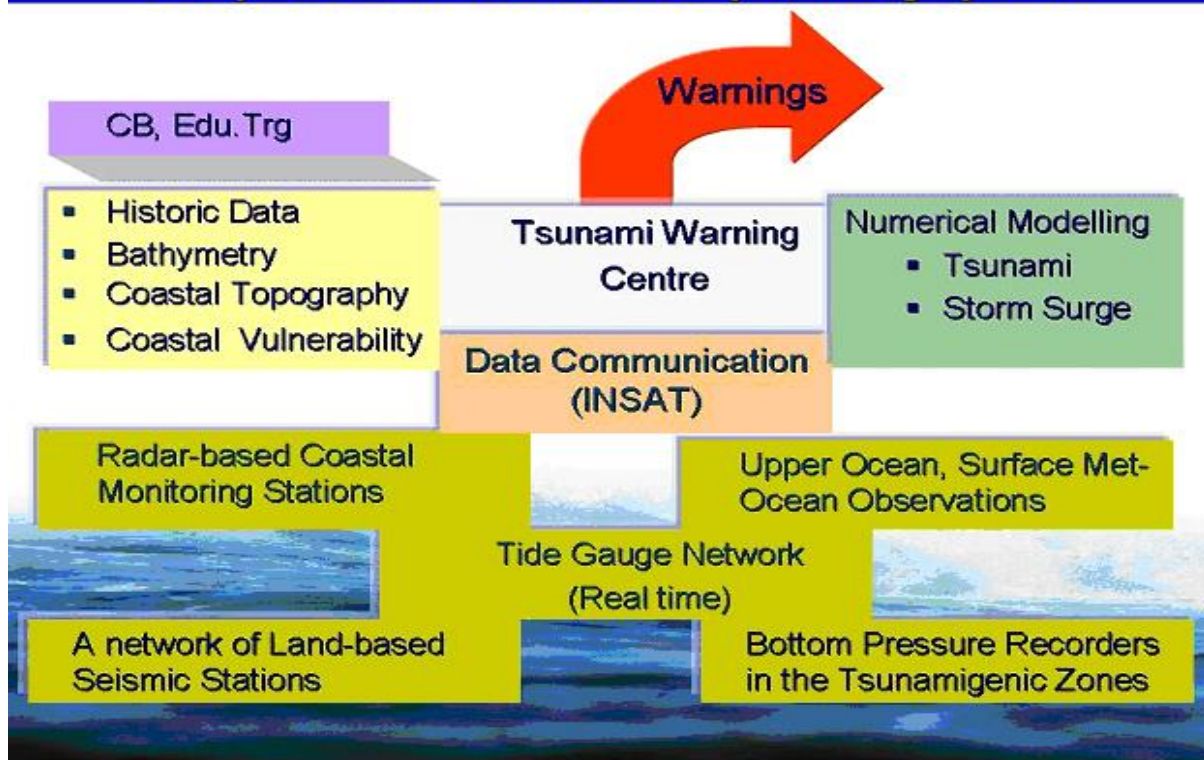
GENERATION OF TSUNAMI

Tsunamis are commonly generated by earthquakes in marine and coastal regions. Major tsunamis are produced by large (greater than 7 on the Richter scale), shallow focus (< 30 km depth in the earth) earthquakes associated with the movement of oceanic and continental plates. They frequently occur in the Pacific, where dense oceanic plates slide under the lighter continental plates.

PROPAGATION OF WAVES

Because earth movements associated with large earthquakes are thousands of square kilometres in area, any vertical movement of the seafloor immediately changes the sea-surface. The resulting tsunami propagates as a set of waves whose energy is concentrated at wavelengths corresponding to the earth movements (~100 km), wave heights determined by vertical displacement (~1m) and wave directions determined by the adjacent coastline geometry.

Components of the Indian Early Warning System



HOW DO EARTH QUAKE GENERATE TSUNAMI?

By far, the most destructive tsunamis are generated from large, shallow earthquakes with an epicentre or fault line near or on the ocean floor. These usually occur in regions of the earth characterized by tectonic subduction along tectonic plate boundaries. The high seismicity of such regions is caused by the collision of tectonic plates.

When these plates move past each other, they cause large earthquakes, which tilt, offset, or displace large areas of the ocean floor from a few kilometres to as much as a 1,000 km or more. The sudden vertical displacements over such large areas disturb the ocean's surface, displace water, and generate destructive tsunami waves. The waves can travel great distances from the source region, spreading destruction along their path.

BEFORE TSUNAMI:

One should prepare before a tsunami strikes. it'll help reduce damage to your home and business, it'll also facilitate your survival.

Ask your council about your tsunami risk, if you reside in an exceedingly coastal area, always keep a check on the local warning arrangements.

If you have a disability or special requirements, arrange along with your support network to provide you with a warning of any warnings and emergency broadcasts.

Know where the closest status is and the way you may reach it. arrange to get as high or as far inland as you'll. Plan your escape route for after you are receiving, similarly as for after you are also working or holidaying near the coast.

DURING TSUNAMI:

If possible, keep your getaway kit with you if possible. don't travel into the areas in danger to urge your kit or belongings.

attempt to take pets with you if you'll be able to do so safely.

One should move instantly to the closest higher ground, or as far inland as you'll. If you have got evacuation maps handy, follow the routes shown.

Walk or bike if possible and drive provided that is essential. If driving, keep going once you're well outside the evacuation zone to permit room for others behind you.

If in any case, one cannot escape the tsunami, then he/she should move to an upper storey of a sturdy building or climb onto a roof or up a tree. Or grab a floating object and hang on until help arrives.

hear your local radio stations as emergency management officials are broadcasting the foremost appropriate advice for your community and situation.

AFTER TSUNAMI

Always try to be connected to the radio for civil defence advice and don't return to the evacuation zones until authorities have given the all-clear.

remember that there is also over one wave and it should not be safe for up to 24 hours, or longer. The waves that follow the primary one can also be bigger.

don't visit for any sightseeing.

One should take extreme caution while re-entering homes or buildings, floodwaters may have damaged buildings.

make sure to require notes and pictures for insurance purposes if the building gets into a damaged state. If you rent your property, contact your landlord and your contents insurance underwriter as soon as possible.

A tsunami is really a series of waves. One must not visit an affected coastal area until it's declared to be safe by authorities.

