

TSUNAMI

A tsunami is a wave which develops as a consequence of an abrupt rising or falling of the sea floor but may also be the result of coastal or submarine landslides or of volcanic eruptions. It propagates in the form of ocean waves over long distances. About 90 percent of all tsunamis are caused by strong earthquakes beneath the ocean floor. However, not all strong earthquakes cause tsunamis.

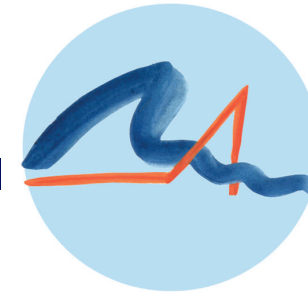
The speed of propagation of a tsunami depends on the depth of the water. At deep sea levels, it equals the speed of a passenger plane, while in shallow waters it travels approximately at the speed of a fast cyclist. The intervals between successive crests and the height of a wave therefore also change depending on the depth of the water. The more shallow the water, the shorter the intervals between the waves and the higher the waves.

Tsunamis cannot be predicted but early warning of the population is possible with the latest technology. The disastrous event of 26 December 2004 has shown that there is a need for protection and early warning in all potentially threatened regions.

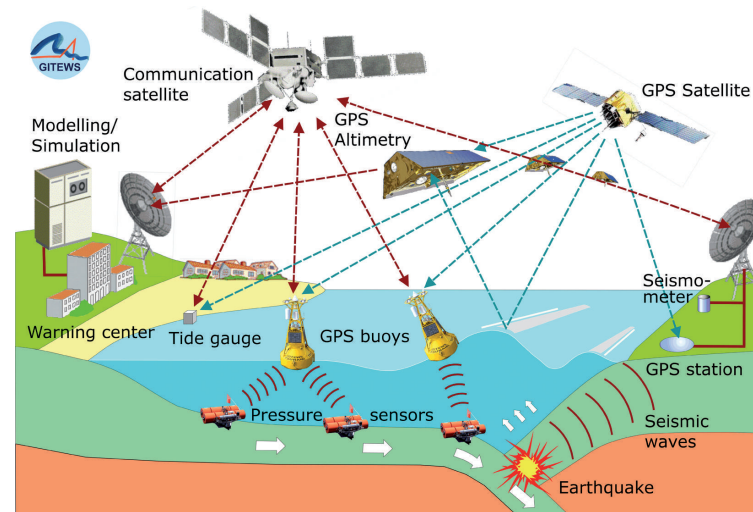
Project Management:
 GeoForschungsZentrum Potsdam
 Dr. Jörn Lauterjung
 Telegrafenberg
 14473 Potsdam
 Germany

Further information:
 Leaflets about what to do when you experience a strong earthquake or a tsunami are available at the homepage of GFZ Potsdam.

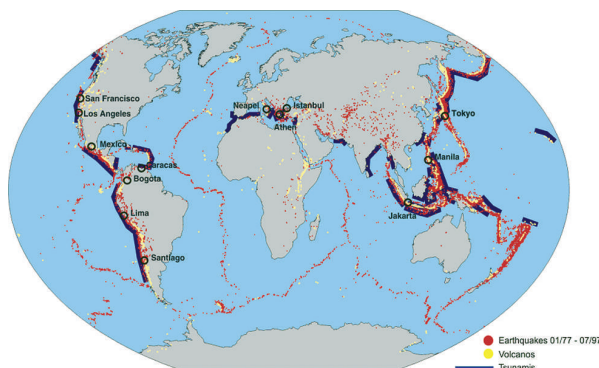
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GITEWS
 German-Indonesian
 Tsunami Early Warning System



GFZ
 POTSDAM

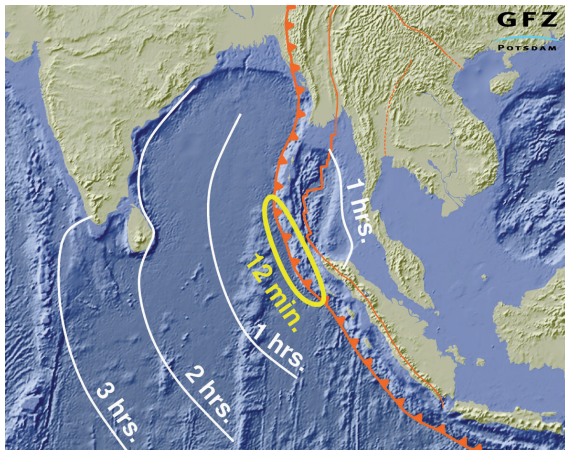


GeoForschungsZentrum Potsdam (GFZ, coordination)
 Alfred Wegener Institute for Polar and Marine Research (AWI)
 German Aerospace Centre (DLR)
 GKSS Forschungszentrum
 Consortium German Marine Research (KDM)
 Leibniz Institute of Marine Sciences (IFM-GEOMAR)
 Federal Institute for Geosciences and Natural Resources (BGR)
 United Nations University Bonn (UNU)
 Deutsche Gesellschaft für Technische Zusammenarbeit (GTZ)

Establishment of a
 Tsunami Early Warning System
 in the Indian Ocean –
 The German-Indonesian Contribution

An early warning system for the Indian Ocean

The Sumatra earthquake of December 2004 was the second largest earthquake ever recorded by instruments. The earthquake waves travelled around the world. In Potsdam/Germany, after 12 minutes they were automatically recorded and analysed. At this point in time, the first tsunami waves had not yet reached the coastlines of Northern Sumatra.



There was no possibility to pass the warning on to the population in time.

Directly after the disaster the Federal Ministry of Education and Research (BMBF) commissioned the Helmholtz Association of National Research Centres with developing a tsunami early warning system for the Indian Ocean which can later be extended to the Mediterranean and the Atlantic Ocean. The conception integrates terrestrial observation networks of seismology and geodesy with marine measuring processes and satellite observation. Thereby, Germany cooperates with Indonesia, which is the area most heavily threatened by earthquakes in the Indian Ocean because of its proximity to the seismically active Sunda trench. The Joint Declaration of BMBF and RISTEK, the Indonesian research ministry, which was signed on 14 March 2005, is the basis for this cooperation. Besides the early warning system itself, it also contains the provision of capacity building for Indonesian institutions.

The integration of the German-Indonesian activities and the contributions of further countries to an overall system for the Indian Ocean is coordinated by the Intergovernmental Oceanographic Commission (IOC) of UNESCO.

The establishment of the German-Indonesian tsunami early warning system aims at the combination of a very rapid and at the same time reliable warning. It has an open design, i.e. it enables an easy integration of compatible external equipment and external data.

This design ensures that observation networks of other countries can be integrated. Rim countries are given the possibility to use the data for their centres in order to issue tsunami warnings in their own countries when required.

The Components

Data and readings from the individual components of the early warning system for the Indian Ocean are to form a chain from the recording of an earthquake to its analysis, its evaluation and finally a warning.

Recording - Earthquake monitoring

A network of broad-band seismometers rapidly localizes the earthquake and determines its strength. At the same time, monitoring of the deformation takes place by means of a high resolution GPS network in order to gather as much information as possible on the earthquake.

Analysis - a tsunami

In order to rule out false alarms, which are unavoidable if only the earthquake itself is considered, a tsunami wave must be oceanographically recorded and its dimension be measured. Ocean floor pressure sensors and specially equipped GPS buoys are used for this task. They are supported by sea level gauges on the coast which, in the case of Indonesia, are installed on the islands off Sumatra and Java. They also provide data for improving ocean models which are the basis for the computation of the wave.

Evaluation - Potential damage

Modelling and simulation of tsunamis are to provide detailed information on its arrival as well as on the potential damage and local differences in impact caused by a tsunami. This presupposes an exact knowledge of the ocean floor topography from the deep sea and the shelf area to the coastline but also of populations and infrastructures. The models are pre-calculated and collected in databases wherefrom they can be retrieved in the case of a tsunami event.

Warning

All data is collected in a data centre which carries out the analysis and evaluation. This must be accomplished under national responsibility. Based on incoming data and simulation results, the data centre is also the institution to issue the warnings.

Implementation

The implementation of the technical installation of the sensor networks and data centre is to be concluded after three years by end of 2008. A subsequent two-year operation phase with German support is planned to follow. The capacity building measures take place over a period of five years. While the early warning system is being established, concept studies on enlargements will be initiated and new technologies will be developed which shall facilitate a future – global – cutting-edge system.



Schematic layout of the GPS buoy