FAQ Tsunami

1. How does the tsunami early warning system in Indonesia work?
2. What differentiates this early warning system from the system already in use in the Pacific and why has the same system not been used?
3. Why was there no early warning system in place in the Indian Ocean before 26 December 2004?
4. How much does the installation alone of the system cost?
5. How is the system financed in the long term?
6. How is sustainable system functionality ensured?
7. What happens in the event that a number of sensors fail?
8. What other safeguards against failures are in place?
9. In what way is it ensured that the early warning system does not mistake a simple flood wave for a tsunami?
10. How are the sensors protected against vandalism?
11. The early warning system registers a tsunami that is threatening the coast. What procedure is followed in such a situation to warn or possibly evacuate the coastal population?
12. No town can be evacuated within 20 minutes. Does this not mean that the system is actually useless?
13. Which channels are used to transmit warnings of a tsunami to the population?
14. How can false alarms be prevented?
15. Are there any disaster plans that, for example, include escape routes?
16. Are children also informed at school about how to behave in an emer gency?
17. How long is the time period between the warning and the arrival of the tsunami, in other words, how much time remains to escape?
18. What staffing does the early warning system require?
19. How long does it take to train this staff?
20. How is the population supplied with medication, food and drinking water in the wake of a disaster if the infra structure has collapsed?
21. How many countries and research institutes worldwide have collabora ted in the development and/or installation of the early warning system?
22. How important is international co— operation for protection against natural disasters, in particular against tsunamis?
23. How high is the probability of a tsunami such the one on 26 Decem ber 2004 in the Indian Ocean occur ring again?
24. Can Germany also be hit by a tsunami?

FAQ Tsunami

1. How does the tsunami early warning system in Indonesia work?

In most cases a tsunami is triggered by an earthquake below the ocean floor, less often also by landslides on the sea floor. The operating mode of the German-Indonesian early warning system in the event of a strong quake is based on early registration by earthquake measuring instruments. The seismological stations are installed throughout the entire region and are supplemented by stations of the Indonesian partner institutions and other countries. As soon as initial information about the location and strength of an earthquake is available, the other measuring instruments, such as GPS stations and tide gauges, are „asked“ if they have already identified signals of a possible tsunami. The data flow together at the warning centre in the Indonesian capital of Jakarta where they are evaluated, in part automatically, in part by experienced specialists. With the help of modelling and simulation, the first arrival times and expected heights of the waves hitting the shoreline are calculated. The national tsunami early warning centre in Jakarta, Indonesia, distributes the alerts to predefined, authorised bodies in the provinces and municipalities, which then implement local warning measures and, where necessary, initiate evacuation or rescue operations.

2. What differentiates this early warning system from the system already in use in the Pacific and why has the same system not been used?

There is a huge difference between this tsunami warning system and the Pacific system, which is operated from Hawaii: namely, the wave travel times. A geological fault zone extends across the south-western flank of the Indonesian archipelago. Earthquakes occur very often in this area and, along with heavy landslides, can trigger a tsunami. Due to the relatively short distance, such a tsunami can already reach the first coastal areas within 20 to 30 minutes. In Hawaii, the conditions are fundamentally different. Here a tsunami is often triggered by earthquakes at a greater distance in the regions around Japan, Alaska or Chile. It takes several hours for tsunami waves to reach the affected coastlines. For this reason, the warning times are considerably longer than those off the Indonesian coast. Similar conditions to Indonesia are found in Japan, where an early warning system has been in operation for some time now. In contrast to these two existing systems in the Pacific, the German system, in addition to the „traditional“ instruments of seismology for earthquake location and the oceanographic method of buoy and sea level measurement, has integrated further instrumentation. Here, Global Positioning Systems (GPS) technology, for example, is used additionally to measure earth mass displacements. In the future, new types of satellite methods will also be used to allow the global measurement of sea levels and thus the detection of large waves.

3. Why was no early warning system in place in the Indian Ocean before 26 December 2004?

The earthquake of 26 December 2004 and the subsequent tsunami undoubtedly belong to the „events of the century“. With a magnitude of 9.3 (Mw), this quake, referred to as the Sumatra-Andaman earthquake, was one of the most severe quakes ever recorded by instruments in the world. There were no signals or signs that such a powerful earthquake or, in particular, that a tsunami of comparable destructive power was to be expected. Also the fact that no similar event had taken place over many generations meant that the population in the affected regions had underestimated the risk.

FAQ Tsunami

4. How much does the installation alone of the system cost?

The costs for development and implementation of the system came to €55 million. The funds were invested by the German government within the framework of reconstruction efforts in the areas of the Indian Ocean affected by the tsunami on 26 December 2004. The work includes not only the development and installation of measuring instruments but also the creation of the actual national warning centre itself. However, training researchers to run the warning centre, training technicians to carry out the maintenance of the systems and training the population about behaviour in an emergency also plays a major role. The promotion of awareness among the population in regard to „tsunami“ as a natural hazard is also essential.

5. How is the system financed in the long term?

The early warning system was taken over completely by Indonesia on 29 March 2011 and since then has been operated by the national Indonesian Meteorological, Climatological and Geophysical Agency (BMKG) which carries sole responsibility for the system. The BMKG is a public authority.

6. How is sustainable system functionality ensured?

The actual operation of the warning system is now the responsibility of the Indonesians. They were prepared intensively for its operation within the framework of the GITEWS project. The German side plans to provide additional support for its operation by means of further training measures up until March 2014 as part of the follow-up PROTECTS project. To service the components of the warning system, the responsible authority actively integrates external service providers. These providers had been integrated in the run-up to the training and educational measures. This ensures that expertise is retained and can be passed on to others.

7. What happens in the event that a number of sensors fail?

The system falls back on many different sensors. In the event that individual sensors fail, the system continues to run as a whole. It is not essential that all sensor stations are available for the seismological work (detection of the earthquake) or the GPS ground-based stations, as they are networks. If one monitoring station fails, the data from the seismometers and GPS networks still remain and thus guarantee sensor redundancy.

8. What other safeguards against failures are in place?

The hardware in the warning centre is backed up by redundant systems, i.e. there is a second parallel computer system in operation. The data transfer from the sensor in the field to the warning centre also has a second communication option (back-up communication).

FAQ Tsunami

9. In what way is it ensured that the early warning system does not mistake a simple flood wave for a tsunami?

Generally speaking, any large wave measured near the coast constitutes a potential danger. However, not every high wave is a tsunami wave. A tsunami is triggered in 90% of cases by earthquakes, less commonly by volcanic eruptions and/or landslides. The respective sensors detect the event and forward the information to the warning centre, where it is compared with other sensor data. If tsunamigenic characteristics (parameters) are detected in the warning centre, a warning dossier for the exposed coastal sections is issued immediately.

10. How are the sensors protected against vandalism?

Ground stations are often installed on fenced-in private land or institute grounds. The buoys, however, have repeatedly been damaged by fishing boats mooring on them. Cases of vandalism have NOT occurred so far, despite frequently expressed concerns. However, to generally prevent this, the United Nations (UN) operate an educational programme which informs the population, particularly in remote rural areas, of the importance and benefits of the sensor stations to prevent vandalism and theft.

11. The early warning system registers a tsunami that is threatening the coast. What procedure is followed in such a situation to warn or possibly evacuate the coastal population?

The warning message is generated in the warning centre in Jakarta. From here, warning messages are sent to the government and the local authorities in the areas likely to be affected. The warning centre is therefore staffed around the clock with the respective ex-perts seven days a week. Due to the fact that the first coastal areas can already be hit by the wave within 20–30 minutes, many activities must take place parallel to each other. The definition and implementation of these processes and chains of action is one the most difficult parts of setting up an early warning system. The precondition for short early warning times is that the population is well trained and immediately knows how to behave when the alarm has been raised. This can only be ensured through the continuous flow of information, regular training and evacuation drills. A role model in this respect is Japan, where training of precisely these behaviour patterns is conducted in the towns and settlements on the coast twice a year.

12. No town can be evacuated within 20 minutes. Does this not mean that the system is actually useless?

No. Disaster quakes cannot be prevented, neither can they be predicted. There will always be victims, including many fatalities. However, the tsunami early warning system will make it possible to substantially reduce the number of victims. The system not only benefits the regions that can be hit by a tsunami wave within a very short period of time, but

FAQ Tsunami

also the areas, regions and countries that are further away. The faster a warning can be issued, the more time remains to take the requisite precautions (for example evacuation). A decisive and important aspect of an early warning system is not just the construction of technical installations and the warning of an approaching tsunami. Intensive study of the warning process in the coastal regions has allowed the implementation of numerous preventive measures which in turn significantly reduce the number of potential victims. These include the creation of hazard maps, the definition of escape routes, the integration of the tsunami risk into town and country planning, the development of risk awareness in the population and many other measures.

13. Which channels are used to transmit warnings of a tsunami to the population?

Dissemination of the warnings is the responsibility of the Indonesian warning centre and the Indonesian authorities. This takes place mainly via radio, fax, mobile radio, TV, public address systems on beaches and at mosques, and a network of locally installed sirens. Further processes such as dissemination via text messages are also to be examined in the long term. However, this option is not yet ideally suited for this purpose, as network congestion can occur during a disaster, thus resulting in significant delays in the transmission of text messages. Solutions based on radio transmitters (FM, MW), where a specialty channel (RDS) similar to the traffic message channel can be used, are more reliable. Appropriate radio receivers, which can also be activated via the radio station when they are turned off, have already been successfully tested and are not expensive.

14. How can false alarms be prevented?

The Decision Support System (DSS), a programme that displays and analyses the sensor data in the warning centre, shows whether further sensor data can improve the existing results. This gives the responsible employee more security when issuing a warning.

15. Are there any disaster plans that, for example, include escape routes?

Within the framework of the GITEWS project, evacuation and action plans are also being developed to protect the population. The Indonesian partners' know-how and experience of the local conditions are the most important input in this connection, in addition to the technical integration of the resulting map material etc. into the early warning system.

16. Are children also informed at school about how to behave in an emergency?

In addition to training courses and other educational programmes for the professionals who have been running the Indonesian warning centre since the completion of the system, the education of the public in respect to the dangers and risks of a tsunami and the requisite behaviour in the case of such an event is a major issue. For education in schools, experienced partners from the fields of international cooperation and development aid prepare the appropriate information and create teaching material. Exercises on evacuation measures and how to behave in the event of a disaster are also conducted regularly in schools.

FAQ Tsunami

17. How long is the time period between the warning and the arrival of the tsunami; in other words, how much time remains to escape?

The aim of the early warning system is to issue a first warning within five minutes of receiving the initial signs of, for example, a strong earthquake that could trigger a tsunami. Assuming that the first coastlines may be affected within 20–30 minutes, this leaves approximately 15 minutes to react. However, regions and neighbouring countries of Indonesia such as Malaysia, Singapore, Thailand, etc. that are further away from the fault zone to the south-west of Indonesia, have one hour or more to take appropriate measures.

18. What staff does the early warning system require?

Although, due to the short reaction time in the event of a tsunami, many processes in the early warning centre must take place automatically, the experience and judgement of experts is an important factor in assessing whether the population must be warned or not. The warning centre in Jakarta therefore employs experts from the fields of seismology, oceanography, GPS and simulation. The decision to issue a warning and transmit it to the Indonesian authorities is the responsibility of the Officer on Duty. The centre is manned by staff working in seven-day shifts around the clock.

19. How long does it take to train this staff?

The development phase was completed and the early warning system installed in Indonesia at the end of 2008. However, the training of technicians and researchers was carried out from the very beginning. On the one hand they received training at consecutive annual courses and, on the other, during several months of research internships with project partners in Germany, ultimately leading to qualification by means of a 3-year doctoral programme. During installation of the various sensor systems in Indonesia, German field engineers are also regularly assisted by local technicians, so that knowledge on the construction, maintenance and repair of each station can be gained in a training-on-the-job programme. Indonesian staff are also trained regularly in the installation of communication technology and hardware in the warning centre. Education and training was part of the project until the warning system was handed over in March 2011.

20. How is the population supplied with medication, food and drinking water in the wake of a disaster if the infrastructure has collapsed?

The goal must be to use „quiet times“ to build up and secure stocks of food and drinking water, medicines and medical supplies and also the materials required to rescue and accommodate the people affected. Suitable locations and transportation routes must also be planned. It is the responsibility of the Indonesian government to take action, supported by international organisations such as the International Red Cross etc.

FAQ Tsunami

21. How many countries and research institutes worldwide have collaborated in the development and/or installation of the early warning system?

Nine German organisations were involved in the development of the German-Indonesian tsunami early warning system within the framework of the GITEWS project. The undertaking was supported by more than ten Indonesian partner organisations on site.

22. How important is international cooperation for protection against natural disasters, in particular against tsunamis?

It is very important. It serves the transfer of knowledge, experience and highly developed technology. It must also be remembered that natural disasters extend across borders. A flood, for example, may have its origins in the Alpine countries in which snow masses are thawing, but the impacts of the elevated water levels can be much more severe in the neighbouring countries. Common strategies and plans of action must therefore also be designed to protect a region. The GITEWS project is actively involved in these developments, which are coordinated in the field of tsunami impacts by UNESCO, an agency of the United Nations. The German early warning system therefore also contributes to the establishment of an operational early warning system in the entire region of the Indian Ocean. Basically, almost all countries bordering on the Indian Ocean, together with Japan, France, China and the USA, are involved.

23. How high is the probability of a tsunami such the one on 26 December 2004 in the Indian Ocean occurring again?

Due to the risk of strong earthquakes posed by the fault zone off Indonesia, the repetition of a similar disaster cannot be excluded. All around the world, experts are working on investigations to identify where the next big event could roughly occur. However, this cannot be predicted with absolute certainty.

24. Can Germany also be hit by a tsunami?

The danger of a tsunami exists even in Europe, as the events of Lisbon in 1755 and in the Mediterranean Strait of Messina in 1908 demonstrate. For this reason, international expert groups are addressing the development of strategies for the best possible preparation, in particular in the Mediterranean and Atlantic regions. The GITEWS project is also involved in these efforts.

For Germany, however, the subject of tsunamis plays next to no role in this context. Strong earthquakes that could trigger a tsunami are highly unlikely here. Model calculations of a tsunami that could, for example, be generated by sliding in the Norwegian continental shelf, show that the travel times of the waves through the shallow North Sea are so long that hardly any energy would arrive at the coast. The impacts would probably be similar to those of storm surges caused by meteorological events, such as the passage of low pressure front storms which have occurred several times already along the German North Sea and Baltic coasts. However, the coastlines concerned are very well prepared for such cases.