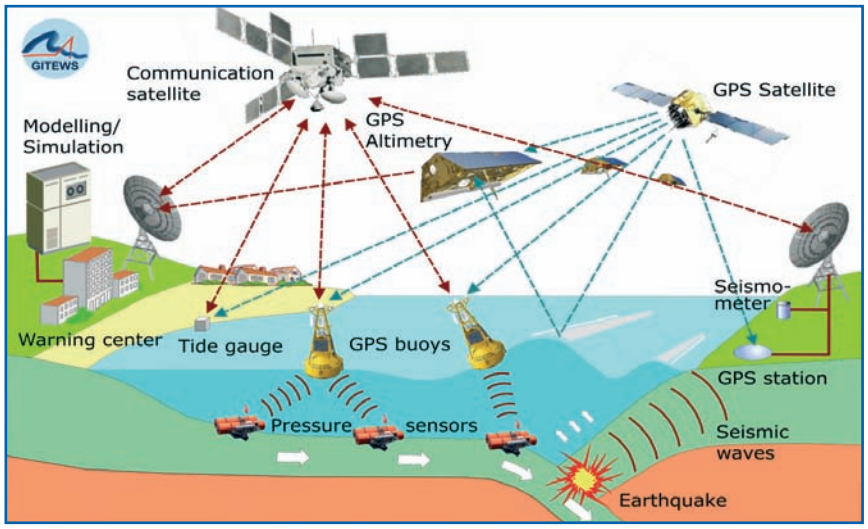
The German Indonesian Tsunami Early-Warning System (GITEWS)

Description

The goal of this activity is to implement an effective tsunami early-warning system for the Indian Ocean. The tsunami early-warning system is integral part of a multi-hazard Early-Warning-System for the registration of other natural catastrophes including earthquakes and volcanic eruptions. The system integrates terrestrial seismologic and geodetic monitoring arrays with marine and satellite-based observation platforms. It is designed to allow easy integration of new technologic advancements, for which a longer-term research program is implemented in parallel. The initiative is coordinated by the Helmholtz Association of German Research Centres, represented by the GeoForschungsZentrum Potsdam and its project partners: German Aerospace Centre (DLR), Alfred-Wegener-Institute for Po-lar and Marine Research (AWI), GKSS Research Centre, Leibniz-Institute for Marine Sciences (IFM-GEOMAR), United Nations University (UNU), Federal Institute for Geosciences and Natural Re-sources (BGR), German Agency for Technical Cooperation (GTZ), as well as from Indonesian and other international partners.



The system concept is focused on the partner countries Indonesia and Sri Lanka. An extension of the system coverage beyond the initial focus areas can readily be achieved. Based on the geologic situa-tion of the region, especially Indonesia faces an acute risk from future catastrophic tsunamis because of its direct neigh-bourhood to the seismically-active Sunda Arc structure.

The integration of further geophysical and geodetic monitoring systems implemented in the frame-work of other national activities to develop early-warning capacity in the region will further enhance the system performance. Concrete cooperation has been agreed on with Japan and China.

A fundamental aspect of the GITEWS is capacity building in the area of disaster management for decision makers, experts and the general public at risk.

The GITEWS represents a strong contribution to tasks in the Societal Benefit Area of "Disasters". In particular, the system will be part of a global tsunami early warning system developed under task DI-06-04. The activities also contribute to multi-hazard assessment and rapid mapping (task DI-06-07) and support DI-06-08. The new observation infrastructure built for the GITEWS contribute to the Global Geodetic Observing System (GGOS) and the Global Ocean Observing System (GOOS). The capacity building activities within the GITEWS contribute to the objectives of task CB-07-02.

Short outline of the system concept

The GITEWS is realized in cooperation with Indonesian ministries and partner organisations. Further cooperations with Sri Lanka, South Africa, Australia, Kenya, Yemen and the Maldives are under discussion).

The focus of the system on Indonesia is due to the fact that the most tsunami-prone continental margin, the Sunda Arc structure, is located almost parallel to the coast line of Indonesia. Tsunamogenic earth-quakes from this continental margin can produce tsunamis, which reach the Indonesian coastline in less than 20 minutes. Other coastlines in the Indian Ocean will be affected after 90 minutes (Thailand, Australia), 120 minutes (Sri Lanka, India) or even later, depending on the source zone. Therefore the GITEWS aims at delivering an early warning message in less than 10 minutes, which will then be substantiated as more geoscientific and oceanographic information becomes available. The early warn-ing messages will be delivered to all Indian Ocean rim countries. This is fully in line with the philoso-phy of UNESCO's Inter-governmental Oceanographic Commission (IOC) which coordinates national activities with respect to the establishment of an Indian Ocean wide integrated Early Warning System.

The components of GITEWS The System consists of different components.

1. Core of the system is a seismological network to detect location and magnitude of Earthquakes as fast as possible. About 25 new seismic stations will be installed in Indonesia for rapid (<2min) and reliable detection of earthquakes. An additional 20 seismic stations will be installed in Sri Lanka, Australia, and countries of the East-African coast or on islands in the Indian Ocean for teleseismic observations, which are needed to obtain information on the rupture process – the most important parameter for tsunami modelling. The seismometer network will be completed by a network of GPS stations for the measurement of crustal deformation due to earthquakes. This generates additional information on the earthquake process.

2. Because not every earthquake produces a tsunami the system has to confirm in the open ocean if a tsunami was generated. This is done by ocean-bottom pressure sensors and specially designed tsunami-buoys. In addition, a number of tide gauges on islands in the Indian Ocean will be installed to confirm whether a tsunami has been generated. The oceanographic equipment measures important parameters for the simulation and modelling, including wave height and wave length.

3. Important elements of tsunami early warning are pre-calculated simulation results. Based on the measured earthquake and oceanographic parameters tsunami models are calculated in advance. These models include inundation at the coastline of Indonesia and propagation models for the entire Indian Ocean. These simulations are updated during the propagation of an actual tsunami with new information becoming available from the sensor networks. Thus at all times an updated model result of tsunami travel times and wave heights is available. This is important information for all Indian Ocean countries and the basis for detailed warning bulletins.

4. An important aspect of the warning system is to combine all available sensor information including the simulation results in a comprehensive manner, derive and display the situation analysis, and generate decision proposals. These are the tasks of a newly developed Decision Support System (DSS) which is an essential part of the Early Warning and Mitigation Centre to be deployed at BMG Jakarta. Depending on the decisions made, the DSS provides further support by ad-hoc provi-sion of warning and information products to be sent to the individual recipients by the Indonesian dissemination system.

5. An important element of the GITEWS is Capacity Building. This includes training of scientists and engineers for the technical and scientific part of the project, but also training of authorities, organizations and people in Indonesia with respect to awareness and preparedness for such catastrophic events.

Timelines

The operational system, i.e. sensor networks including seismic, GPS and oceanographic instruments, the early warning and mitigation system including DSS, the modelling data base, shall be completed end of 2008.Test and Operation of the above mentioned System in Indonesia will be performed in 2009 and 2010 jointly by Indonesian and German partners. The complete system shall be handed over to Indonesia in 2010. Activities in the field of Capacity Building have already started and will run until 2010.