FACTSHEET
Early Warning and Mitigation Centre

GITEWS

German Indonesian Tsunami Early Warning System

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

DLR

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Decision Support for Tsunami Early Warning

Indonesia is especially threatened by tsunami because of its proximity to the Sunda Trench, one of Earth's largest subduction zones. Tsunami can be generated here anytime along a distance of several thousand kilometers and quickly reach the coast in a short time. Usually there are only 20 to 40 minutes travel time to the coastline of Indonesia. Rapid warning is therefore critical for the local population.
GITEWS therefore processes real time data from a wide variety of sensor systems to provide the most precise assessment of a threatening situation. Using these measurements the Chief Officer on Duty (COOD) at the warning center must decide whether it is likely that a tsunami will result and whether the population should be warned accordingly. A Decision Support System (DSS) newly developed by the German Aerospace Center (DLR) will provide highly aggregated information to assist the COOD in his decision. It evaluates the various measurements arriving from the sensors and performs a situation analysis, making use of previously calculated tsunami scenarios. This depiction and recommendations for action are displayed in a clear and practical way on several monitors so that the COOD can make a decision as rapidly and correctly as possible. If a decision is made to send a warning message, the system developed by DLR produces individual alerts for the endangered provinces and relevant authorities which are simultaneously informed via various communication channels such as radio, facsimile, and SMS. This procedure enables potentially affected people to be efficiently informed and evacuation measures to be rapidly initiated.
The DSS is tailored for use in crisis situations. The user interface and process workflows have been designed for decision making under uncertainty and time pressure. In addition to extensive compilations of geodata, the system's databases also have preprocessed risk information and scenarios readily available. The interfaces to the sensor and dissemination systems are based on standards which ensure an interoperable and open system. For example, the alerts are also issued using the "Common Alerting Protocol" (CAP) format, which is an international standard for disaster management usable in different languages and for spatially differentiated alerts.

Geodata Management

Spatial data sets, known as geodata, are essential components of any early warning system. They are the basis for modeling tsunami scenarios and for generating risk maps and evacuation plans. Obtaining, processing, assessing and updating heterogeneous data sets which may be in a wide variety of scales, represents a considerable challenge. Such data are brought together centrally at DLR, harmonized, and quality controlled. Bathymetry and

topography, the surface beneath and above sea level are particularly crucial for tsunami and risk modeling. Administrative, socio-economic and statistical data as well as infrastructure and land use data are also required for risk mapping and the DSS. Integrating all this information in the DSS in the framework of a geospatial data infrastructure was another key task.

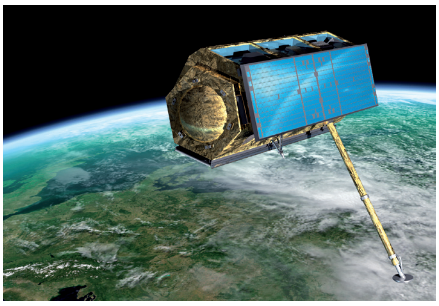
Modeling Risk

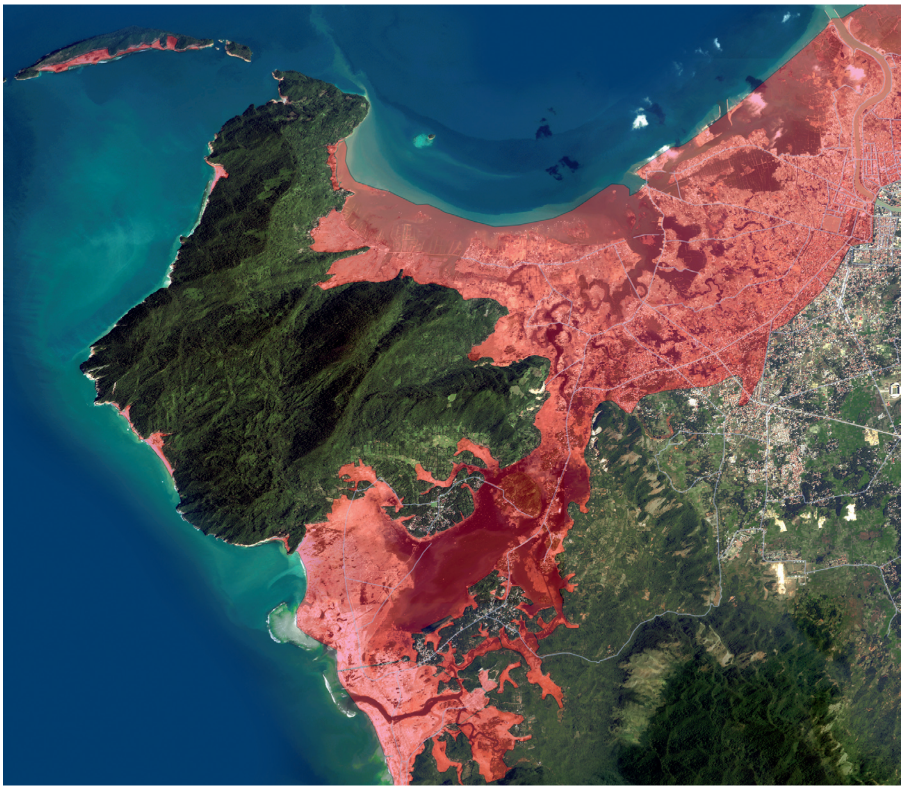
Risk maps provide an important basis for civil defense and local planning authorities. They show the extent to which a particular area is threatened by tsunami and facilitate the effective preparation of evacuation measures. They must answer two critical questions: how high is the tsunami risk at a particular location and how vulnerable are the people and infrastructure there? With the help of numerous tsunami scenarios already calculated by AWI, risk maps for coastal areas along the Sunda Trench in Sumatra, Java and Bali have been generated at DLR. Using spatial and statistical data, vulnerability analyses were carried out and then combined with analyses of the probability of the occurrence of a tsunami to produce risk maps. These information products are available for planning purposes and are also integrated into the DSS at the early warning centre.

Technical coordination of both the methodology development and the resulting products takes place in a joint Indonesian-German working group. DLR activities also include participation in establishing guidelines under the aegis of UNESCO-IOC.

New Earth Observation Technologies

Innovative earth observation technologies could make important future contributions to tsunami early warning systems. DLR scientists are currently investigating new ways to detect a tsunami wave early and over wide areas. Both ground- and space-based methodologies are being considered.
For example, both vertical crustal displacements induced by an earthquake or tsunamis generate infrasound waves which propagate through the atmosphere and cause temperature fluctuations in the so-called OH*-airglow in the mesopause region at about 87 km altitude. These temperature fluctuations can be detected from the ground within about 5 to 6 minutes using the infrared spectrometer GRIPS (Ground-based Infrared P-branch Spectrometer). This approach allows for rapid detection of such earthquakes or tsunamis.
Another example is a sensor concept known as NESTRAD. It uses microwaves actively emitted by radar sensors to monitor the ocean surface day and night, undisturbed by clouds. Sea surface changes, such as brief increases in the ocean level, can be measured in this way. Other studies are engaged in deriving shallow water bathymetry from high resolution optical earth observation satellite data.





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