German-Indonesian Tsunami Early Warning System (GITEWS)

Status after Six Years

Joern Lauterjung and the GITEWS-Team

Challenge Indonesia

Short Early Warning Time

Tsunamis are generated at the trench (orange line)
Traveltimes to coastline (yellow line) 20-40 Minutes
GITEWS Partner - National

Helmholtz-Association of German Research Centres (HGF)
GeoForschungsZentrum Potsdam (GFZ)
German Aerospace Centre (DLR), Oberpfaffenhofen
Alfred-Wegener-Institute for Polar- and Marine Research (AWI), Bremerhaven
Research Centre GKSS, Geesthacht

German Marine Research Consortium (KDM)
Leibniz-Institute for Marine Sciences (IFM-GEOMAR), Kiel

United Nations University (UNU)
Institute for Environment & Human Security (EHS), Bonn

Agency for Technical Co-operation (GTZ), Eschborn

Federal Institute for Geosciences and Natural Resources (BGR), Hannover

Components and Partner

(Germany, Indonesia, Japan, China, USA)

(1) Earthquake-Monitoring / Deformation-Monitoring
   (GFZ, BMG, BAKOSURTANAL, JMA, CEA, USGS)

(2) Sea level monitoring
   (IFM-GEOMAR, GFZ, AWI, BAKOSURTANAL, BPPT, NOAA)

(3) Modelling
   (AWI, GFZ, GKSS, DLR, BPPT, ITB, JMA, NOAA)

(4) Early-Warning and Mitigation Centre
   (DLR, GFZ, BMG, JMA, PTWC)

(5) Capacity Building
   (GTZ, UNU, BGR, GFZ, DLR, RISTEK, LIPI, JICA, USAID,.....)
GITEWS Concept

Sensor Stations in Indonesia
Seismic, GPS, Tide Gauges, GPS-Buoys
Warning Process

1. Earthquake Monitoring
2. Sensor Systems
   - Tidal Gauges
   - UBI PACT
   - GPS-Boje
3. Tsunami Service Bus
4. Situation Assessment and Decision Support
   - Simulation System
   - Risk & Vulnerability Modelling
5. Geospatial Data Repository

Modelling

- Time: 00:30:00 h
- Indischer Ozean
- Sumatra

Water elevation (m)

-2 -1 0 1 2 3 4 5 6 7 8 9 10
Patch concept: 2250 Patches of 45x15 km
- Tsunamigenic zone (0-60 km depth)
- Displacement model 1D layered (Wang et al., 2003)
- > 3000 Scenarios in Tsunami Database

Multi Sensor Scenario Selection

earthquake → crust deformation → tsunami wave → inundation

EQ parameters → dislocation vectors → sea surface data

SeisComp3 → CGPS → Tide Gauges → Buoys

matching → matching → matching

EQ parameters → dislocation vectors → sea surface data

EQ parameters → RuptGen → TsunAWI

Numerical model

Sensor systems

Physical world
Tsunami risk maps at scale of 1:100 000, entire coast

- hazard map
- vulnerability map

Based on 1300 scenarios generated by AWI

Based on physical and socio-economic parameters

Risk = f (hazard and vulnerability)

Availability of tsunami risk assessment products sub-national scale 1:100 000

- Tsunami Hazard map
- Tsunami Exposure – Population map (day-, night time)
- Tsunami Vulnerability map
- Tsunami Risk map
Tsunami risk map at scale of 1:25 000 GITEWS Pilot areas

- Low Risk (green colour)
- Moderate Risk
- High Risk

Tsunami Risk: Padang city, Indonesia
- potential casualties (pie charts)
- areas where evacuation is possible in given time (low risk: green colour)
- where to prioritize risk reduction
- with which measures (e.g. additional shelters for evacuation)

DSS Information in the Warning Center
Training and Education

Annual Training courses (since 2006)
"Seismology, Data Analysis and Tsunami Detection"
Organised by: GFZ Potsdam, BMKG Jakarta, US Geological Survey
(always 30 participants from Indian Ocean countries)

Academic Program
10 PhD-Students for 3 years at German research institutions.
Participants from Indonesia, Malaysia, Madagascar und Thailand
Visiting program for scientists and engineers
(3-4 months in Germany)

25 January - 13 February 2010, CITEKO/Indonesia
Tsunami Early Warning in the Indian Ocean

30 Participants from 19 countries:
Bangladesh, Egypt, India, Indonesia, Kenya, Madagascar, Malaysia, Maldives, Mozambique, Myanmar, Oman, Pakistan, Papua NG, Philippines, Singapore, Tanzania, Thailand, Vietnam, Yemen
Capacity Development

• “Low-tech” Hazard Mapping
• “Science meets Politics”
• Receiving, understanding and interpretation of tsunami warning & decision making
• SOP development and training for local 24/7
• Local warning dissemination technologies
• Evacuation and contingency planning
• Approaches to increase knowledge & awareness
The German-Indonesian Tsunami Early Warning System (GITEWS) is part of the German reconstruction aid to Indonesia and other Indian Ocean rim countries. It is financed with about 70 Mio US$.

The project includes

(a) Set-up of a technical early warning infrastructure  
(b) Training and education (science and engineering)  
(c) Capacity development on institutional and local level

It is planned to hand over the System to Indonesia in the 1st quarter 2011