Training Course
21 January - 10 February 2008, Jakarta/Indonesia

Seismology, Data Analysis and Tsunami Detection
Part II: System Architecture and Decision Support

A contribution of the
German Indonesian Tsunami Early Warning System (GITEWS)
- Capacity Building -

Circular and Programme

Organized by

GeoForschungsZentrum Potsdam, GFZ
Deutsches Zentrum für Luft- und Raumfahrt, Oberpfaffenhofen, DLR
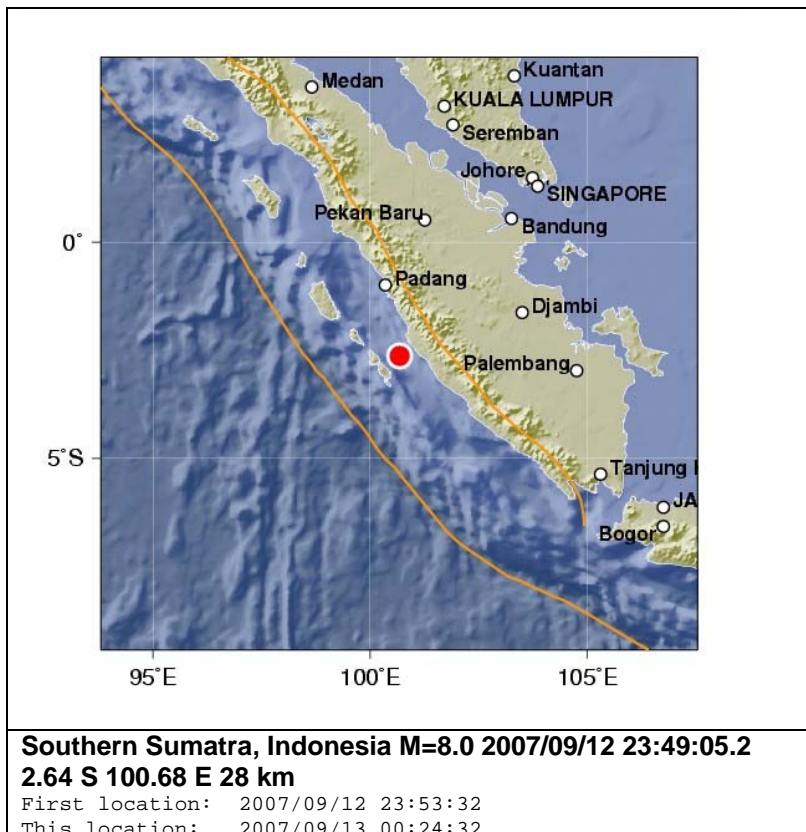**Meteorological and Geophysical Agency of Indonesia, Jakarta, BMG**

Indonesia is currently establishing the Indonesian Tsunami Warning System (InaTWS) in co-operation with several international partners; especially Germany who is contributing via the GITEWS project (German Indonesian Tsunami Early Warning System). The corresponding monitoring systems consist of seismic networks, tide gauge networks, buoys, and a GPS and satellite observation network. The processing center is at the BMG Headquarters and regional offices. Each network is operated by different institutions; the seismic network by BMG, tide gauges and GPS by BAKOSURTANAL, DART-buoys by BPPT and satellite observation by LAPAN. These institutions together are the operators of InaTWS.

The aim of GITEWS of the establishment of a Tsunami Early Warning System in cooperation with Indonesia is based on different meshing components. In about 90% of cases, a tsunami is generated by an earthquake, while volcanic eruptions and landslides may also be the triggering events. The conception aims at achieving indicators of a tsunami and its dimension by the analysis of different measurements at a very early stage. Several sensor systems that will be installed at selected locations inside the considered propagation areas, are able to rapidly detect deviations from normality (anomalies). Three training courses on "Seismology, Data Analysis and Tsunami Detection" over three years will be realised within the frame work of the GITEWS project. This year's training course is the second. It focuses on the system architecture and the decision support logic.

GITEWS is a project of the German Government associated with the reconstruction of the tsunami-prone region of the Indian Ocean. It is a consortium of nine institutions: GeoForschungsZentrum Potsdam (GFZ), Alfred Wegener Institute for Polar and Marine Research (AWI), German Aerospace Center (DLR), GKSS Research Centre Geesthacht, Deutsche Gesellschaft für Technische Zusammenarbeit (GTZ), German Marine Research Consortium (KDM) with Leibniz Institute of Marine Sciences (IFM-GEOMAR), United Nations University's Institute for Environment and Human Security (UNU-EHS) and the Federal Institute for Geosciences and Natural Resources (BGR).

**Southern Sumatra, Indonesia M=8.0 2007/09/12 23:49:05.2
2.64 S 100.68 E 28 km**
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First location:  2007/09/12 23:53:32
This location:   2007/09/13 00:24:32
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The work of the GITEWS project is realised in close cooperation with the Intergovernmental Oceanographic Commission (IOC) of UNESCO, which coordinates the different contributions in this region. Coordination takes place in thematic working groups and at periodical meetings. Besides collaboration with the Indonesian partners, there are close contacts with organisations in Australia, Kenya, Madagascar, Maldives, Republic of South Africa, Sri Lanka, Tanzania and Yemen. Cooperation with other Indian Ocean countries is in preparation and aimed for.

1. OBJECTIVE OF THE TRAINING COURSE II

GITEWS System Architecture
The sensors of the Tsunami Early Warning System are comprised of seismometers, GPS instruments, tide gauges and ocean bottom pressure sensors. In the central warning centre in Indonesia, sensor data will immediately be verified with a multitude of pre-tailored tsunami simulations to derive and deliver trustworthy warnings. By the involvement of local scientists and technicians in the framework of the Capacity Building Programme and by targeted actions to raise awareness regarding the tsunami threat, the realisation of a long-term strategy towards the prevention of disastrous losses is aimed at.

The ongoing realisation of the GITEWS project and cooperation with the other partners shows that **the final system in Indonesia will be complex** and has to integrate several components, such as different sensors, communication lines and download stations, sensor processing systems, a Decision Support System, and a modelling system. Within Indonesia, the contributions of three Indonesian institutions (BMG, BAKOSURTANL, BPPT) and different donors (Japan, China, Germany, U.S.A.) have to be integrated. The challenge of the system is the provision of reliable warnings for Indonesia within extremely short times compared to all other already existing systems. The only system it may be comparable to is the system in Japan operated by JMA.

The situation is that three Indonesian institutions cooperate with GITEWS, and are responsible for different instruments and instrument networks. All three institutions operate download stations and receive real-time raw data streams from the instruments. In addition, all institutions have remote control of the stations.

The concept within GITEWS is to store the data in data servers. This follows the model of the seismic Seed-Link Server where all incoming data from the seismic instruments are stored and can thereafter be retrieved by different processing systems simultaneously. We plan to introduce such data servers in the different institutions where we have most of the expertise for troubleshooting. In the case of seismology, we have raw data from broadband and other seismometers, but also data from strong-motion sensors. Some of the strong-motion sensors are operated together with tide-gauges, therefore these data will arrive at BAKOSURTANAL and should be directly stored in the data server at BMG. GPS data are measured by all instrument systems and should be stored in the GPS data server at BAKOSURTANAL. Sea-level data from tide-gauges are stored at BAKOSURTANAL, from the buoy-systems at BPPT.

In the next step all these data are available for any processing system that needs these data and are connected to the servers with the right to retrieve data from the respective server. The concept of GITEWS is that the Early-Warning Processing Centre will include all processing systems of each instrument or instrument network, and the modelling subsystem at BMG. This includes people with expertise in seismology, GPS and oceanography being available directly in the Warning Centre on a 24/7 basis. The reasons are:
- The Early Warning Processing Centre has to be operated in a 24/7 service
- The timelines of Early Warning have to be as short as possible
- The Officer on Duty who has to issue the warning needs the direct and immediate personal support from the different experts for correct interpretation and judgement of the available information. He/she needs the experts for direct instrument and data quality control to be assured, so that false alarms are minimized and the maximum amount of information is available.

For these reasons we strongly recommend to operate all processing systems at the warning centre at BMG with the necessary experts available. The processing systems in the warning centre for the different instruments retrieve data directly from the data servers.
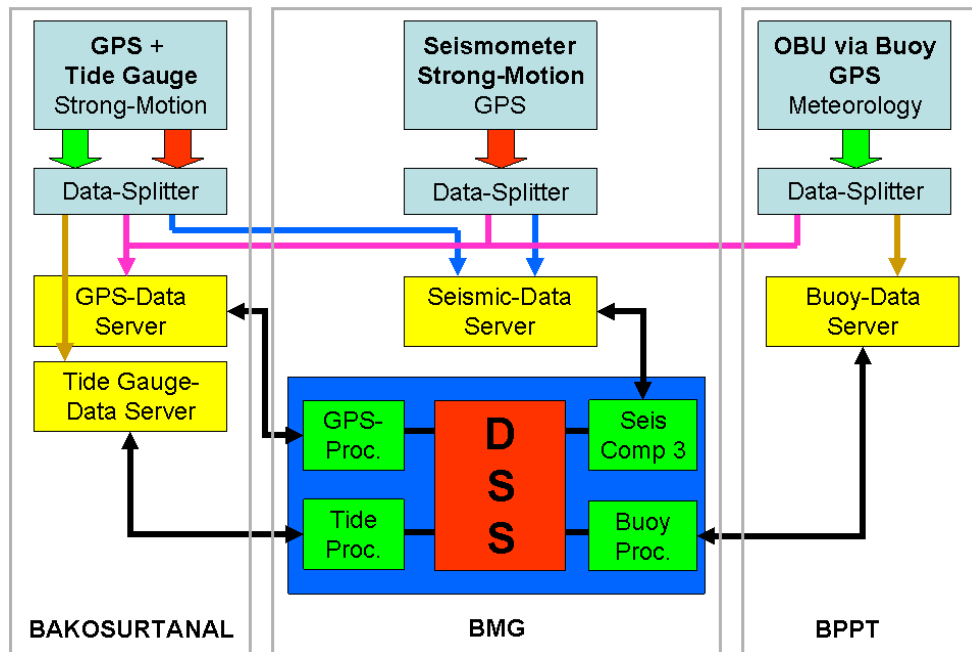
System outline and final configuration of the Early Warning Processing System with all relevant data flows and the decision support system (DSS) as a mediator between the main sensor nodes and data servers.

In normal mode of operation, the instruments and instrument network report their health status to the respective institutions. The Early Warning centre also receives these health messages for survey. Actions when any instrument has a problem are undertaken by the responsible institution, who will report any activities in this case to the Warning Centre for their information.

In case of an early tsunami warning (i.e. if a tsunami prone earthquake is identified) the instrument control of all instruments that can contribute to an early warning within a certain time span (i.e. one hour tsunami travelling) shall be done by the warning centre.

In the warning centre, at least 5 experts will be in charge: the Officer on Duty, a Seismologist, a GPS expert, an Oceanographer and a specialist for IT-system operating and communication. These 5 people per shift shall be together in the warning centre and will form the Early Warning Team, supported by the decision support system (DSS) as the mediator between the system components.

Seismology

Seismometers of the GEOFON Network, which is operated by GFZ Potsdam, form the backbone of the sensor systems. Strong and tsunami generating earthquakes will be detected at an early stage by the recording and analysis of seismic waves. A few minutes after a shock the first information on its strength and location will already be available.
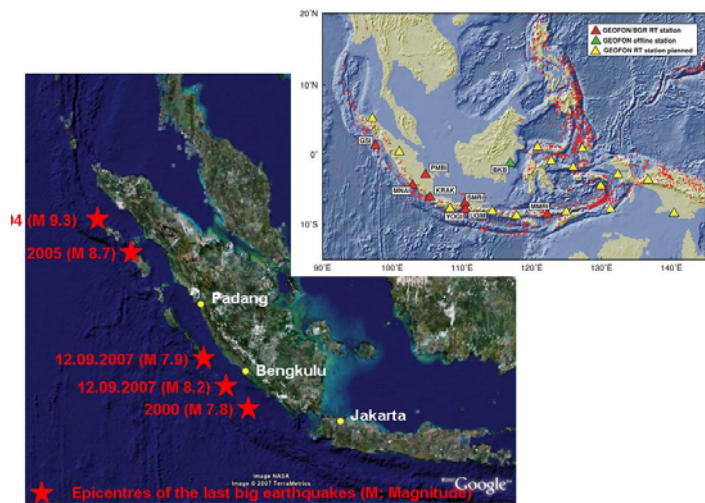
Ocean Instrumentation
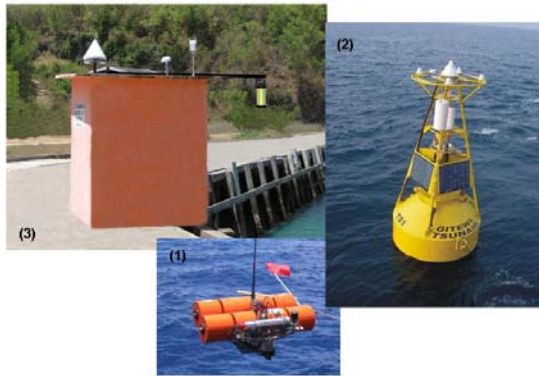
Sea-level monitoring is done by the combination of ocean-bottom units (OBU, 1), buoys (2) and tide gauges (3). The OBUs consist of pressure sensors, ocean bottom seismometers and marsh gas detectors, and detect anomalies in water pressure as well as seismicity. The buoys contribute to sea level monitoring by GPS technology and serve as communication nodes for data transmission. Tide gauges measure the water level at the coastline in real-time and are also equipped with GPS.

GPS Technologies

GPS Land Stations along the coastline of the Indonesian mainland and the islands off Sumatra shall detect horizontal and vertical deformations of the earth's surface due to a strong earthquake. This will give additional information on the earthquake's characteristics within minutes with an accuracy of a few centimetres. Both the buoys and tide gauges are equipped with GPS, in order to monitor their particular location and movement with respect to horizontal position and altitude.
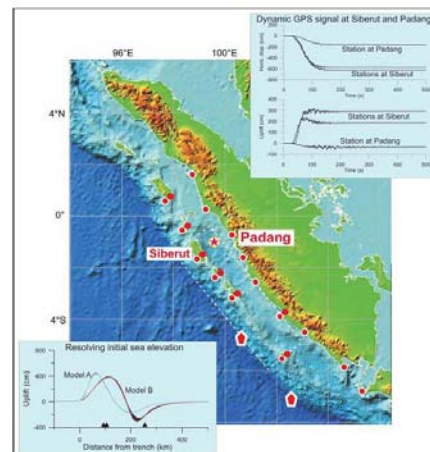
Modelling
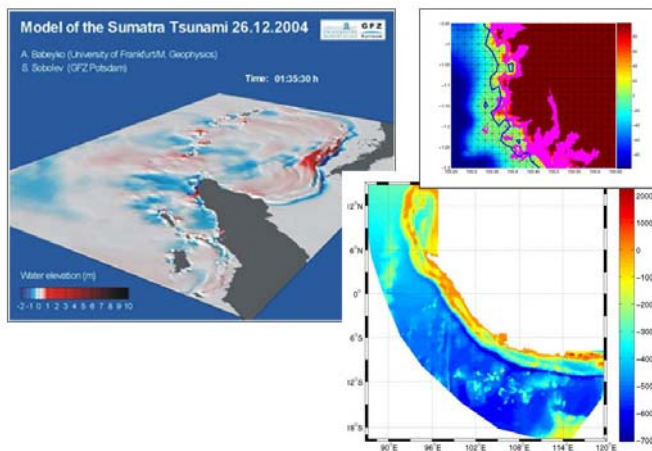
The subject of modelling in GITEWS is the simulation of a tsunami wave in the Indian Ocean, beginning from the epicentre of the initial earthquake (source modelling), the propagation of the wave in the open ocean (ocean modelling), up to its arrival at the coast (run-up modelling). The aim of these studies is to give statements about the danger at different coast segments. A multitude of pre- calculated scenarios will be used for real-time prognoses in the case of a strong earthquake along the Sunda Arc. The generation of vulnerability and risk maps will furthermore support mitigation efforts.

Warning Centre – Decision Support System

The different components of the Tsunami Early Warning System run together in a central warning centre. By means of a decision support system (DSS), the data of the particular sensor systems are analysed and supplemented by simulations and risk maps of the coastlines. The "Officer on Duty" is then able to assess if a tsunami has been generated, where and when it is to be expected, and what height the wave might reach. This information will be delivered to governmental institutions, local disaster management, action forces and the media. The people at risk can then be effectively warned and evacuation actions initiated.
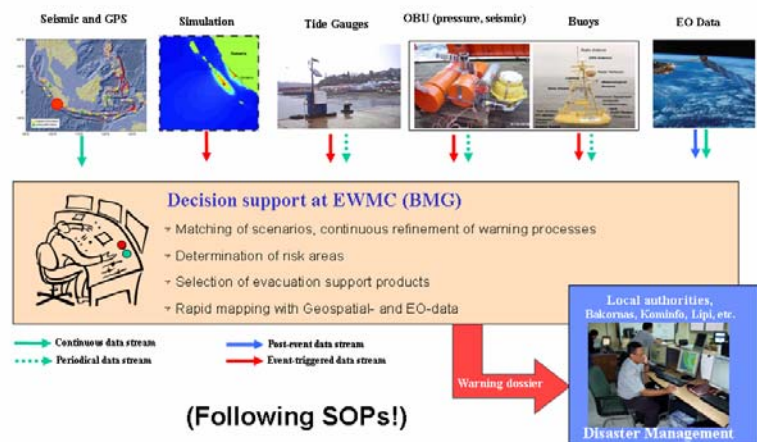
Capacity Building

Education and training of the warning centre staff, as well as the consulting of agencies, authorities and ministries in the Indian Ocean region, are the main focus of GITEWS Capacity Building. Furthermore, measures for the secure dissemination of warnings are developed and evacuation and escape plans generated. First, scientists from Indian Ocean rim countries will visit selected German institutions for research periods of several months.

There is, of course, this annual training course, which is offered by the GITEWS and BMG Jakarta within the framework of Capacity Building. The training courses last three weeks and focus on the new Tsunami Early Warning System installed in Indonesia. They offer the possibility to young scientists/engineers to learn the necessary background knowledge to work with the individual technical components, and how to use the system to find the information needed to start or to stop a Tsunami Early warning.

Part II will be conducted in 2008 and offer advanced techniques supplementary to first year's training course and Part III will follow in 2009. This will pave the way for participants to continue their formal education by pursuing a Master or Doctorial degree in Germany. The final goal of this training course is to broaden the experience and expertise of Indonesian scientists, which is of vital importance when establishing the InaTWS.

Information about the Meteorological and Geophysical Agency (BMG), Jakarta

Meteorological and Geophysical Agency of Indonesia (BMG) has a task of disseminating tsunami warnings in Indonesia. In addition, the warning will be sent to neighbouring countries at risk in a timely manner so as to save lives and property. To accomplish this task, monitoring systems are now being installed with the processing centre located at BMG: the Indonesian Tsunami Warning System (InaTWS) is on its way to taking shape. The monitoring system consists of a seismic network, a tide-gauge network, DART-buoys, a GPS and satellite observation network and the processing centers at BMG Headquarters and at regional offices. Each network is operated by different institutions; the seismic network by BMG, tide gauges and GPS by BAKOSURTANAL, DART-buoys by BPPT and satellite observation by LAPAN. These institutions are the operators of InaTWS. Data streams and parameters of monitoring systems are transmitted in real time via satellite links to the processing center at BMG.

The experience with local tsunamis in the past that have affected most parts of the Indonesian Region has shown that the arrival times of tsunamis are about 30 minutes after the initial earthquake. Therefore, rapid hypocenter determination and estimation of associated earthquake parameters is of paramount importance to determine whether the earthquake has the potential to generate a tsunami or not.

The President of Indonesia has instructed BMG to release a tsunami warning within 5 minutes after the earthquake has occurred. So the goal has been set to develop the InaTWS. To reach this goal, InaTWS will set up its headquarter in Jakarta and in 5 regional offices, located in Medan (North Sumatra), Ciputat (West Java), Denpassar (Bali), Makassar (South Sulawesi) and Jayapura (Irian Jaya). Another 5 regional offices will be installed in Padang (West Sumatra), Yogyakarta (DIY, central Java), Ambon (Molucca), Kupang (Timor) and Manado (North Sulawesi). Finally, there will be 10 regional offices to share the task and work load of earthquake and tsunami monitoring, operating 24 hours a day and 7 days a week. In order to efficiently run the InaTWS, all operators (BMG, BAKO, BPPT, LAPAN and LIPI) require expertise and experience, as well as a equal perception of tsunami monitoring systems.

Information about the German Aerospace Center (DLR)

DLR is Germany´s national research center for aeronautics and space. Its extensive research and development work is integrated into national and international cooperative ventures. As Germany's space agency, DLR has been given responsibility for the forward planning and the implementation of the German space program by the German federal government as well as for the international representation of German interests.

Approximately 5600 people work for DLR; the center has 28 institutes and facilities at 13 locations in Germany: Berlin, Bonn, Braunschweig, Bremen, Cologne (headquarters), Göttingen, Hamburg, Lampoldshausen, Neustrelitz, Oberpfaffenhofen, Stuttgart, Trauen and Weilheim. DLR also has offices in Brussels, Paris and Washington, D.C.

The German Remote Sensing Data Center (DFD) is an institute of the German Aerospace Center. Together with the Remote Sensing Technology Institute, it comprises DLR's Applied Remote Sensing Cluster, in which many of DLR's activities related to earth observation with satellites and aircraft are concentrated.

The German Remote Sensing Data Center is concerned with the reception, processing, archiving, distribution and utilization of earth observation data. In addition to applied research objectives, DFD is expert in developing and assuring the operational performance of information technology systems. Its technical expertise is concentrated in the following areas:

• Reception of data from earth observation satellites. For this purpose DFD operates both stationary antenna facilities in Germany and transportable receiving systems able to record data from remote regions worldwide;

• Long-term data archiving in the National Remote Sensing Data Library. Via the Internet this data can be accessed, ordered, and in some cases directly downloaded;

• Development of innovative methods, products and services for gaining practical information from remote sensing data for environmental protection and planning,

sustainable development, climate and atmospheric research, civil security, and rapid mapping for natural disasters and in the context of humanitarian aid activities
- Encouraging the utilization of data in cooperation with partners in science, education, government and industry.

As a DLR research institution, DFD is firmly embedded in European and international space infrastructures. It acts on behalf of the European Space Agency (ESA) as a data and processing center for European and international earth observation missions. It is also a partner of NASA in other missions. DFD operates dedicated user services, such as the Center for Satellite Based Crisis Information (ZKI), the GeoVisualization Center (GeoVIS), the World Data Center for Remote Sensing of the Atmosphere (WDC-RSAT), and jointly with the Remote Sensing Technology Institute an Optical Airborne Remote Sensing and Calibration Facility.

Information about the Alfred Wegener Institute for Polar and Marine Research (AWI)
Polar and Marine research are central themes of Global system and Environmental Science. The Alfred Wegener Institute is Germany's leading institute for polar and marine research and it conducts research in the Arctic, the Antarctic and at temperate latitudes. It coordinates Polar research in Germany and provides both the necessary equipment and the essential logistic back up for polar expeditions. Recent additional research themes include North Sea Research, contributions to Marine Biological Monitoring, Marine Pollution Research, Investigation of naturally occurring marine substances and technical marine developments.
The Institute was established as a public foundation in 1980. The Foundation Alfred Wegener Institute for Polar and Marine Research includes the Alfred Wegener Institute in Bremerhaven the Potsdam Research Unit (1992), the Biologische Anstalt Helgoland and the Wadden Sea Station Sylt. It is a member of the Helmholtz Association of German Research Centres; the German Federal Ministry of Education and Research (BMBF) covers 90% of financing, the state of Bremen 8% and the states of Brandenburg and Schleswig-Holstein provide 1% each. The Foundation has 780 employees and a total budget of 100 million Euro in 2005.
AWI collaborates in numerous international research programmes and maintains close contacts with many universities and institutes in Europe and farther afield. It sends scientists to other institutes throughout the world, to other research ships and stations, and invites scientists from other nations to cruises aboard "Polarstern", as well as to Bremerhaven and Potsdam. About a quarter of those participating in "Polarstern" expeditions are scientists from abroad. More information about the AWI is available at http://www.awi.de .

Information about the Federal Institute for Geosciences and Natural Resources (BGR)
The Federal Institute for Geosciences and Natural Resources (BGR) is committed to sustainable use of natural resources and protection of the human habitat. As a neutral institution feeling responsible for the future we advise ministries and the European Community and act as partners in industry and science. The leading motive of our daily work is "Improvement of Living Conditions by Sustainable Use of the Geo-Potentials".
The Federal Institute for Geosciences and Natural Resources (BGR) is the geoscientific center of excellence within the federal government and part of its scientific and technical infrastructure. BGR is a federal institute accountable to the Federal Ministry of Economics and Technology (BMWi). We provide neutral and independent advice and information about all geoscientific and natural resource issues. With this, we support the federal government in their following objectives:
- Stimulating economic development
- Long-term protection and improvement of the quality of life
- Enhancing technical and scientific expertise

BGR's mission comprises the following five tasks:
- Advice to the federal government on natural resource and geoscientific issues
- Advice and information to the German industry, exploration for natural resources including marine research
- Technical cooperation with developing countries

- International geoscientific cooperation, including polar research and geological maps
- Geoscientific Research and Development

More information about the BGR is available at http://www.bgr.bund.de .

Information about the USGS

The United States Geological Survey (USGS) is providing reliable scientific information to describe and understand the Earth; minimize loss of life and property from natural disasters; manage water, biological, energy, and mineral resources; and enhance and protect our quality of life. USGS has become a world leader in the natural sciences thanks to our scientific excellence and responsiveness to society's needs.

The USGS employs the best and the brightest experts who bring a range of earth and life science disciplines to bear on problems. By integrating our diverse scientific expertise, the USGS is able to understand complex natural science phenomena and provide scientific products that lead to solutions. Every day the 10,000 scientists, technicians, and support staff of the USGS are working for you in more than 400 locations throughout the United States.

As the Nation's largest water, earth, and biological science and civilian mapping agency, the U.S. Geological Survey (USGS) collects, monitors, analyzes, and provides scientific understanding about natural resource conditions, issues, and problems. The diversity of our scientific expertise enables us to carry out large-scale, multi-disciplinary investigations and provide impartial scientific information to resource managers, planners, and other customers. More information about the USGS is available at http://www.usgs.gov .

Information about the GeoForschungsZentrum (GFZ) Potsdam

The GeoForschungsZentrum Potsdam is the national research centre for geosciences of Germany and belongs to the Helmholtz Association of German Research Centres (http://www.helmholtz.de/). Its five departments are: Geodesy and Remote Sensing, Physics of the Earth, Geodynamics, Chemistry of the Earth, and Geo-Engineering.

Research at the GeoForschungsZentrum Potsdam ranges from the regional environment to the planet as a whole. The aim is to understand this highly complex, nonlinear system and the interactions of its natural subsystems with their mutually invasive circuitry and complex branching chains of cause and effect; to monitor and quantify the extent of global change and determine its regional effects, and finally, to assess the influence of human activities on "System Earth". Using a well developed understanding of system and process, the aim is to develop strategies and indicate action options to ensure the sustainable use of natural resources, to prepare for natural disasters and reduce their effects, to ensure sustainable use of the areas above and below the Earth, and to deal with climate and environmental change and its impact on the human environment.

GFZ Potsdam covers all disciplines of the geosciences from geodetics to geo-engineering. Its work in these fields has close interdisciplinary links with the other natural sciences - physics, mathematics and chemistry – and with applied sciences such as rock mechanics, geotechnics, hydraulic engineering and engineering seismology. The GFZ's core expertise in terms of methodology is to be found in the application and development of satellite technologies and other space-based measurement methods, the operation of global and regional geodetic and geophysical land-based measuring networks, the deployment of deep geophysical sounding methods using tomography, the implementation of research drilling projects, as well as laboratory and experimental techniques and the analysis and modelling of geoprocesses.

GFZ Potsdam maintains various instrument pools for use in the field and global measurement work, a team of engineers specialising in geoscientific instrument technology and a "Task Force" group of specialists for rapid response in natural disasters.

An underlying principle of the GFZ is that the geoscientific resources of universities and other research institutions should be combined in national and international joint projects. More information is available from the GFZ web-page http://www.gfz-potsdam.de, and additional information about GITEWS from http://www.gitews.org/ .

List of Lecturers

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2. Scientific Programme 2008

**Training Course II on
"Seismology, Data Analysis, and Tsunami Detection"
Part II: System Architecture and Decision Support**

Monday, Jan. 21		Opening of the Training Course II
09:30 – 10.00 10:00 – 10:02 10:02 – 10:05 10.05 – 10.10 10.10 – 10.15 10.15 – 10.25 10.25 – 10.35		**Opening of the GITEWS Training Course 2008 "Seismology, Data Analysis and Tsunami Detection"** Registration Welcome, MC Report of the Organizing Committee, Dr. Fauzi Opening address, Dr. Claus Milkereit, GFZ Opening address, Dr. Walter Mooney, USGS Opening Address, Dr. Idwan Suhardi, RISTEK Opening Remarks, Ir.Sri Woro B Harijono, DG of BMG
10:35 – 11:00		*Coffee Break + Group Photo*
11.00 – 11.30		Jan Sopaheluwakan (LIPI) Developing people centered TWS in Indonesia : a personal view on national and international perspectives
11:30 – 12.00		Prih Hajardi (BMG) Implementation of InaTWS
12.00 – 12.30		Jörn Lauterjung (GFZ) GITEWS – Progress Report and Distant Early Warning System (DEWS)
12:30 – 13:30		Lunch Break
		1. Seismology, Decision Support and Capacity Building
13.30 – 14.00	1.0	Torsten Riedlinger (DLR) The GITEWS Decision Support System
14.00 – 14.30	1.1	Djumarna Wirakusumah (DGTL) The GeoRisk Project
14.30 – 15.00	1.2	Walter Mooney (USGS) Progress Report on US Activities
15.00 – 15.30		Coffee Break
15.30 – 16:00	1.3	Klaus Klinge (BGR) Seismological Research in the Focus of BGR
16:00 – 16:30	1.4	Harald Spahn (GTZ) Capacity Building in Local Communities, the Cilacap Project
16:30 – 17:00	1.5	Fenno Brunken (InWEnt) Capacity Building Unit (CBU) in Indonesia

Tuesday, Jan. 22		2. SEISMOLOGY
08.30 – 10.00	2.1	C. MILKEREIT Results of the Training Course I and Introduction to the course 2008
10.30 – 11.00	2.2	T. HOFFMANN The GITEWS Seismological Observation Network
11.00 – 12.00	2.3	K. KLINGE Seismological Stations, Networks, and Arrays
13.30 – 15.00	2.4	K. KLINGE Introduction to Seismogram Interpretation and Phases
15.30 – 17.00	2.5	W. MOONEY The Seismicity of Indonesia: A modern analysis
Wednesday, Jan. 23		2. SEISMOLOGY
08.30 – 10.00	2.6	K. KLINGE Analysis of the Sumatra (26.12.2004) and Nias Earthquake (28.3.2005)
10.30 – 12.00	2.7	B. WEBER, K. KLINGE Exercise 2: Analysis of the 2004 and 2005 earthquakes I
13.30 – 15.00	2.8	W. MOONEY Earthquake Locations, Depths, Magnitudes and Focal Mechanisms
15.30 – 17.00	2.9	B. WEBER, K. KLINGE Exercise 3: Analysis of the 2004 and 2005 earthquakes II
20.00 - 21.30 Evening Lecture		DR. Wandono (BMG) Seismic Tomography
Thursday, Jan. 24		2. SEISMOLOGY
08.30 – 10.00	2.10	K. KLINGE Analysis of the 2006 Java (17.7.) and Banda Sea (27.1.06) Earthquakes
10.30 – 12.00	2.11	B. WEBER, K. KLINGE Exercise 4: Analysis of the 2006 Java (17.7.) and Banda Sea (27.1.06) Earthquake
13.30 – 15.00	2.12	K. KLINGE Analysis of the 2007 Java (8.8.) and Bengkulu (12.9.) Earthquake
15.30 – 17.00	2.13	B. WEBER, K. KLINGE Exercise 5: 2007 Java and Bengkulu Earthquake

Friday, Jan. 25		
08.30 – 10.00	2.14	K. KLINGE Analysis of the 2006 Yogyakarta (26.5.) and Padang (16.5.) Earthquakes
10.30 – 12.00 13:30 – 17:00	2.15	B. WEBER, K. KLINGE Exercise 6: Analysis of the 2006 Yogyakarta and Padang Earthquakes
20:00 – 21:30	2.15a	Dr. Harkunti Rahayu Experience on Tsunami Drill

Saturday, Jan. 26		**Visit the BMG Tsunami Warning Centre**
10.00 – 12.00 13.30 – 18.00		*FAUZI: Installation of the InaTWS, Visit BMG* *Visit of BPPT*

Sunday, Jan. 27	Leisure Day

Monday, Jan. 28		**2. SEISMOLOGY**
08.30 - 09.00	2.16	A. ANGGRAINI, S. PAROLAI, D. BINDI Task Force Mission after the 2006 Yogyakarta Earthquake
09.00 - 10.00	2.17	S. PAROLAI, D. BINDI Generalized spectral inversion (GIT). Part A: introduction
10.30 – 12.00	2.18	S. PAROLAI, D. BINDI Source, path, and site effects (refresher)
13.30 – 15.00		WAHYU TRIYOSO Rigidity Analysis
15.30 - 17.00	2.19	S. PAROLAI, D. BINDI Fourier analysis and instrument response (refresher)
20.00 - 21.30 Evening Lecture	2.20	S. PAROLAI, D. BINDI Data processing for GIT (with Matlab)

Tuesday, Jan. 29		**2. SEISMOLOGY**

08.30 - 10.00	2.21	S. PAROLAI, D. BINDI, A. ANGGRAINI Generalized spectral inversion, Part B: matrix of coefficients
10.30 - 12.00	2.22	S. PAROLAI, D. BINDI Construction of the matrix of coefficients (Matlab)
13.30 - 15.00	2.23	S. PAROLAI, D. BINDI Simultaneous evaluation of source, path and site effect (matlab)
15.30 - 17.00	2.24	S. PAROLAI, D. BINDI Analysis of the results (Matlab)
20.00 – 21.30 Evening Lecture		H. LATIEF Tsunami Simulation Data Base
Wednesday, Jan. 30		**3. Tsunami and Source Process Modeling**
08.30 - 10.00	3.1	S. BRUNE Refreshing Geodynamics (Tectonics, Dip-Slip Earthquakes, Okada's surface response model)
10.30 - 12.00	3.2	S. BRUNE Exercise: Okada's model to calculate static surface response (Sumatra 2004, Bengkulu 2007, potential future Padang eq.)
13.30 - 15.00	3.3	S. Harig, W. Pranowo Setting up a Tsunami-Model (Theory): Grid generation, Numerical background of TsunAWI
15.30 - 17.00	3.4	S. Harig, W. Pranowo Setting up a Tsunami-Model (Ex.): Installing the software, compiling, setting up the environment
Thursday, Jan. 31		**3. Tsunami and Source Process Modeling**
08.30 - 10.00	3.5	S. BRUNE Introducing the Rupture Generator
10.30 - 12.00	3.6	S. BRUNE Exercise: Rupture Generator (3 earthquake examples: Sumatra 2004, Bengkulu 2007, potential future Padang earthquake)
13.30 - 15.00	3.7	S. HARIG, W. PRANOWO Generating Tsunami-Scenarios with TsunAWI (Theory): How to run the model, questions to ask, and traps to avoid
15.30 - 17.00	3.8	S. HARIG, W. PRANOWO Generating Tsunami-Scenarios with TsunAWI (Ex.): Starting the model, dealing with uncertainty in the data, visualization
20.00 - 21.30 Evening Lecture	3.9	S. BRUNE Characteristics of landslides as tsunami sources (Historical events, Difference to earthquakes, Modeling)

Friday, Feb. 1		**3. Ocean Observation**
08.30 - 10.00	3.10	T. SCHÖNE, P. MANURUNG Ocean Observation and Instrumentation
10.30 - 12.00	3.11	T. SCHÖNE, P. MANURUNG Ocean Observation Examples
14.00 – 15.15	3.12	WAHYU PANDU Operational InaTEWS Tsunameter: status data management, relay and processing
15.45 – 17.00	3.13	DANNY HILMAN Slow deformation before the big earthquake
Saturday, Feb. 2		**Visit BAKOSURTANAL**
9.30 - 17.00		*Visit BAKOSURTANAL*
Sunday, Feb. 3		Leisure Day
Monday, Feb. 4		**3. GPS and Sensor Integration**
08.30 - 9.00	3.14	C. SUBARYA, R. GALAS GPS observation network for fast determination of deformation
09.00 - 10.00	3.15	R. GALAS GPS technology for Sumatra tsunami shield
10.30 - 12.00	3.16	R. GALAS GPS Exercise (measurements and analysis)
13.30 - 15.00	3.17	R. HÄNER Sensor Integration
15.30 - 17.00	3.18	R. HÄNER Sensor Integration

Tuesday, Feb. 5		**4. Decision Support: DSS Overview Day**
08.30 - 10.00 Manual Chapters 1, 2	4.1	FAUZI, U. RAAPE Introduction to the DSS training Overview of Training, Background, EWMS Approach; InaTEWS
10.30 - 12.00 Manual Chapters 3, **4**	4.2	U. RAAPE GITEWS Concept (**Overall Concept**, Warning Process)
13.30 - 15.00 Manual Chapters 4, 6, 7	4.3	M. WNUK DSS Concept (Roles & Tasks; Situation Awareness & Decision Support; Simulation System)
15.30 - 17.00 Manual Chapters **5**, 6	4.4	S. TESSMANN DSS Technical Issues / Infrastructure (DSS Architecture; Interfaces, esp. Dissemination Interface; Workplaces, EWMC)

Wednesday, Feb. 6		**4. Decision Support: DSS Topics Day**
08.30 - 10.00 Manual Chapters 8	4.5	U. RAAPE Situation Awareness (Incident Concept, Warning Levels, Staged Assessment, Imperfect Information,..)
10.30 - 12.00 Manual Chapters 9; 10	4.6	U. RAAPE Decision Process (Time constraints, cost and risk, decision proposals,..), Dissemination Process (DSS Products, PIO,..)
13.30 - 15.00 Manual Chapters 11	4.7	M. WNUK DSS GUI
15.30 - 17.00 Manual Chapters 11, 12	4.8	M. WNUK DSS GUI: Tasks and Procedures

Thursday, Feb. 7		**4. Decision Support: DSS Practice Day**
08.30 - 10.00 Manual Chapters 13	4.9	M. WNUK, U. RAAPE Introduction to DSS Practice Day Group Split: Group A / Group B
10.30 - 12.00 Manual Chapters 13	4.10	Group A: Prototype exercises at BMG: S. Tessmann, M. Wnuk Group B: Exercises at magnetic wall: T. Steinmetz, U. Raape
13.30 - 15.00 Manual Chapters 13	4.11	Group B: Prototype exercises at BMG: S. Tessmann, U. Raape Group A: Exercises at magnetic wall: T. Steinmetz, M. Wnuk
15.30 - 17.00	4.12	S. TESSMANN, T. STEINMETZ Practice Day WrapUp Feedback by Trainers and Trainees

Friday, Feb. 8		**4. DSS Wrap-Up**
08.30 - 10.00	4.13	U. RAAPE, FAUZI Wrap-Up and Conclusion Summary
10.15 - 11.45	4.14	U. RAAPE Discussion, Feedback, Outlook
14.00 – 14:30		**Final Discussion, Closing of Training Course II**
14:30		*Check out at Conference Hotel*
15.00		*Begin of excursion – Departure by Bus - Travel to Lembang*
Saturday, Feb. 9		**5. Excursion to Bandung**
		Visit Volcano near Lembang, visit Bandung University (?)
		Farewell Party and Hand-out of Course Certificates
Sunday, Feb. 10		**5. Excursion**
		Visit ITB, Travel back to Jakarta
		Arrival at Jakarta, Departure of the Participants
End of the Training Course 2008		