

Report for the Indonesia training course on seismology and tsunami warnings, May 2006



Participants and trainers for the Indonesia training course on seismology and tsunami warnings

The 9-day training course in seismology and tsunami warnings was held in the Sofyan Hotel, Jakarta from the 8th-17th May, 2006. The course was designed to improve understanding of the science of earthquake seismology and tsunami warning system operations to 40 new employees of the Indonesian Meteorological and Geophysical Agency (BMG). These scientists will be responsible for the day-to-day operations at the BMG regional centers across Indonesia. In addition, 5 longer standing employees of the BMG and two representatives from the Malaysian Meteorological Service (MMS) also attended. A list of participants is provided in Appendix 1. The training course was sponsored by the US Agency for International Development, the BMG, the UNESCO Intergovernmental Oceanographic Commission and the US Geological Survey.

The training was directly relevant to the daily duties of all participants. The level of previous knowledge of earthquake seismology and tsunami warning was generally quite basic, with most participants holding a bachelors degree in Exploration Geophysics (focusing largely on controlled source normal-incidence seismology) or a more general Earth Science degree. However, all participants had already undergone several weeks of induction training with the BMG.

The course was designed to cover theoretical seismology and the interpretation of seismic data relevant to tsunami warning systems in the first two days, with the third day focused on earthquake forecasting and an introduction to seismic instrumentation and arrays. Learning was directed through lectures complemented with nearly 4 hours of computer-based practical sessions. Days four though six covered seismic instrumentation, siting seismic vaults, data telemetry, station power supply and best practices in deployment and data off-load. This portion of the training was provided by IRIS PASCAL and involved hands-on experience with the instruments.

The seismology training was followed by two days of training in tsunami warnings and warning center operations. Learning was directed entirely through lectures given by experts with considerable experience in operations at the Japan Meteorological Agency and the Pacific Tsunami Warning Center. The topics included: tsunami

science; tsunami warning systems; data processing, warning dissemination and emergency response following a warning; warning center staffing and training; the TsunamiTeacher resource; and tsunami hazard mitigation. This completed the formal training portion of the course.

On day nine, a roundtable meeting was held which discussed the current warning system in Indonesia and formulated a plan for future enhancement of the system. The training course agenda is given in Appendix 2.

The lecture and practical material was supported by a course handout which contained information on the training course (such as sponsoring organizations and timetabling) and additional information on the topics covered in the training course. In addition, at the end of the course the participants were all provided with a copy of the lecture PowerPoint slides and the computer codes used in the practical sessions.

Selected quotes from the feedback forms:

"Thank you for your kindness we get many information"

"The course is very important to give new knowledge for new seismologists that the earth science start to grow up in their nation"

"This course can give me many information about my job"

At the completion of the seismology component of the course the participants were asked to fill out a questionnaire on the training provided. Feedback was obtained from 39 of the 45 participants. The responses were generally very enthusiastic, with 89% of the participant stating that the course had fulfilled their expectations and all the participants indicating that had gained knowledge on

the course (40% stating that they felt they had learned a great deal).

There were language problems during the training, with many of the participants having difficulty with lectures given in English, particularly from the lecturers without American accents. This was identified as a problem during the training, and an extra effort was made to present the lectures in a clear manner. Despite this, 50% of the participants indicated that they had difficulty with the speed of the lectures. The computer-based practical session were extremely popular with 97% of participants believing that they reinforced the lectures and many people suggesting a greater quantity of hands-on exercises in future training courses.

Quotes regarding the practical sessions:

"Very good to more understand"

"Amazing training"

"I think good if many more practical"



- a) Group work on the computer
- b) Question during a lecture session
- c) Dr Bruce Beaudoin demonstrating instrument set-up
- d) Dr Fauzi describing seismicity in Indonesia
- e) Dr Yamamoto providing help during a practical session.

Appendix 1 – Participants

NAME	INSTITUTION
Mr. Saw Bun Liong	MMS
Mr. Ahmad Nizam Bin Om	MMS
Ajat Sudrajat	BMG
A. Jeszy Wan Irfandy	BMG
Akbar	BMG
Andi Amran	BMG
Andi Suryani	BMG
Aprilyanto	BMG
Ardhianto Septiadhi	BMG
Ari Sungkowo	BMG
Asep N. Rachman	BMG
Benyamin Heryanto R	BMG
Biana R. Wulandari	BMG
Dian Oktiari	BMG
Firdaus Muhiddin	BMG
Gian Ginanjar	BMG
Gunawan Bayu Aji	BMG
Hamdy Arifin	BMG
Hendrik Leopatty	BMG
Husnul Kamal Zega	BMG
Kaharuddin	BMG
M. Amin	BMG
M. Tanwiruz Zaman	BMG
Marniati	BMG
Maya Minangsih	BMG
Meida Yustiana	BMG
Novita Hendrastuti	BMG
Nurhayati P.	BMG
Retno Agung P K	BMG
Rr. Theresia Elvien Setyadhini	BMG
Rudy Teguh I	BMG
Sarifuddin	BMG
Siti Rahma	BMG
Sri Wahyuni	BMG
Suci Dewi Anugrah	BMG
Suwarto	BMG
Tri Handayani	BMG
Tri Haryono	BMG
Tristin Yosefa	BMG
W. Nugrahani Farisa	BMG
Yahya Darmawan	BMG

Zulfikar	BMG
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Lecturers

Name	Affiliation
Dr Bruce Beaudoin	IRIS PASCAL
Dr Fauzi	BMG
Dr Annabel Kelly	US Geological Survey
Dr Laura Kong	International Tsunami Information Center
Dr Masturyono	BMG
Dr Walter Mooney	US Geological Survey
Dr Stuart Weinstein	Pacific Tsunami Warning Center, Hawaii
Dr Sri Widianoro	Institute of Technology Bandung
Dr Masahiro Yamamoto	UNESCO IOC

Appendix 2 – Agenda

Day 1 – SEISMOLOGY: Introduction and the Tectonic Situation of Indonesia, Introduction to Earthquakes

9am- Session I.1: Introductions

Welcome by Indonesia: Dr. Prih Harjadi

Welcome by US Embassy and USAID: William Frej, Mission Director,
USAID/Indonesia

Welcome on behalf of US IOTWS Program: Orestes Anastasia, USAID

Outline of Training Course: Annabel Kelly

Logistical Information (maps, rooms, meals, etc): Dr. Fauzi

10am- Session I.2

Topic: Introduction to Earthquake Science: A Historical Perspective

Lecturer: Annabel Kelly

11am- Coffee Break

11:15am- Session I.3

Topic: The Earth's Structure and Seismicity

Lecturer: Annabel Kelly

12:15pm- Lunch Break

1:30pm- Session I.4

Topic: Theoretical Seismology 1: Sources

Lecturer: Masahiro Yamamoto

3pm- Coffee Break

3:15pm- Session I.5

Topic: Theoretical Seismology 1: Wave Propagation

Lecturer: Masahiro Yamamoto

4:15pm- Discussions

5pm- TV Documentary: Nature Tech Earthquakes

Day 2 – SEISMOLOGY: Seismic Theory & Applications

9am- Session II.1

Topic: Theoretical Seismology 3: Media, Seismic Tomography

Lecturer: Dr. Sri Widianoro

10am- Session II.2

Topic: Structure & Interpretation of Seismograms 1: Waveforms and Hypocentral

Locations

Lecturer: Walter Mooney

11:00am- Coffee Break

11:15am- Session II.3

Topic: Structure & Interpretation of Seismograms 2: Magnitude and Source

Mechanisms

Lecturer: Walter Mooney

12:15pm- Lunch Break

1:30pm- Session II.4

Topic: Computer Exercises, Seismic Data Exercise, *or* Hypocenter Exercise

Lecturer: Annabel Kelly

3:15pm- Coffee Break

3:30pm- Session II.5

Topic: Damaging Effect of Earthquakes / Hazard Assessment

Lecturer: Annabel Kelly

4:45pm- Discussions
5pm- TV Documentary: Nature Tech Tsunamis

Day 3 – SEISMOLOGY: Global and Local Seismic Networks, Instrumentation & Seismic Data Analysis

9am- Session III.1
Topic: Earthquake Forecasting
Lecturer: Annabel Kelly

9:45am - Session III.2
Topic: Instrumentation, Recording systems, Data Transmission & Archiving
Lecturer: Masahiro Yamamoto

10:30am - Session III.3
Topic: Global & Local Arrays
Lecturer: Walter Mooney

11am - Coffee Break

11:15pm- Session III.4
Topic: Evaluation of current Seismic Network of BMG
Lecturer: Masturyono

12:45pm - Lunch Break

2:15pm– Session III.5
Topic: Computer Exercises, Seismic Data Exercise, *or* Hypocenter Exercise
Lecturer: Annabel Kelly

4:15pm - Coffee Break
4:30pm- Discussions
6pm- Dinner

Days 4-6 - IRIS Instrumentation Training

Lecturer: Bruce Beaudoin

Topics:

Introduction to IRIS

Introduction to portable seismic experiments

Tasks of an Instrument Facility

- Logistics
- Field support
- Maintenance and repair
- Training
- Data reduction support

Instrumentation - hands on setup and operation

Sensors- general overview, operation, maintenance

- Passive velocity transducers (ie L22, L4, HS10, S6000)

- Active broadband seismometer (ie, STS2, CMG 3T, CMG 3ESP)

Data acquisition systems - general overview, maintenance

- Reftek R130

- Quanterra Q330

Power systems

- Designing a power system for given a location and instrument load

Communications

- Types of RF data transmission using spread spectrum radios

- RF surveys, interference problems

- VSAT systems ... survey of units used in the USA

Integration of DAS with communications systems
Portable Broadband Sensor Vaults
Elements required for a good vault (coupling, thermal stability, protection)
Examples from over 15 years of portable deployments
Comparison of various portable and semi-portable broadband vaults
Station Siting
Noise sources to avoid (rules of thumb and examples)
Security
Flooding risk - mitigating techniques
Data Handling & Software for field and lab QC
Viewing waveforms
Accessing State of Health Data
Manipulating mseed files

Day 7 - Tsunami Warnings and Tsunami Warning Center Operations

9am – Session VII.1

Topic: Tsunami Science

- a. Wave characteristics
- b. Source Zones
- c. Source types, Generation, Propagation, and Directivity
- d. Travel-times and coastal inundation

Lecturer: S. Weinstein

10am- Coffee Break

10:15am - Session VII.2

Topic: Tsunami Warning System

- a. History & Mission
- b. Components (communication, research, outreach, and education)
- c. Organizational structure
- d. TWS Partners (Met. Services, Emergency management, IRIS, GEOSS, etc)

Topic: Tsunami Warning Center Operations

- a. Objectives and Activities of Warning Centers
- b. Guidance on developing new National Warning Centers

Topic: Tsunami Warning Center Event Processing

Overview - procedures, event flowcharts

Lecturer: BMG and/or L. Kong

12pm - Lunch Break

1:30pm- Session VII.3

Topic: Tsunami Warning Center Event Processing (Seismic Analysis)

- a. Signal acquisition and transmission formats
- b. Earthquake locations and associations
- c. Magnitudes and mechanisms
- d. Alarm types and Duty Personnel notifications

Lecturer: S. Weinstein, M. Yamamoto, L.Kong

3pm - Coffee Break

3:15pm- Session VII.4

Topic: Tsunami Warning Center Products - Message Dissemination

- a. Types of Products and Criteria for Product Issuance
Pacific and Indian Ocean scenarios
- b. Methods of Dissemination
- c. Communications Tests

Lecturer: S. Weinstein, M. Yamamoto, L. Kong

4:15pm- Discussions

5pm- End

Day 8 - Tsunami Warnings and Tsunami Warning Center Operations

9:30am – Session VIII.1

Topic: Tsunami Warning Center Data Processing (Sea Level Analysis)

- a. Geographical Information system
- b. Sea Level Analysis
- c. Tsunami models (BMG)
- d. Tsunami travel-time software

Lecturer: S. Weinstein, BMG

10:30am- Coffee Break

10:45am - Session VIII.2

Topic: Tsunami Warning Center Staffing and Training

- a. Staffing profile and workday flow
- b. Staff Training requirements
- c. Exercises and Drills

Topic: Indonesia Seismic and Tsunami Monitoring – Present and Future

Lecturer: M. Yamamoto, BMG

11:45am - TsunamiTeacher Resource Toolkit – L. Kong

12:15pm - Lunch Break

1:45pm- Session VIII.3

Topic: Tsunami Emergency Response after Tsunami Warnings Issued, including operation centers, warning dissemination, evacuation, shelters, etc

- a. Objectives and Activities involved in Emergency Response
- b. Guidance on developing tsunami response
- c. RANET and other methods of alert

Topic: Indonesia Tsunami Emergency Response – Present and Future

Lecturer: L.Kong, BMG

3pm- Coffee Break

3:15pm- Session VIII.4

Topic: Tsunami Hazard Mitigation - Preparedness, Education, and Outreach, including Earthquake Hazard Mitigation building codes and engineering design guidance

- a. Preparedness - risk assessment, exercises and drills, structural mitigation
- b. Education and Outreach - reasons for, examples, and how carried out

Topic: Indonesia Tsunami Preparedness Program – Present and Future

Lecturer: L. Kong, BMG

4:30pm - Discussions:

Comments from Lecturers & Participants, Recommendations, Conclusions

5:15 pm- Presentation of Certificates, Closing Ceremony

5:30 pm- *End of Training*

Day 9 - Roundtable – Tsunami Warnings for Indonesia

Participants:

Indonesian Government Representatives and other invited responsible organizations

Pacific Tsunami Warning Center, Deputy Director

Japan Meteorological Agency, represented by IOC Tsunami Senior Advisor

International Tsunami Information Centre, Director

Training participants

Time	Event
8.0 – 9.00	Registration
9.00 – 9:10	Opening remark (DG of BMG)

9.10 – 9.30	Key note speech, DR. Jan Sopaleuwakan
9.30 – 10.00	Key note speech, DR. Laura Kong
10.00 – 10.30	Coffee break
Monitoring, current status and plan in TWS Chair: DR.Prih Harjadi	
10.30 – 10.45	DART-buoy, BPPT
10.45 – 11.00	Tide Gauges, BAKOSURTANAL
11.00 – 11.15	GPS network, BAKOSURTANAL
11.15 – 11.30	Earth Observation, LAPAN
11.45 – 12.00	Seismic Network, BMG
12.00 – 12.15	Operation Center of EITWC, BMG
12.15 – 13.15	Lunch
Preparedness and Mitigation current status and plan in TWS Chair: Dr.Yamamoto	
13.15 – 13.30	Tsunami Modeling, ITB or BPPT
13.30 – 13.45	Operation center of BAKORNAS, BAKORNAS
13.45 – 14.00	System Dissemination, Kominfo
14.00 – 14.15	Public preparedness, LIPI
14.15 – 14.30	Scenario
Panel Discussion, scenario and plan for a drill 26 December 2006 DR.Laura Kong DR.Prih Haryadi	
14.30 – 17.40	DR.Laura Kong MR. Yamamoto DR.Weinstein DR.Jan Sopaleuwakan
17.40 – 18.00	Closing