

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



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

The 7-day training course in seismology and tsunami warnings was held in the Department of Mineral Resources, Bangkok from the 15th-22nd May 2006. The course was designed to improve the understanding of the science of earthquake seismology and tsunami warning system operations to National Disaster Warning Center (NDWC) and Meteorological Department staff employed in the day-to-day running of the Thai tsunami warning system and earthquake data processing. The course was also attended by a number of geologists from the Department of Mineral Resources, engineers from the Generating Authority of Thailand and academic Earth Scientists from the local universities. A list of participants is provided in Appendix 1. The training course was sponsored by US Agency for International Development, the NDWC, the UNESCO Intergovernmental Oceanographic Commission, and the US Geological Survey.

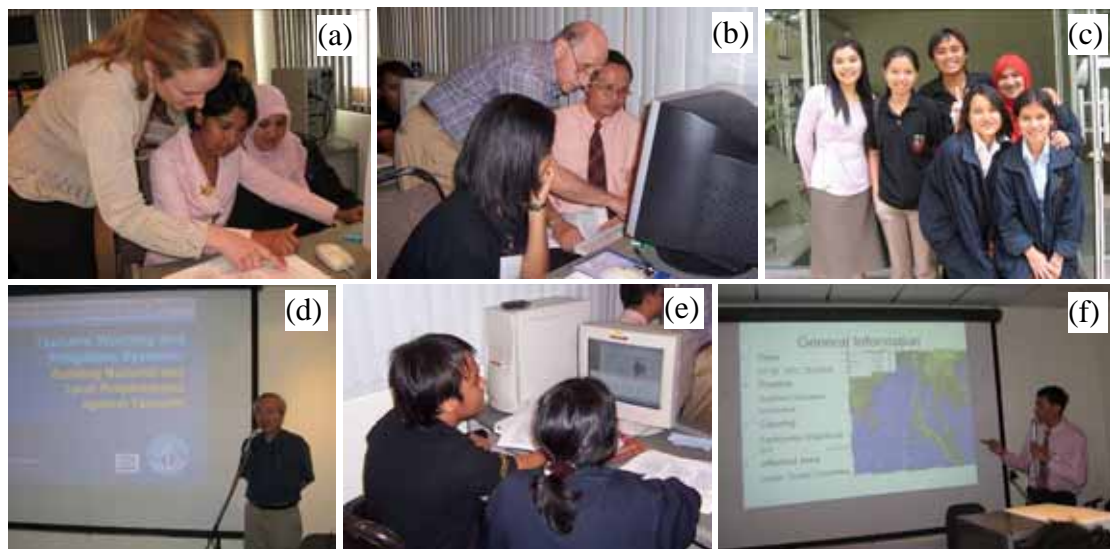
The training was directly relevant to the daily duties for the majority of the participants. The level of previous knowledge of earthquake seismology and tsunami warning was very varied, with experience ranging from less than one year employment at the NDWC following a degree not in Earth Science, to an Assistant Professor of Geophysics. The range in experience among the participants, combined with a variation in English language skills, presented a considerable challenge to presenting the course at an appropriate level. However, a balance was largely achieved as indicated by the participants who provided feedback at the end of the course (16 responses), all except one said they gained knowledge on the course, 80% said the course fulfilled their expectations and 73% said that the starting level of the lectures was appropriate. The expertise present in the audience was also used to augment the training course, with several of the academics asked to give short presentations on their areas of research. Although these presentations did not constitute a formal part of the training course, they were popular with the other

participants as they were given in Thai, provided a break from the structured lecture course, and introduced some of the research being conducted in Thailand.

The course was designed to cover theoretical seismology and the interpretation of seismic data relevant to tsunami warning systems in the first two days. On the morning of the third day the students participated in the Pacific-wide tsunami exercise. The afternoon and all of the fourth day covered more general earthquake seismology, such as forecasting, instrumentation and arrays. Learning was directed through lectures complemented with nearly 4 hours of computer-based practical sessions.

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 (history and organizational structure); 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 seven a roundtable meeting was held which discussed the current warning system in Thailand and formulated a plan for development 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.



Photos: a) Dr Kelly helping participants with a practical; b) Dr Mereu showing information on a seismogram; c) Some of the participants from the NDWC; d) Dr Yamamoto lecturing on tsunami warning systems; e) Participants analyzing seismic data during a practical session; f) Burin Wechbunthung lecturing on the seismicity and earthquake location procedures in Thailand.

Appendix 1 – Participants

(No.)	(Agency)	(Name)		(Position)
1	Meteorological Department Of Thailand	Mr.Puwiang	Prachammin	Senior Meteorologist
		Mr.Burin	Wechbungthung	Senior Meteorologist
		Mr.Aothai	Panya	Meteorologist
		Mrs.Kamonrat	Saringkanpasit	Meteorologist
		Mr.Adisorn	Fungkajorn	Meteorologist
2	Department of Mineral Resources	Mr.Wisut	Chotikasathien	Geologist
		Mr.Weerachat	Wiwegwin	Geologist
		Mr.Sakda	Thammavitwas	Geologist
		Mr.Wallop	Wisedsind	Geologist
		Mr.Wachirachai	Sak-apa	Geologist
3	Prince of Songkla University	Dr.Tripob	Bhongsuwan	Assistant Professor of Geophysics
4	Chulalongkorn University	Dr.Anat	Ruangrassamee	Lecturer
6	Mahidol University	Dr.Prinya	Putthapiba	Instructor
7	Electricity Generating Authority of Thailand	Mr.Somboon	Gesrarut	Engineer 8
		Mr.Anucha	Intawichan	Engineer 7
8	National Disaster Warning Center (NDWC)	Mr.Sanchai	Sujaritwongsanon	Exeprt in GIS
		Mr.Tawan	Sukkho	Senior Geologist
		Mr.Suwit	Khosuwan	Senior Geologist
		Mr.Passkorn	Kanthasap	Geologist
		Ms.Tamonwun	Wunpun	Scientist
		Mr.Pisnupong	Anuratpanich	Meteorologist
		Mr.Tinnakorn	Tatong	Geologist

		Mr.Supamit	Jantakham	Geologist
		Ms.Tipsakorn	Aiadmusik	Geologist
		Ms.Jumleang	Chutab	Geologist
		Ms.Apinya	Chaila	Geologist
		Ms.Chantana	Da-te	Geologist

Lecturers

Name	Affiliation
Dr George Choy	US Geological Survey
Dr Annabel Kelly	US Geological Survey
Dr Laura Kong	International Tsunami Information Center
Dr Charles McCreery	Pacific Tsunami Warning Center, Hawaii
Dr Robert Mereu	University of Western Ontario, Canada
Dr Walter Mooney	US Geological Survey
Dr Koichiro Nagasaka	Japan Meteorological Agency
Yuji Nishimae	Japan Meteorological Agency
Dr Masahiro Yamamoto	UNESCO IOC

Appendix 2 – Agenda

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

9am- Session I.1: Introductions

Welcome by Thailand

Welcome by IOC and USGS: Walter Mooney (also on behalf of IOC)

Welcome by US Embassy and USAID: Timothy Beans, Mission Director, USAID
Regional Development Mission for Asia

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

Outline of Training Course: Annabel Kelly

Logistical Information (maps, rooms, meals, etc): Cherdsak Virapat

10:15am- Session I.2

Topic: Introduction to Earthquake Science: A Historical Perspective

Lecturer: Bob Mereu

11:15am- Coffee Break

11:30am- Session I.3

Topic: The Earth's Structure and Seismicity

Lecturer: Walter Mooney

12:30pm- Lunch Break

1:45pm- Session I.4

Topic: *Practical Session*

Lecturer: Bob Mereu

2:45pm- Coffee Break

3pm- Session I.5

Topic: Theoretical Seismology 1: Sources

Lecturer: George Choy

4:15pm- Discussions

5pm- TV Documentary: Nature Tech Earthquakes

Day 2 – SEISMOLOGY: Seismic Theory & Applications

9am- Session II.1

Topic: Theoretical Seismology 2: Wave Propagation

Lecturer: George Choy

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: *Practical Session*

Lecturer: Bob Mereu

4pm- Coffee Break

4:15pm- Session II.5

Topic: Damaging Effects of Earthquakes

Lecturer: Annabel Kelly

5pm- TV Documentary: Nature Tech Tsunamis

Day 3 – SEISMOLOGY: Pacific Tsunami Early Warning Center Exercise, Global and Local Seismic Networks, Instrumentation & Seismic Data Analysis

8am- *Special Session:* Exercise Pacific Wave 06

Location: National Disaster Warning Center

12:30pm- Lunch Break

Training resumes at Department of Mineral Resources at 3 pm

3pm - Session III.1

Topic: Global & Local Arrays

Lecturer: Bob Mereu

4pm –Session III.2

Topic: Instrumentation, Recording systems, Data Transmission & Archiving

Lecturer: Bob Mereu

5pm- Discussions

6pm- Dinner

Day 4 - Earthquake Hazard Assessment & Tsunami Science

9am- Session IV.1

Topic: Earthquake Forecasting

Lecturer: George Choy

10am- Session IV.2

Topic: Challenges in Observational Seismology in the Indian Ocean with special reference to the 2004 Sumatra-Andaman earthquake

Lecturer: Annabel Kelly

11am- Coffee Break

11:15am- Session IV.3

Topic: Web Resources for Earthquake Information (Hands-On Computer Lab Exercise)

Lecturer: Annabel Kelly

12:15pm- Lunch Break

1:45pm- Session IV.4

Topic: *Practical Session*

Lecturer: Bob Mereu

3:15pm- Coffee Break

3:30pm- Session IV.4

Topic: *Practical Session*

Lecturer: Bob Mereu

4:30pm- Session IV.5

Topic: Summary of seismology component of training course

Lecturer: Annabel Kelly

5pm- Discussions

6pm- Dinner

Day 5 - Tsunami Warnings and Tsunami Warning Center Operations

9am- Session V.1

- Topic: Tsunami Science – Generation, Propagation, Shoreline Impact
- Mechanisms (earthquakes, landslides, volcanoes, meteor impacts)
 - Source Zones (Pacific Basin, Pacific Marginal Seas, Indian Ocean)
 - Source Characteristics (wave period, directionality, size, complexity)
 - Amplitude and Shoreline Impact (deep ocean, islands, spreading, reflections, attenuation, currents, number of waves, seiches, bores)
 - Wave Observations, long wave theory)
 - Tsunami travel-times, tides and their effects

Lecturer: PTWC (C. McCreery)

9:45am- Session V.2

- Topic: Tsunami Warning and Mitigation Systems
- History & Mission – PTWS and globally
 - System Components (communication, research, outreach, and education)
 - Organizational structure – ICG
 - TWS Partners (WMO, ISDR, Met. Services, Emergency management, FDSN/IRIS, GEOSS, etc)

Lecturer: IOC (M. Yamamoto)

10:30am- Coffee Break

10:45am - Session V.2

- Topic: Component: Warning Guidance - Tsunami Warning Center Operations
- Objectives and Activities of Warning Centers - PTWC
 - Guidance on developing and staffing new National Warning Centers -

PTWC

- Data Networks required for earthquake monitoring and tsunami warning -

IOC

Lecturer: PTWC, IOC

12pm- Lunch Break

1:30pm- Session V.3

- Topic: Tsunami Warning Center Operations
- Reliability and Robustness
 - Information Technology architecture
 - Data and Message Communications

Lecturer: PTWC

2:15pm – Coffee Break

2:30pm – Session V.4

- Topic: Tsunami Warning Center Data Processing (global / regional systems) -

PTWC

Seismic Analysis

- TWC data processing history & background
- Signal acquisition and transmission format
- Disk writing format
- Earthquake locations and associations
- Magnitudes and mechanisms
- Alarm types and notifications

Tsunami / Sea Level Analysis

- Geographical Information system
- Tsunami travel-times
- Tsunami modeling and wave forecasting

Lecturer: PTWC

4:30pm – General Discussions

6pm- Dinner Break

Day 6 - Tsunami Warnings and Tsunami Warning Center Operations

9:00am- Session VI.1

Topic: Tsunami Warning Center Data Processing (national / local systems) - JMA
Seismic Analysis

- a. TWC data processing history & background
- b. Signal acquisition and transmission format
- c. Disk writing format
- d. Earthquake locations and associations
- e. Magnitudes and mechanisms
- f. Alarm types and notifications

Tsunami / Sea Level Analysis

- a. Geographical Information system
- b. Tsunami travel-times
- c. Tsunami modeling and wave forecasting

Lecturer: JMA

10:45am- Coffee Break

11am - Session VI.2

Topic: Component: Warning Guidance - Tsunami Emergency Response after
Tsunami Warnings Issued (included\ hazards, shelters, etc)

- a. Objectives and Activities involved in Emergency Response - IOC
- b. Guidance on developing tsunami response - IOC
- c. Thailand Tsunami Emergency Response – Present and Future - NDWC

Lecturer: L. Kong, Thailand NDWC

12pm - Lunch Break

1:30pm- Session VI.3

Topic: Component: Tsunami Hazard Risk Assessment and Preparedness

- a. Hazard and Risk Identification of Vulnerable Communities
- b. Tsunami numerical modeling
- c. Inundation and Evacuation Maps

Lecturer: IOC or PTWC

2:30pm- Coffee Break

2:45pm- Session VI.4

Topic: Component: Tsunami Hazard Mitigation - Preparedness, Education, and
Outreach

(Earthquake Hazard Mitigation building codes and design guidance here)

- a. Preparedness - risk assessment, exercises and drills, structural mitigation
- b. Education and Outreach - reasons for, examples, and how carried out
- c. IOC TsunamiTeacher Resource Toolkit
- d. Thailand Preparedness Program and other initiatives – NDWC or other Agency

Lecturer: L. Kong, Thailand NDWC or appropriate Agency

4:15pm- Session VI.5

Topic: Discussion, Conclusions, and Recommendations

Lecturer: IOC (Kong, Yamamoto), PTWC, JMA

5:15pm- Closing

Day 7 -Roundtable Discussion – Tsunami Warnings for Thailand

Participants:

Thailand Government Representatives and other invited responsible organizations

Pacific Tsunami Warning Center (Dr. Charles McCreery, Director)

Japan Meteorological Agency (Koichi Nagasaka, Former Director-General; Yuji Nishimae, Senior Scientific Officer)

IOC (International Tsunami Information Centre, Dr. Laura Kong, Director)

Training Participants

- 9am** Opening
Welcome by Thailand
Welcome by IOC
- 9:15am** JMA's Tsunami Warning and Earthquake Information Service
Koichi Nagasaka, Former Director-General, JMA
- 10:15am** Coffee Break
The Morning Session will cover how the PTWC and JMA respond to earthquake and tsunami alarms, and include timelines for alarms, data receipt and evaluation, decision making for determining message content, and alert dissemination. Each Presentation is followed by 10-min Question-and-Answer and Discussion.
- 10:30am** Tsunami Warning Center Operations - Scenarios
Procedures of the Northwest Pacific Tsunami Advisory Center for the South China Sea Region – JMA
Case Study: Exercise Pacific Wave 06 source – JMA
Case Study: Other sources of concern – PTWC
- 11:45am** Tsunami Warning Center Operations - Scenarios
Procedures of the IOTWS Interim System – PTWC
Case Study: Northern and Southern Sumatra source – PTWC
Case Study: Andaman-Nicobar Islands sources - JMA
- 12:30pm** Lunch Break
- 2pm** Recent developments and future plans of Thailand organizations – Thailand Agencies
- 3pm** Coffee Break
- 3:15pm** Panel Discussion – Opportunities and Challenges for Thailand
IOC (L. Kong), PTWC (C. McCreery), JMA (K. Nagasaka, Y. Nishimae)
PDC (S. Goosby), Thailand (NDWC, TMD, others)
5 min statements, followed by moderated discussion
- 4:45pm** Recommendations and Conclusions
- 5pm** Closing
- 5:30 – 8 pm** Farewell Dinner