A five-day international training course in Seismology and Tsunami Warnings was held at the Malaysia Meteorology Department in Kuala Lumpur (Petaling Jaya district), Malaysia from August 21-25, 2006. The course involved participants from Indonesia, Thailand, Sri Lanka, Vietnam and Malaysia. The Malaysian Meteorology Department (MMD), the UNESCO Intergovernmental Oceanographic Commission (IOC), the US Geological Survey (USGS) and the US Agency for International Development (USAID) sponsored the training course.

A total of 49 participants attended: 10 from the Indonesian Meteorology and Geophysics Agency (BMG) offices in Jakarta and Bali; 3 from the Thai National Disaster Warning Center (NDWC); 2 Sri Lankans, 1 from the National Disaster Management Center and 1 from the Department of Meteorology; 2 Vietnamese scientists, from the Institute of Oceanography and the Institute of Geophysics; and 32 Malaysian scientists, 3 from Astronautic Technology (M) Sdn. Bhd., 2 from the Crisis & Disaster Management Directorate, and the remainder from the Meteorology Department. A full list of participants and lecturers is provided in Appendix 1.
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 varied, with experience ranging from new employees of the MMD to experienced seismologists from the Indonesian BMG.

The training course was structured to give an introduction to earthquake seismology and tsunami warning center procedures and operations. The first day gave an overview of the basic theory of earthquake seismology, covering plate tectonics, earthquake source and seismic waves. The second day reviewed the technical seismology used in tsunami warnings, including earthquake location and focal mechanism solutions. For the morning of the third day more general topics in earthquake seismology were discussed, including seismic instrumentation and networks. This day also introduced tsunami science, reviewing the generation and propagation of tsunami waves. In the afternoon of day 3 the Malaysian Meteorology Department arranged a visit to a local seismic station.

The final two days of the training were focused on tsunami warnings. On day 4, this section of the training began with a review of tsunami warning systems and warning center practices. This review was followed by detailed discussion of scenarios for tsunami events in the Indian Ocean and the South China Sea, and a hands-on session using the Integrated Tsunami Data Base computer program (winITDB). On the final day of the training reviewed the communication of warnings and the work of warning centers in education and mitigation. The full agenda for the course is provided in Appendix 2.

At the end of the training course questionnaires were given to the participants. 45 of the participants provided feedback. In general the reports were very positive, with all but one of participants reporting that they gained knowledge in the training and a little over a third stating that they gained a great deal of knowledge. General comments provided by the participants included: "Very good course. Very useful to me since I am directly involved in earthquake instrumentation, monitoring and warning. A great job was done by all lecturers. The
handout, slides, presentations were very good and informative", "I'm new to seismology, the course has really improved my knowledge", "I've read about earthquakes and tsunamis before, but this course really opened my eyes to the dangers of tsunami to Malaysia", "Learnt the importance of sharing information, every second counts". Several of the participants had attended the previous training courses in Thailand and Indonesia, these participants gained less new information than those attending the training for the first time. However, the development of training materials and the more advanced level of this course ensured that the returning participants reinforced existing knowledge and gained some knowledge. This was indicated in the feedback forms, for example, "Some of the material I previously got when the course was in my country, Indonesia, so here I just take some new information from this course". A combination of improved PowerPoint slides and participants with more experience of teaching in English reduced the communication problems that were experienced in previously training programs. In the feedback forms 89% of the participants indicated that the lectures were at the correct speed, with 1 participant indicating that the lectures were a little too slow and 3 that they were too fast. Additionally the participants were almost unanimous with their support for the starting level of the lectures, with just 2 reporting that they believed the level was a little too basic. As with previous courses the hands-on sessions were very popular with the participants, and despite more than 7 hours of practical sessions, 3 of the responses requested more hands-on time.

The feedback forms also asked the participants to provide information on what further training they would like. The responses indicated that a further training would be appreciated in a wide range of topics, as indicated by Figure 7.
Appendix 1 Participants and Lecturers

INDONESIA

1. Mr. Setyoajie Prayoedhie
   Analyst
   Meteorologi and Geophysical Agency

2. Mr. Bayu Pranata
   Analyst
   Meteorologi and Geophysical Agency

3. Mr. Nurpujiono
   Analyst
   Meteorologi and Geophysical Agency

4. Mr. Oktifar Tri Bandono
   Analyst
   Meteorologi and Geophysical Agency

5. Mr. Fauzi
   Analyst
   Meteorologi and Geophysical Agency

6. Mr. Handi Sulistyo Widodo
   Analyst
   Meteorologi and Geophysical Agency

7. Mr. Iwan Hermawan
   Meteorologi and Geophysical Agency

8. Mr. Sujabar
   Meteorologi and Geophysical Agency

9. Mr. Sutiyono
   Analyst
   Meteorologi and Geophysical Agency

10. Mr. Agus Riyanto
    Analyst
    Meteorologi and Geophysical Agency
    Regional Seismological Center III Denpasar-Bali

SRI LANKA

11. Ms. D.G. Fernando
12. Mr. N.W.A.M.M.K.N. Bandara
   Assistant Director/Geologist
   Disaster Management Centre

VIETNAM

13. Mr. Nguyen Le Minh
   Researcher
   Institute of Geophysics

14. Mr. Tran Van Chung
   Researcher
   Department of Marine Physics
   Institute of Oceanography

THAILAND

15. Mr. Supamit Jantakham
    Geologist
    National Disaster Warning Center (NDWC)

16. Ms. Apinya Chaila
    Meteorologist
    National Disaster Warning Center (NDWC)

17. Ms. Tipsakorn Aiadmusik
    Meteorologist
    National Disaster Warning Center (NDWC)

MALAYSIA

18. Ms Irene Eu Swee Neo
    Assistant Director
    Seismology Division
    Malaysian Meteorological Department

19. Mr. Asmadi bin Abdul Wahab
    Assistant Director
    Seismology Division
    Malaysian Meteorological Department

20. Ms. Sandra Richard a Scholastica
    Assistant Meteorological Officer
21. Mr. Devadas a/l Ramachandran
   Assistant Meteorological Officer
   Seismology Division
   Malaysian Meteorological Department

22. Mr. Lim Chin Tiong
   Assistant Meteorological Officer
   Seismology Division
   Malaysian Meteorological Department

23. Ms. Lizafadzleena Zaimah binti Ahmad Zabidi
   Assistant Meteorological Officer
   Seismology Division
   Malaysian Meteorological Department

24. Mr. Muhammad Helmi bin Abdullah
   Principal Assistant Director
   Central Forecast Office
   Malaysian Meteorological Department

25. Mr. A. Kamiluddin bin Hj. Ibrahim
   Principal Assistant Director
   Central Forecast Office
   Malaysian Meteorological Department

26. Mr. Ambun Dindang
   Principal Assistant Director
   Central Forecast Office
   Malaysian Meteorological Department

27. Ms. Zaridah binti Md. Jalal
   Meteorological Officer
   Central Forecast Office
   Malaysian Meteorological Department

28. Mr. Azlai bin Taat
   Meteorological Officer
   Central Forecast Office
   Malaysian Meteorological Department

29. Mr. Wellson David
   Assistant Meteorological Officer
   Information Communication & Technology (ICT) Division
30. Mr. Afiq Zhofri bin Abdul Razak  
   Meteorological Officer  
   Malaysian Meteorological Department

31. Mr. Mohd Ridzuan bin Adam  
   Meteorological Officer  
   Malaysian Meteorological Department

32. Ms. Surina binti Othman  
   Meteorological Officer  
   Malaysian Meteorological Department

33. Ms. Heernani binti Abu Bakar  
   Meteorological Officer  
   Malaysian Meteorological Department

34. Ms. Amzura binti Amran  
   Meteorological Officer  
   Malaysian Meteorological Department

35. Ms. Siti Fauziah binti Mat Adam  
   Meteorological Officer  
   Malaysian Meteorological Department

36. Ms. Mimi Adilla binti Sarmani  
   Meteorological Officer  
   Malaysian Meteorological Department

37. Mr. Prince Assad bin A. Kahar  
   Meteorological Officer  
   Malaysian Meteorological Department

38. Ms. Nur Syarafina binti Shafie  
   Meteorological Officer  
   Malaysian Meteorological Department

39. Mr. Shamshumar bin Shuhani  
   Meteorological Officer  
   Malaysian Meteorological Department

40. Ms. Junainah binti Ali  
   Meteorological Officer  
   Forecast Office Subang
41. Ms. Norhadizah binti Mohd Khalid  
   Meteorological Officer  
   KLIA Meteorological Office

42. Ms. Toh Ying Ying  
   Meteorological Officer  
   KLIA Meteorological Office

43. Ms. Zaty Aktar binti Hj. Mokhtar  
   Meteorological Officer  
   Forecast Office Bayan Lepas

44. Mr. Rosli bin Zakaria  
   Meteorological Officer  
   Kuching Meteorological Office

45. Mr. Mohd Razif bin Samsudin  
   System Engineer  
   Astronautic Technology (M) Sdn. Bhd. (ATSB)

46. Ms. Aumuhaimi binti Md. Yusof  
   System Engineer  
   Astronautic Technology (M) Sdn. Bhd. (ATSB)

47. Ms. Yulia binti Jaswar  
   Assistant System Engineer  
   Astronautic Technology (M) Sdn. Bhd. (ATSB)

48. Mr. Mohamad Syazwan Bin Saleh  
   Assistant Director  
   Crisis & Disaster Management Directorate  
   National Security Council (BKN)

49. Mr. Norhisham bin Kamarudin  
   Assistant Director  
   Crisis & Disaster Management Directorate  
   National Security Council (BKN)

LECTURERS

Prof. Jim Mori  
   Disaster Prevention Research Institute  
   Kyoto University,  
   Japan

Dr. R.K. Chadha  
   Deputy Director
National Geophysical Research Institute
India

Dr. Annabel Kelly
Research Seismologist
US Geological Survey

Dr. Laura S Kong
Director
UNESCO-IOC, International Tsunami, Information Centre

Mr. Masahiro Yamamoto
Senior Tsunami Advisor
UNESCO-IOC
## Appendix 2 Training Course Agenda

<table>
<thead>
<tr>
<th>Time</th>
<th>Topic</th>
<th>Day</th>
<th>Time</th>
<th>Topic</th>
<th>Day</th>
<th>Time</th>
<th>Topic</th>
</tr>
</thead>
<tbody>
<tr>
<td>9:00-10:30</td>
<td>Introductions</td>
<td>1</td>
<td>9:00-10:00</td>
<td>Seismic data interpretation - Location</td>
<td>2</td>
<td>9:00-10:00</td>
<td>Tsunami Warning and Mitigation Systems - Tsunami Warnings</td>
</tr>
<tr>
<td>10:30-11:00</td>
<td>Coffee</td>
<td>1</td>
<td>10:00-11:00</td>
<td>Seismic arrays and networks</td>
<td>2</td>
<td>10:00-11:00</td>
<td>Tsunami Warning Center Operations</td>
</tr>
<tr>
<td>11:00-11:30</td>
<td>Seismic data interpretation - Focal mechanisms</td>
<td>1</td>
<td>10:45-11:00</td>
<td>Coffee</td>
<td>2</td>
<td>11:00-11:30</td>
<td>Tsunami Warning Center Operations</td>
</tr>
<tr>
<td>11:30-12:30</td>
<td>Earthquake forecasting</td>
<td>1</td>
<td>11:00-11:45</td>
<td>Tsunami generation and physics</td>
<td>2</td>
<td>11:00-11:30</td>
<td>Tsunami Warning Center Operations (PTWC and JMA) - IO Scenario</td>
</tr>
<tr>
<td>12:30-1:30</td>
<td>Lunch</td>
<td>1</td>
<td>11:45-1:00</td>
<td>Computer learning - TsunamiTeacher</td>
<td>2</td>
<td>11:00-11:30</td>
<td>Procedures for the IOTWS Interim Advisory Information Service</td>
</tr>
<tr>
<td>1:30-3:30</td>
<td>Computer exercises (earthquake location and focal mechanisms)</td>
<td>1</td>
<td>1:00-2:00</td>
<td>Lunch</td>
<td>2</td>
<td>12:30-1:30</td>
<td>Case Study: Indonesia Source Region</td>
</tr>
<tr>
<td>3:30-4:00</td>
<td>Dreaming</td>
<td>1</td>
<td>2:00-5:00</td>
<td>Visit to seismic station</td>
<td>2</td>
<td>2:30-3:30</td>
<td>Case Study: Exercise Pacific Wave 06 source, north of Philippines</td>
</tr>
<tr>
<td>4:00-5:00</td>
<td>Dreaming</td>
<td>1</td>
<td>3:30-4:00</td>
<td>Computer tsunami exercises (winTDB)</td>
<td>2</td>
<td>3:30-4:00</td>
<td>Kong, Kelly, Yamamoto</td>
</tr>
</tbody>
</table>

### Day 1
- **Seismology**
- 9:00-10:30 Introductions
- 10:30-11:00 Coffee
- 11:00-11:30 Seismicity and Plate Tectonics  
  - RK Chadha
- 11:30-12:30 Earthquake theory - sources  
  - Jim Mori
- 12:30-1:30 Lunch
- 1:30-3:30 Computer exercises (seismic data interpretation)  
  - Annabel Kelly
- 3:30-4:00 Coffee
- 4:00-5:00 Earthquake theory - waves  
  - Jim Mori
- 5:00-6:00 Optional: DVD documentary on earthquakes

### Day 2
- **Seismology**
- 9:00-10:00 Seismic data interpretation - Location  
  - RK Chadha
- 10:00-11:00 Seismic data interpretation - Focal mechanisms  
  - Annabel Kelly
- 11:00-11:30 Coffee
- 11:30-12:30 Earthquake forecasting  
  - Jim Mori
- 12:30-1:30 Lunch
- 1:30-3:30 Computer exercises (earthquake location and focal mechanisms)  
  - Annabel Kelly
- 3:30-4:00 Coffee
- 4:00-5:00 Damaging effects of earthquakes  
  - Jim Mori
- 5:00-5:30 The July 17, 2006 Indonesia Tsunami  
  - Jim Mori

### Day 3
- **Seismology and Tsunamis**
- 9:00-10:00 Seismic instrumentation  
  - RK Chadha
- 10:00-10:45 Seismic arrays and networks  
  - RK Chadha
- 10:45-11:00 Coffee
- 11:00-11:45 Tsunami generation and physics  
  - Masahiro Yamamoto
- 11:45-1:00 Computer learning - TsunamiTeacher  
  - Kong + Kelly
- 1:00-2:00 Lunch
- 2:00-5:00 Visit to seismic station

### Day 4
- **Tsunami Warning and Mitigation Systems - Tsunami Warnings**
- 9:00-10:00 Tsunami Warning and Mitigation Systems  
  - Laura Kong
- 10:00-11:00 Tsunami Warning Center Operations  
  - Masahiro Yamamoto
- 11:00-11:30 Coffee
- 11:30-12:30 Tsunami Warning Center Operations (PTWC and JMA) - IO Scenario  
  - Masahiro Yamamoto
  - Procedures for the IOTWS Interim Advisory Information Service  
  - Laura Kong
- 12:30-1:30 Lunch
- 1:30-2:30 Tsunami Warning Center Operations (PTWC and JMA) - South China Sea Scenario  
  - Masahiro Yamamoto
  - Procedures for the Northwest Pacific Tsunami Advisory Center - SCS events  
  - Laura Kong
- 2:30-3:30 Computer tsunami exercises (winTDB)  
  - Kong, Kelly, Yamamoto
- 3:30-4:00 Coffee
<table>
<thead>
<tr>
<th>Time</th>
<th>Session</th>
<th>Presenter(s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>4:00-5:00</td>
<td>Computer learning: TsunamiTeacher, winTDB</td>
<td>Kong, Kelly, Yamamoto</td>
</tr>
<tr>
<td>5:00-6:00</td>
<td>Optional: DVD documentary on tsunamis</td>
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</tr>
<tr>
<td><strong>Day 5</strong></td>
<td><strong>Tsunami Hazard Assessment, Emergency Response, Mitigation</strong></td>
<td></td>
</tr>
<tr>
<td>9:00-10:00</td>
<td>Tsunami Hazard Risk Assessment and Preparedness</td>
<td>Laura Kong</td>
</tr>
<tr>
<td>10:00-11:00</td>
<td>Warning Dissemination and Public Alerts - Communications Technologies</td>
<td>Yamamoto, Kong</td>
</tr>
<tr>
<td>11:00-11:30</td>
<td>Coffee</td>
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<tr>
<td>11:30-12:30</td>
<td>Tsunami Emergency Response after warning issuance</td>
<td>Laura Kong</td>
</tr>
<tr>
<td>12:30-2:30</td>
<td>Lunch</td>
<td></td>
</tr>
<tr>
<td>2:30-3:30</td>
<td>NHK 2004 Indian Ocean Tsunami Summary Video</td>
<td>Masahiro Yamamoto</td>
</tr>
<tr>
<td>3:30-4:00</td>
<td>Discussion, and Question and Answer</td>
<td>Kong, Yamamoto</td>
</tr>
<tr>
<td>4:00-4:30</td>
<td>Summary and Closing</td>
<td>All</td>
</tr>
<tr>
<td>3:30-4:00</td>
<td>Coffee</td>
<td></td>
</tr>
</tbody>
</table>