



Sri Lanka Training Program in Seismology and Tsunami Warnings

3-7 April, 2006



Sponsored by:

Geological Survey & Mines Bureau (GSMB)
Intergovernmental Oceanographic Commission (IOC)
U.S. Geological Survey (USGS)
U.S. Agency for International Development (USAID)

Responsible Organizers:

Mr. Sarath Weerawarnakula

Director, Geological Survey & Mines Bureau, Sri Lanka

Dr. Laura Kong

Director, IOC International Tsunami Information Center, Hawaii

Dr. Walter Mooney

Research Seismologist, U.S. Geological Survey, Menlo Park, California

Assistant Training Program Organizer:

Ms. Susan T. McDonald

Research Assistant, U.S. Geological Survey, Menlo Park, California

Lecturers:

Dr. Annabel Kelly, *Coordinating Lecturer; Seismologist*

U.S. Geological Survey, Menlo Park, California

Dr. Peter Davis, *Seismologist, Institute of Geophysics and Planetary Physics*
Scripps Institute of Oceanography, University of California, San Diego

Dr. J. R. Kayal, *Deputy Director (Geophysics)*

Geological Survey of India

Dr. Laura Kong, *Seismologist*

Director, IOC International Tsunami Information Center, Hawaii

Professor James Mori, *Seismologist*

Disaster Prevention Research Institute, Kyoto University, Japan

Venue:

Construction Equipment Training Center (CETRAC)

No. 17, D.P. Wijesinghe Mawatha

Pelawatta, Battaramulla, Sri Lanka

TRAINING COURSE AGENDA

Monday: Introduction and the Tectonic Situation of Sri Lanka
Introduction to Earthquakes

Tuesday: Seismic Theory & Applications

Wednesday: Global and Local Seismic Networks
Instrumentation & Seismic Data Analysis

Thursday: Earthquake Hazard Assessment & Conclusion from Seismology
Introduction to Tsunamis

Friday: Seismology, Tsunamis and Tsunami Warnings in Sri Lanka
Summary, discussion, recommendations, and conclusions

Training Program Course Objectives

Increase capacity building in Sri Lanka through instruction in the following areas:

- Global distribution and frequency of earthquakes, and relationship to plate tectonics
- Elastic Rebound Theory
- Paths taken by major body and surface wave phases (P, P, pP, sS, SKS, Love, Raleigh)
- Identifying P, S and surface waves in seismogram
- Hypocentral location and magnitude calculations
- Identifying different focal mechanisms
- Seismometer/recording station operations
- Physics of tsunamis and how they differ from wind-generated waves
- Steps involved in an end-to-end tsunami warning system
- What action to take in the event of an earthquake/tsunami warning

Day One: Monday, April 3

**Introduction and the Tectonic Situation of Sri Lanka
Introduction to Earthquakes**

9am- Session I.1: Introductions

Welcome by Sri Lanka: Sarath Weerawarnakula, Director of GSMB

Welcome by IOC/USGS: Laura Kong

Outline of Training Course: Annabel Kelly

Logistical Information (maps, rooms, meals, etc): Athula Mudunkotuwa

10:15am- Session I.2

Topic: Introduction to Earthquake Science: A Historical Perspective

Lecturer: Peter Davis

11:15am- Coffee Break

11:30am- Session I.3

Topic: The Earth's Structure and Seismicity

Lecturer: Annabel Kelly

12:30pm- Lunch Break

1:45pm- Session I.4

Topic: Seismotectonics of Southeast Asia with special reference to Sri Lanka

Lecturer: J. R. Kayal

2:45pm- Coffee Break

3pm- Session I.5

Topic: Theoretical Seismology 1: Sources

Lecturer: James Mori

4:15pm- Discussions

6pm- Dinner

8pm- MOVIE

Day Two: Tuesday, April 4

Seismic Theory & Applications

9am- Session II.1

Topic: Theoretical Seismology 2: Wave Propagation

Lecturer: James Mori

10am- Session II.2

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

Lecturer: J. R. Kayal

11:00am- Coffee Break

11:15am- Session II.3

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

Lecturer: J. R. Kayal

12:15pm- Lunch Break

1:30pm- Hands on Computer Exercises (Annabel Kelly)

3:15pm- Coffee Break

3:30pm- Session II.4

Topic: Review of December, 2004 Sumatra Earthquake

Lecturer: Annabel Kelly

4:45pm- Discussions

6pm- Dinner

8pm- MOVIE

Day Three: Wednesday, April 5

**Global and Local Seismic Networks
Instrumentation & Seismic Data Analysis**

9am- Session III.1

Topic: Earthquake Forecasting

Lecturer: James Mori

10am - Session III.2

Topic: Instrumentation, Recording systems, Data Transmission & Archiving

Lecturer: Peter Davis

11:15am - Coffee Break

11:30pm- Session III.3

Topic: Global and Local Arrays

Lecturer: Peter Davis

12:45pm - Lunch Break

2pm - Hands on Computer Exercises (Annabel Kelly)

3:30pm- Coffee Break

3:45pm –Session III.4

Topic: Damaging effects of earthquakes

Lecturer: James Mori

4:45pm- Discussions

6pm- Dinner

8pm- MOVIE

Day Four: Thursday, April 6

**Earthquake Hazard Assessment & Conclusion from Seismology
Introduction to Tsunamis**

9am- Session IV.1

Topic: Earthquake Hazard Assessment (Hazard maps, Seismic Building Code for Sri Lanka)

Lecturer: J. R. Kayal

10am- Coffee Break

10:15am- Session IV.2

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

Lecturer: J. R. Kayal

11:30am – Session IV.3

Topic: Summary of seismology component of training course

Lecturer: Annabel Kelly

12:15pm- Lunch Break

1:45pm- Session IV.3

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

Lecturer: Annabel Kelly

3pm- Coffee Break

3:15pm- Session IV.4

Topic: Tsunami Generation and Propagation

Lecturer: Peter Davis

4:15pm- Discussions

6pm- Dinner

8pm- Presentation: *Paleotsunamis*, by Starin Fernando (GSMB)

Day Five: Friday, April 7

**Seismology, Tsunamis and Tsunami Warnings in Sri Lanka
Summary, discussion, recommendations, and conclusions**

9am - Session V.1

Topic: Earthquake Monitoring Center Operations – HYDRA, Antelope
The Use of Seismology and Sea Level Data for Tsunami Warning

Lecturer: Annabel Kelly, Peter Davis, Laura Kong

9:45am - Session V.2

Topic: Tsunami Warning Center Operations
a. Objectives and Activities of Warning Centers
b. Guidance on developing new National Warning Centers
c. Regional Indian Ocean Interim Tsunami Advisory Information System
d. Sri Lanka Seismic and Tsunami Monitoring – Present and Future

Lecturer: Laura Kong, GSMB (Sarath Weerawarnakula or representative) and/or National Tsunami Warning Centre (Department of Meteorology G.H.P. Dharmaratna or representative)

11:15am - Coffee Break

11:30am – Session V.3.

Topic: Tsunami Emergency Response after Tsunami Warnings Issued (included hazards, shelters, etc)

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

Lecturer: Laura Kong, Sri Lanka Disaster Management Centre (Major General Gamini Hettiarachchi or representative)

12:45am - Lunch Break

2pm- Session V.4.

Topic: 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. Sri Lanka Model Village Preparedness Program and other initiatives

Lecturer: Laura Kong, GSMB and/or Department of Meteorology

3:15pm- Coffee Break

3:30pm- Session V.5

Topic: Conclusions, Recommendations, & Discussion

Lecturer: P. Davis, J. R. Kayal, A. Kelly, L. Kong