

Preface to the Special Issue on the Great Sumatra Earthquakes and Indian Ocean Tsunamis of 26 December 2004 and 28 March 2005

Wilfred D. Iwan,^{a)} M.EERI

[DOI: 10.1193/1.2241982]

At 7:58 A.M. local time on Sunday, 26 December 2004, a great earthquake occurred in the Indian Ocean approximately 250 km west of Sumatra, Indonesia. With a moment magnitude of 9.1–9.3, this was the second largest instrumentally recorded earthquake in history. The earthquake had an average source duration of about 500 seconds, the longest ever recorded, and a rupture length of about 1,300 km, the largest ever determined instrumentally. This earthquake generated one of the most devastating tsunamis in recorded history.

The tsunami of December 26 affected at least 16 nations directly, and indirectly affected the entire globe. The initial impact of the tsunami was the inundation of the cities of Banda Aceh and Meulaboh along the northwestern coast of the island of Sumatra. There were 131,000 confirmed deaths in this region and 37,000 people were listed as missing. Over 80,000 houses sustained damage or collapsed, and it is estimated that 518,000 people were displaced from their homes. Within hours the tsunami brought death and destruction to the shores of Thailand to the east and to Sri Lanka, India, and the Maldives to the west. The tsunami also caused death and destruction in Somalia and other nations along the east coast of Africa. The death toll from the tsunami has been estimated to be about 300,000. This includes local residents of the affected regions as well as a sizeable number of tourists from Europe, Asia, and the Americas. In addition to the direct loss of life was the extensive damage to homes, hospitals, schools, centers of worship, government buildings, infrastructure, and the social fabric of the affected communities. It will be years before the affected regions will return to anything like a “normal” existence.

Three months after the December earthquake, on 28 March 2005, another large earthquake with a moment magnitude of about 8.7 struck off the coast of Sumatra near the island of Nias. This earthquake generated only a rather small tsunami. However, approximately 900 people died and 22,000 people were displaced by the event.

Immediately following the December 26 event, EERI dispatched and participated in the sending of a number of reconnaissance teams of scientists and engineers to the affected region to make on-site observations and collect perishable data. These teams included experts in seismology, geology, tsunamis, structures and lifelines, disaster re-

^{a)} Professor Emeritus, California Institute of Technology, MC 104-44, Pasadena, CA 91125; E-mail: wdiwan@caltech.edu

sponse, and societal issues. Team members came from many of the affected countries as well as from other countries, including the United States, New Zealand, Canada, and Japan. This special issue of *Earthquake Spectra* contains the reports of these teams. Because of the enormous magnitude of the disaster that resulted from the December 26 and March 28 events and the unprecedented scope of the reconnaissance effort that followed these events, it is believed that this special issue provides a valuable resource for future analysis and action regarding such mega-events. At the same time, it must be acknowledged that data on some aspects of the disaster, such as the effectiveness of recovery and rebuilding efforts, will not be known for many years.

Since the geographic region of the earthquake and tsunami was so large, different teams of researchers focused on different regions, although there was some overlap within the same region. Because of the geographic overlap of some teams, it is possible to draw some significant conclusions about the inherent variability in the observations of different teams examining the same data from a disastrous event. Also, some teams visited the regions at different times from other teams and therefore had a different perspective on what they saw, allowing conclusions about the effect of time on disaster reconnaissance observations. The teams dispatched also had different mixes of disciplines among their members. Obviously, members from different disciplines see the same event from different perspectives, demonstrating the value of a multidisciplinary approach. For these reasons, the reports of different teams have not been edited to bring all observations into conformity. The differences between reports are an important part of the reconnaissance process, and need to be understood.

This special issue is organized into topical sections as follows: Seismology; Geology and Geophysics; Tsunami Field Surveys and Analyses; Performance of Structures and Lifelines; Preparedness; Societal Impacts; and Recovery and Reconstruction. The large number of authors and papers reflects the unique nature of this event. The issue includes an overview paper on tsunami runup measurements from all over the Indian Ocean, as well as papers on individual tsunami field surveys from 12 countries. Comprehensive papers on the seismologic and geologic aspects of the two large earthquakes are also included, as well as many papers describing the impacts of these events on communities throughout the region.

Oversight for the organization and preparation of the special issue was provided by an Editorial Board consisting of Donald Ballantyne, C. B. Crouse, Lori Dengler, Marjorie Greene, Kenneth Hudnut, Wilfred Iwan, Hiroo Kanamori, Costas Synolakis, Kathleen Tierney, and Loring Wyllie. As a compendium to this special issue, the Editorial Board has prepared a summary and conclusions report that will be published separately by EERI. This compendium will summarize the major findings from the many articles in this large issue, and synthesize some of the most important lessons, both for the countries and communities affected by the tsunami and for countries and communities facing future risk from tsunamis. Support for this publication was provided to EERI's Learning from Earthquakes Program by the U.S. National Science Foundation under grant CMS-0131895.

(Received 15 June 2006; accepted 6 July 2006)