The 2007 Kyoto Prize Workshop in Basic Sciences

Symposium

"From Great Earthquake Seismology to Real Time Seismology"

Laureate: Dr. Hiroo Kanamori

[Professor Emeritus, California Institute of Technology]

November 12, 2007 (Mon.), 13:00 - 17:30
Kyoto International Conference Center

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With the cooperation of Japan Geoscience Union,Seismological Society of Japan, The Volcanological Society of Japan, Japan Association for Earthquake Engineering

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Program

Coordinators/Moderator

Yoshio Fukao

(Member, Kyoto Prize Committee; Director-General, Institute for Research on Earth Evolution, Japan Agency for Marine-Earth Science and Technology)

13:00 **Opening Address**

Humitaka Sato (Chairman, Kyoto Prize Committee; Professor Emeritus, Kyoto University)

Lecture

Seiya Uyeda (Professor Emeritus, The University of Tokyo)

"Revolution of Solid Earth Geoscience we lived in"

Introduction to Laureate

Hitoshi Mizutani (Member, Kyoto Prize Committee; Emeritus Professor, Institute of Space and Aeronautical Science, Japan Aerospace Exploration Agency)

Laureate Lecture

Hiroo Kanamori (the Laureate in Mathematical Sciences)

"Waves in the Earth—Unravelling Earthquakes and Related Phenomena—"

Intermission

Lecture

James Jiro Mori (Professor, Disaster Prevention Research Institute, Kyoto University)

"University-Government Programs in Earthquake Hazards: The Caltech-USGS Collaboration"

Lecture

Akira Nishitani (Vice-President, Waseda University; Professor, Faculty of Science and Engineering, Waseda Universtiy)

"Future Direction of Relationship between Structural Control and Seismology"

Intermission

Free Discussion

Moderator Hitoshi Mizutani

Participation by all including audience

17:30 **Closing**

Abstract of the Laureate Lecture

Dr. Hiroo Kanamori
Emeritus Professor, California Institute of Technology

Waves in the Earth

—Unravelling Earthquakes and Related Phenomena—

In geophysics and seismology, we investigate various processes occurring in the Earth's interior which are not visible to our eyes. We need to use waves to study these processes. We will discuss how we use these waves to unravel the mystery of earthquakes and related phenomena.

The advancements in seismic instrumentation, theory and practice since the 1960s resulted in significant changes in our understanding of earthquake source. For example, with the use of long-period waves seismologists became capable of measuring the overall size of great earthquakes accurately. With the old instruments, the wave amplitudes were measured at short periods only, which led to underestimates of the size (i.e., magnitude) of great earthquakes. The use of long-period waves with rigorous use of wave theory rectified this problem, and our perception of the global seismicity during the 20th century changed drastically. Also, it allowed seismologists to recognize the importance of long-period waves excited by great earthquakes for designing tall buildings which began to sprawl in many large cities.

These broad-band studies revealed a remarkable diversity of earthquakes in slip characteristics and energy budget. Some earthquakes slip slowly and some slip rapidly depending on the tectonic environment in which they occur. Also, in some earthquakes more than 97% of the released energy is dissipated as heat near the source with only a small fraction radiating as seismic waves. This diversity not only has important implications for seismic hazard but also provides important clues to the fundamental physics of earthquakes.

The successful use of seismic waves for understanding earthquakes helped seismologists to expand their intellectual basis, and lured them to investigate other related phenomena such as atmospheric oscillations excited by volcanic eruptions, large-scale landslides, and the atmospheric perturbations observed in Jupiter's atmosphere during the Shoemaker-Levy comet impact.

With the rapid development of technology, now seismologists can determine seismic source parameters accurately in real-time. The real-time information can be used effectively for rapid post-earthquake recovery efforts and in some cases for early warning purposes, especially tsunami warning.

Abstracts

Seiya Uyeda

Professor Emeritus, The University of Tokyo

Revolution of Solid Earth Geoscience we lived in

A revolution took place in solid earth geophysics during the last century. It was the paradigm shift to "Mobile earth", which was brought about by the advent of Plate tectonics. It can be comparable with Theory of evolution and Quantum Theory. During the process of the revolution, it seems that "Serendipity" played an important role. Serendipity is a word for unexpected success in scientific research after a legend about three Sri Lanka princes. There are numerous examples of great discoveries unexpectedly made as a result of some mistakes. The "Mobile earth revolution" was "Serendipitic" in the sense that apparently unrelated phenomena were unexpectedly correlated to result in important discoveries by bold hypotheses and their proofs. Also in the next revolution, which will be on earthquake prediction, similar "Serendipity" will be needed. "In the fields of observation, chance favors only the prepared mind" (Pasteur).

James Jiro Mori

Professor, Disaster Prevention Research Institute, Kyoto University

University-Government Programs in Earthquake Hazards: The Caltech-USGS Collaboration

The California Institute of Technology (Caltech) and the US Geological Survey (USGS) have worked closely together in southern California for over 30 years. The two organizations jointly operate the large seismograph network for southern California and collaborate on earthquake research. Applications of new seismic instrumentation have traditionally made southern California one of the best sources of earthquake data in the world. Also, there is close coordination in providing regional hazard information about earthquakes. Following strong earthquakes in California, the public and news media look to Caltech/USGS for the latest information.

In 1990, one of the first realtime earthquake information systems was established in southern California by CUBE (Caltech-USGS Broadcast of Earthquakes). This pioneering project combined the current communication technology with the improved seismic network, to provide quick information following earthquakes. The system continued to be developed and improved through interactions between seismologists and information users. For the 1994 Northridge earthquake, which caused extensive damage in the Los Angeles area, the system helped provide valuable information to regional utility companies.

Combining the credibility of an established federal agency with the more flexible resources of a renown private university, has led to this productive partnership in Pasadena. Much of the leadership for the collaboration has been provided by Dr. Hiroo Kanamori.

Abstracts

Akira Nishitani

Vice-President, Waseda University; Professor, Faculty of Science and Engineering, Waseda University

Future Direction of Relationship between Structural Control and Seimology

In the technological development history of seismic design, a lot of milestones have been marked. Surely the birth of the world's first active-controlled building in Tokyo in 1989 is among those milestones. Structural control providing more sophisticated seismic safety is now one of the major research targets in the civil engineering field. The concept of seismic response control is not a totally new idea, which was actually proposed in Japan more than forty years ago. However, it had not passed beyond the purely academic stage because of the less matured technological environment those days. It took us nearly thirty years to put the concept into practical stage. On the other hand, since the 1995 Hyogoken-Nanbu earthquake (Kobe earthquake) the network of measuring ground motions resulting from earthquakes have been rapidly formed throughout Japan. Effectively utilizing such a network, we could skillfully reflect forecasted earthquake information in conducting the control operation. The future directions of the relationship between structural control and prior seismic information are discussed from the control efficiency point of view.