SSA 2008 Annual Meeting Announcement
Seismological Society of America

Technical Sessions:
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Santa Fe, New Mexico, USA

Hosted by:
Los Alamos National Laboratory
in cooperation with other Rio Grande institutions including
New Mexico Institute of Mining and Technology, Sandia National Laboratory,
and University of Texas at El Paso.

IMPORTANT DATES	
Program with Abstracts Online	22 February 2008
Meeting Pre-registration Deadline	14 March 2008
Hotel Reservation Cut-Off	23 March 2008
Online Registration Cut-Off	6 April 2008

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Exhibitor Information

http://www.seismosoc.org/meetings/2008/exhibitors.html

TECHNICAL PROGRAM

The Heritage of F. Anthony Dahlen

Conveners: Jeroen Tromp (jtromp@caltech.edu) and Guust Nolet (nolet@princeton.edu)

Theoretical geophysics—and seismology in particular—is being affected by the rapidly growing possibilities offered by high performance computing. Approximations that were essential yesterday have become obsolete today, and what is done on a parallel computer now can be done on a laptop tomorrow. This is significantly influencing theory and analysis on a wide range of topics, from seismic tomography to hazard analysis. This session will be devoted to those areas in which Tony Dahlen, who died in June 2007 just after learning he would be the recipient of this year's Reid medal, left behind a massive heritage of theory. Some of his work can only now be fully exploited with the computing power available to us: seismic tomography, earthquake seismology and the evolution of mountain ranges. This session invites frontline research contributions that build upon Tony Dahlen's scientific heritage.

(3D) earth models. While 3D modeling has been used in the earthquake strong motion community for years, the nuclear explosion monitoring (NEM) research has been slower to adopt these methods. The NEM problem in contradistinction to the earthquake problem requires high frequency ground motion simulations over large distances (> 200 km), typically much larger distances than required for strong motion modeling. Common to both the earthquake and NEM problems are the challenges of developing accurate 3D models for forward calculations. Validation of 3D models remains a common challenge to both earthquake and explosion modeling. This presentation will report methods for characterizing sources using recent advances in ground motion modeling. We will describe how one-dimensional (1D) modeling of broadband waveforms can be extended into regions where the actual seismic velocity structure is poorly known using the Cut-and-Paste (CAP) algorithm of Zhu and Helmberger (1996). We will show how this method can be used to characterize sources for subsequent analysis, including estimation of earth structure. We will present results from recently developed codes that compute anelastic wave propagation in three-dimensional earth models, these include the spectral element (SEM) and finite difference (FD) methods. Full waveform calculations of the October 9, 2006 North Korean nuclear test and nearby earthquakes shows that some features of the observed seismograms can be predicted by existing 3D models, although improvements can clearly be made. Other examples will be presented as well.

Implications of the CLVD on Long-Period Seismic Waves from Nuclear Explosions

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The traditional source model for long-period waves from nuclear explosions consists of a monopole releasing tectonic strain. Tectonic release has been studied since the 1960's, and numerous studies have shown that linear superposition of monopole + double-couple sources can explain many observations of Rayleigh and Love waves. Free surface interactions and dynamics of shock-wave rebound are responsible for modes of tensile failure which can also lead to permanent deformations affecting long-period excitation. Indeed, the vast majority of nuclear explosions worldwide were conducted under containment conditions constrained by drilling costs such that they experience significant tensile failures. In this study, I propose a new source model which is a superposition of monopole + tectonic release + tensile failure, the latter represented by a compensated-linear-vector dipole CLVD with vertical z axis of symmetry. This CLVD source does not excite Love waves. I draw upon the Toksöz-Kehrer(1972) model for the tectonic-release mechanism where F is an index measuring strength of the release relative to monopole moment M_I. A new index K is introduced, providing a relative measure of M_{clvd}, the source strength of tensile failure. M_{clvd} vanishes for K = 1, and is > 0 in the case of extensional deformation along the z axis, *e.g.* K > 1. Rayleigh waves from the CLVD destructively interfere with waves from the monopole, and polarity reversals occur on all azimuths for K > 3 in Poisson media. Most observations support ~1 < K < 3, and as such the new model predicts a lower M_s compared to the traditional model involving just tectonic release. This effect of tensile failure on M_s improves m_b-M_s discrimination and suggests that a possible cause of anomalously large M_s compared to m_b for the North Korean test of 9Oct2006 is due to the complete absence of tensile failure on this explosion.

High-Frequency Source Radiation in Lg Waves: A Long Standing Controversy and the Effort to Resolve It

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Of all the major high-frequency regional phases used in event monitoring and identification, the Lg has the most robust amplitude at lower frequencies near 1 Hz. Yet there is decade-long debate on whether the corner frequency, fc, in the Lg radiation is the same as fc in the local S. Over the years we have used the empirical Green's function (EGF) approach to estimate Lg fc of some continental earthquakes. This estimate is difficult because Lg is composed of rays with different take-off angles, making it more difficult to find event pairs with sufficiently similar Green's functions. Choosing different small events as the Green's function event can lead to significantly different estimate of fc of the larger event. We usually have higher confidence of the estimated fc only when a time domain deconvolution results in sharp source rupture pulses. An additional difficulty of comparing Lg fc with S fc is that regions with dense local network coverage and plenty of S wave recordings often have atypical continental crust, too thin for Lg to be well developed. We are currently increasing the number of Lg fc estimates with the EGF on various continents, particularly in central Asia. We will compare these estimates with those of S fc. If they are not similar, we will explore the reason. This work will likely to lead to an improved stochastic modeling of Lg spectra from earthquakes and explosions.

Historical Materials Characterizing Activities at the Semipalatinsk Nuclear Test Site, 1949 to 1989

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The Semipalatinsk Test Site (STS) was the first and the principal Soviet site for testing nuclear weapons on the ground surface (30 tests), in the air (86 tests), and underground (340 tests), conducted from 1949 to 1989. Much new information about these tests became available during the 1990s from books, papers, and reports, published in Russia and Kazakhstan. We are summarizing this information in a series of papers.Principal items of interest include: the scale of effort needed to build infrastructure at the test site; reasons why large-yield testing had to be moved to a new site (Novaya Zemlya) beginning in 1957; the extent of radioactivity on-site from past testing, and of air-born radioactivity down-wind from particular tests; the extent of damage to military equipment, buildings, and animals, exposed to nuclear weapons effects; the numbers of large (kiloton level) chemical explosions at STS; yields of underground nuclear tests and the remarkable accuracy of yield estimates based upon seismic observations; particular activities carried out in about ten different sub-areas; military maneuvers carried out in test areas shortly after a nuclear test; and a summary of problems faced today by Kazakhstan, the country now responsible for clean-up operations at STS.

"Middle-Earthscope"—An Update on the GeoNet Project and Earthquake Research in New Zealand

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GeoNet is a system of integrated geophysical networks and data centers for detection, data gathering and rapid response related to New Zealand earthquakes, tsunami, volcanic activity, large landslides and slow earth deformation. GeoNet is being rolled out over ten years by GNS Science and is funded by the New Zealand Earthquake Commission (EQC), a government entity responsible for dealing with geological risks via its residential property insurance scheme and the facilitation of research and public education into natural hazards and risk mitigation. One beneficial aspect of GeoNet is the seamless incorporation of data collected during short-term deployments into the national seismogram database. This has yielded detailed 3-D tomographic images of seismic velocities and attenuation in many parts of the country, including the development of surface wave models based on ambient noise correlation. These models provide key information on structure and tectonics and underpin nationwide seismic velocity and attenuation models being used to improve routine earthquake location, as well as seismic attenuation relationships for engineering use. Recent studies using the 3-D models to relocate seismicity have shown the benefits of this approach. GeoNet's expanded broadband seismic network has also enabled routine calculation of moment tensors for earthquakes larger than Mw~4, yielding a greatly improved image of crustal seismicity throughout New Zealand and the immediate offshore region. One of the most exciting developments arising from the CGPS component of GeoNet is the discovery of slow slip events on the Hikurangi subduction thrust beneath the North Island. This has led to a greatly enhanced understanding of strain accumulation and release processes at the Hikurangi subduction thrust, including insight into the potential hazard posed by the subduction zone.

A Simple and Rapid Earthquake Detection and Discrimination System for ELARMS

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We present the test of a simple and rapid methodology for earthquake detection and phase association dedicated to dense and reliable networks of seismic stations. The system is based on the idea of small subnets of stations each one surrounding the station that produce the first trigger. The goal is to provide a rapid detection of relevant earthquakes and to activate ElarmS but also to prevent misinterpretation of out of the network events or the association of false triggers. We apply this system to the case of the Italian National Seismic Network and to the Italian seismicity.

Microseism-Based Climate Monitoring

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