Seismological Society of America

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Tip Sheet
2002 Seismological Society of America Meeting

Embargoed: Contents not for release until 5:00 am the day of the session.

The meeting takes place on April 17, 18, and 19 at the Victoria Conference Centre in downtown Victoria, British Columbia. The News Room will be set up in the Victoria Room. The room will be staffed from approximately 8:30 to 5:30 on Wednesday and Thursday and until 4:00 on Friday.

Wednesday, April 17

Nisqually and Other Warm Slab Earthquakes, 9:00–12:00, Theatre.

The February 28, 2001 Nisqually earthquake in Washington state is still an area of active research. Researchers will present their latest findings on seismicity patterns preceding the earthquake, why intraslab earthquakes have so few aftershocks, and detailed analyses of GPS and traditional seismologic data.

A quantitative analysis of seismicity since 1978 has revealed some interesting patterns. First, there was a statistically highly significant decrease in seismicity for the area around the hypocenter, beginning 3–5 years before the mainshock. The results of the analysis suggest that the recurrence interval for an M7 event is approximately 60 years [1]. (Note: Author will not be able to attend the meeting. May be available by e-mail or phone.)

It has been recognized for over 30 years that intra-slab earthquakes such as Nisqually have fewer and smaller aftershocks than comparable shallow earthquakes. However, the mechanism behind the difference has not been determined conclusively. A new hypothesis suggests that in the intra-slab case, there is less fluid water available to re-charge pore pressure in the fault following rupture of the deep faults, inhibiting additional seismic slip [2].

[1] Stefan Wiemer, Swiss Seismological Service, Zurich, 011-41-1-273-6708, stefan@seismo.ifg.ethz.ch.

[2] Stephen Kirby, U.S. Geological Survey, Menlo Park, 650-329-4847 skirby@usgs.gov.

Advances in Event Location, Source Discrimination, and Mathematical Modeling. Oral Session 9:00 a.m.to 12:00 p.m., Saanich Room.

Events of various types that occur beneath the surface of the crust or ocean can be identified, classified, and located with increasing precision and accuracy. This session reports on advances in the tools used to identify and discriminate between events and some of the recent findings from global monitoring sources.

Hydroacoustic (T-phase) stations in Polynesia identified unusual signals in late 2000. In their effort to understand these unusual signals from the far South Pacific, the team turned to seismic data from land-based stations and satellite imagery. These combined data sources indicate that the signals emanated from huge icebergs that had calved off the Ross Ice shelf in July 2000. [1].

[1] Emile Okal, Northwestern University, Evanston, IL, 847-491-3194, emile@earth.nwu.edu.

Advances in Event Location, Source Discrimination, and Mathematical Modeling. Poster Session, 9:00 a.m.to 5:00 p.m., Carson Hall.

This poster session addresses the same issues as the oral session. Posters will be available for viewing all day, and authors will commit to spending a certain block of time at the poster for discussions and interviews.

The inability of official International Monitoring System stations to detect known "subcritical" tests that have been carried out by the United States, Russia, and China has been cited as evidence that the Comprehensive Test Ban Treaty is unverifiable. An analysis of data from the Southern Great Basin Seismic Network (SGBSN) operated by the University of Nevada has led to a proposal for establishing "test site transparency" by operating a seismic network in and around the bounds of existing test sites. The SGSBN, though not designed for test site monitoring, was sufficiently sensitive to identify subcritical explosions as small as tens to hundreds of pounds of TNT [1].

Another criticism of the International Monitoring System is that in some parts of the world, there is simply too much error in locating suspicious events for the system to be useful. An academic-industry research consortium has developed correction grids that reduce the median location error in Eastern Asia by more than 5-fold [2].

[1] Anne Paquette, University of Arizona, Tucson, AZ, 520-621-4849, paquette@geo.arizona.edu.

[2] Paul Richards, Lamont-Doherty Earth Observatory, Palisdes, NY, 845-365-8389, richards@LDEO.columbia.edu.

Seismological Studies of the Lithosphere. Oral session, 1:30 p.m. to 4:30 p.m., Oak Bay Room.

Although plate tectonics is recognized as a fact by earth scientists, the driving force behind plate motion has not yet been determined. One possibility is that the plates are pushed from the side, dragging portions of the mantle behind them. The other is that the mantle itself drives the plate motion. A careful study of seismic wave behavior under the stable part of North America has revealed a simple shear deformation in the mantle, consistent with the mantle traveling faster than the overlying crust. An active role for the mantle explains why North American plate motion has slowed down during the past 100 million years and suggests that eventually it will stop altogether [1].

[1] Goetz Bokelmann, Stanford University, 650-725-9181, goetz@pangea.stanford.edu.

Thursday April 18

Deformations, Transients, and Neotectonics. Oral Session, 9:00 a.m. to 12:00 p.m., Theatre.

GPS measurements of surface deformation are providing an increasingly detailed picture of plate and fault behavior between earthquakes. Intense monitoring of the Cascadia subduction zone may eventually provide insight into how the so-called silent earthquakes (also called silent slip events) contribute to the initiation of megathrust subduction zone earthquakes.

Silent slip events in the Cascadia region may be quite common and have fairly regular timing. GPS data indicate that there have been several of these events since 1992, with an average recurrence interval of 1.2 ± 0.1 years [1].

Although there are still only a limited number of events available for analysis, there is increasing evidence that the slip events have many features in common (location, size, direction, etc.) and that these events in fact occur on the subduction interface. The apparent consistency among the events analyzed so far suggests that these events play an important role in stress redistribution in the region and may play a role in triggering megathrust events[2].

The northern Cascadia region is tectonically complex, as it includes the boundary between a subduction zone (Juan de Fuca and Explorer plates underthrusting the North American plate) and strike-slip motion between the Pacific Plate and the North American plate. The stress due to subduction can result in M 9 megathrust events, and the strike-slip stress results in M8 earthquakes on the Queen Charlotte Fault, but there is no record of large earthquakes in the transition zone itself. GPS data have been used to better understand the current motions and seismic stress accumulation in the area. The data are consistent with stress accumulating at higher rates along the southern end of the Queen Charlotte Fault, an area previously thought to have relatively low earthquake potential [3].

GPS data are also useful for characterizing the very long-term post-seismic movements that happen after huge, M9 earthquakes. Although the last Cascadia megathrust event occurred over 300 years ago, the inland crust in the southern Cascadia region is still moving seaward to catch up with the sudden motion of the forearc that occurred during the earthquake. This post-seismic deformation needs to be considered when calculating the rate and direction of plate movement in the southern Cascadia zone.

[1] William Sumner, Central Washington University, Ellensburg, WA, 509-963-2792, sumner@geology.cwu.edu.

[2] Herb Dragert, Pacific Geoscience Center, Sidney, BC, 250-363-6447, dragert@pgc.nrcan.gc.ca.

[3] Stephane Mazzotti, Pacific Geoscience Center, Sidney, BC, 250-363-6451, mazzotti@pgc.nrcan.gc.ca.

[4] Kelin Wang, Pacific Geoscience Center, Sidney, BC, 250-363-6429, wang@pgc.nrcan.gc.ca.

Cascadia Studies. Oral session, 2:15 p.m. to 5:15 p.m., Theatre.

This session explores many aspects of seismic hazard in the Cascadia region, including subduction events, deep intraslab earthquakes, and earthquakes due to crustal faults.

Large, potentially damaging crustal earthquakes may pose a more important hazard for most residents of the Cascadia region than subduction events, simply because they occur more frequently. Current estimates of recurrence intervals for crustal earthquakes come from extrapolation of data from smaller earthquakes in the historical earthquake catalog, which may be incomplete. Therefore, an independent estimate has been made using GPS and geologic data. The study estimates the recurrence interval for M > 6 earthquakes somewhere in the region to be about 45 years, and the interval for M > 7 earthquakes to be about 39 years. These estimates are largely in agreement with estimates from the earthquake catalogs. However, there is evidence that the rate of crustal earthquakes undergoes a significant, temporary increase following huge subduction earthquakes [1].

Researchers have used Japanese tsunami data from the 1700 Cascadia earthquake and the 1960 Chilean earthquake to better estimate the magnitude of the 1700 megathrust event [2] [3].

The Spokane, Washington area experienced four bursts of seismic activity between June 2001 and November 2001. Each burst included a magnitude 3-4 event, followed by aftershocks that decayed in magnitude over about three weeks. Because there were no previous historic earthquakes in Spokane, the area was not well monitored, and earthquake locations could only be estimated roughly. A temporary seismic network eventually allowed more precise location of the events. The earthquakes were all very shallow (< 5 km below the surface) and tightly clustered near downtown Spokane. The earthquakes do not appear to have occurred on any previously recognized fault [4].

[1] Roy Hyndman, Pacific Geoscience Center, Sidney, BC, 250-363-6428, hyndman@pgc.nrcan.gc.ca.

[2] Brian Atwater, U.S. Geological Survey/University of Washington, Seattle, WA, 206-553-2927, atwater@u.washington.edu.

[3] Kenji Satake, Active Fault Research Center, Tsukuba Japan, kenji.satake@aist.go.jp.

[4] Amy Wright, University of Washington, Seattle, WA, 206-543-0198, amyw.ess.washington.edu.

Earthquake Hazard, Strong Motion, and Source Studies. Oral Session, 2:15 p.m to 3:15 p.m., Saanich Room.

A preliminary seismic risk map for California from the insurance industry perspective has been prepared using the most up-to-date seismic hazard models from the U.S. Geological Survey and the California Department of Mines and Geology. The map shows average annualized insurance losses by ZIP code. In the Los Angeles area, the annualized losses are driven primarily by more-frequent, moderate-magnitude events. In the San Francisco Bay Area, the San Andreas and Hayward faults contribute to the majority of the risk [1].

[1] Chesley Williams, Risk Management Solutions, Inc., Menlo Park, CA, 510-505-2500, Chesley.Williams@rms.com.

Seismicity and Seismic Hazard of Stable Continents. Oral session, 2:15 p.m. to 3:15 p.m., Oak Bay Room.

Although stable continental interiors have a much lower rate of seismicity than do inter-plate regions, they are capable of producing very large earthquakes, as evidenced by the 1811-1812 New Madrid earthquake sequence and the 2002 Gujarat earthquake. This session considers seismic hazard in several stable continental regions of North America.

The New Madrid Seismic Zone (NMSZ) is fundamentally very different from seismic sources near plate boundaries. The NMSZ has recently been shown to be a relaxing weak zone that was perturbed by geologically recent stress changes, perhaps related to glaciation. Numerical modeling studies indicate that in such a seismic zone, either recurrence time increases or moment release decreases with subsequent seismic cycles. These recent findings on the nature of the NMSZ need to be considered when developing seismic hazard analysis and seismic design requirements for the region. The current, high, seismic design levels are based on assumptions about the seismic source that are true for plate-boundary sources but may not apply to the NMSZ. [1].

[1] Zhenming Wang, University of Kentucky, Lexington, KY, 859-257-5500, zwang@kgs.mm.uky.edu.

Earthquake Hazard, Strong Motion, and Source Studies. Poster Session, 9:00 a.m. to 5:00 p.m., Carson Hall

Note: Posters will be available for viewing all day. Authors will commit to spending a specific block of time at their posters for discussion and interviews.

Draft versions of seismic hazard maps for the United States have been prepared by the U.S. Geological Survey. Features of the map include (1) a seismic hazard model for California that matches observed seismicity since 1850, (2) revision of the Puget Sound seismic hazard based on GPS data, (3) reduction of seismic hazard estimates for the Oregon coast, and (4) more localized definitions of high-hazard areas around the New Madrid and Charleston, South Carolina areas [1].

Southwestern British Columbia has the highest seismic hazard for all of Canada. A study to estimate damage in the event of a large earthquake has been carried out for three cities in southwestern BC: Victoria, Vancouver, and New Westminster. Damage estimates were based on the design ground motions in the National Building Code of Canada and data on the performance of various building types during earthquakes. The highest levels of damage are expected in downtown Victoria and the older parts of Vancouver, but the highest economic losses are expected for downtown Vancouver [2].

[1] Art Frankel, U.S. Geological Survey, Denver, CO, afrankel@usgs.gov.

[2] C.E. Ventura, University of British Columbia, Vancouver, BC, ventura@civil.ubc.ca.

Friday, April 19

Seismotectonics, Landslides, and Tsunamis. Oral session, 9:00 a.m. to 12:15 p.m., Saanich Room.

The Queen Charlotte Basin in British Columbia is an area of high seismic activity. The Queen Charlotte Fault is the major strike-slip Pacific-North American plate boundary in the area. Although the Queen Charlotte Fault was the source of a magnitude 8.1 earthquake in 1949, it is not the source of most of the recorded seismicity since 1982. Rather, the recorded seismicity from the previous 20 years appears to be due to random seismicity on various subsidiary faults, most of which are unmapped [1]. The magnitude 6.3 October 12, 2001 earthquake provided a good example of the seismic potential of these subsidiary faults. This earthquake, apparently caused by a thrust fault, was felt all over the Queen Charlotte Islands and the adjacent mainland. It even produced a small tsunami (about 20 cm in height) that was recorded on Vancouver Island [2].

[1] Alison Bird, Pacific Geoscience Center, Sidney, BC, 250-363-6432, bird@pgc.nrcan.gc.ca.

[2] Garry Rogers, Pacific Geoscience Center, Sidney, BC, 250-363-6450, rogers@pgc.nrcan.gc.ca.

Seismotectonics, Landslides, and Tsunamis. Poster session, 9:00 a.m. to 4:30 p.m., Carson Hall.

An apparent northward-propagating sequence of earthquakes in Baja California and coastal southern California may culminate in a future earthquake on the northern segment of the Newport-Inglewood fault zone. Modeling of stress transfer from the 1933 Newport-Inglewood earthquake and analysis of recent seismicity both raise the possibility that the northern end of the fault zone may be approaching the end of its seismic cycle. However, there is no specific prediction regarding a specific time or magnitude of any future earthquake on this fault zone [1].

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