WSSPC
WESTERN STATES SEISMIC POLICY COUNCIL

We develop seismic policies and share information to promote programs intended to reduce earthquake related losses.

A non-profit earthquake consortium for the western states

Spring 2019
e-Newsletter

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<u>In This Issue</u>

WSSPC NEWS

Save the Date!

WSSPC Annual Business Meeting and National Earthquake Program Managers Meeting

The WSSPC Annual Business Meeting and National Earthquake Program Manager's (NEPM) Meeting will be held in Salt Lake City, Utah during the week of April 22nd-26th, 2019 at the Salt Lake City Marriott University Park.

The WSSPC meeting will take place on April 25th and 26th, 2019.

Image: Salt Lake City Skyline Source: smcslc.org

Thursday, April 25th, 2019:
5:00-6:00: WSSPC Policy Workgroup Sessions
Friday, April 26th, 2019:
12:00-1:00: WSSPC Awards Luncheon
1:00-2:00: WSSPC Board Meeting
2:15-4:15: WSSPC Annual Business Meeting

For more details and information on registration please visit:
http://eqprogram.net/2019-national-earthquake-program-managers-meeting/

April 8th is the hotel cut-off date to get the meeting rate of $125 a night.

Idaho's Successful Clearinghouse Exercise:

WSSPC participated in Idaho's successful first clearinghouse exercise! It was held on March 5th-7th and included participants not only from Idaho, but partners from neighboring states and other organizations.

Various organizations, both governmental and private, were involved with the development of the clearinghouse exercise. Those involved with participation included: IGS, IOEM, EERI, MBMG, NBMG, USGS, Boise State University, WSSPC, IDT, UGS, and WyGS. Both a physical and a virtual clearinghouse were activated for the exercise, with a great amount of digital input from partners.

We are grateful to have been a part of this experience. Thank you to everyone that was involved!

NEWS

Earthquake Early Warning Funding Passed in the House

On February 6, 2019 the U.S House of Representatives passed a bill that would fund earthquake early warning systems along the Cascadia Subduction Zone. Oregon Representative Peter DeFazio sponsored the H.R 876 bill, which would require that "the Federal Emergency Management Agency develop a plan to purchase and install an early warning system." Not only does it set aside federal funds for the early warning system, it also directs the president to create an Earthquake and Tsunami Task Force to make recommendations on how to plan for emergencies caused by earthquakes and tsunamis.

Due to the currently overdue earthquake on the Cascadia Subduction Zone, representatives from the Pacific Northwest have been pushing for greater funding towards early warning systems. The passing of the H.R. 876 bill would be a major step towards earthquake preparedness.

References:
https://www.nrtoday.com/news/national/national_politics/house-passes-bill-to-fund-early-earthquake-warning-system/article_af7db604-e659-5442-a159-550da9f6b96a.html
https://news.bloombergenvironment.com/environment-and-energy/pacific-northwest-earthquake-preparedness-bill-passes house?utm_source=rss&utm_medium=NEVE&utm_campaign=00000168-c427-db11-af6d-d7af589a0002

Tsunami in Indonesia Caused by Volcanic Activity

A tsunami hit the Indonesian islands of Sumatra and Java on December 22nd, 2018. The tsunami came without warning as it was likely caused by the collapse of an offshore volcano, separating itself from past tsunami events that were largely triggered by earthquakes.

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Due to the lack of warning, there was no notice of the tsunami approaching, leading to a more destructive event than it would have been otherwise. The tsunami is thought to have caused at least 430 casualties.

Anak Krakatau, the volcano thought to have caused this tsunami, lost a large portion of its southern flank that slid into the ocean, according to images for the European Space Agency's Sentinel-1 satellite. Although this is a relatively common occurrence for volcanoes, this particular one created a landslide that is suggested to have traveled southeast or southwest with waves that took about half an hour to arrive on shore in the form of a tsunami.

Image: Eruption of Anak Krakatoa Source: Phys.org

As Indonesia is still recovering from the earthquake and tsunami that hit in September, this devastating event will add to emergency response teams' focus on providing food and shelter for displaced people and minimizing fatalities and the spread of disease while recovering.

Resources:
https://www.nationalgeographic.com/science/2018/12/indonesia-volcano-tsunami-surprise-explained-anak-krakatau/
https://www.nbcnews.com/news/world/indonesia-high-alert-new-tsunami-volcano-rumbles-n952221

continued

Earthquake Early Warning Systems Means False Alarms, but Research Claims it's still worth it

Researchers from USGS, the University of Southern California, and the California Institute of Technology designed a statistical simulation to determine which tradeoff is better in regards to early warning systems: to get more warnings but also get false alarms, or to only be alerted when it is certain that there will be an earthquake, with the risk of missing a warning. Their research found that the benefits of being alerted before an earthquake strikes drastically outweighs the costs of getting a few false alarms.

The study resulted in three major findings. First, there is no possible way to have an early warning system that is 100 percent accurate, as the multitude of variables involved in an earthquake make it impossible to always predict its patterns accurately. Second, the scientists calculated that "any particular California location had the chance of feeling an earthquake just twice a decade." Lastly, they found that for an early warning system that gives you a high likelihood of being alerted to the predicted twice-a-decade earthquakes, there are a predicted four warnings that turn out to be false. However, if the priority is to only get an alert when we are certain a quake is coming, there is a far higher probability of getting no warning at all.

These findings show that the overall cost is lower when we bet on having an early warning system that may occasionally send out false alarms, but will signal people to warn of an earthquake when it is actually coming.

As California has recently gotten an influx of federal and state funding, officials hope that all 1,115 seismic sensor stations will be online by 2021.

<u>Resources:</u>
https://www.latimes.com/local/lanow/la-me-ln-earthquake-early-warning-false-alert-20190222-story.html
https://www.adn.com/nation-world/2019/02/23/earthquake-early-warning-system-will-mean-false-alarms-but-its-still-worth-it-researchers-say/

Earthquake Early Warning App for Los Angeles is Now Available

The city of Los Angeles has come out with ShakeAlertLA, an early warning app that is available for download on both Android and Apple. The app is designed to work with the USGS earthquake early warning system to give residents of L.A up to over a minute of warning before an earthquake arrives.

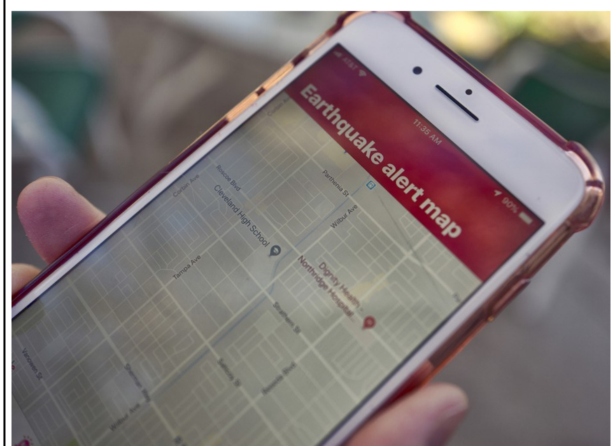

Image: ShakeAlert App Source: Richard Vogel/AP

Programed to send the user information when a M5.0 or greater earthquake shakes Los Angeles County, the app is designed to help save lives in the case of an earthquake by giving people the chance to take precautions and "stop elevators, pull to the side of the road, and to drop, cover, and hold on."

The system is not expected to be perfect, especially in the beginning of its operation. False alarms and missed warnings are common issues that accompany earthquake early warning systems. This can be seen in Japan and Mexico, both of which have employed an early warning system.

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However, these limitations are thought of as a small cost in comparison to the benefits such a system could bring to L.A.

The programing for ShakeAlertLA is owned by taxpayers and is open source. This allows other communities, cities, and countries to use the coding for their own earthquake early warning systems. With this step towards creating a successful and accessible early warning system, other systems, like USGS's QuakeAlert now available in beta, are following close behind.

References:
https://www.latimes.com/local/lanow/la-me-ln-earthquake-early-warning-app-20190102-story.html
https://www.citylab.com/environment/2019/01/earthquake-early-warning-los-angeles-app-shakealertla/579418/

Earthquake Warning Sign Ordinance Delayed in Portland, Oregon

A policy that required Portland's 1,600 unreinforced masonry buildings to have plaques placed on them that read "This is an unreinforced masonry building. Unreinforced masonry buildings may be unsafe in the event of a major earthquake" has been postponed due to an ordered temporary injunction.

The ordinance, originally planned to take effect March 1st, 2019, has been approved to be pushed back until November 2020 by a 3-1 Portland City Council vote.

A judge ordered the temporary injunction disallowing the enforcement of the ordinance until after the lawsuit, filed by a coalition of brick building owners, has been heard. Those who brought the lawsuit to court are asking for it to be ruled unconstitutional "under free-speech and due-process rights." The lawsuit is scheduled to be heard in April.

The NAACP also opposed the policy. The group said that their opposition to the ordinance is due to it disproportionately affecting black residents in North and Northeast Portland.

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They argue that this ordinance would mean a disproportionate increase in the displacement of black residents in Portland.

Despite the postponement of the policy, efforts to add to the policy by identifying strategies for the city to pay for seismic upgrades, rather than

Image: URM Plaque Source: Justin Katigbak

put the burden on the owner, are being focused on. Additionally, the replacement ordinance adds that owners of unreinforced masonry buildings "provide the warning to potential tenants on lease applications."

With the high likelihood of an earthquake in the Portland area, and the high risk unreinforced masonry buildings pose to residents, the city of Portland is trying to come up with a policy that both protects citizens while allowing their constituents to raise their concerns and contribute to the conversation.

Resources:
council-delays-controversial-urm-signage-requirement/article_555a1d22-3bae-11e9-b726-e7d01c9f7834.html

September's Quake in Indonesia Might be First Documented "Super-Shear" Earthquake

The tsunami that occurred from the September earthquake in Palu piqued researchers' curiosity as it was caused by a strike-slip quake rather than a megathrust, the type more commonly associated with tsunamis. Now, according to two papers published in Nature Geoscience, they have found an even more curious fact about this tsunami and earthquake. The researchers claim that "as the fault ruptured, the leading edge of the rupture tore through the crust much faster than usual, perhaps magnifying the shaking that led to the underwater landslide." The speed of the rupture was so fast that such behavior has never been conclusively documented in nature and only predicted in theory.

Image: bridge destroyed by the earthquake and tsunami that struck Palu Source: Beawiharta Beawiharta/Reuter

Typically in geophysical theory, a rupture can travel no faster than its slowest seismic waves. However, the research suggests that the rupture from the Palu earthquake was faster than its own S-waves. This constitutes it being considered a "super-shear" earthquake, the first one ever to be documented.

Current theoretical models suggest "a rupture must travel some minimum distance before hitting super-shear speeds." However, the rupture in Palu traveled at this velocity right from the beginning.

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These findings give researchers a new set of questions to grapple with: why super-shear earthquakes begin, if they are intrinsic to certain faults, and how unique such an event truly is. As measurement techniques are becoming more sophisticated, scientists hope to answer these questions with greater accuracy.

References:
https://www.nature.com/articles/s41561-018-0296-0
https://www.nytimes.com/2019/02/05/science/earthquake-tsunami-indonesia.html

University of Oregon Awarded $400,000 to Fund Earthquake Early Warning System Research

The U.S Geological Survey has awarded the University of Oregon a total of $400,000 to fund seismic research. Specifically, the award is intended to fund research focused on the school's work with ShakeAlert early warning system.

This funding will pay UO $283,362 to fund their early warning research and $119,600 for research into their regional seismic networks.

This funding is part of the $13 million USGS has to allocate to researching earthquake monitoring networks. As the entire West Coast is especially vulnerable to earthquakes and subsequent tsunamis, these grants to the University of Oregon will allow them to continue creating "innovative work developing the best earthquake monitoring technology."

Resources:
https://kpic.com/news/local/uo-gets-400k-to-fund-earthquake-early-warning-system-research
https://www.kdrv.com/content/news/University-Of-Oregon-Receives-400000-For-Earthquake-Warning-System-Research--506754831.html

RESILIENCE AND RECOVERY

Housing Insecurity in the Case of a Large Earthquake in Southern California

With the recent 25th anniversary of the Northridge earthquake, the city of Los Angles, a city where homelessness has already been declared a state of emergency, has brought up the question of housing insecurity in the case of the next "Big One." Studies project in the case of a 7.8 magnitude earthquake that an estimated 270,000 people in Southern California will be displaced from their homes, 175,000 of which will need to be housed in public shelters as they will not be able to find housing with family, friends, or be able to afford hotels.

Although natural disasters, earthquakes included, are indiscriminate about what types of people they affect, the implications of the disaster are felt more intensely for those who can't afford to leave the city. An earthquake of this magnitude could possibly exacerbate the wealth gap in L.A and even cause regional depressions. One statistic based on the Whittier Narrows Earthquake in 1987 claims that "for affluent white men, it takes an average of seven days to return home post-disaster, but for poor women of color, it takes an average of seven years." Those who are forced to stay in the city will have to face obstacles like fires, water shortages, limited transportation and communication outages.

Those who can afford to leave the city will likely leave. This is reflected in the population dip of Los Angeles in the wake of Northridge, one of the only four times the city's population has ever fallen. The most likely destination for these people will be Arizona, where city leaders will have to find room for Southern California's refugees.

continued

Although focus on the aftermath immediately after an earthquake hits is critical, the socioeconomic effects of natural disasters need to be addressed in order to have a holistic approach to preparedness and recovery.

Resources:
https://la.curbed.com/2019/1/15/18182585/earthquake-california-evacuation-shelter-predictions
https://www.businessinsider.com/photos-1994-northridge-earthquake-in-los-angeles-2019-1#thousands-of-single-family-homes-apartments-and-mobile-homes-were-either-destroyed-or-severely-damaged-4

MITIGATION

Effort to Keep Earthquake Sensors in Alaska

Alaska's scientists and officials are in favor of keeping a statewide network of seismic sensors that have been installed throughout Alaska, beginning in 2014. The 150 seismic sensors installed by the National Science Foundation, whose main goal was to image the deep continent of North America, are scheduled to be decommissioned next year. However, Alaska's officials are claiming that the USArray project was so helpful for the state's emergency preparedness and earthquake research that they are fighting to keep at least 80 of the sensors.

The $50 million project has drastically improved Alaska's ability to "pinpoint the depth, orientation, and footprints of the most remote quakes," improving and supplementing the current state-system. With the recent M7.0 earthquake in Anchorage, there has been a huge push to keep these stations and bolster Alaska's earthquake research capabilities.

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The system has allowed scientists to pinpoint earthquakes that they were usually unable to due to their remote location. Earthquakes such as the 6.4 quake in northeast Alaska and the 7.9 earthquake off the coast of Kodiak, both of which hit it in 2018, would be almost impossible to properly study without this new seismic network.

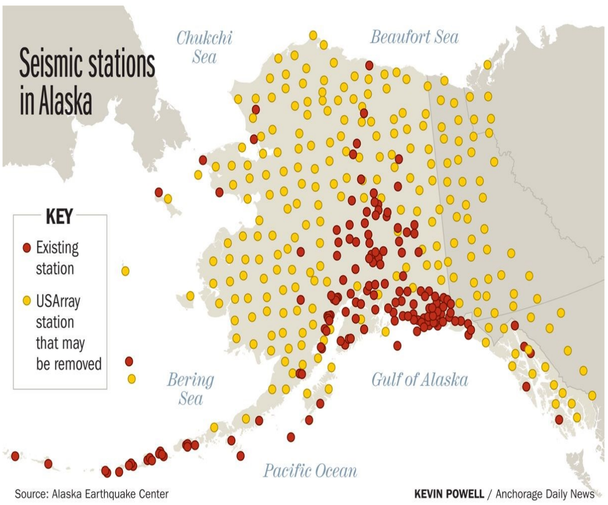

Image: Map of Seismic Stations Source: Alaska Earthquake Center

The seismic sensors are valuable for infrastructure and city planners to help minimize the risks from a potential earthquake. By allowing scientists to better understand "where faults are, and forecast the size of earthquakes and where they might be, we can better provide for the safety of infrastructure and people in the regions." There is also hope that technology like these seismic sensors could put Alaska on the same trajectory as states like California that have begun rolling out early warning systems.

Keeping the seismic sensors would allow for greater research opportunities and provide more safety for Alaska's residents. The project is seen as so important that the University of Alaska used its only capital budget request of $5 million in research funds to keep the seismic sensors.

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The science community is optimistic that there will be federal funding given to the effort due to the project's importance for the nation's most seismically active state.

References:
https://earthquake.alaska.edu/usarray-sustainability
https://www.adn.com/alaska-news/2019/01/05/officials-push-to-keep-dozens-of-earthquake-sensors-slated-for-removal-across-alaska/

Assessment of Seismic Hazards in British Columbia's North Coast Region

Due to the increased development of British Columbia's north coast over the last decade, an effort in 2013 had been made by Natural Resources Canada to research and understand the possible negative impacts of geohazards and their secondary effects in the region. The research had two main avenues: marine and terrestrial-based research. The main goal was to get a better understanding of active faulting, earthquake recurrence relationships, and strain accumulation patterns in the British Columbia's north coast and the possible secondary effects, such as tsunamis, of these occurrences.

In their multidisciplinary efforts to better understand the geohazards of the region, the researchers deployed and monitored the data from seven new seismographs to allow the "microseismicity patterns in the British Columbia's north coast to be mapped in more detail." It was confirmed at the recent conclusion of the study that "the regional seismic hazard of British Columbia's north coast region is, in general, being adequately represented in Canada's seismic hazard mode." However, this research allows for more detailed reports to be made in the future and allows for improved hazard models and more information available for building codes and engineering design.

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The earthquake monitoring systems will continue to be used for up to ten years and continue to collect data to better inform policies that attempt to mitigate the negative impacts of geohazards in the region.

References:
https://geoscan.nrcan.gc.ca/starweb/geoscan/servlet.starweb?path=geoscan/fulle.web&search1=R=313286
http://ftp.maps.canada.ca/pub/nrcan_rncan/publications/ess_sst/313/313286/of_8461.pdf

M9 Project Predicts Stronger Shaking for Seattle's High-Rises

The results from the M9 project, a four year long effort to estimate the effects a M9.0 Cascadia earthquake would have on Seattle, are in and the predicted results on high-rises are more severe than previously estimated. The type of shaking expected to occur after the Cascadia earthquake is particularly hazardous to high-rises and researchers have found that the "sedimentary basin under the city can amplify this type of ground motion...by a factor of two to five," a factor much higher than previously thought.

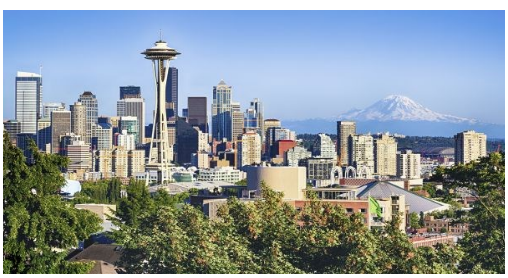

Image: Seattle Skyline Source: CNBC.com

In order to better estimate how the Cascadia earthquake would affect ground motions in Seattle, the M9 researchers took records from previous subduction-zone earthquakes from around the world and ran computer simulations of 50 different Cascadia earthquake scenarios. These simulations were "the most detailed ever for the Pacific Northwest, covering more than a billion grid points and taking as much as three

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days of each supercomputer time each."

The research found that the shaking intensity in Seattle can vary by a factor of ten and is predicted to last four times longer than most earthquakes. Due to Seattle's location, by the time the seismic waves reach it, it will mimic a rolling movement instead of one more similar to a jackhammer. Buildings under ten stories can usually survive this type of movement, but is the exact movement that tall buildings are most vulnerable to.

In response to these findings, the cities of Seattle and Bellevue have begun increasing their seismic standards for new buildings over 240 feet tall. However, this new effort does not address older buildings, which not only do not meet modern building codes, but also contain fracture-prone welds discovered after the 1994 Northridge earthquake. These older skyscrapers with fracture-prone welds are up to five times more likely to collapse in a strong earthquake than a modern high-rise. Despite the fact that in Seattle a Cascadia Subduction Zone earthquake is more likely to threaten skyscrapers than in California, the city has made no formal efforts to identify the potentially dangerous high-rises.

The M9 research project has prompted Washington cities like Seattle and Bellevue to increase seismic standards for new buildings of twenty stories or higher. However, regulations and efforts to identify potentially dangerous buildings in Seattle lags behind the efforts made in California and San Francisco, despite the fact that Seattle's high-rises will likely face the biggest threat.

References:
https://www.seattletimes.com/seattle-news/science/how-safe-are-seattles-high-rises-new-study-predicts-stronger-earthquake-shaking/
https://archpaper.com/2019/01/seattle-boosts-building-codes-for-high-rises-after-study-deems-them-at-risk/

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RESEARCH

Using Dark Fiber for Long-Distance Earthquake Detection

Researchers at the U.S Department of Energy's Lawrence Berkeley National Laboratory have turned "parts of a 13,000 mile long testbed of "dark fiber," unused fiber optic cables, owned by the DOE Energy Science Network, into a highly sensitive seismic activity senor."

Traditionally, seismologists rely on incredibly expensive sensors that are installed underground. Because of the high cost and the labor that is involved in this process, few seismic sensors have been installed throughout the remote areas of California. This finding could significantly change earthquake early warning systems in the western U.S.

The research group's 2017 study in Richmond, California demonstrated how Distributed Acoustic Sensing (DAS) can image the shallow subsurface of a trench. In a follow up to this study, the researchers "demonstrated that fiber-optic cables could be used as sensors for detecting earthquakes."

In this study, the team used the same DAS technique, but on the 20 mile segment of the 13,000 mile long Dark Fiber Testbeds that run

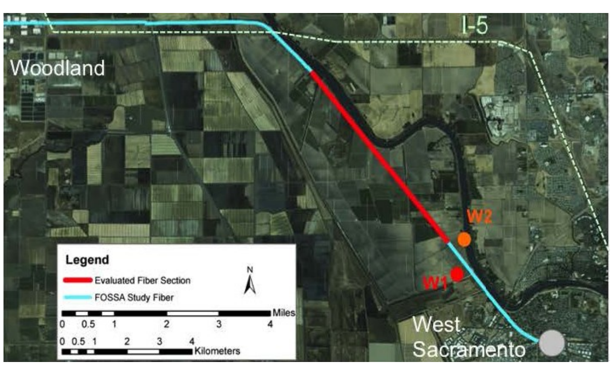

Image: 20-mile segment of the 13,000-mile-long ESnet Dark Fiber Testbed Source: Ajo-Franklin/Berkeley Lab

from West Sacramento to Woodland, California instead of their own fiber-optic cable. This provided the researchers with "subsurface images at a higher resolution and larger scale than would have been possible with a traditional sensor network."

According to this study, even with just one fiber-optic cable, small ground motions can be picked up with surprising detail over several months.

These findings broaden the tools available to seismologists and, as this one is readily accessible and comparatively inexpensive, the possibilities in scientific discovery that might come from it seem promising.

References:
https://newscenter.lbl.gov/2019/02/05/dark-fiber-lays-groundwork-for-long-distance-earthquake-detection-and-groundwater-mapping/
https://www.sciencedaily.com/releases/2019/02/190205151006.htm

Possibility for Earlier Earthquake Warnings with Gravimeters

Scientists from the University of Tokyo's Earthquake Research Institute (ERI) have developed a new method in earthquake sensing believed to be able to produce earlier warnings. Their research suggests that "subtle gravitational signatures precede an earthquake's earliest tremors," thus being able to send out an alarm before a quake begins.

The researchers at ERI were inspired by research done in Italy suggesting that gravimeters could detect earthquakes. If earthquakes could be detected with gravimeters as well as seismometers, it could lead to new opportunities in seismic research.

The vibrations caused by a large fault slip can change the density of the earth's layers, thus altering the gravitational field.

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The researchers used this fact to extrapolate that, "because gravity travels at the speed of light, gravimeters can register a potential earthquake-triggering fault slip before seismic waves reach a nearby seismometer." The researchers were able to locate early earthquake warning signals among the gravitational and seismic data produced by the devastating March 11, 2011 Tohoku earthquake.

Their research has been the first time definitive earthquake signals using this method have been shown by anyone. Although others have conceptualized and investigated the idea, it is not until now that reliable signals have been found. Using specific processing methods to isolate quiet gravitational signals form the other noisy data collected during the Tohoku earthquake, as well as examining a broader range of sensors active during the quake, these researchers were able to show these earthquake signals using gravimeters.

Currently, these sensors are not as sensitive as they should be in order to better detect earthquakes. The researchers are hoping to develop a new type of gravimeter to be able to detect the "subtle gravitational signatures of faults with greater reliability." They are hoping that this new technology will be able to greater improve research on earthquake detection worldwide.

Resources:
https://www.upi.com/New-earthquaking-sensing-method-could-give-earlier-warnings/5581552272322/
https://earth-planets-space.springeropen.com/track/pdf/10.1186/s40623-019-1006-x

New Explanation why Foreshocks Precede Large Earthquakes

Oregon State University researchers have found that large quakes tend "follow a short period of shallow mantle creep and seismic warms," explaining why foreshocks often precede large earthquakes. The findings give us more information on silent slip, the phenomenon

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where parts of the Earth's crust is displaced along a fault line, but no earthquake occurs.

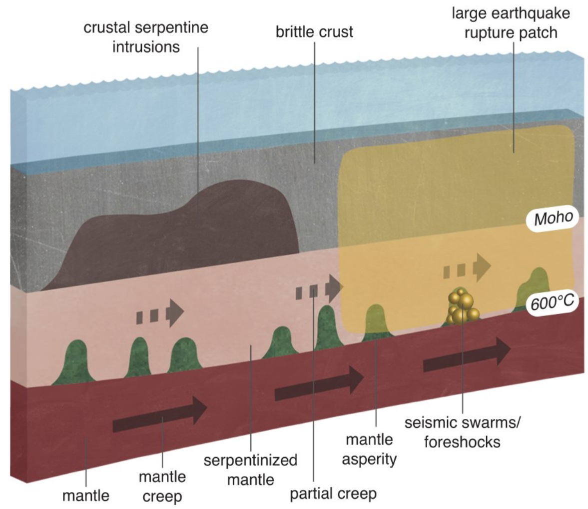

Image: diagram showing how movement deep beneath the Earth's surface silently builds up stress that leads to earthquakes Source: John Nabelek and Vaclav Kuna, OSU College of Earth, Ocean and Atmospheric Sciences

The researchers used 55 seismometers off the coast of Oregon along the Blanco Transform Fault for a year. They found that "slow slip directly triggers seismic slip" and have found relationships between the mantle slip and the crust slip, explaining why big earthquakes are usually preceded by foreshocks associated with creep.

References:
https://www.ktvz.com/news/osu-research-silent-slip-on-fault-line-a-big-quake-prelude/984665328
https://today.oregonstate.edu/news/%E2%80%98silent-slip%E2%80%99-along-fault-line-serves-prelude-big-earthquakes-research-suggests

Using Computer Models to Investigate Megathrust Earthquakes
Researchers at the University of Texas at Austin are improving our understanding of what drives megathrust earthquakes by using computer models to investigate the 2011 Tohoku earthquake in Japan. Using these models, the researchers conducted the first comprehensive study testing the small tremors detected before the Tohoku earthquake and seeing if they have any connection to the disaster itself.

Although these tremors may be linked to the quake, it is impossible to know at the moment if these two occurrences are connected. However, "the seismic signature of the tremors is helping refine a computer model that could help untangle the connection." The seismic data that was collected through the research of the Tohoku earthquake was collected and imported into the computer model, which allows scientists to image Earth's crust interactions and shows how forces change the fault over time. The model originally used geodetic information about the surface of Earth's shape. The model "matched observations of how the plate deformed in the years before and after the earthquake." This is significant because gaining similar results using the two different data sets (those found from seismic waves and those found by the planet’s shape) better supports the accuracy of the earthquake model.

The researchers hope that their findings help support the study of the physics of earthquakes and contribute to the possibility of earthquake forecasting.

References:
https://ig.utexas.edu/2019/01/09/new-computer-modeling-approach-could-improve-understanding-of-megathrust-earthquakes/
https://www.sciencedirect.com/science/article/pii/S0012821X1830582X

continued

New Technology Explored to Develop More Accurate Earthquake Early Warning System
Currently, networks are in place that can detect seismic activity, but they are limited in the fact that they can’t send an alert until “all of the sensors in the network covering a given area have detected seismic waves.” This means it could take up to a minute for the alert to be sent out. In an effort to minimize the time it takes between an earthquake occurring to an alert being sent out, engineers at Caltech Seismological Laboratory are using a variety of tools to shorten the time it takes for a warning to be sent out to a matter of seconds.

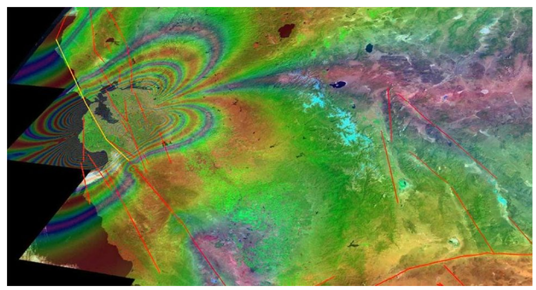

Image: NVIDIA GPUs, AI, And Deep Learning Are Being Used To Develop A Quake Early Warning System Source: NVIDIA

These engineers are using artificial intelligence, NVIDIA GPUs, and Deep Learning models to develop these more intelligent earthquake early warning system prototypes. As part of this attempt to greater streamline the alert process, Zachary Ross of Caltech Seismological Laboratory is analyzing information from more than 250,000 seismograms, all of which were recorded during various earthquakes in Southern California. Ross then uses one of his deep learning models to “look at a single sensor at that time to identify seismic waves.” The second model he uses makes use of a recurrent neural network and it “recognizes wave patterns from multiple sensors over the duration of a seismic event.” The research shows that the first-order characteristics of the seismic waves from these models are similar to earthquakes in regions other than Southern California, making it useful when analyzing earthquakes internationally.

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According to Ross, if this new system is implemented, it can “reduce false triggers by a factor of 100 and also help recognize smaller earthquakes, the vast majority of which are missed by existing signals.” This new model would, theoretically, greatly improve the accuracy and reliability of earthquake early warning systems.

Resources:
https://www.forbes.com/sites/marcochiappetta/2019/02/28/nvidia-gpus-ai-and-deep-learning-used-to-develop-quake-early-warning-system/#d25747a66d9f
https://blogs.nvidia.com/blog/2019/02/28/deep-learning-seismology-earthquake-early-warning/

New Methods Discovered for Sequencing Ancient Earthquakes Along the Wasatch Fault

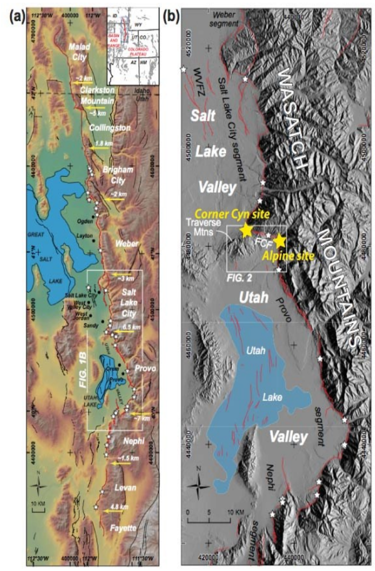
Two recent paleoseismic studies of the Wasatch fault zone done by USGS investigated the geologic evidence of historic ground rupturing earthquakes in the area. The scientists determined the earthquakes' age and sequence, as well as coming up with new ways of evaluating earthquake data. Their evidence will be useful in future studies about whether or not the boundary between the Salt Lake City and Provo segments of the fault have been ruptured by past earthquakes.

At each of the two sites, the Alpine trench site and the Corner Canyon site, geologists studied "exposures of geologic units faulted by large earthquakes in a paleoseismic trench.” There were six earthquakes detected in the last 6,000 years at the Alpine trench site on the northernmost part of the Provo segment. At least two of these historic earthquakes appeared to have ruptured the boundary between the Salt Lake City and Provo segments, but further studies are needed to make this conclusion.

The researchers also found that there were six ground rupturing earthquakes in the past 4,800 years on the southernmost part of the Salt Lake City segment.

continued

For each of the studies, the researchers refined or created new methods of scientific observation. In the study at the Alpine trench site, they were able to estimate the fault offset at a particular location by using the amount of sediment that collapses off a fault scarp. At the Corner Canyon site, the "scientist developed a multi-method approach to evaluate and model the timing of individual earthquakes at the site." This new method "more accurately assess earthquake time in areas with a more sporadic sedimentary record" than the typical method of analyzing collected data using statistical analysis.



A close-up view of the Salt Lake City and Provo segments of the Wasatch fault zone Source: USGS

These two studies show the history of large earthquakes along the Wasatch fault, specifically on either side of the boundary between the Salt Lake City and Provo segments. The data collected will help prepare scientists on what to expect during the next large earthquake along the Wasatch Front.

Resources:
https://earthquake.usgs.gov/research/everyone/2018/wasatch-sequencing/

CONFERENCES, WORKSHOPS & EVENTS

NEMA Mid-Year Forum
March 29-April 2, 2019
Alexandria, VA
https://www.nemaweb.org/index.php/forums-meetings/save-the-date

Mitigation Strategies and Opportunities Workshop
The Westin Resort Guam, Tumon
March 25-26, 2019

National Earthquake Program Managers Meeting and WSSPC Annual Meeting
April 22-26, 2019
Salt Lake City, Utah
https://eqprogram.net/2019-nepm-meeting-set-for-april-22-26-2019/

WSSPC Annual Business Meeting and Awards Luncheon
April 26, 2019
Salt Lake City, Utah
https://eqprogram.net/2019-nepm-meeting-set-for-april-22-26-2019/

Seismological Society of America Annual Meeting
April 23-26, 2019
Seattle, Washington
https://www.seismosoc.org/annual-meeting/

Thank You 2019 WSSPC Affiliate Members!

WSSPC welcomes all members of the professional community who share the common goal of reducing losses from earthquakes. Thanks to our new 2019 Affiliate Members:

Corporate	**Government**
California Earthquake Authority	City of Las Vegas Building and Safety
Saunders Construction, Inc.	Clark County Building and Fire Prevention
Individual	**Non-Profit Organizations**
Dominic Sims	Applied Technology Council

Publication of this e-Newsletter was funded through
FEMA Cooperative Agreement EMW-2018-CA-00001.

If you have a newsworthy item for our e-Newsletter, please forward it to
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