Earthquake Early Warning System for Alaska

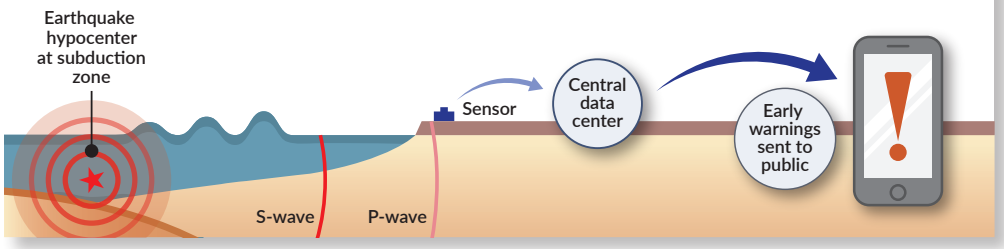
Fact Sheet

Earthquake Early Warning (EEW) is a system for warning the public and automated alert systems that a significant earthquake has begun and that shaking will soon occur at their location.

EEW does not predict earthquakes

How does Earthquake Early Warning work?

Earthquakes begin at a source location inside the Earth called the hypocenter. Seismic waves move outward from this point like ripples in a pond. If you can detect the P-waves close to the hypocenter, you can warn locations farther away of impending shaking before the destructive S-waves reach them.



How are warnings delivered?

EEW alerts can be delivered via internet, radio, television, dedicated emergency broadcast networks, and cellular networks via smartphone apps or the federal Wireless Emergency Alerts system.

Who benefits?

We all do. Lives can be saved and injuries reduced by giving people time to take protective actions (for example: "Drop, Cover, and Hold On") or move away from hazardous areas.

People and infrastructure can be protected by triggering automatic actions like halting surgeries, slowing down trains to prevent derailments, opening firehouse doors so they don't jam shut, and closing valves to protect water and fuel distribution systems.

Do any other states or countries use EEW systems?

An EEW system for the Pacific Coast, known as USGS's ShakeAlert, is currently operational in California and is being tested in Washington and Oregon. Other systems have long been in place in Japan, Taiwan, parts of Mexico, China, and Korea.

The 2011 Tohoku earthquake in Japan proved the benefit of the system by providing the residents of Tokyo 80 seconds of warning prior to the shaking.

The National Tsunami Warning Center could utilize data generated by an Alaska EEW system to make faster, more reliable tsunami warnings.

How soon will I get a warning?

It depends. The warning can vary from no warning* to more than a minute and will depend on how close you are to the epicenter of the earthquake and how the alert is delivered.

**For every earthquake, there is a region near the epicenter where alerts will not arrive before shaking begins because the system needs time to characterize the earthquake's size and likely shaking levels.*

Theoretical warning times for historic earthquakes in Alaska (seconds)

	Anchorage	Valdez	Fairbanks
1964 M9.4 Great Alaska Earthquake	20	10	100
2002 M7.9 Denali Earthquake	65	65	25
2018 M7.1 Anchorage Earthquake	0	40	105

Table based on 15-second detection and alert time and seismic wave velocity of 2.1 mi/sec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Doesn't the Alaska Earthquake Center (AEC) already have a seismic monitoring network? Why can't we just use this for EEW?

The AEC seismic network is built for the detection and scientific study of earthquakes and is capable of determining basic parameters of seismic events within 1–2 minutes. An effective EEW system must operate much faster, and the AEC seismic network would require significant upgrades to station infrastructure, computing capability, and data delivery methods.

Challenges for EEW in Alaska

- **Alaska is Huge:** An EEW system requires a large and dense array of seismic monitoring stations.
- In Japan there are over 4,300 seismic stations; one per 34 square miles. In California there are 1,100 stations; one per 140 square miles. **Alaska currently only has 500 stations; one for every 1,100 square miles.**
- Not all earthquake sources in Alaska are well known and major faults are located offshore, deep below the Pacific Ocean where seismic sensors are very difficult and expensive to install.
- Many existing and potential seismic monitoring stations are in remote locations accessible only by helicopter, making them expensive to install and maintain.
- Stations must provide their own power and communication.
- EEW is expensive to build and maintain. The estimated cost to implement the Pacific Coast EEW system is $50 million plus an additional $38 million per year for maintenance and operations.

The total expenditure for an Alaska EEW system will likely be in the tens of millions of dollars.

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More Information

Shake Alert
www.shakealert.org

USGS Earthquake Hazards Program
www.usgs.gov/natural-hazards/earthquake-hazards

Alaska Seismic Hazards Safety Commission
seismic.alaska.gov

DGGS Active Tectonics Program
dggs.alaska.gov/hazards/earthquakes.html

Steps to Implement EEW in Alaska

- Install several hundred more seismic monitoring stations and upgrade most of the existing seismic stations
- Designate a central location with robust computational power and communication capabilities to serve as a main hub for data collection and processing
- Hire a full-time, dedicated staff to develop and test EEW methods in Alaska
- Integrate with alert networks and test the system with the public, emergency services, and other stakeholders
- Educate the public with an outreach campaign regarding how to use the system, its general capabilities, and its limitations

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