

Earthquake occurrence rate in Alaska 1960-2010

Michael West, mewest@alaska.edu
Geophysical Institute, Univ. Alaska Fairbanks

The Alaska earthquake catalog has improved over the past century reflecting technical advances in instrumentation and data analysis. The 1964 Good Friday earthquake was a turning point. Following the catastrophic magnitude 9.2 event, the catalog is complete down to about magnitude 5, improving to magnitude 3 by the early 1970s. By this time, Mb and Ms were supplementing local magnitudes for most events above magnitude 4.

Beginning in 1976 the global CMT project began contributing Mw magnitudes for events 5 and greater. Moment magnitudes generated by the Alaska Earthquake Information Center, beginning in 2002, brought the Mw threshold closer to 4.

Over the past 50 years, the Alaska region has generated an average of 150 earthquakes per year of magnitude 4.5 or greater. This is 5 times the rate of earthquakes in the entire contiguous US (or "lower 48" in Alaska parlance). During this time there have been 11 earthquakes in the U.S. greater than 7.5—all of them have occurred in Alaska.

Based on the recurrence times implied by the 50-year catalog, it is possible to approximate the likelihood of earthquakes of at least a certain size.

There are caveats to this methodology, especially at the largest magnitudes. However, the Alaska seismicity rate is sufficiently high to support this up to magnitudes above 7.

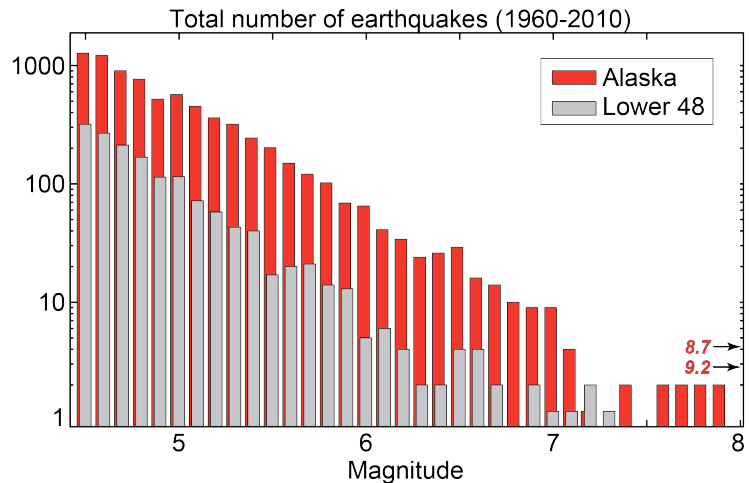


Figure 1. Histogram of earthquakes in Alaska and in the lower 48 states in the past 50 years. Magnitudes for Alaska events¹ are used in order of preference: Mw, Ms, Mb, ml. Magnitudes for the lower 48 are the preferred magnitudes published in the ANSS composite catalog².

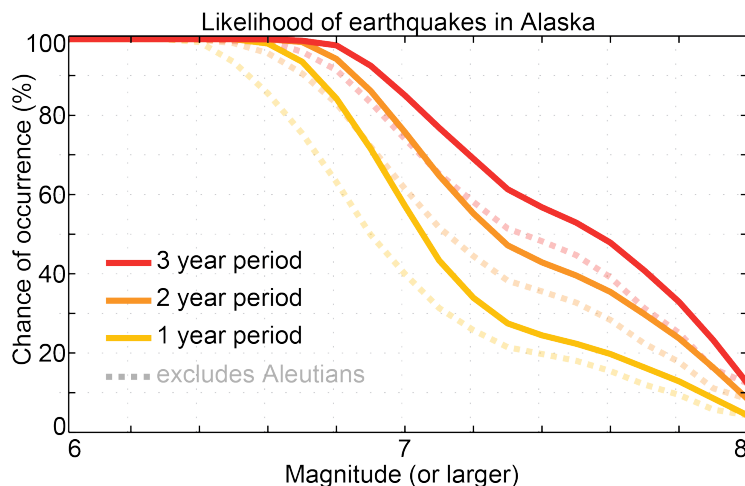


Figure 2. Likelihood of an earthquake occurring with at least a given magnitude. The longer the observation window the greater the chance of an earthquake. The dashed line is the same analysis without including earthquakes in the Aleutian Islands (west of 163°W and south of 57°N)

During a 1-3 year period, an earthquake exceeding 6.5 is a certainty. The likelihood of recording a magnitude 7 or greater is strongly a function of the observation time. There is a 60% chance of a magnitude 7 during a 1-year period, increasing to nearly 90% during a 3-year observation period. While a magnitude 8 earthquake cannot be counted on during a temporary deployment, there is a very real possibility of capturing such an event during the lifetime of a USArray deployment.

Perhaps the most compelling argument for Alaska as a place to understand large earthquakes cannot be observed in figure 2. Magnitude 5 earthquakes occur in Alaska, on average, every 6 days.

Data sources

Alaska earthquake data from the Alaska Earthquake Information Center (www.aeic.alaska.edu)

Lower 48 earthquake data drawn from the ANSS composite catalog (<http://www.ncedc.org/cnss/catalog-search.html>)