Implementation of the ShakeMap System in Alaska

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ShakeMap

- The USGS ShakeMap system is a tool for the real-time generation of ground-shaking maps following significant earthquakes.
- ShakeMaps provide vital information within minutes after an earthquake to emergency response agencies, the media and the general public.
- ShakeMaps are produced on the basis of observed ground motion values (peak velocities, peak accelerations, and spectral accelerations) and complemented by calculated values using empirical attenuation relationships.
ShakeMap Workflow at AEIC

- Alaska Seismic Network
- AEIC Antelope Real-Time System
- Parametric and Ground Shaking Data
- ShakeMap System
- ShakeMap Web Pages
• Observations for ShakeMaps are collected from more than 80 broadband and 25 strong motion stations throughout the state.

• Ground motion grids are based on maximum peak ground accelerations and velocities of two horizontal components.

• Currently, ShakeMaps are produced for events with magnitudes greater that M3.5 with at least 10 associated arrival picks and calculated MMI greater than 2.0 at the epicenter.
Map of Seismic Stations
ShakeMap Methodology

- The ShakeMap triggering and production is based on the Antelope system used for real-time seismic operations at AEIC.
- The ShakeMap generation sequence is triggered once a new event above certain magnitude appears in the real-time event database.
- The first ShakeMap is automatically generated within 1-2 minutes after that, and then several updates may be automatically issued if new data becomes available from different sources.
- Analyst-reviewed ShakeMaps are generated for alarm events after the revision of the automatic solutions, usually within 25 to 45 min of the origin time.
- A cancellation script is activated if an updated hypocenter is no longer eligible for ShakeMap.
- A final version of ShakeMap is manually produced for larger events, if necessary, in order to utilize any additional information, including extended source geometry.
## Summary Database

<table>
<thead>
<tr>
<th>lat</th>
<th>lon</th>
<th>depth</th>
<th>time</th>
<th>oirid</th>
<th>eirid</th>
<th>ness</th>
<th>ml</th>
<th>auth</th>
<th>(ldate-11895543930)/00</th>
</tr>
</thead>
<tbody>
<tr>
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<td>100.0000</td>
<td>9/11/2007 (254) 23:46:33.52503</td>
<td>15974</td>
<td>15973</td>
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<td>76</td>
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</tbody>
</table>
Choose "Most Recent Event" to see maps for the most recent earthquake, select one of the maps from the list of "Recent Significant Events" or click on the "Map Archive" tab at the top of the page to view past events.

**Most Recent Event**

<table>
<thead>
<tr>
<th>Location</th>
<th>Date</th>
<th>Time</th>
<th>Magnitude</th>
</tr>
</thead>
<tbody>
<tr>
<td>59.5 miles WNW of Anchorage</td>
<td>Sep 11 2007</td>
<td>15:46:34 AKDT</td>
<td>4.4</td>
</tr>
</tbody>
</table>

**Maps of Recent Significant Events**

<table>
<thead>
<tr>
<th>Location</th>
<th>Date</th>
<th>Time</th>
<th>Magnitude</th>
</tr>
</thead>
<tbody>
<tr>
<td>146.8 miles WSW of Adak</td>
<td>Aug 1 2007</td>
<td>19:24:40 AKDT</td>
<td>5.4</td>
</tr>
<tr>
<td>151.7 miles WSW of Adak</td>
<td>Aug 1 2007</td>
<td>19:21:41 AKDT</td>
<td>6.6</td>
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<tr>
<td>35.3 miles SE of Adak</td>
<td>Jul 13 2007</td>
<td>13:54:44 AKDT</td>
<td>6.0</td>
</tr>
</tbody>
</table>

Please use the comment form for questions, comments, or suggestions about the ShakeMaps.
Page maintained by the ShakeMap Working Group.
NEAR REAL-TIME SHAKEMAPS

AEIC ShakeMap: 59.5 miles WNW of Anchorage
Tue Sep 11, 2007 03:46:34 PM YDT  M 4.4  N61.54 W151.57  Depth: 100.6 km  ID:15973

AEIC Peak Accel. Map (in %g): 59.5 miles WNW of Anchorage
Tue Sep 11, 2007 03:46:34 PM YDT  M 4.4  N61.54 W151.57  Depth: 100.6 km  ID:15973
• The site corrections are based on the average shear-wave velocity values for the uppermost 30 meters (Vs30).
• Vs30 values are derived from the slope of the topography.
Correlation of Vs30 and Site Response in Anchorage

![3D Graph showing correlation between Vs30 and site response in Anchorage. The graph includes a color scale and data points for different site classes and shear wave velocities.](image-url)
Attenuation Relationships

- Boore et al. (1997) model is used for the crustal events with M>5.3.
- Youngs et al. (1997) model is used for subduction-zone events.
- ShakeMap Small Regression model for shallow events with M<=5.3.
Observed and Predicted PGA During the Denali M7.9 Earthquake

- Observed accelerations, rock sites
- Observed acceleration, soil sites
- Sadigh et al. (1997), rock
- Sadigh et al. (1997), deep soil
- Boore et al. (1997), rock
- Boore et al. (1997), soil
- Campbell (1997), firm soil
- Campbell (1997), soft rock
SCENARIO SHAKEMAP
M7.1 earthquake on the Border Ranges Fault near Anchorage

- Scenario ShakeMaps represents the expected ground motions from hypothetical earthquakes.
- Earthquake scenarios play an important role in planning and coordinating emergency response and conducting training exercises based on realistic situations.
Thank You!