Deciphering the record of prehistoric Aleutian megathrust earthquakes and tsunamis west of Kodiak Island, Alaska

USGS PIs:
Rich Briggs
Guy Gelvenbaum
Alan Nelson

Collaborators:
Peter Haeussler
Rob Witter
Tina Dura
Jeff Freymueller

Breany MacInnes
Simon Engelhart
Dmitry Nicolaevsky
Jason Padgett
Yuki Sawai

This information is preliminary, is subject to revision, and it is not for citation or further distribution. This material solely provides a record of the slides shown during the USGS-NTHMP Workshop held on February 1-2, 2016 and is not a final scientific record complete with references to prior work. The information is provided on the condition that neither the U.S. Geological Survey nor the U.S. Government shall be held liable for any damages resulting from the authorized or unauthorized use of the information.
MISSION, PRODUCT, OR SERVICE WE WILL DELIVER

To reconstruct Aleutian megathrust earthquake and tsunami histories west of Kodiak Island

Sitkinak Island, 2011
BIG SCIENCE QUESTIONS THAT NEED ANSWERING

- What are the recurrence intervals of Aleutian megathrust earthquakes and tsunamis?
- How has coseismic slip varied spatially along the megathrust?
- How do ancient rupture patterns compare to patterns of modern geodetic coupling?
- What controls rupture lengths for earthquakes of different magnitude?
MOTIVATION

1. Most of the Aleutians lack paleoseismic data
2. Aleutian tsunamis can have BIG trans-Pacific impacts
3. Proposed work supports Natural Hazards Science Strategy

East Aleutian scenario
Magnitude 9.25
(Butler et al., 2014)
Field investigations 2010–2015

We want to double our productivity!

Eight sites investigated:
- Umnak Island
- Chirikof Island
- Sedanka Island
- Sitkinak Island
- Sanak Island
- Sitkalidak Island
- Simeonof Island
- Kenai Peninsula

Sanak Island, 2014

1946 tsunami deposit
Umnak Island

- 9 sand sheets in ~2200 yrs
- Sand sheets meet tsunami criteria
- Youngest sand sheet deposited in 1957
- Stranded drift logs indicate >23 m runup in 1957
- 270–340 yr average tsunami recurrence interval

This information is preliminary, is subject to revision, and it is not for citation or further distribution. This material solely provides a record of the slides shown during the USGS-NTHMP Workshop held on February 1-2, 2016 and is not a final scientific record complete with references to prior work. The information is provided on the condition that neither the U.S. Geological Survey nor the U.S. Government shall be held liable for any damages resulting from the authorized or unauthorized use of the information.
WHO WILL BENEFIT AND HOW?

- Seismic hazard community
- Tsunami modeling community
- Risk assessments
- Emergency managers

This information is preliminary, is subject to revision, and it is not for citation or further distribution.

This material solely provides a record of the slides shown during the USGS-NTHMP Workshop held on February 1-2, 2016 and is not a final scientific record complete with references to prior work.

The information is provided on the condition that neither the U.S. Geological Survey nor the U.S. Government shall be held liable for any damages resulting from the authorized or unauthorized use of the information.
Need mega results?
Get megathrust paleoseismology!

“Our results demonstrate that Aleutian paleoseismology can provide fundamental constraints to answer the Big Science Questions.

This is astoundingly cheap work compared to most geophysical studies, and we know it will have significant impact.

Fund this First!”

Simeonof Island, 2011
Large earthquakes don’t always stop at Sitkinak

Briggs et al., 2014

This information is preliminary, is subject to revision, and it is not for citation or further distribution.
This material solely provides a record of the slides shown during the USGS-NTHMP Workshop held on February 1-2, 2016 and is not a final scientific record complete with references to prior work.
The information is provided on the condition that neither the U.S. Geological Survey nor the U.S. Government shall be held liable for any damages resulting from the authorized or unauthorized use of the information.
Tsunami sources along a creeping megathrust

Witter et al., 2015

Tsunamis hit Stardust Bay every 300–340 yrs on average

This information is preliminary, is subject to revision, and it is not for citation or further distribution. This material solely provides a record of the slides shown during the USGS-NTHMP Workshop held on February 1-2, 2016 and is not a final scientific record complete with references to prior work. The information is provided on the condition that neither the U.S. Geological Survey nor the U.S. Government shall be held liable for any damages resulting from the authorized or unauthorized use of the information.