Oregon Tsunami Sources
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Largest Historical Distant Tsunami Event: 1964 Prince William Sound Earthquake
Hypothetical Maximum Alaska Tsunami Source – (Source 3, Tsunami Pilot Study Working Group, 2006)
Source 3 illustration from Tsunami Pilot Study Working Group (2006)

Facility for the Analysis and Comparison of Tsunami Simulations (FACTS)
Maximum Wave Height (cm)

T (SECONDS): -30 to 86430
## Maximum Uplift
### Alaska vs Maximum Cascadia Source
(all $\sim$Mw 9.2)

<table>
<thead>
<tr>
<th>Source</th>
<th>Peak Slip (m)</th>
<th>Peak Uplift (m)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cascadia XXL (Witter et al., 2011)</td>
<td>40</td>
<td>10</td>
</tr>
<tr>
<td>Alaska Max (Source 3, Gonzalez et al., 2008))</td>
<td>30</td>
<td>9-12</td>
</tr>
<tr>
<td>1964 Alaska (Johnson et al. (1996))</td>
<td>20-22</td>
<td>4-6</td>
</tr>
</tbody>
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Probabilistic Implications: Oregon Cascadia Scenarios

• “Small”:
  – Approx. inundation for 5 of 19 full-margin events over the last ~10,000 years.
  – Approx. min. slip to produce the 13 of 32 (~41%) tsunamis that made it into Bradley Lake (southern Cascadia) over the last 7,300 years.

• “Medium”
  – Approx. inundation for 10 of 19 full-margin events
  – Approx. min. slip for tsunamis to cover AD1700 tsunami sands (AD1700 = “average” turbidite)

• “Large” Approx. mean inundation for 3 of the top 4 full-margin events over the last ~10,000 years.

• XL and XXL are similar and approx. inundation for the largest event over the last 10,000 years.
Cascadia Rupture Lengths from Turbidite Data

~40 earthquakes over the last 10,000 years

Modified from Goldfinger et al., (2012)
19 CSZ Earthquakes & Tsunami Over past 10,000 Years

Occurrence and Relative Size of Cascadia Subduction Zone Megathrust Earthquakes

larger but much less frequent tsunamis

smaller but more frequent tsunamis

Research-indicated radiocarbon age of CSZ event (most recent in January 1700)

Average offshore landslide turbidite mass used as a proxy for landslide size.

(Modified from Witter and others, 2011; DOGAMI Special Paper 43)
Frequency and size (mass) of full-margin turbidites vs. inter-event follow times over the last 10,000 years

Scenario slip is calculated from the 1200-, 800-, 525-, and 300-yr follow times. Note that follow time times do not correlate exactly with turbidite size (mass).

Graph is from Witter et al. (2011), DOGAMI Special Paper 43

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Further Implications to consider:

- Published inundation maps use only the splay fault model
  - Probably okay for M-XXL cases; maybe not for “Small” slip
  - Amplifies inundation by 6-20% and elev. at shore by 27-31%.

- $M_w = 8.7$ to 9.2

- Slip patches = regional north to south (no “null” zones)
  - “Null” zones create de facto segments
  - Segment tsunamis die out quickly north and south of patch
  - “Null” zone patches are thus effectively “no tsunami” cases

- Slip tapers E-W from a maximum near the slope break
  - Based on observations of many modern events (Sumatra, etc.)
  - May be problematic for southern Cascadia (e.g., Tohoku slip to trench)

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Regional Experiment: Tsunami Elevations at 50-m Isobath

Unpublished data and graphics of Oregon Dept. of Geology and Mineral Industries.

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Vertical Deformation: Splay Fault vs Buried Rupture Sources


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