OR Approach based on:

- Knowledge of the structure of the Cascadia megathrust;

- Theoretical understanding of megathrust ruptures;

- Paleoseismic records extending back 10,000 years (i.e. deep sea turbidites);

- Coastal evidence of coseismic subsidence and tsunami inundation

OVERALL GOAL:
Represent as full a range of potential sources (covering all reasonable geologically reasonable model space, erring on the conservative side)
Qualitative Explanation of Cascadia Tsunami Scenarios shown on published tsunami inundation maps

Occurrence and Relative Size of Cascadia Subduction Zone Megathrust Earthquakes

- **XXL**: 100% of local tsunamis (~5000-yr event)
  - **Local Tsunami Evacuation Zone for Oregon**
- **XL**: 98% of local tsunamis (~5000-yr event)
- **L**: 95% of local tsunamis (~2500-yr event)
- **M**: 79% of local tsunamis (~500-yr event)
- **S**: 79% of local tsunamis (~500-yr event)

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

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(Modified from Witter and others, 2011, DOGAMI Special Paper 43)

- Average offshore landslide turbidite mass used as a proxy for landslide size.
Summary: Cascadia Tsunami Scenarios

<table>
<thead>
<tr>
<th>Rupture Scenario (Witter and others, 2011)</th>
<th>Tsunami Inundation Map (TIM Series) Scenario</th>
<th>Length (km)</th>
<th>Width (km)a</th>
<th>Slip Deficit Time (years)</th>
<th>Maximum Slip (mb)</th>
<th>Average Slip (mc)</th>
<th>Moment Magnitude (Mw)d</th>
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<tbody>
<tr>
<td>XXL1</td>
<td>XXL</td>
<td>1,000</td>
<td>83</td>
<td>1,200</td>
<td>41</td>
<td>20</td>
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<tr>
<td>XL1</td>
<td>XL</td>
<td>1,000</td>
<td>83</td>
<td>1,050–1,200</td>
<td>41</td>
<td>20</td>
<td>9.1</td>
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<tr>
<td>L1</td>
<td>L</td>
<td>1,000</td>
<td>83</td>
<td>650–800</td>
<td>27</td>
<td>13</td>
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<tr>
<td>M1</td>
<td>M</td>
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<td>83</td>
<td>425–525</td>
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<td>8.9</td>
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<tr>
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<td>S</td>
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<td>83</td>
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<td>Alaska M9.2 (1964)</td>
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<tr>
<td>AKmax</td>
<td>Alaska Maximum</td>
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<td>100</td>
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<td>30</td>
<td>no data</td>
<td>9.2</td>
</tr>
</tbody>
</table>

a Equivalent fault width calculated from rupture area divided by length; modeled fault width varies with latitude; Cascadia values (Sm1–XXL1) are from Witter and others (2011).
b Maximum slip estimates for Cascadia scenarios (Sm1–XXL1) are calculated from the recurrence interval multiplied by a convergence rate in southern Oregon (34 mm yr⁻¹ at 42.94°W latitude) and are from Witter and others (2011); estimates for AK64 and AKmax are derived from the maximum subfault slip of Johnson and others (1996) and TPSW (2006), respectively.
c Average slip estimate is 0.49 of maximum slip estimate for Cascadia scenarios (XXL1–Sm1) and is from Witter and others (2011); estimates for AK64 and AKmax are from Johnson and others (1996) and TPSW (2006), respectively.
d Moment magnitude (Mw) = (log M₀ – 9.1)/1.5 where M₀ = seismic moment assuming rigidity = 4 x 1010 N m² and is from Witter and others (2011).

Tsunami Runup: 4 to >25 m  
Max Shoreline Flow Depth: 4 to >25 m  
Inundation distance: 1 to >3 km  
Tsunami arrival: 15 to 20 min
Needs:

- Short term: assign approximate probabilities to model scenarios already developed in Oregon. Necessary to place the logic tree approach in a better context;

- Longer term: Offer new probabilistic inundations and force levels, especially as an alternative to the ASCE 7;

- Refinements to the along coast co-seismic response.

- Better coordination between USGS and state modeling teams.

- Submarine landslides?
Open coast

XXL1 mean = 62 ft
Recurrence intervals and rupture extents for Cascadia earthquakes, Goldfinger et al. (2011)

- 19 to 20 full length or nearly full length ruptures
- 2 to 3 ruptures of ~75% of the length of the margin
- 19 shorter ruptures of southern segments
(After Witter and others, 2011)
Figure 7. Schematic logic tree used to rank 15 Cascadia earthquake models. See Table 3 for a list of all parameters and weights used in the analysis. Earthquakes sizes are extra extra large (XXL), large (XL), large (L), M, medium (M), and small (SM).