Tsunami Evacuation Guidance for the Oregon Maritime Community

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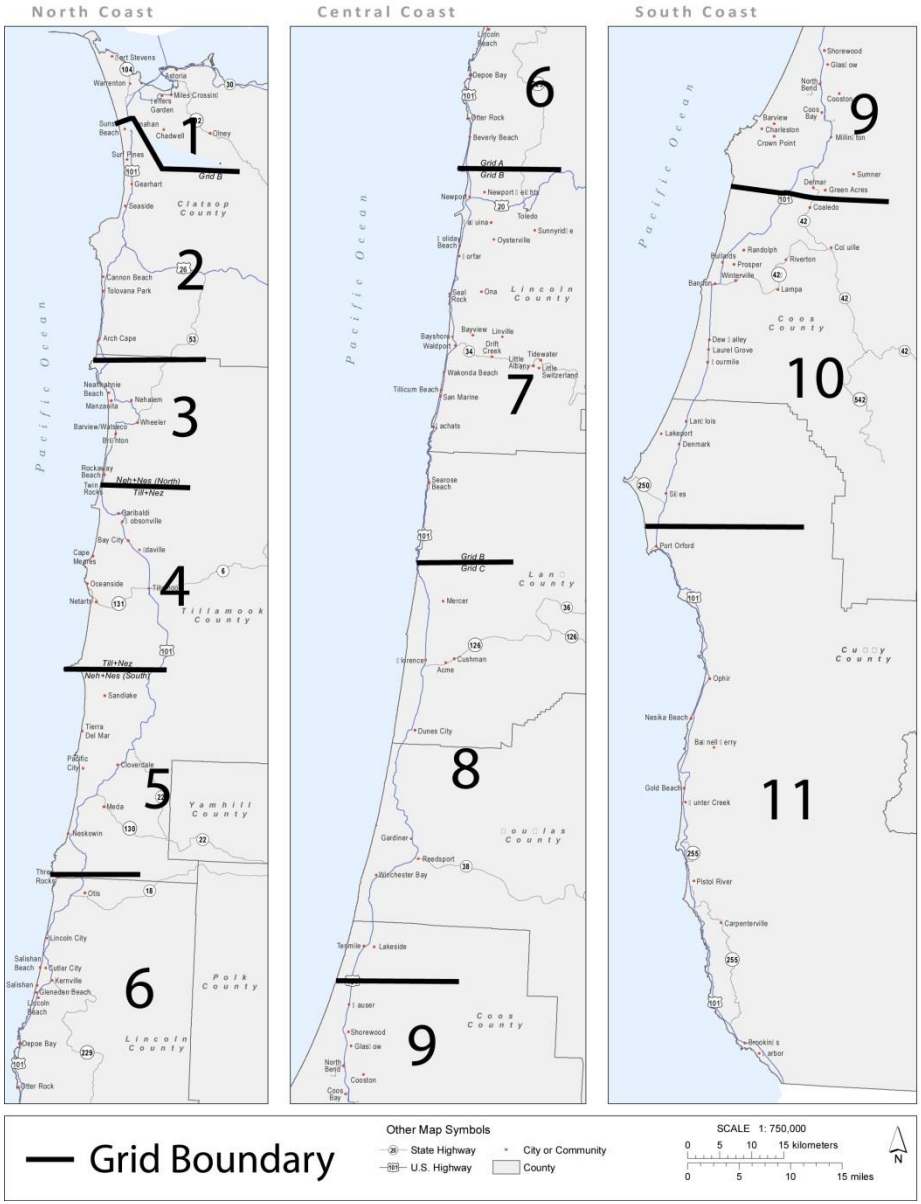
FY13 NTHMP Task for Oregon: Statewide Maritime Guidance

1. Maritime advisory committee (MAC) representing
   - US Coast Guard
   - Port managers
   - Shipping fleet
   - Fishing fleet
   - Emergency responders
   - Planners
   - NTHMP partners (MMS)
2. Determine hazard parameters
   (velocity, min. flow depth, vorticity, wave steepness, shear flow)
3. Determine offshore safety zone (or zones) – maximum-considered distant and local tsunamis
4. Produce a statewide brochure/guide

Use Detailed Simulations from 11 Grids (2009-2012 work)



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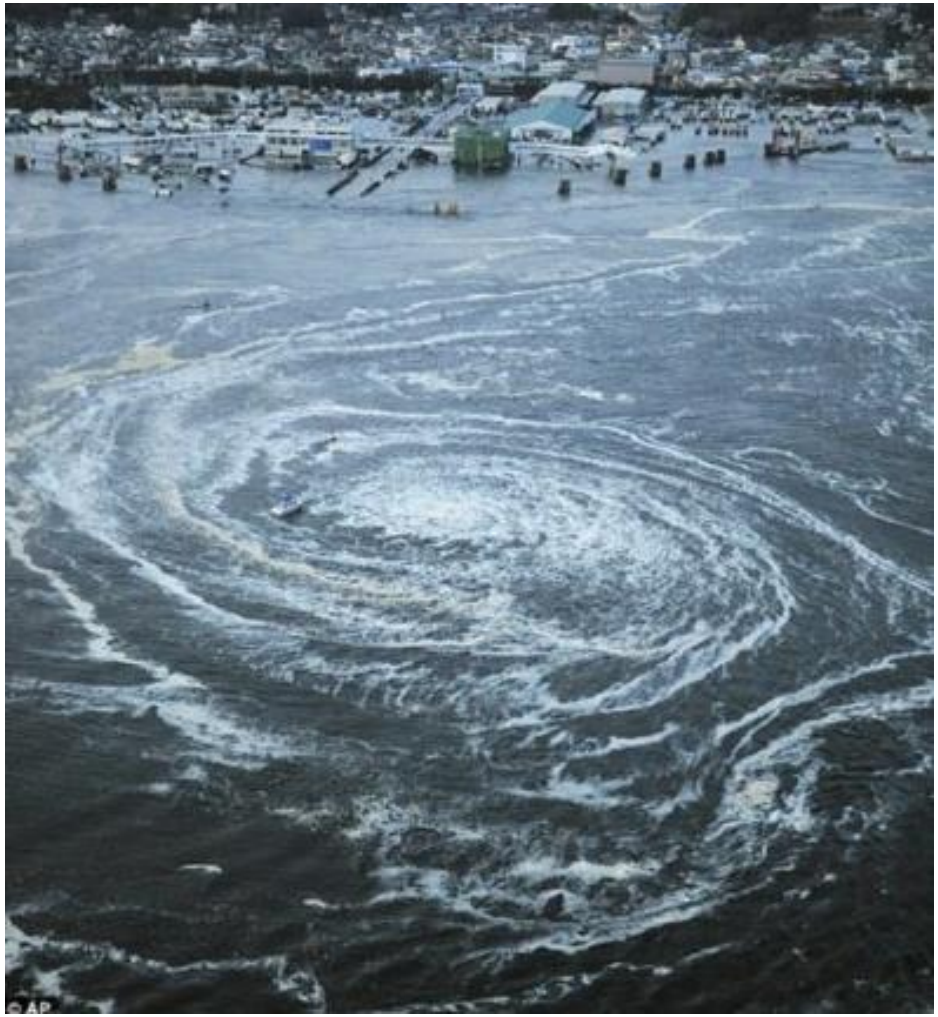
Open Ocean Hazard Issues

- California study of port damage may not be suitable for offshore hazard
  (i.e., **3-6 knots** = minor to mod., **6-9 knots** = mod. to significant, **>9 knots** = significant to total)
- Rapid velocity changes (over time and space), whirlpools, steep waves, and grounding may be more important than velocity.
- Debris hazard, especially from local events, may be important but how to evaluate?

Shear flow/vorticity

Tohoku, Japan Tsunami, March 11, 2011



Source of picture: http://news.nationalgeographic.com/news/2011/03/pictures/110311-tsunami-earthquake-japan-hawaii-science-world-waves/#/japan-tsunami-earthquake-hits-northeast-whirlpool_33139_600x450.jpg

DRAFT
Real-Time Mitigation Guidance

Distant Tsunamis

- Warning: NOAA
- Tsunami arrival: ≥ 4 hrs
- Tied to dock: Check w. port for guidance.
- Offshore: go to >30 fathoms(?)*
- Land: Go to evacuation site until local officials say it is safe to return.

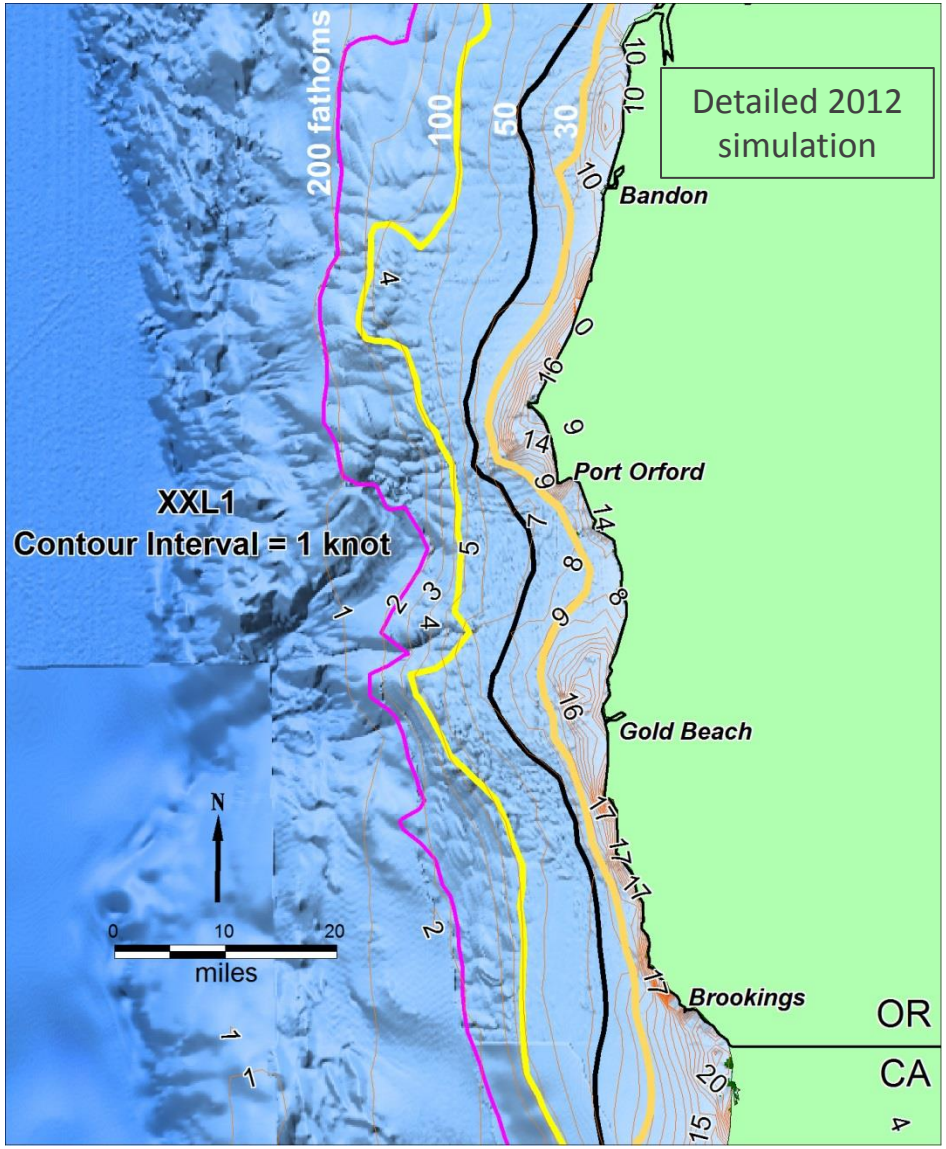
Local Tsunamis

- Warning:
  - Ground shaking
  - Ocean roar
  - Water receding or surging
- Tsunami arrival = 15-20 min.
- Tied to dock: Go to evacuation site until local officials say it is safe to return.
- Offshore: go to >100 fathoms (?)*
- Land: Go to evacuation site until local officials say it is safe to return.

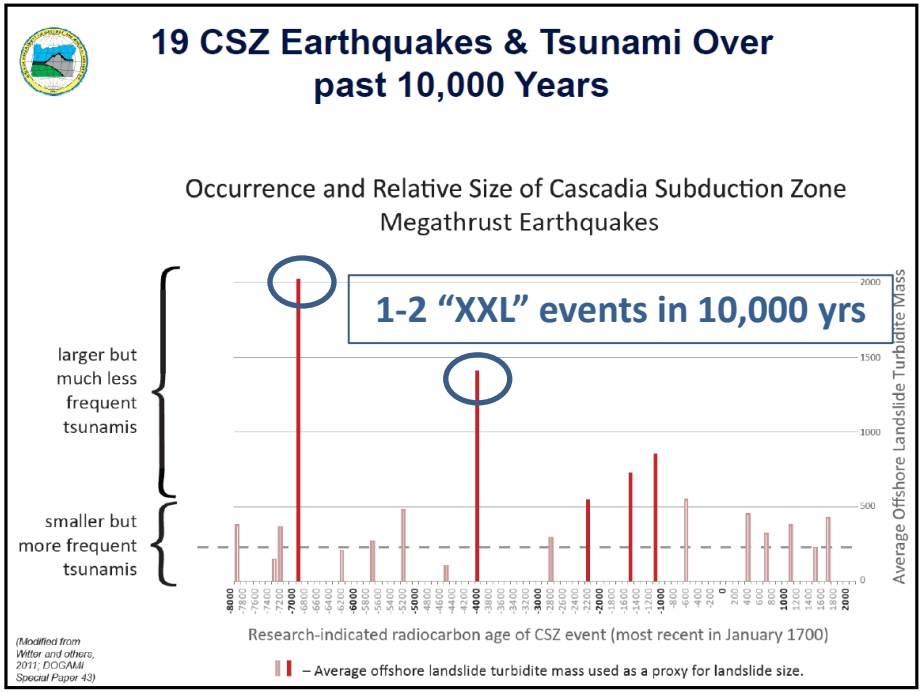
**Depth to be determined in FY13 work.*

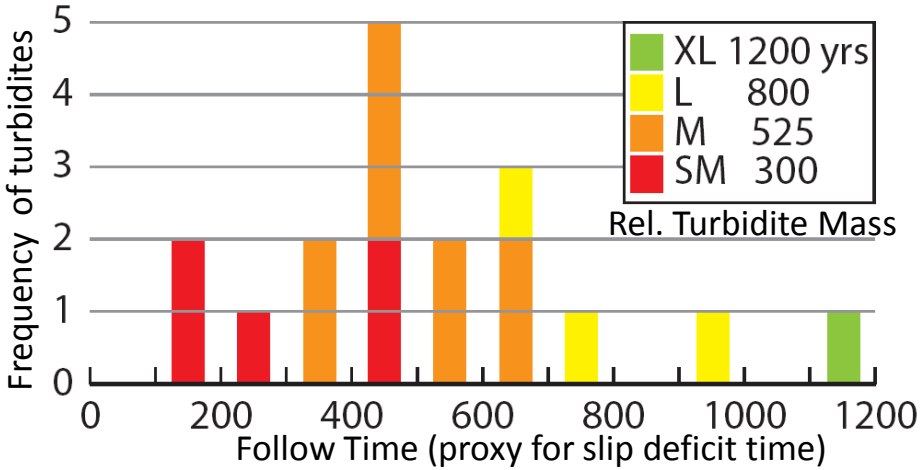
XXL1 (~5,000-10,000-yr Cascadia event)

Velocity Simulation Relative to Key Isobaths



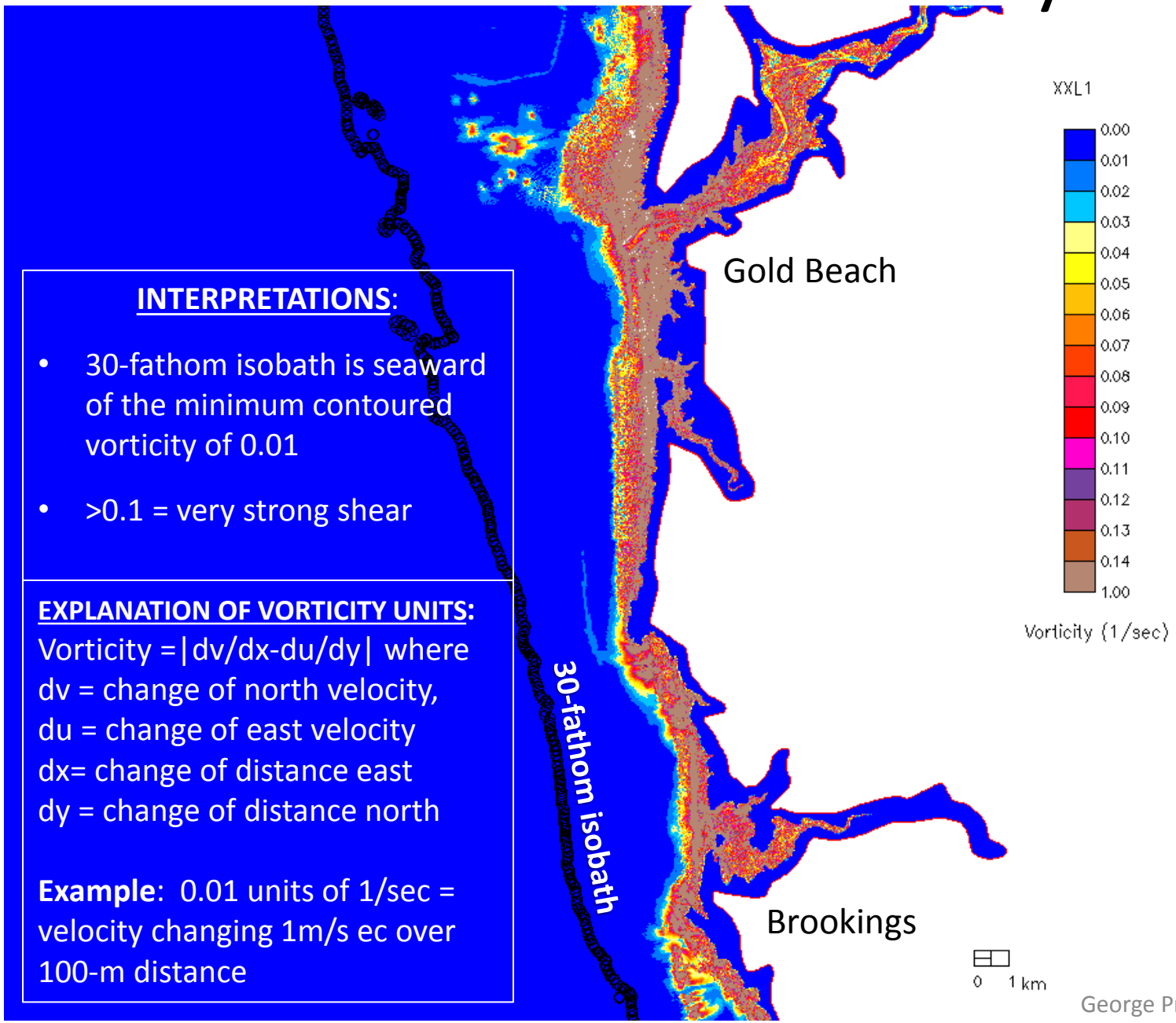
Paleoseismic Data - Turbidites





Histogram modified from Witter et al. (2011), DOGAMI Special Paper 43

XXL1 Maximum Vorticity



INTERPRETATIONS:

- 30-fathom isobath is seaward of the minimum contoured vorticity of 0.01
- >0.1 = very strong shear

EXPLANATION OF VORTICITY UNITS:
Vorticity =|dv/dx-du/dy| where
dv = change of north velocity,
du = change of east velocity
dx= change of distance east
dy = change of distance north

Example: 0.01 units of 1/sec = velocity changing 1m/s ec over 100-m distance

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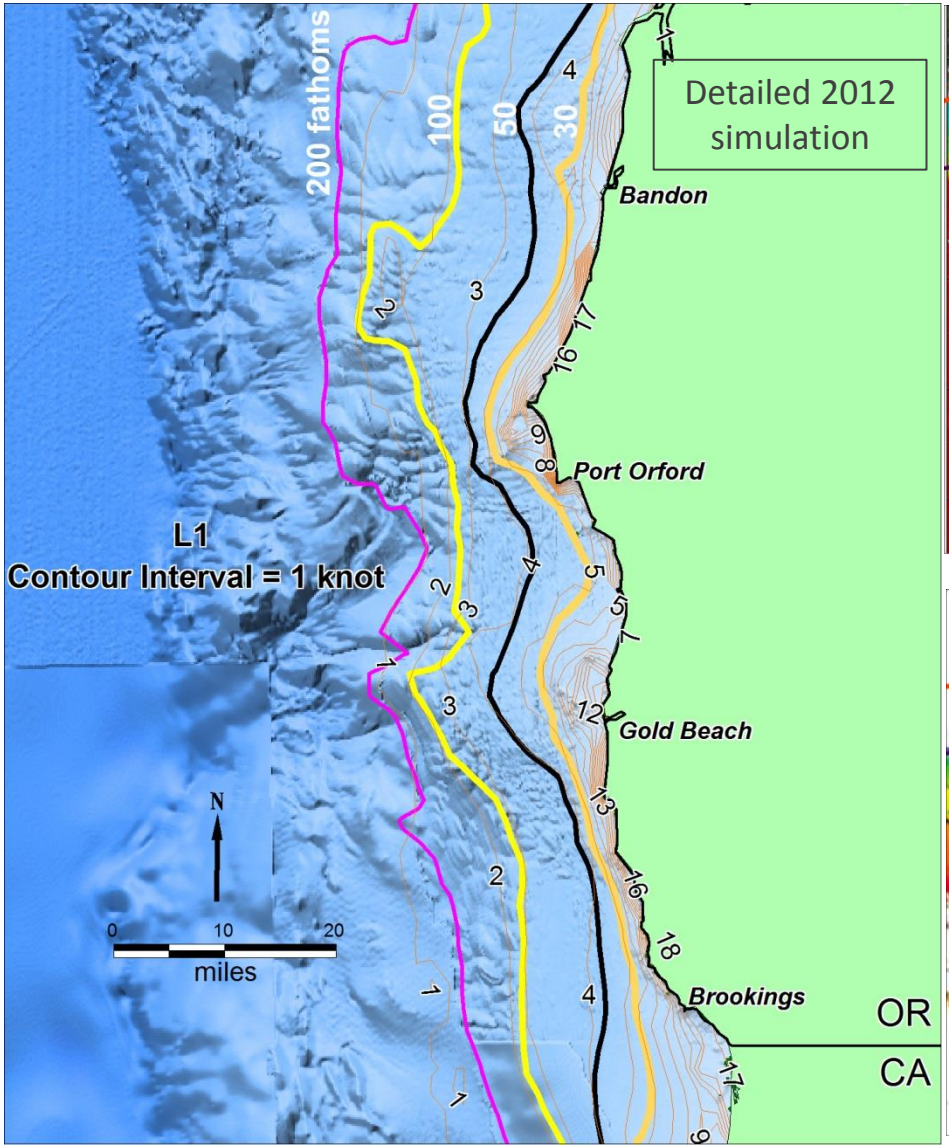
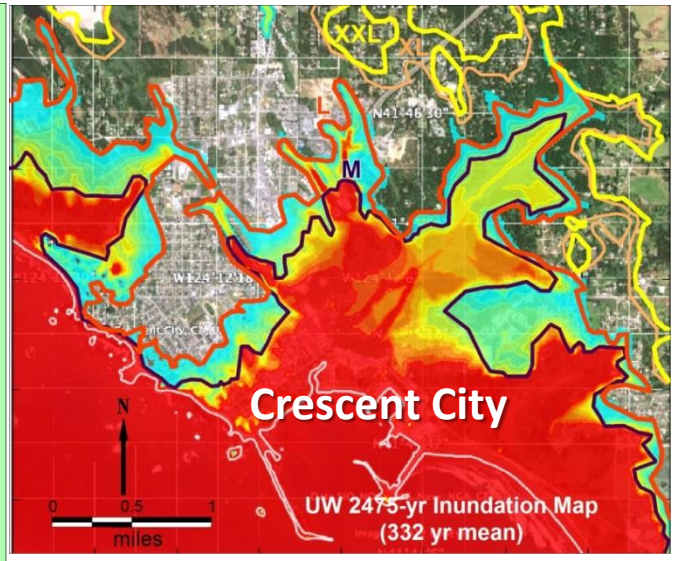
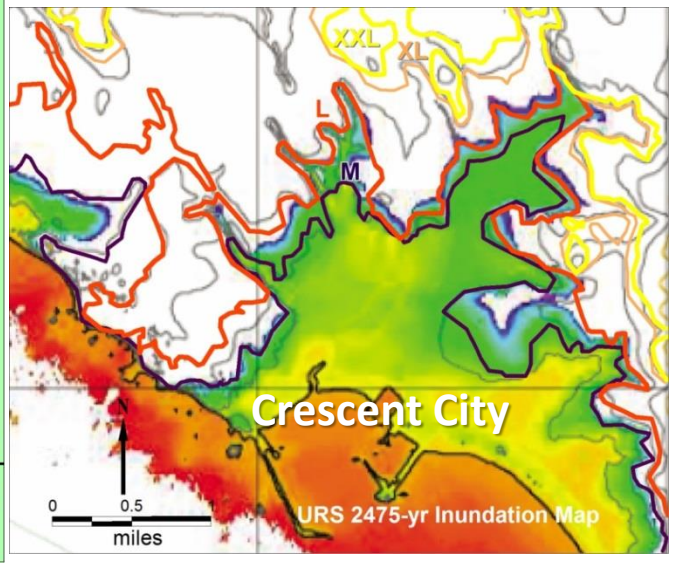
L1 (~ 2,500-yr exceedance event – Crescent City PTHA)

Velocity Simulation Relative to Key Isobaths



L1 (red line) vs 2475-yr Inundation





Colored Areas are 2475-yr Inundation (as flow depth)

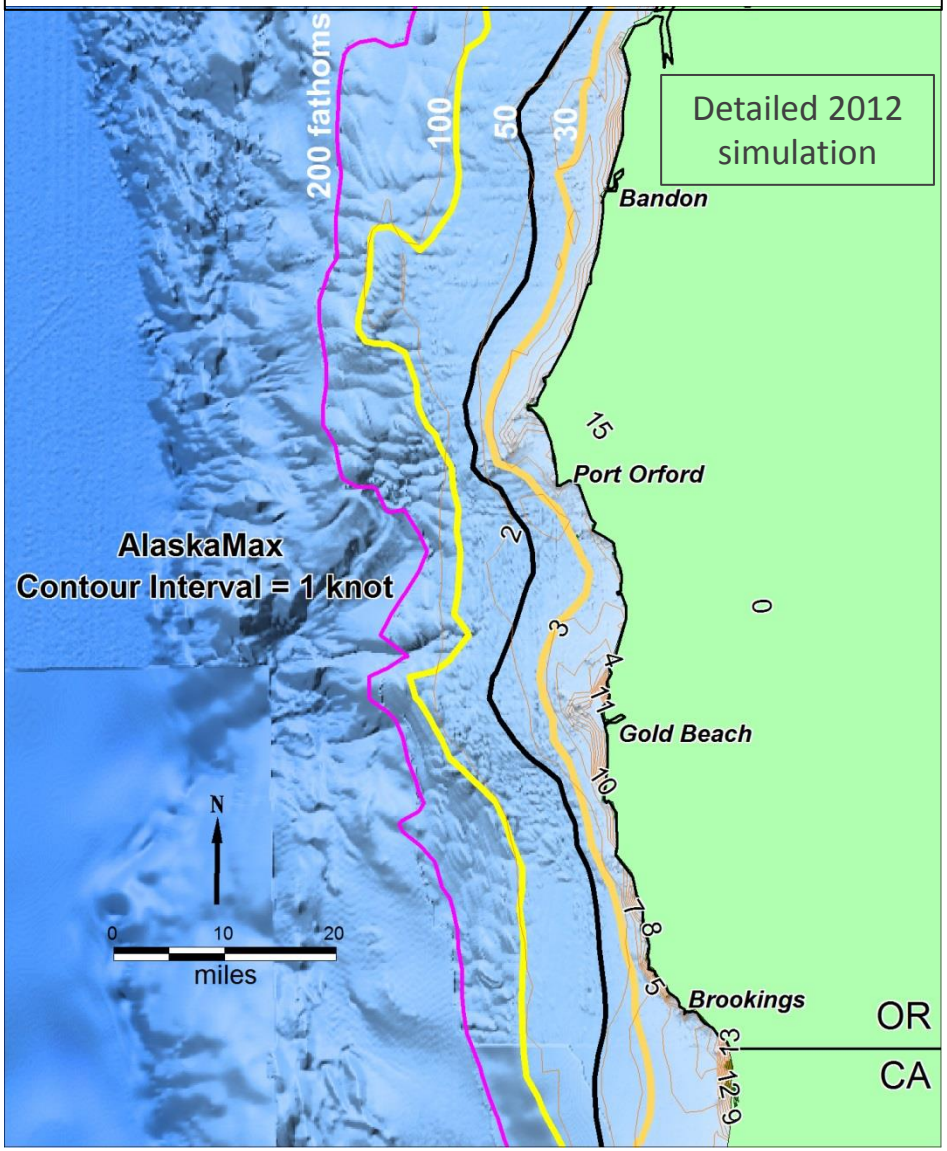
Colored Lines are Inundation boundaries from Oregon Scenarios

PTHA MAPS are modified from Crescent City Demonstration Projects of the California Probabilistic Tsunami Hazard Analysis Work Group by adding labels and inundations from Oregon CSZ splay fault sources M1, L1, XL1, and XXL1 simulated by the UW team.

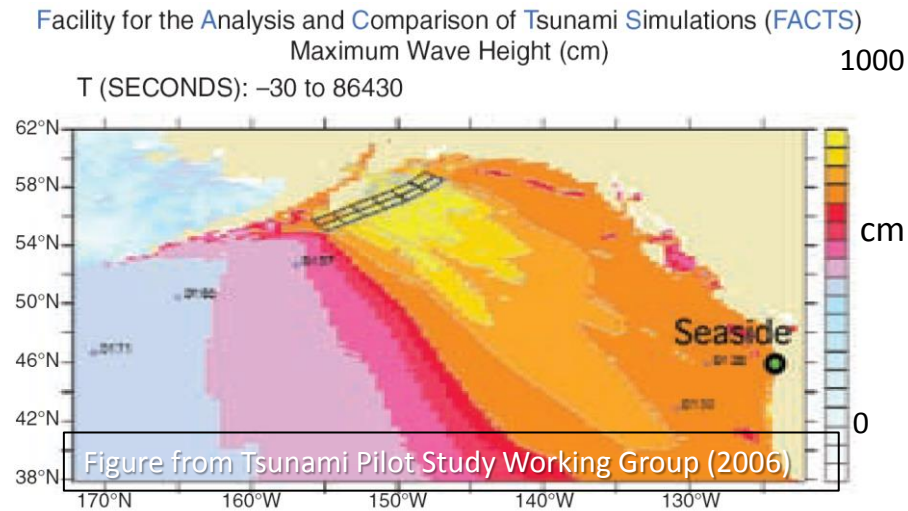
AlaskaMax

Hypothetical Max. Distant Tsunami with ~750-yr return

Velocity Simulation Relative to Key Isobaths



Tsunami Focusing by AlaskaMax Source



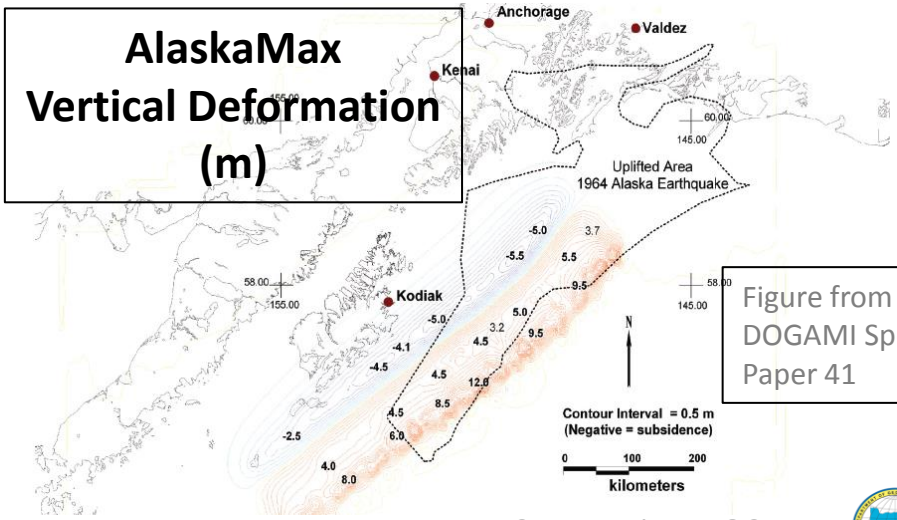
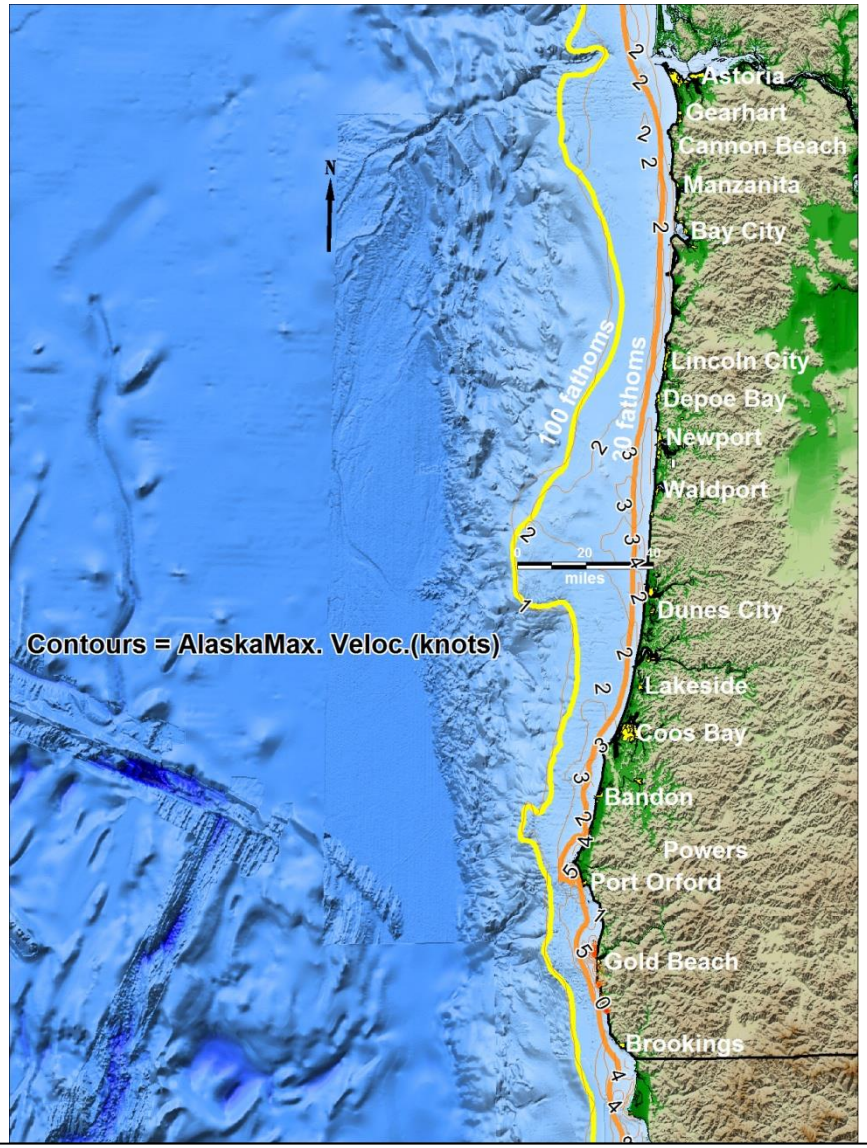
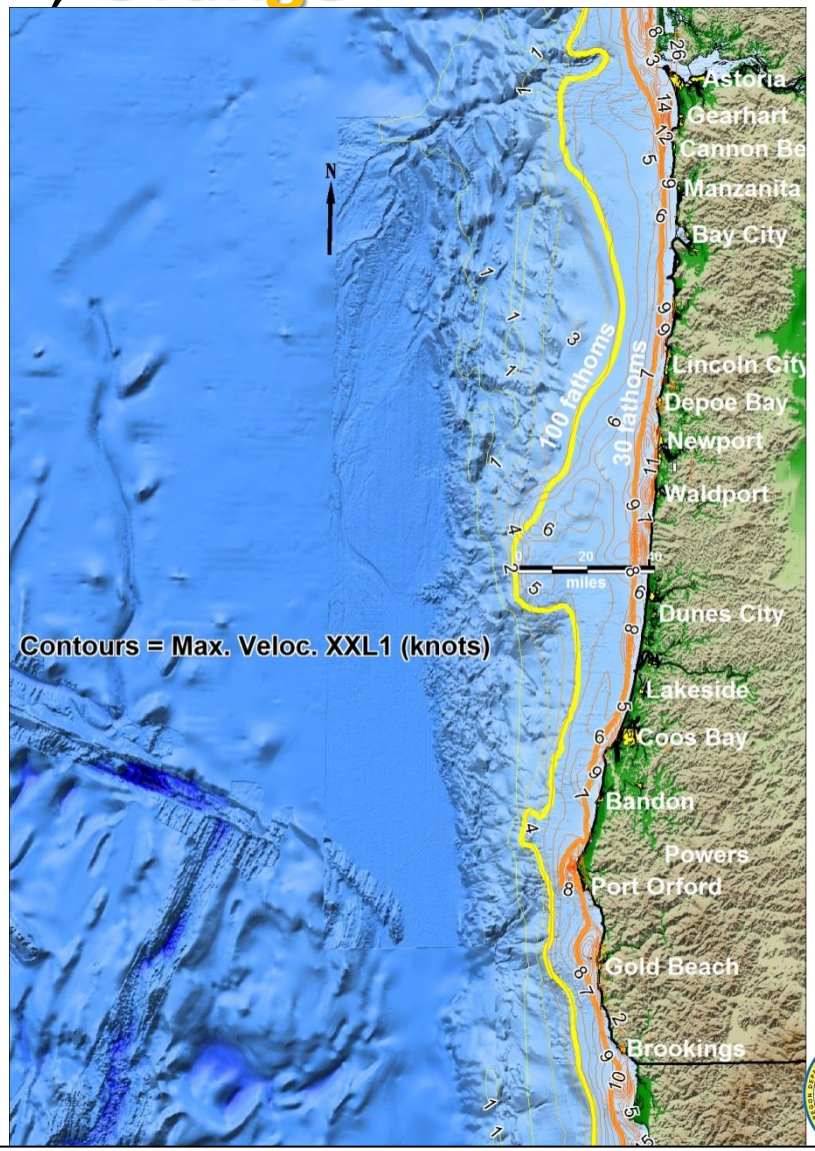


Figure from DOGAMI Special Paper 41

Example of "Two-Zone" Maritime Tsunami Evacuation Map

Yellow = Local Cascadia Event; Orange = Distant Event





Maximum velocities and isobaths from preliminary 2011 regional simulations on coarse grids.