Cascadia CoPes Hub
THE CASCADIA COASTLINES AND PEOPLES HAZARDS RESEARCH HUB

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COASTLINES AND PEOPLE

Funded in 2021 by the NSF Coastlines & People Hubs for Research and Broadening Participation

Oregon State University · UNIVERSITY of WASHINGTON · UNIVERSITY OF OREGON · Sea Grant Oregon · Sea Grant Washington · HUMBOLDT STATE UNIVERSITY · THE WILLIAM D. RUCKELSHAUS CENTER · SWINOMISH INDIAN TRIBAL COMMUNITY · USGS science for a changing world · Georgia Tech · ASU ARIZONA STATE UNIVERSITY

The Cascadia Coastlines and Peoples Hazards Research Hub

PI: Peter Ruggiero, Co-PIs: Ann Bostrom, Alison Duvall, Dwaine Plaza, Harold Tobin
Leadership Team Members: Jenna Tilt, Nicole Errett, Lisa Gaines
Project Manager: Ali Burgos

Contribute to socioeconomic viability and equitable resilience **in service of coastal community identities, needs, and values through targeted scientific advances**

Inform and enable integrated hazard assessment, mitigation, and adaptation—including comprehensive planning, policy making, and engineering — **co-produced in sustained collaboration with coastal communities**.

Oregon State University

UNIVERSITY of WASHINGTON

UNIVERSITY OF OREGON

HUMBOLDT STATE UNIVERSITY

WASHINGTON STATE UNIVERSITY
THE WILLIAM D. RUCKELSHAUS CENTER
UNIVERSITY OF WASHINGTON

USGS
science for a changing world

Sea Grant Oregon

Sea Grant Washington

SWINOMISH INDIAN TRIBAL COMMUNITY

GEORGIA TECH

ASU ARIZONA STATE UNIVERSITY

NSF Award 2103713
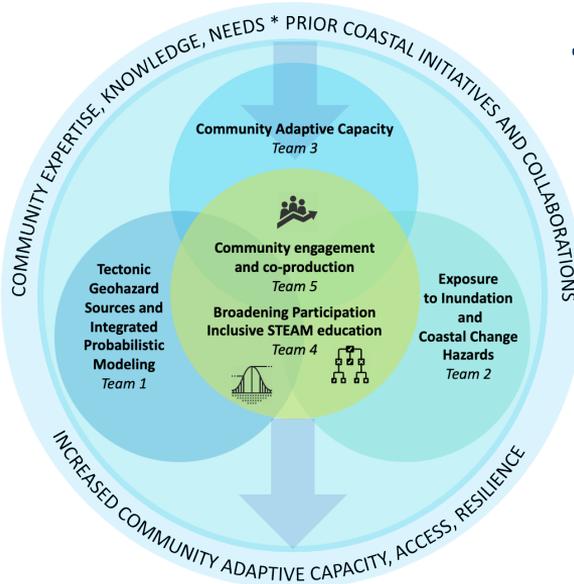
Five interconnected teams

Team 1 - Tectonic Geohazard Sources and Integrated Probabilistic Modeling
Team 2 - Exposure to Inundation and Coastal Change Hazards
Team 3 - Community Adaptive Capacity
Team 4 - Broadening Participation and Inclusive STEAM Education
Team 5 - Community Engagement and Co-Production of Coastal Hazards Knowledge

Testing two hypotheses

Fundamental advances in convergent coastal hazard sciences will transform understanding of the risks coastal communities face

An inclusive, co-produced approach to advancing hazard assessment and mitigation will increase coastal communities' adaptive capacity and broaden participation in achieving equitable and just disaster risk reduction

COMMUNITY EXPERTISE, KNOWLEDGE, NEEDS * PRIOR COASTAL INITIATIVES AND COLLABORATIONS

Community Adaptive Capacity
Team 3

Community engagement and co-production
Team 5

Broadening Participation Inclusive STEAM education
Team 4

Tectonic Geohazard Sources and Integrated Probabilistic Modeling
Team 1

Exposure to Inundation and Coastal Change Hazards
Team 2

INCREASED COMMUNITY ADAPTIVE CAPACITY, ACCESS, RESILIENCE

https://cascadiacopeshub.org/
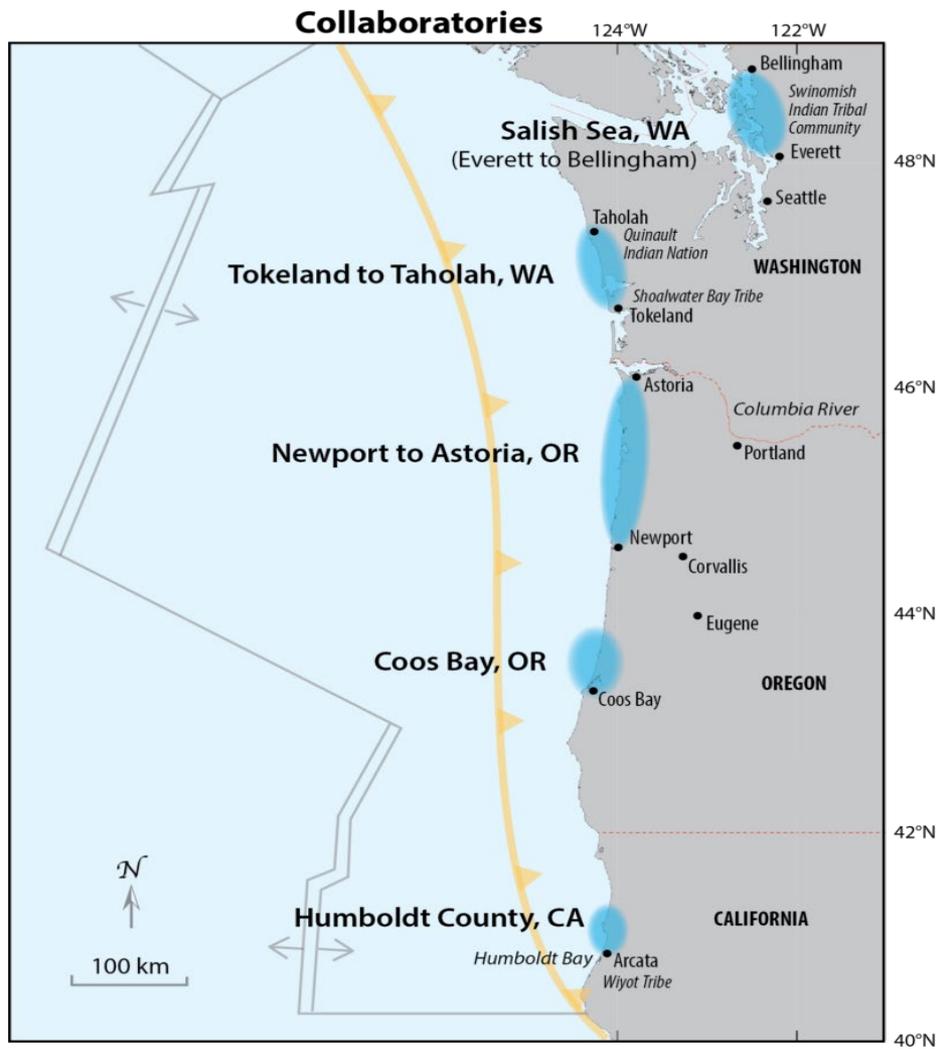cascadia.copes@oregonstate.edu

~80 researchers across 10 institutions

2 Advisory Committees:
- **External Advisory Committee** (mostly scientists)
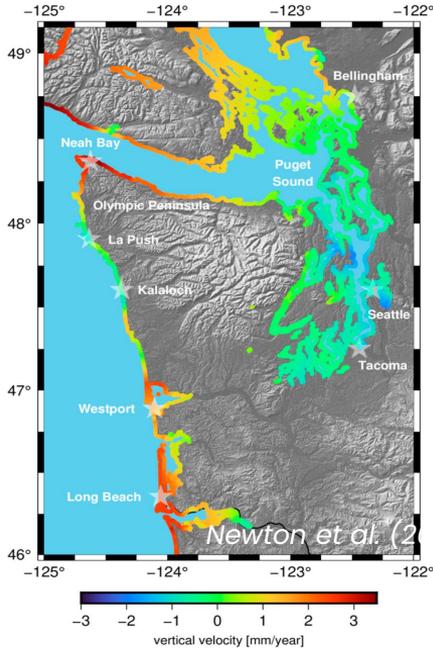- **Community Advisory Council** (mostly stakeholders at all levels)

Merges physical science, social science, engineering risk analysis, and community engagement to understand PNW coastal hazards and advance resilience

Cascadia Coastlines and Peoples Hazards Research Hub

Program Management and Administration

Administrative Core
- Peter Ruggiero (PI)
- Ann Bostrom (co-PI)
- Alison Duvall (co-PI)
- Dwaine Plaza (co-PI)
- Harold Tobin (co-PI)
- Nicole Errett
- Lisa Gaines
- Jenna Tilt

Project Manager: Alessandra Burgos

Senior Leadership Steering Committee
- Administrative Core
- Project Manager
- Team Leads
- Theme Leads
- External Evaluators

External Evaluators
- Julia Melkers
- Eric Welch

Graduate Research Assistants (Advisor):
- Lesley Michalegko (Welch)
- June Mi Kang (Melkers)

External Advisory Committee
- Rebecca Bendick
- Ian Boxill
- Gregory Guannel
- Mike Harryman
- Onora Lien
- Diego Melgar
- Tommy Moore
- Emma Norman
- Jan Newton
- Kelin Wang

Community Advisory Council
- Corina Allen
- Bridgette Blakesley
- Beatriz Botello-Salgado
- Tiffany Brown
- Adam Canter
- Pat Corcoran
- Clancy De Smet
- Maximilian Dixon
- Gus Gates
- Eliza Ghitis
- Kevin Goodrich
- Mike Harryman
- Jennifer Kalt
- Meade Krosby
- David Lewis
- Larissa Pfleeger
- Charlie Plybon
- Meg Reed
- Ryan Sealy

Team 5: Community engagement and co-production of coastal hazards knowledge

Leads:
- Nicole Errett
- Jamie Donatuto
- Amanda Murphy
- Phyllis Shulman

Participating Members:
- Coastal Community Leads
- Collaboratory Representatives
- All Hub investigators

Postdoctoral Community Liaisons (Advisor):
- Natasha Fox (Tilt)
- Cassandra Jean (Errett)
- Rajasree Radhamma (Bolte/ Ruggiero)

Team 4: Broadening participation, inclusive STEAM education

Leads:
- Dwaine Plaza
- José Meléndez
- Lisa Gaines
- Dan Abramson

Graduate Research Assistants (Advisor):
- Joseline Raja Vara (Plaza)

Participating Members:
- Coastal Community Leads
- All Hub investigators

CHARTER Fellows:
- Grace Backen
- Hazel Curley O'Malley
- Ximena Nava Diaz
- David Nieto Wenzell
- Irene Pablo Lora
- Tiana Powell
- Nina Sanchez
- Kaitlynn Spino
- Helena Thompson
- John Williams Jr.
- Timothy Withrow

Team 1: Tectonic geohazard sources and integrated probabilistic modeling

Research Leads:
- Alison Duvall
- Harold Tobin
- Erin Wirth
- Dan Cox
- Marc Eberhard

Coastal Community Lead: Carrie Garrison-Laney

Investigators:
- Loyce Adams
- Andre Barbosa
- Jeffrey Berman
- Juliet Crider
- Art Frankel
- Carrie Garrison-Laney
- Joan Gomberg
- Frank Gonzalez
- alex grant
- Randy LeVeque
- Joseph Louis
- Guillaume Mauger
- Ian Miller
- Michael Motley
- David Schmidt
- Haizhong Wang
- Joe Wartman
- Janet Watt
- Yong Wei

Postdoctoral Researchers (Advisor):
- Mehrshad Amini (Cox/ Barbosa)
- Audrey Dunham (Wirth)
- Ian Stone (Wirth)

Graduate Research Assistants (Advisor):
- Addie Lederman (Berman/Eberhard)
- Erich Herzig (Duvall)
- Madeline Lucas (Tobin)
- Paul Morgan (Duvall)
- Dylan Sanderson (Cox)

Team 2: Exposure to inundation and coastal change hazards

Research Leads:
- Alex Horner-Devine
- Peter Ruggiero

Coastal Community Lead: Ian Miller

Investigators:
- John Bolte
- Dan Cox
- Steven Dundas
- Joan Gomber
- Sally Hacker
- Terrie Klinger
- Guillaume Mauger
- Andrea Ogston
- Meagan Wengrove

Postdoctoral Researchers (Advisor):
- Rajasree Radhamma (Bolte/ Ruggiero)

Graduate Research Assistants (Advisor):
- Meredith Leung (Ruggiero)
- Sarah Vollero (Ogston)

Team 3: Community Adaptive Capacity

Research Leads:
- Jenna Tilt
- Nicole Errett
- Dan Abramson

Coastal Community Lead: David Hansen

Investigators:
- John Bolte
- Ann Bostrom
- Jamie Donatuto
- Steve Dundas
- Joseph Louis
- Michael Howard
- Jennifer Marlow
- José Meléndez
- Laurie Richmond
- Peter Ruggiero
- Ana Spalding
- Jamie Vickery
- Haizhong Wang

Postdoctoral Researchers (Advisor):
- Natasha Fox (Tilt)
- Cassandra Jean (Errett)
- Rajasree Radhamma (Bolte/Ruggiero)

Graduate Research Assistants (Advisor):
- Joshua Blockstein (Tilt)
- Cameron George (Meléndez)
- Matias Korfmacher (Errett)
- Trisha Patterson (Tilt/ Plaza)
- Jordan Totty (Meléndez)

Cascadia CoPes Hub — THE CASCADIA COASTLINES AND PEOPLES HAZARDS RESEARCH HUB

Theme	Lead
Theme 1: Spatial and temporal scaling and cross-scale interactions	**Lead:** Dan Abramson
Theme 2: Science and risk communication, decision support	**Lead:** Ann Bostrom
Theme 3: Probabilistic modeling and simulation	**Lead:** Jeffrey Berman

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Collaboratories

Bellingham

Swinomish Indian Tribal Community

Salish Sea, WA
(Everett to Bellingham)

Everett

Seattle

Taholah

Quinault Indian Nation

WASHINGTON

Tokeland to Taholah, WA

Shoalwater Bay Tribe

Tokeland

Astoria

Columbia River

Newport to Astoria, OR

Portland

Newport

Corvallis

Eugene

Coos Bay, OR

OREGON

Coos Bay

Humboldt County, CA

CALIFORNIA

Humboldt Bay Arcata

Wiyot Tribe

N

100 km

124°W   122°W

48°N

46°N

44°N

42°N

40°N

Team 1: Tectonic Geohazard Sources and Integrated Probabilistic Modeling

Coastal Vertical Land Velocity

Newton et al. (2

Goal 1: Identifying Tectonic Hazards & Recurrence Rates

- Identifying onshore and offshore faults
- New landslide mapping and dating
- Landscape modeling and geomorphic assessments

- Updated estimates of vertical land movement
- New geologic observations & dating
- Recurrence interval estimations

Goal 2: Scenario Simulations

- Coupled earthquake-landslide-tsunami simulations
- Multi-Hazard Impacts of Shaking and Inundation on Coastal Infrastructure
- Tsunami Debris Forecasting and Vulnerability Assessment

Probabilistic Seismic and Tsunami Hazard Assessment (PSTHA)

Goal 1: Identifying Tectonic Hazards & Recurrence Rates

- **Identifying onshore and offshore faults**

- **New landslide mapping and dating**

- **Landscape modeling and geomorphic assessments**

- **Updated estimates of vertical land movement**

- **New geologic observations & dating**

- **Recurrence interval estimations**

Coastal Vertical Land Velocity
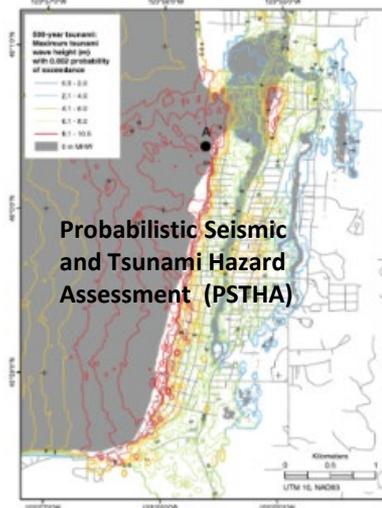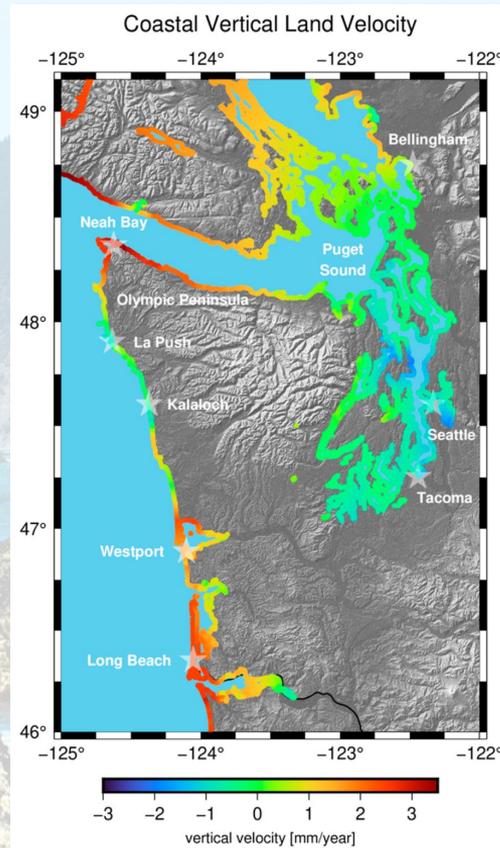
Newton et al. (2021)

USGS PCMSC
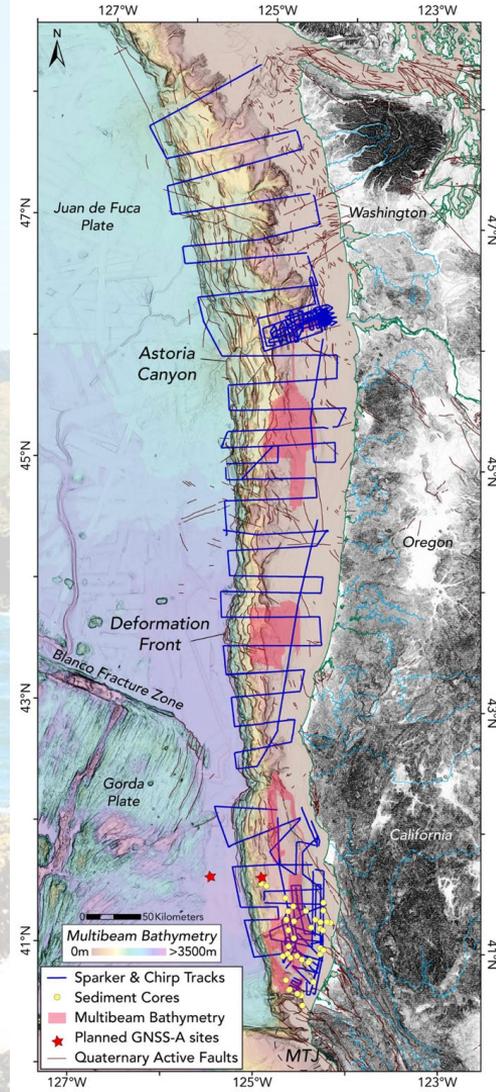
Developing 3D fault geometries

Madeleine Lucas,
Anna Ledeczi, with
Watt and Tobin
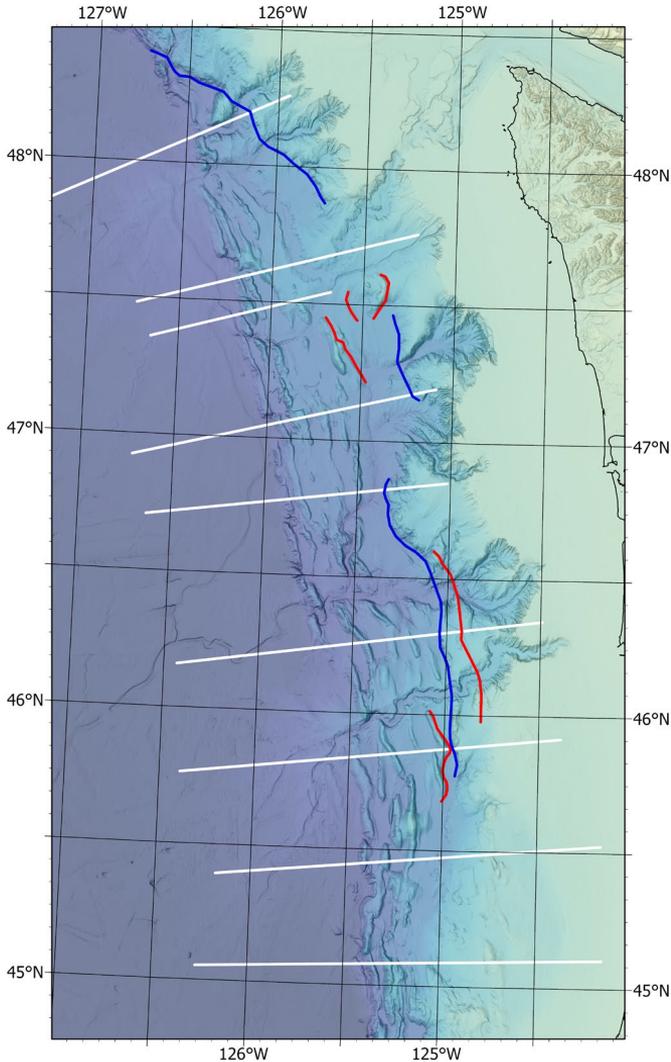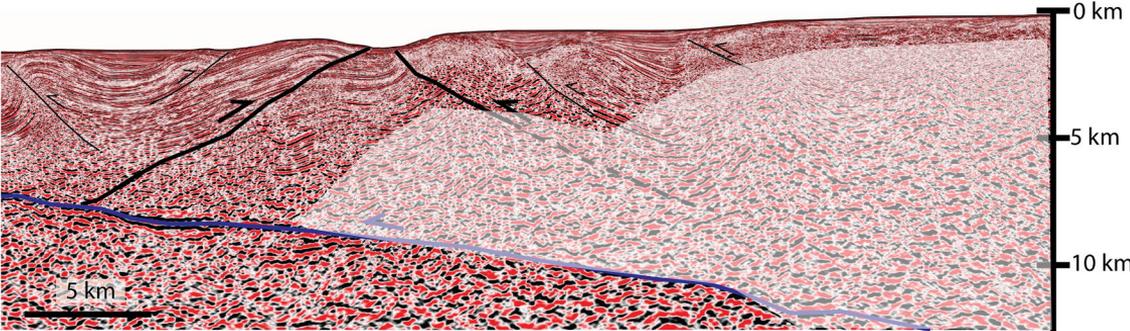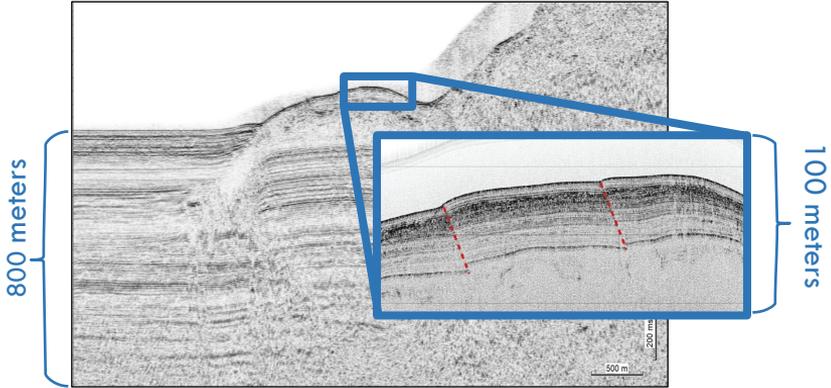
Earthquake Ground Motion Simulations

Draft set of Cascadia earthquake scenarios:

Slip Distribution

Down-dip Rupture Limit

Up-dip Rupture Limit

M8.7, 8.9, 9.1, 9.3 (0.2 increments)

Slip derived from offshore locking estimates

Random slip distribution

Shallow (mostly offshore)

Middle (near coastline)

Deep (partially inland)

Rupture to the trench

Buried rupture

Splay fault
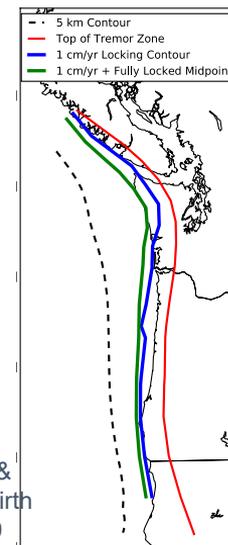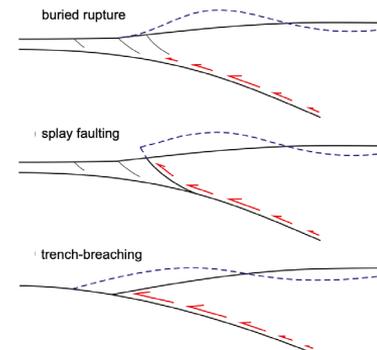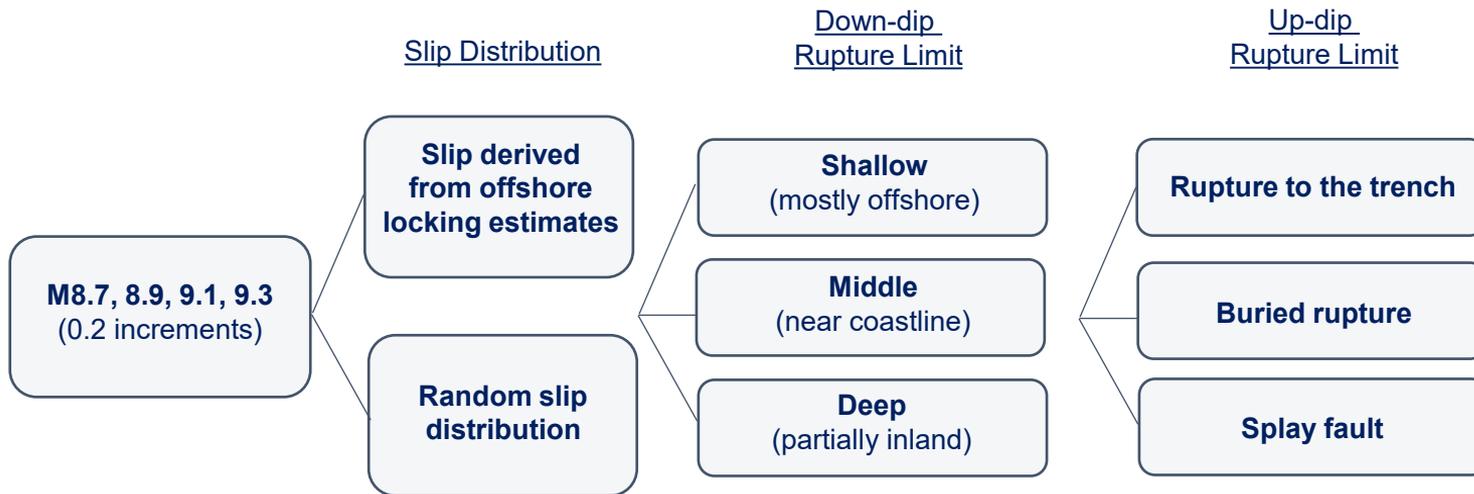
4 magnitudes x 2 slip distributions x 3 down-dip limits x 3 up-dip limits = 72 scenarios

Figures: Wang & Trehu, 2016; Wirth & Frankel, 2019

Erin Wirth
ewirth@usgs.gov

Probabilistic Estimates of Vertical Land Movement

Anticipated Research Products:
- Map of interseismic uplift of the coastline (WA, OR, N. CA)
- Predict the ground movement for various EQ scenarios
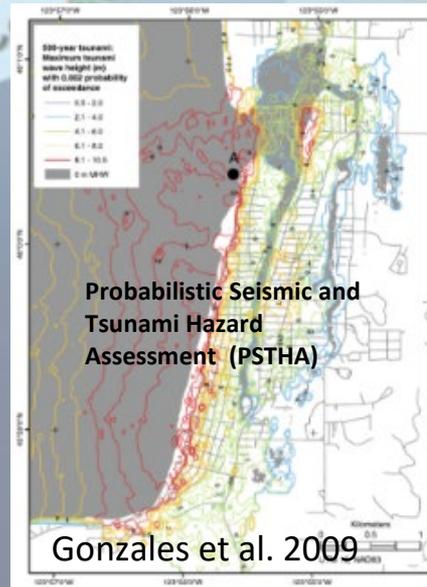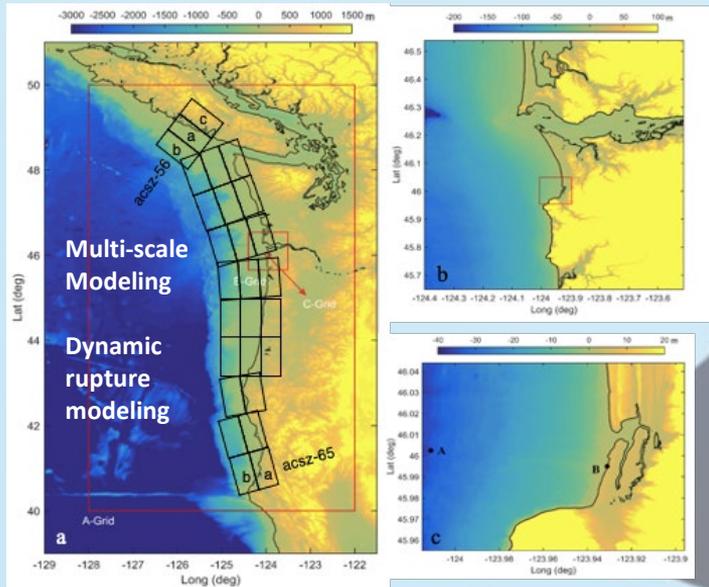- Probabilistic estimates of land level at points in the future

Coastal Vertical Land Velocity

vertical velocity [mm/year]

(a)

Newton et al., 2021

David Schmidt
dasc@uw.edu
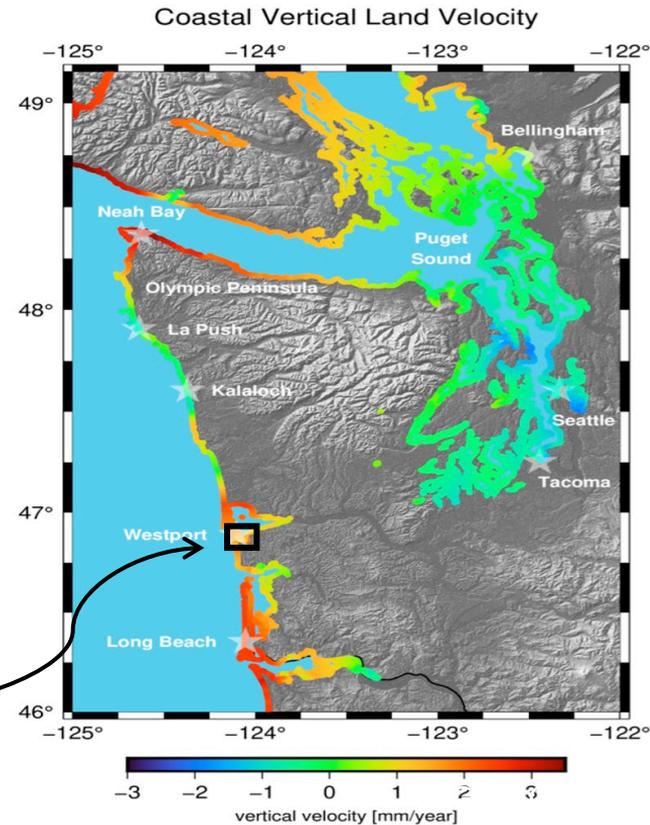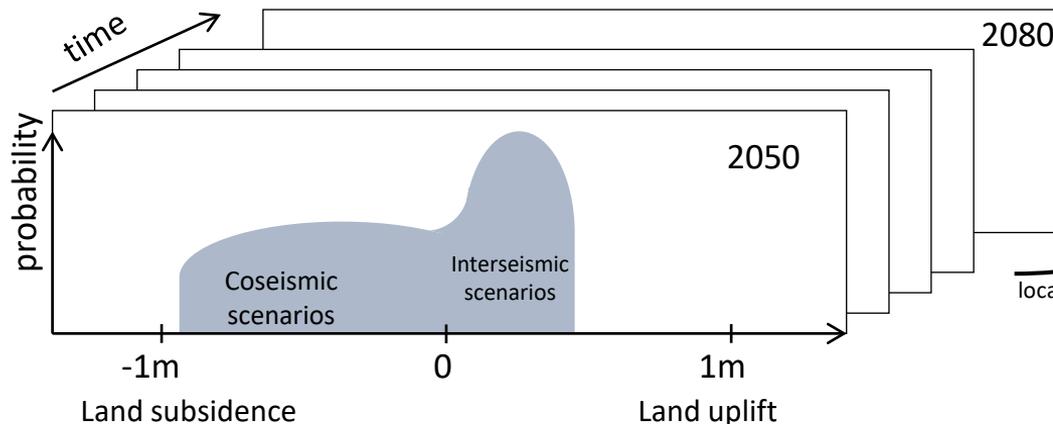
Goal 2: Scenario Simulations

- **Coupled earthquake-tsunami simulations for inundation**

- **Multi-Hazard Impacts of Shaking and Inundation on Coastal Infrastructure**

- **Tsunami Debris Forecasting and Vulnerability Assessment**

Multi-scale Modeling

Dynamic rupture modeling

Probabilistic Seismic and Tsunami Hazard Assessment (PSTHA)

Gonzales et al. 2009

Joint probability of hazard intensity

Spatial correlation
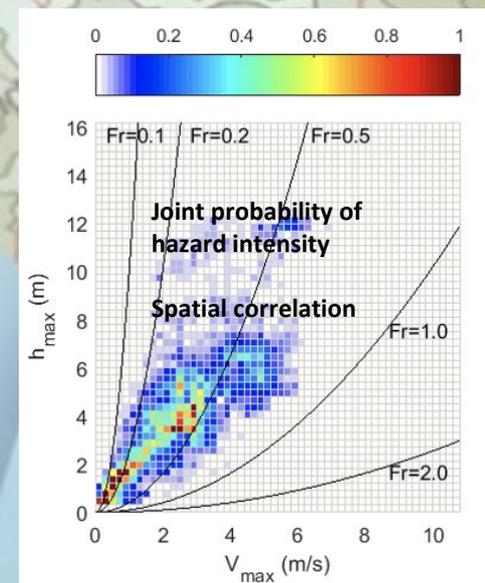
Team 2: Exposure to Inundation and Coastal Change Hazards

Goal 1: Measure risk from extreme coastal water levels

- There is a lack of information to plan for increased flood and erosion risk

Goal 2: Determine the change in coastal morphology and coastal ecological response

- Predict erosion and the resulting habitat change (muddy embayment's, on sandy shorelines)
- Determine the likely impacts on resources threatened with habitat loss
- Evaluate future changes in sand supply, wave environments, and marine nutrients

Goal 3: Evaluate natural and nature-based features for climate change adaptation

- Evaluating natural and nature based features such as salt marshes and sandy beaches and dunes for climate change adaptation.

Team 3: Community Adaptive Capacity

Overall Goal:

Increase adaptive capacity of coastal communities to prepare, respond, and recover from chronic and acute hazards

Preparing for the *Really Big One*:

ABTEM: Agent-based Tsunami Evacuation Models

Modeling how people evacuate with a tsunami warning in real-world scenarios

Validated with drill data

Scenario testing: e.g., severed lifelines like bridges, addition of Vertical Evacuation Structures

Haizhong Wang and collaborators, OSU

Team 4: Broadening participation, inclusive Science, Technology, Engineering, Arts and Mathematics (STEAM) education

Cascadia CHARTER Undergraduate Fellowship Program
Coastal Hazards and Resilience Training, Education, and Research

Enhance university sophomore-junior experiences in research, outreach & engagement for underrepresented and minority undergraduate students

Cascadia TEACH Project
Training, Education, and Research in Coastal Hazards

Create new university K-12 citizen science research experiences

Cascadia CoPe GRT
Graduate Research Traineeship

Convergent science training of graduate students and postdocs

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USGS science for a changing world
GEORGIA TECH
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https://cascadiacopeshub.org/
cascadia.copes@oregonstate.edu

Team 5: Community Engagement and co-production of coastal hazards science

Community Engagement and Co-Production Approach:

- Work strategically with tribal, state, and other coastal community organizations to:
  - Identify and implement place-based strategies and initiatives
  - Integrate and connect Hub research to community interests and needs
  - Co-Design community engagement activities with Hub members to support research teams, findings, and goals

- Creation of the CCERC (Cascadia Community- Engaged Research Clearinghouse)

  - Provides a pathway to link community leaders and practitioners with the Hub resources and services