A multiple-methods vertical land movement analysis and its integration into probabilistic sea level rise projections for coastal Washington

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Speaker
Ian Miller, Tyler Newton, Ray Weldon, David Schmidt, Guillaume Mauger, and Eric Grossman

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The Washington Coastal Resilience Project

A multiple-methods vertical land movement analysis and its integration into probabilistic sea level rise projection for coastal Washington

Ian Miller, Washington Sea Grant

with

Tyler Newton, University of Oregon
Ray Weldon, University of Oregon
Guillaume Mauger, Climate Impacts Group
Harriet Morgan, Climate Impacts Group
David Schmidt, University of Washington
Mark Welch, University of Washington (former)
Objective 1

“Fill critical information gaps and improve the communication of risk about coastal hazards and related climate impacts (sea level rise, storm surge, wave impacts and shoreline erosion) that hinder planning and action in Washington’s coastal communities.”
Probabilistic absolute sea level projections for Washington

From Miller, Mauger, Morgan and Grossman, in press. Derived from Kopp et al, 2014
Absolute vs. Relative Sea Level Change

Neah Bay, WA

Seattle, WA
Responding to demand for an updated approach with better resolution

**CGPS (N=165):**
- UN RENO Group
- JPL
- PANGA
- SOPAC (Scripps)

**Tectonic Locking Model:**
- at 1/10th degree intervals, bedrock vertical movement estimates.
- Courtesy of David Schmidt and Ray Weldon

**Water Level (N=17):**
- All coastal estimates!

**Leveling (N=425):**
- Unpublished data courtesy of David Schmidt and Ray Weldon

**VLM Point Estimates with uncertainty (N=607 observations + Locking Model):**
- Individual estimates averaged.
- Uncertainty = SD

**Interpolated VLM field with uncertainty estimate:**
- Physically derived model. Arbitrary uncertainty of 2 mm/yr

**Tied to an absolute reference frame using CGPS**
Time for an update using more and newer data

Subsidence on the north coast?

Subsidence in Puget Sound

Rapid uplift in SW WA?
Translation into relative projections

Median 2100 RSL Projection (in feet) for RCP 85
The role of uncertainty
The Co-Seismic Subsidence Disclaimer
Take-Aways:

1. We’ve developed a new, higher resolution vertical land movement analysis for coastal Washington.
2. Our approach facilitates the incorporation of VLM and its uncertainty into relative sea level projections at community-scale resolution.
3. Co-seismic land motions are not explicitly incorporated.
4. Next up: The tide/wave/storm surge driven extreme water level component.
5. Comments, Questions, Complaints? Ian Miller, immiller@uw.edu or 360 417 6460.
Making SL projections relative (and local): Vertical land movements

Mote et al, 2008: Single CGPS data set (N=50 for BC/OR/WA)

NAS, 2012: Small number (N=4 for WA/OR) of co-located tide gauge/CGPS stations
Uncertainty based on 1000 interpolated surfaced

Large uncertainties:
- on the coast,
- SW Washington,
- north Puget Sound