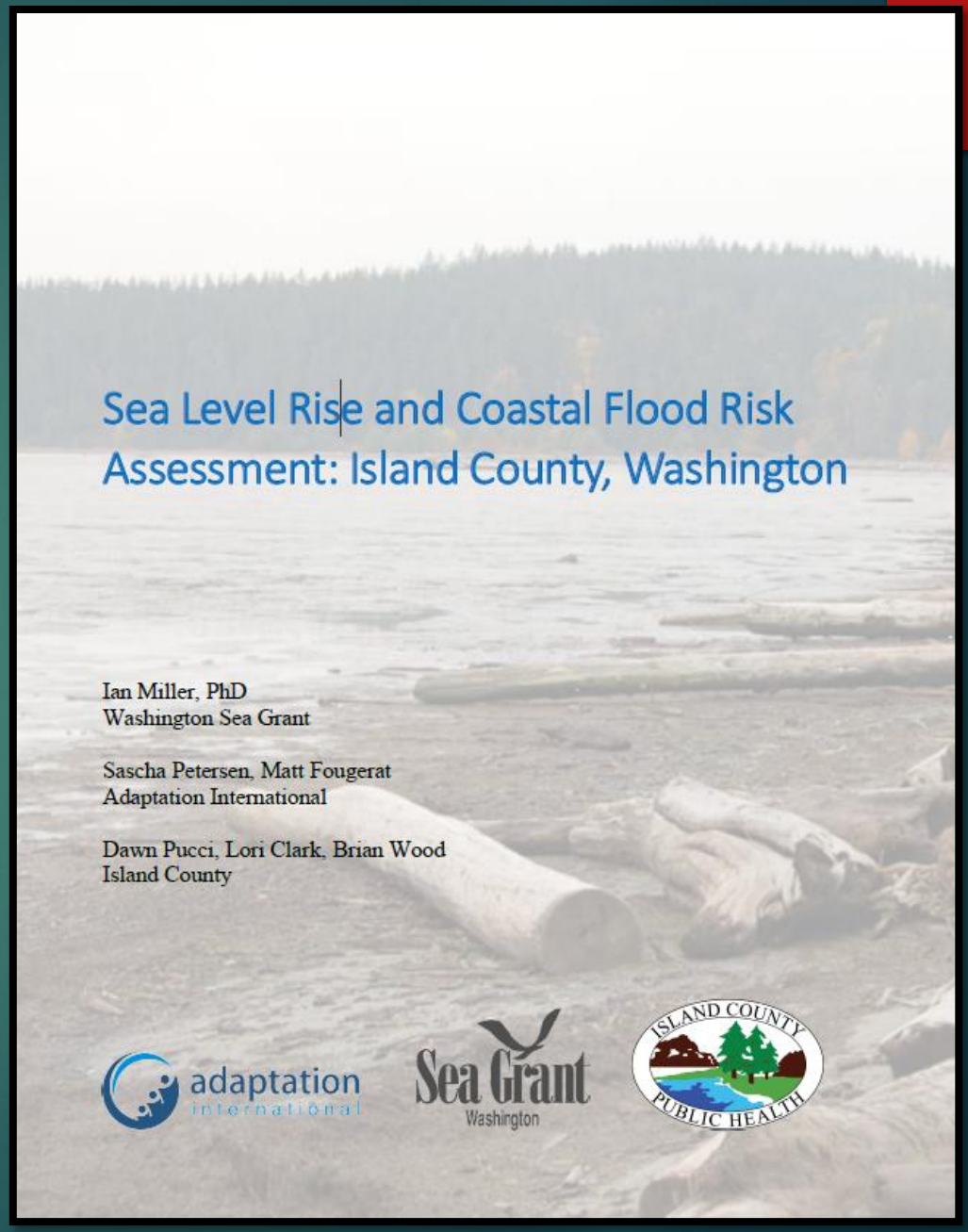
Sea Level Rise & Storm Surge

ISLAND COUNTY DNR

What -

- Predictive model
  - Choose level of risk and certainty
  - Instead of range
- Sea Level Rise
- Storm Surge
- Table
- Maps

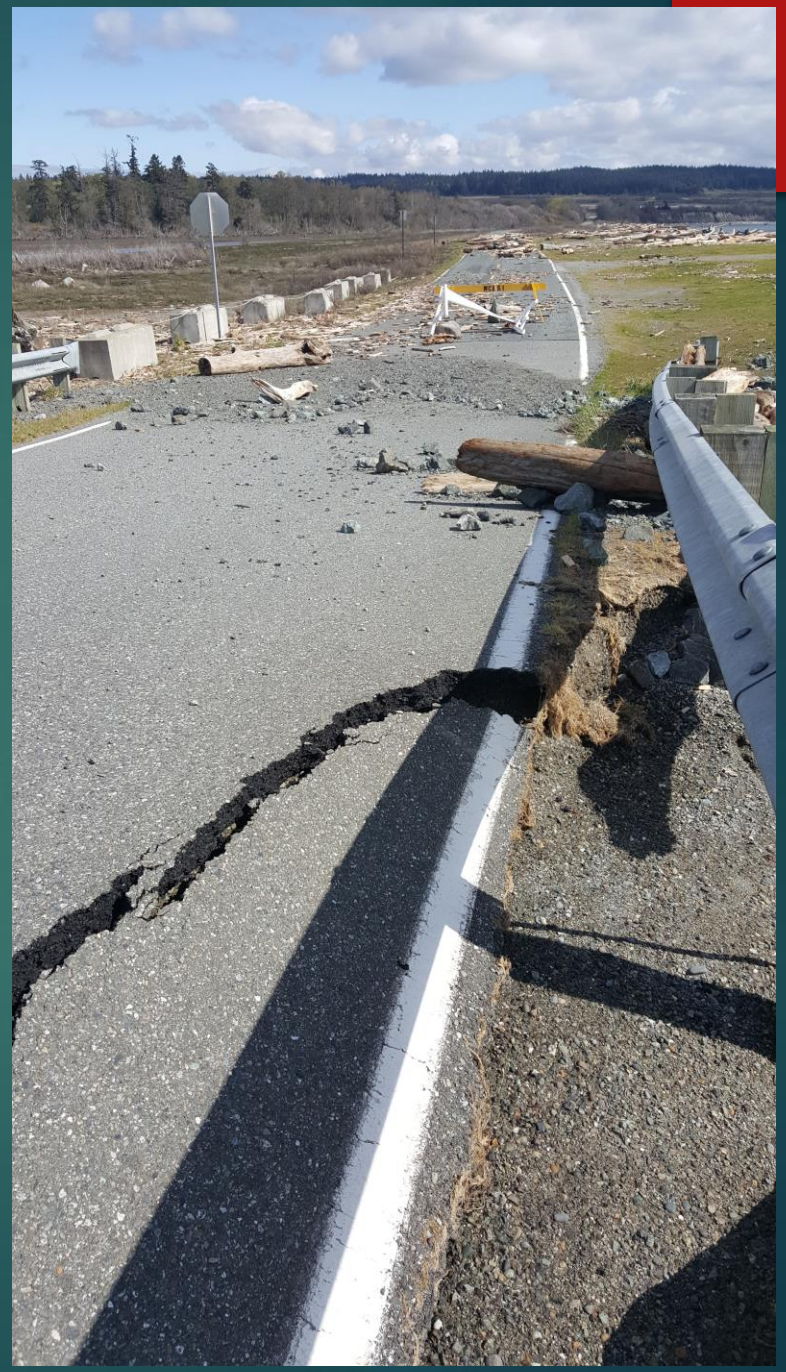


Who

- WRIA 6 Lead Entity for Salmon Recovery
- Island Local Integrating Organization
- UW Sea Grant
- Adaptation International

Why

- Restoration planning
- Communication tool



What's Missing

- Wave run up
- Bathymetry
- Certainty of future trends
- Dikes, tidegates, berms

What's Next

- Washington Regional Coastal Resilience Grant
- How to *actually* use the information
- GIS and Island County's maps

How

- Absolute sea level projections **(ASL)**
- Vertical land movement **(VLM)**
- Glacial isostatic adjustment **(GIA)**

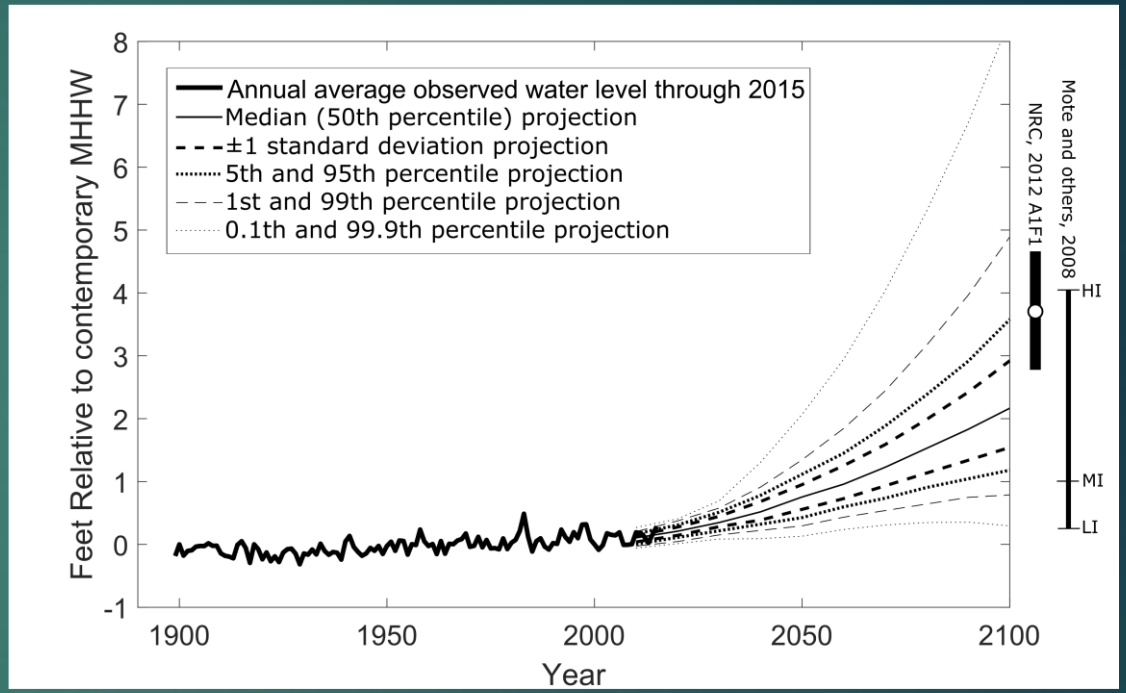
Relative Sea Level = ASL + VLM + GIA

- Historic extreme water level
- Errors/variations are addressed

- Please see Dr. Ian Miller's reports and explanations of this model. He is much better at explaining the intricacies…

ASL projections

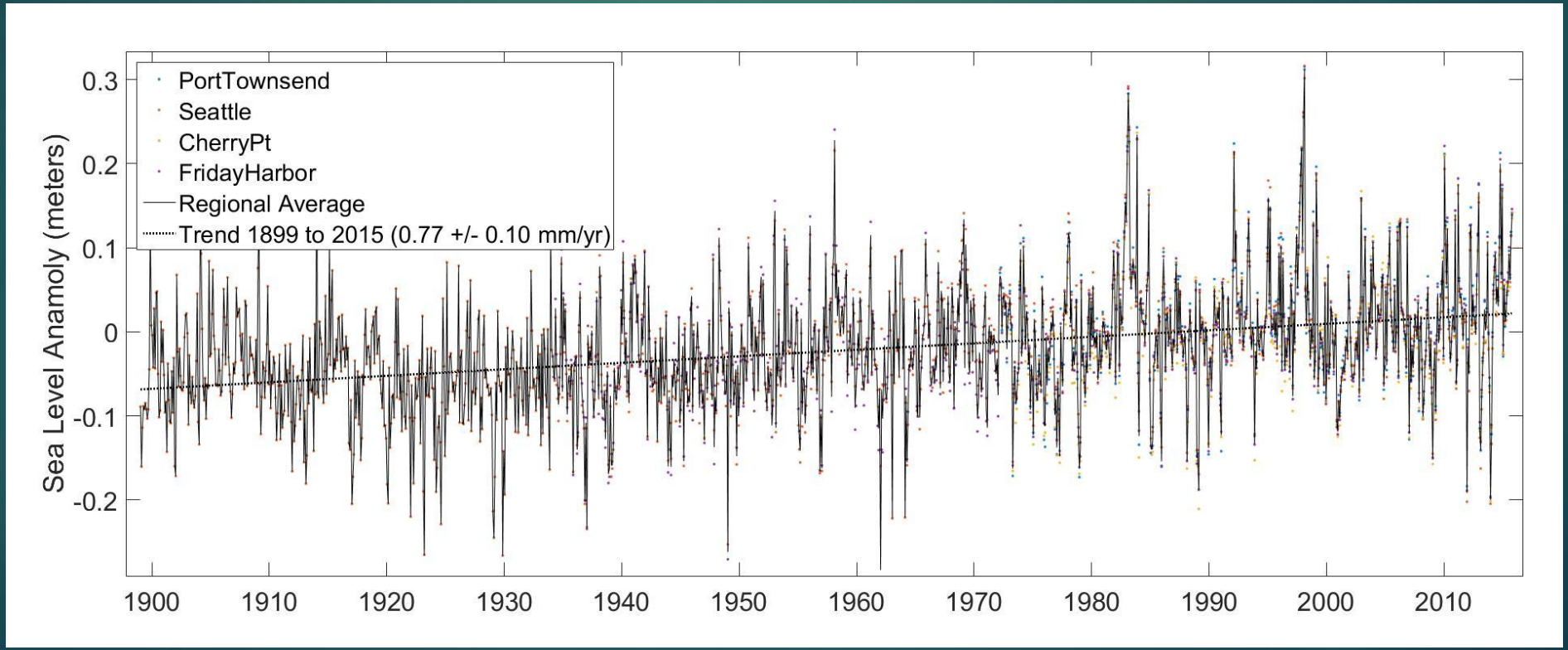
- Absolute Sea Level projections
- Northern Puget Sound
- RCP 8.5 mapped (business as usual)
- RCP 4.5 (stabilized) and 2.6 (reduction) also modeled



- Kopp and others, 2014. Probabilistic 21st and 22nd century sea-level projections at a global network of tide-gaugesites. Earth's Future (2): 383-406
- Kopp and others, 2015. Geographic variability of sea-level change. Current Climate Change Reports (1): 192-204

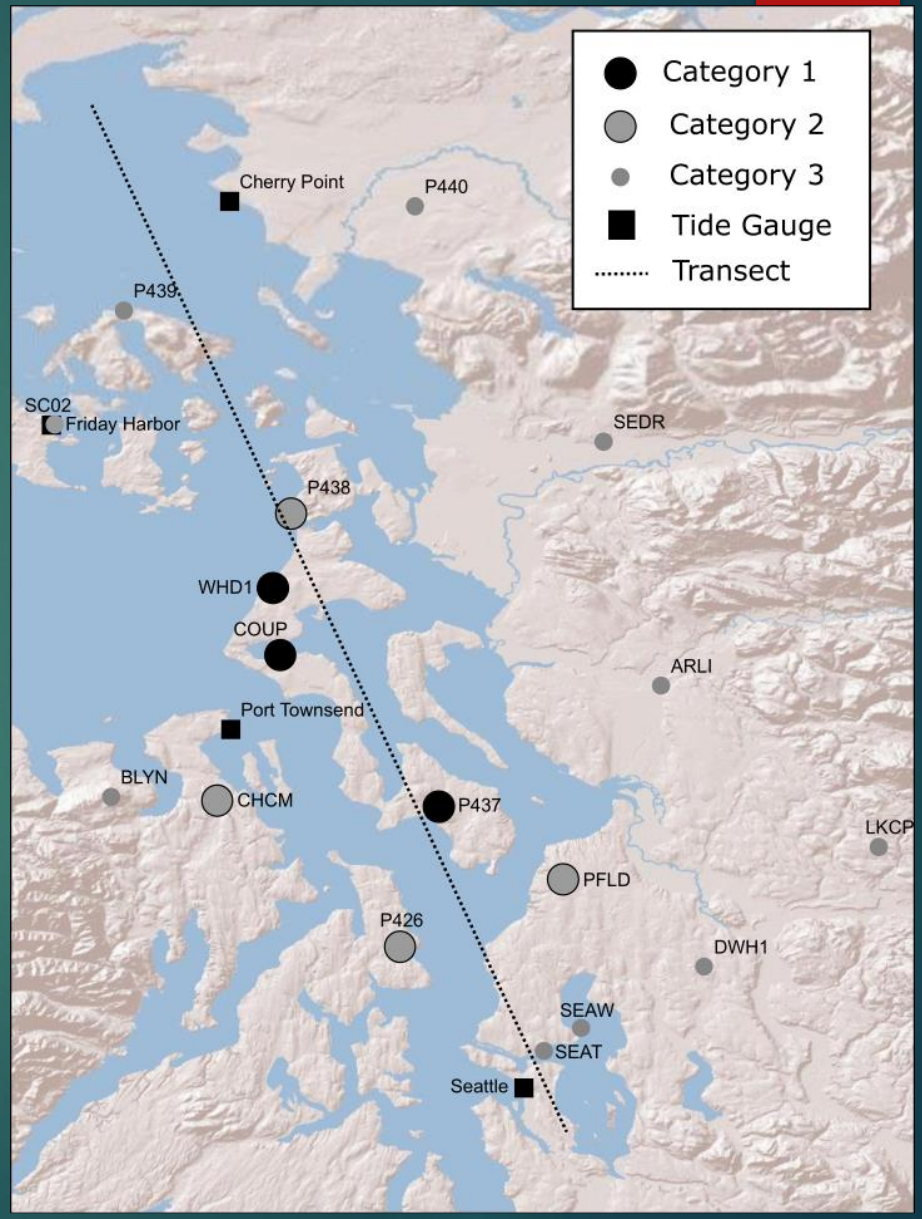
Historically speaking….

1899-2015 = 0.77 ± 0.10 mm/yr

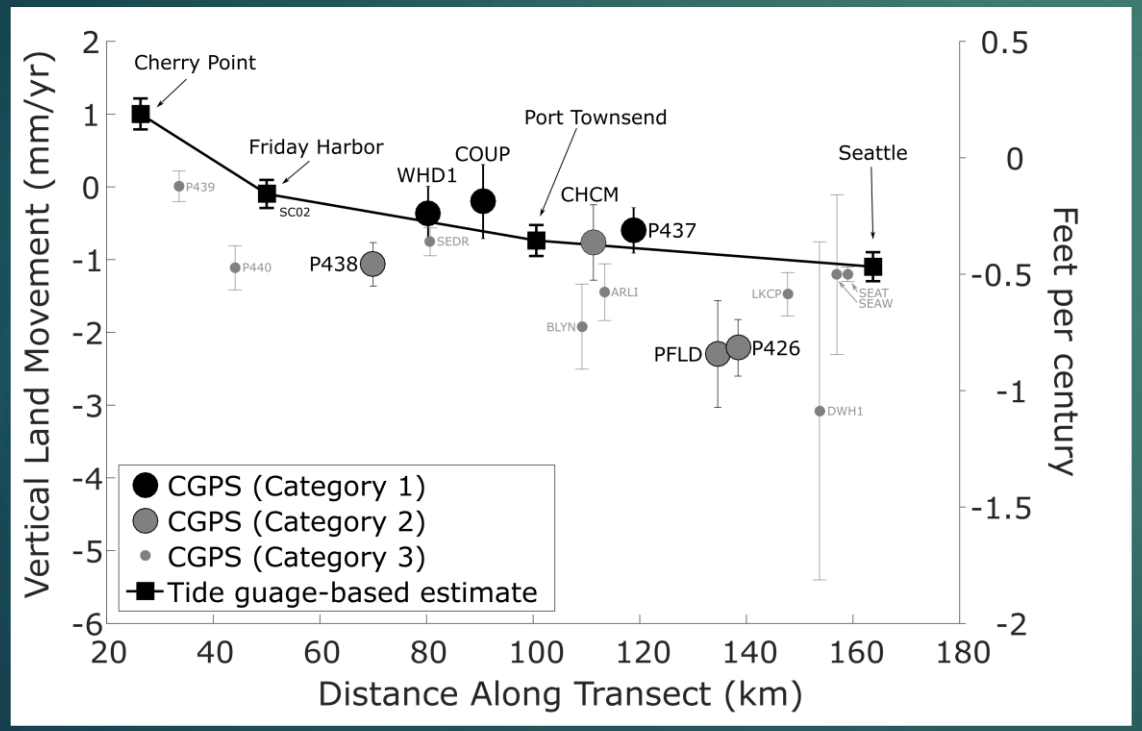


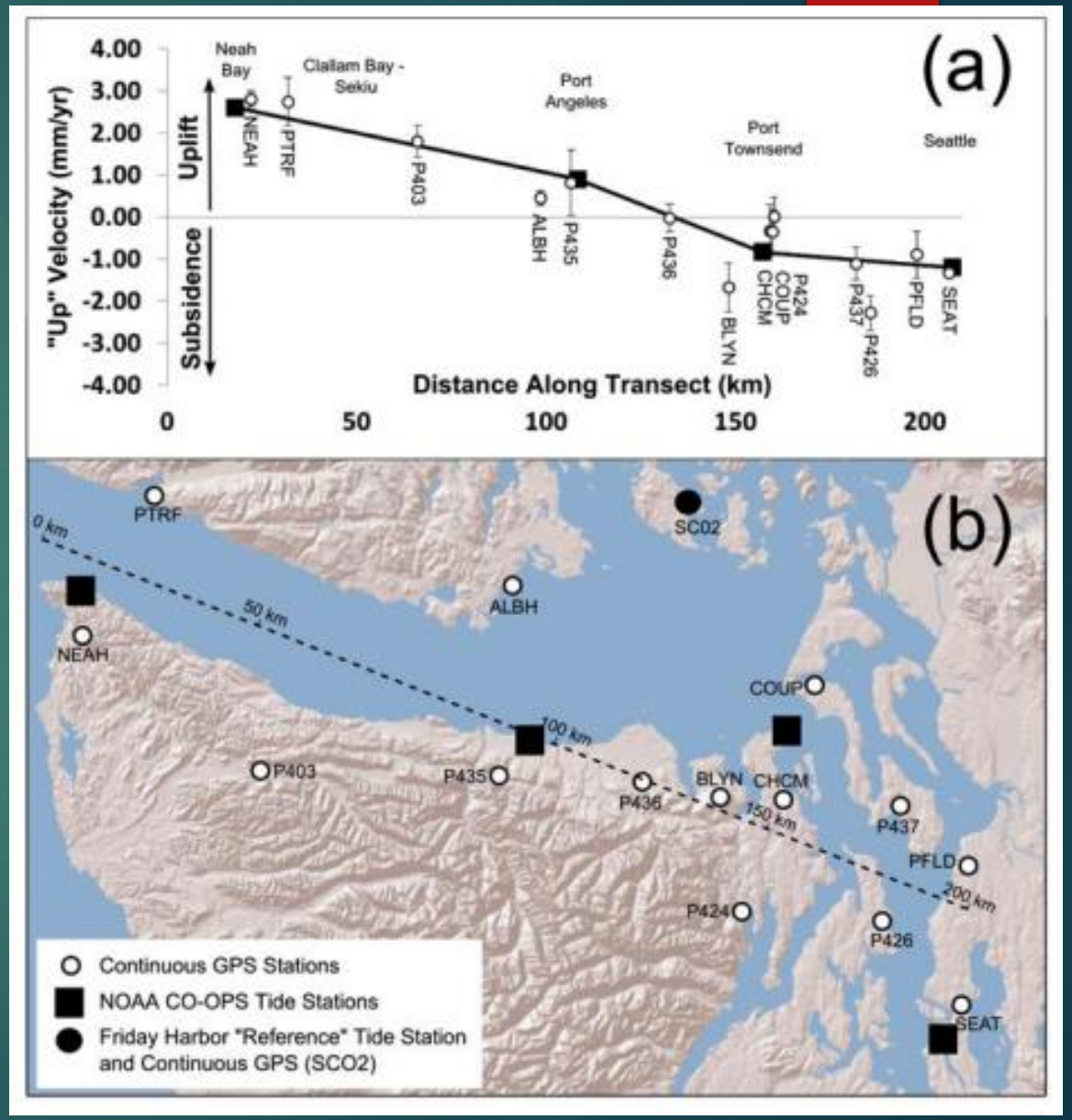
VLM - Sinking or Rising?

- CGPS
  - Friday Harbor
- Tide Gauges
  - Friday Harbor
  - Seattle
  - Cherry Point
  - Port Townsend
- Avg. sea level data from beginning of record to Oct 2015



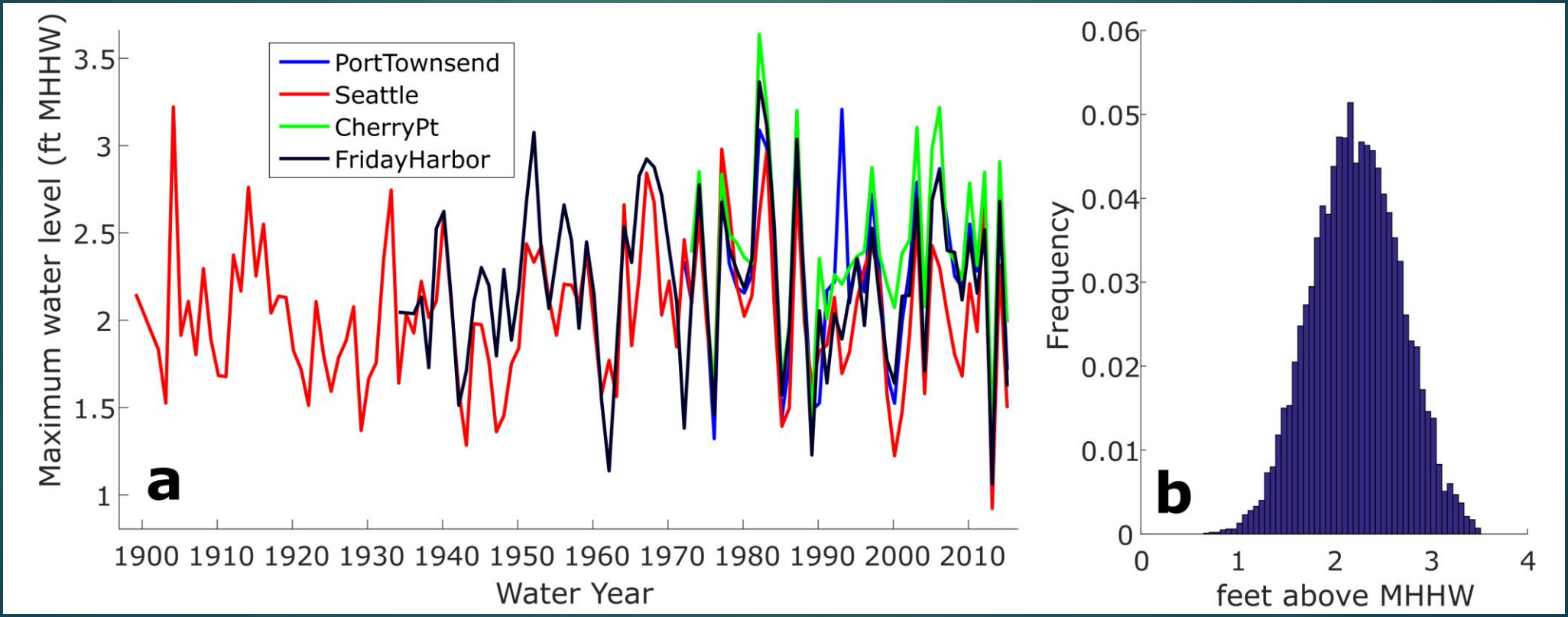
-0.39 ± 0.70 mm/yr


Cherry Point
Friday Harbor
WHD1
COUP
Port Townsend
CHCM
Seattle
P437
P438
P426
PFLD
P439
P440
SC02
SEDR
ARLI
BLYN
LKCP
SEAT
SEAW
DWH1
CGPS (Category 1)
CGPS (Category 2)
CGPS (Category 3)
Tide guage-based estimate
Vertical Land Movement (mm/yr)
Feet per century
Distance Along Transect (km)


(a)
"Up" Velocity (mm/yr)
Uplift
Subsidence
Neah Bay
Clallam Bay - Sekiu
Port Angeles
Port Townsend
Seattle
NEAH
PTRF
P403
ALBH
P435
P436
BLYN
P424
COUP
CHCM
P437
P426
PFLD
SEAT
Distance Along Transect (km)
(b)
0 km
50 km
100 km
150 km
200 km
Continuous GPS Stations
NOAA CO-OPS Tide Stations
Friday Harbor "Reference" Tide Station and Continuous GPS (SCO2)

Storm Surge

- Highest recorded level for each year at each station
- Estimate of likelihood in any given year of extreme coastal still water level



Flood Risk

By the year _____, there is a ___ % likelihood of a annual flood exceeding _____ ft above current MHHW

	Probability of Exceedance (RCP8.5)									
YEAR	99.9	99	95	75	50	25	5	1	0.2	0.1
Current	0.9	1.2	1.5	1.9	2.2	2.6	3.0	3.2	3.4	3.4
2010	1.0	1.3	1.6	2.0	2.3	2.6	3.1	3.3	3.5	3.5
2020	1.1	1.4	1.7	2.1	2.4	2.8	3.2	3.5	3.6	3.7
2030	1.2	1.5	1.8	2.3	2.6	2.9	3.4	3.6	3.8	3.8
2040	1.3	1.7	2.0	2.4	2.8	3.1	3.6	3.8	4.0	4.1
2050	1.5	1.8	2.2	2.6	3.0	3.3	3.8	4.2	4.5	4.7
2060	1.7	2.0	2.4	2.9	3.2	3.6	4.1	4.5	5.0	5.3
2070	1.8	2.2	2.6	3.1	3.5	3.9	4.5	5.0	5.8	6.4
2080	2.0	2.4	2.8	3.4	3.8	4.2	4.9	5.7	6.9	7.7
2090	2.1	2.5	3.0	3.6	4.1	4.6	5.4	6.4	8.0	9.2
2100	2.2	2.7	3.2	3.9	4.4	5.0	6.0	7.3	9.3	10.9
2110	2.4	2.9	3.3	4.1	4.6	5.2	6.3	7.9	10.6	12.0
2120	2.6	3.1	3.6	4.3	4.9	5.6	7.0	9.0	12.1	14.3
2130	2.7	3.2	3.7	4.6	5.2	6.0	7.6	10.0	14.0	15.9
2140	2.6	3.3	3.9	4.8	5.6	6.4	8.4	11.1	15.8	18.0
2150	2.7	3.3	4.0	5.1	5.9	6.9	9.1	12.4	17.8	20.5

In other words…..

	95% SLR	95% Storm Surge	1 % SLR	1% Storm Surge
2030	0.2	1.8	0.6	3.6
2050	0.5	2.2	1.4	4.2
2100	1.2	3.2	4.9	7.3

Ft/yr

1% = 1 in 100 chance / year = 100 year flood

Maps

- Useless Bay
- Crescent Harbor
- Crockett Lake
- Moran Beach
- Livingston Bay