Sea Level Rise in Washington State and the San Juan Islands

29-30 June 2017
Lopez, Orcas and San Juan Island

Ian Miller, PhD
Coastal Hazards Specialist
Washington Sea Grant
Olympic Peninsula Field Office
immiller@uw.edu

Sea Grant
Washington

With contributions from Sascha Petersen and Matt Fougerat, Adapation International
And Guillaume Mauger and Harriet Morgan, UW Climate Impacts Group

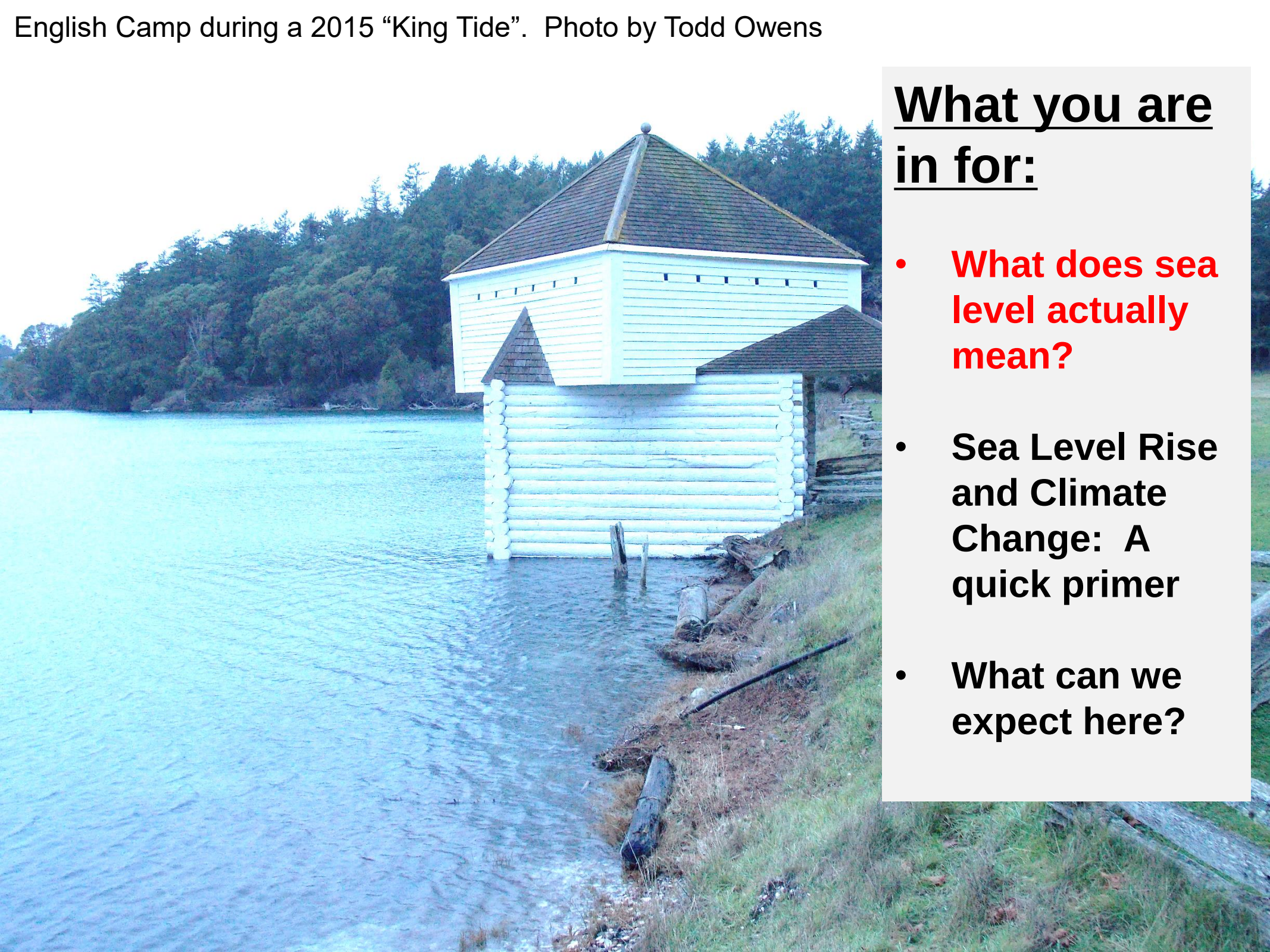
Sea Grant
Washington

“The Community”…

“Ivory Tower”

Washington Sea Grant funds marine research and provides science-based information and expertise to communities to strengthen understanding of the marine and coastal environment.

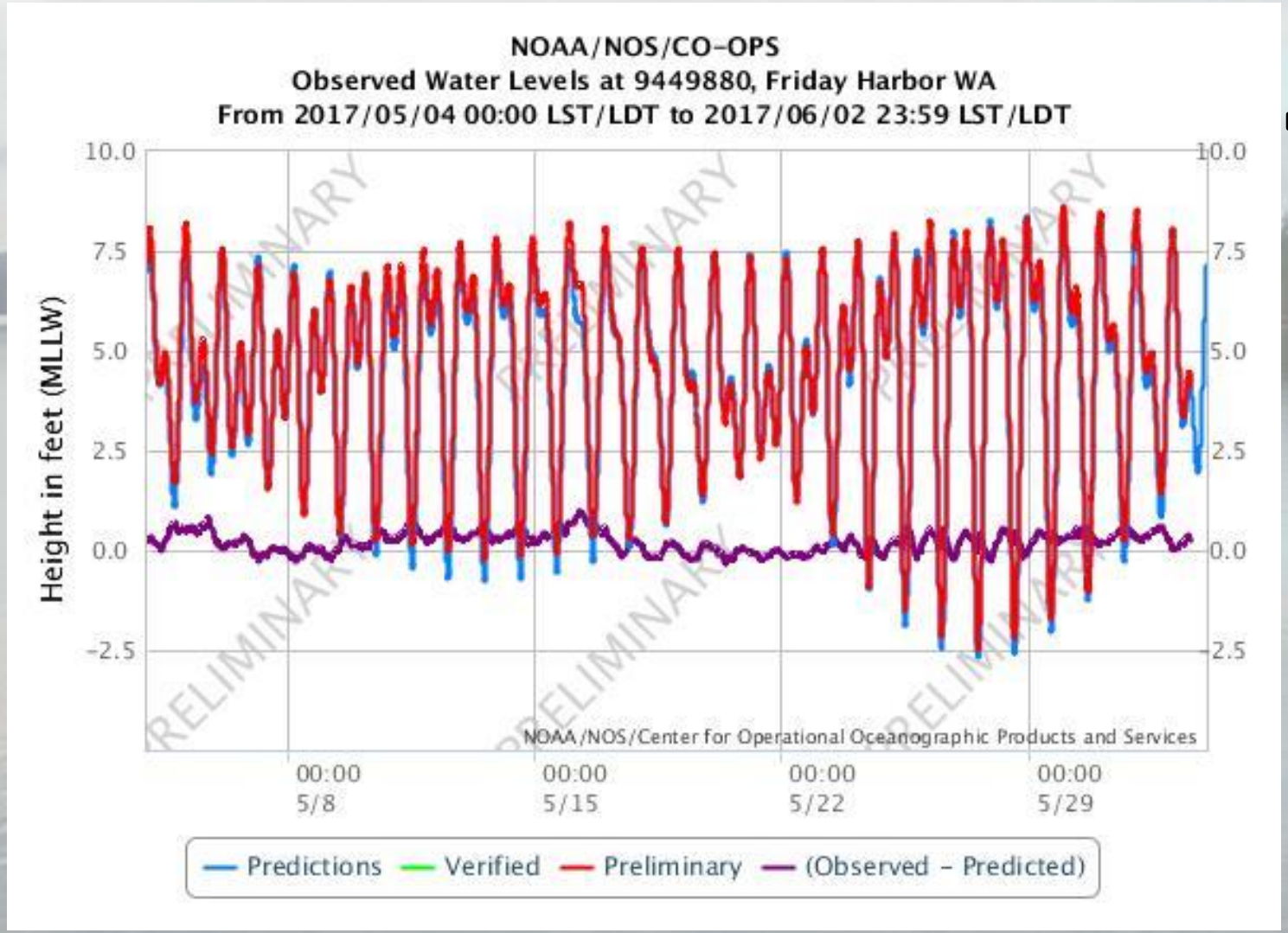
English Camp during a 2015 “King Tide”. Photo by Todd Owens



What you are in for:

- **What does sea level actually mean?**
- **Sea Level Rise and Climate Change: A quick primer**
- **What can we expect here?**

The sea is not level



HOWL

MHHW

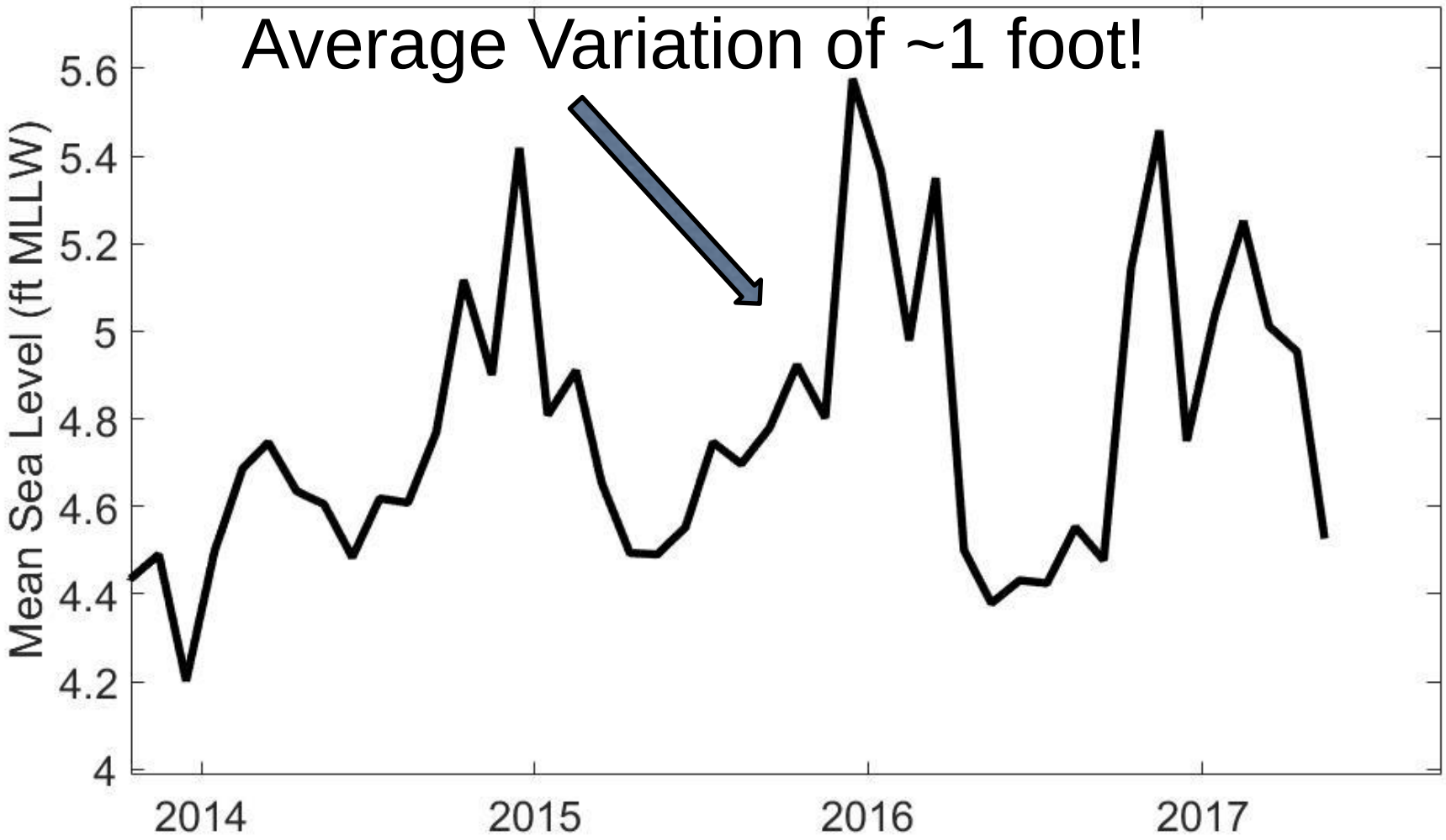
MSL

MLLW

LOWL

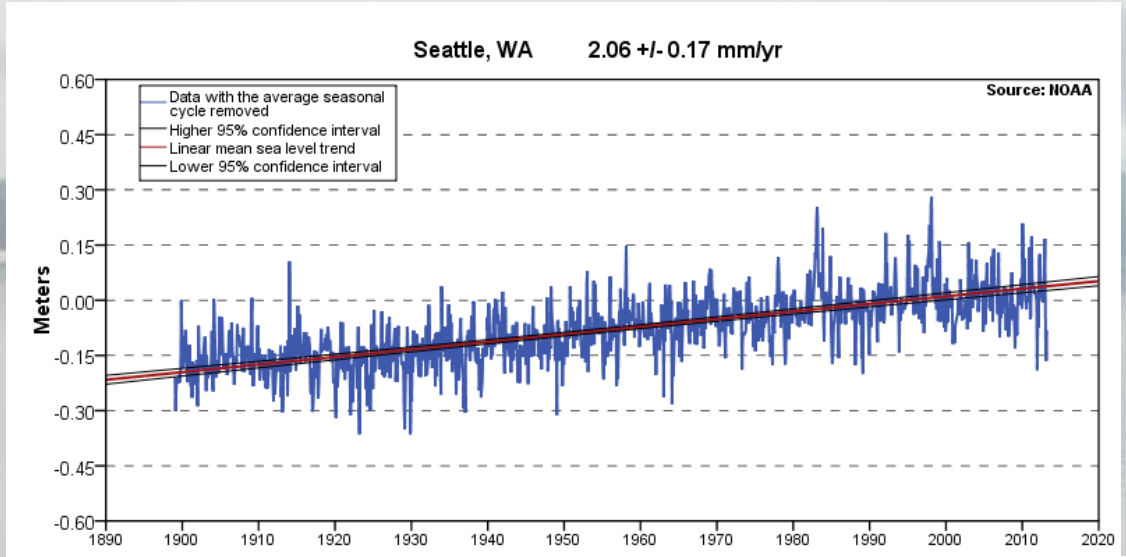
Tides dominate water level variations in WA

The sea is not level



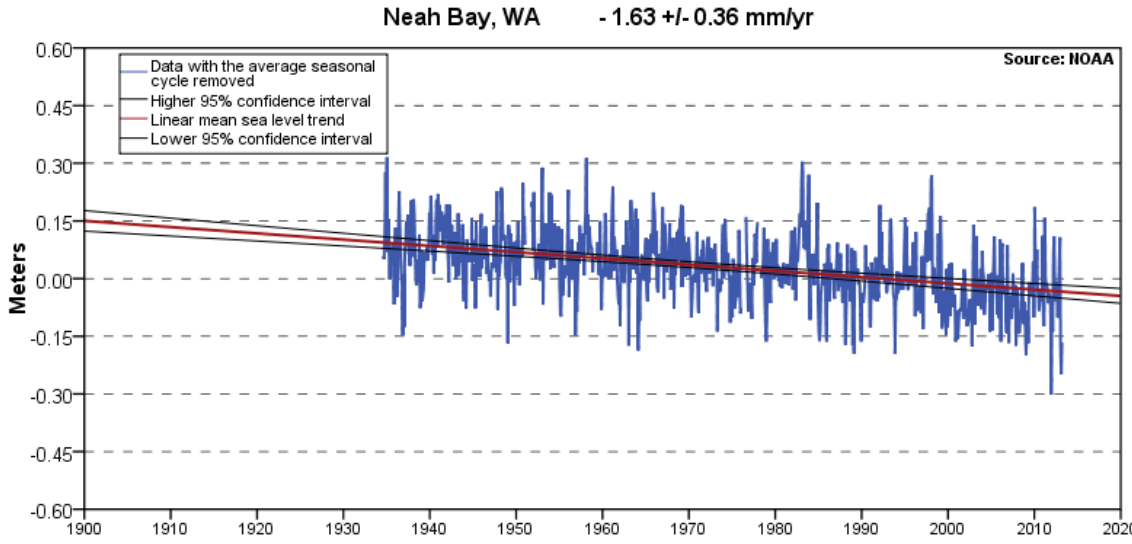
…there is a *repeating* seasonal pattern

We also find land movement in tidal sea level records



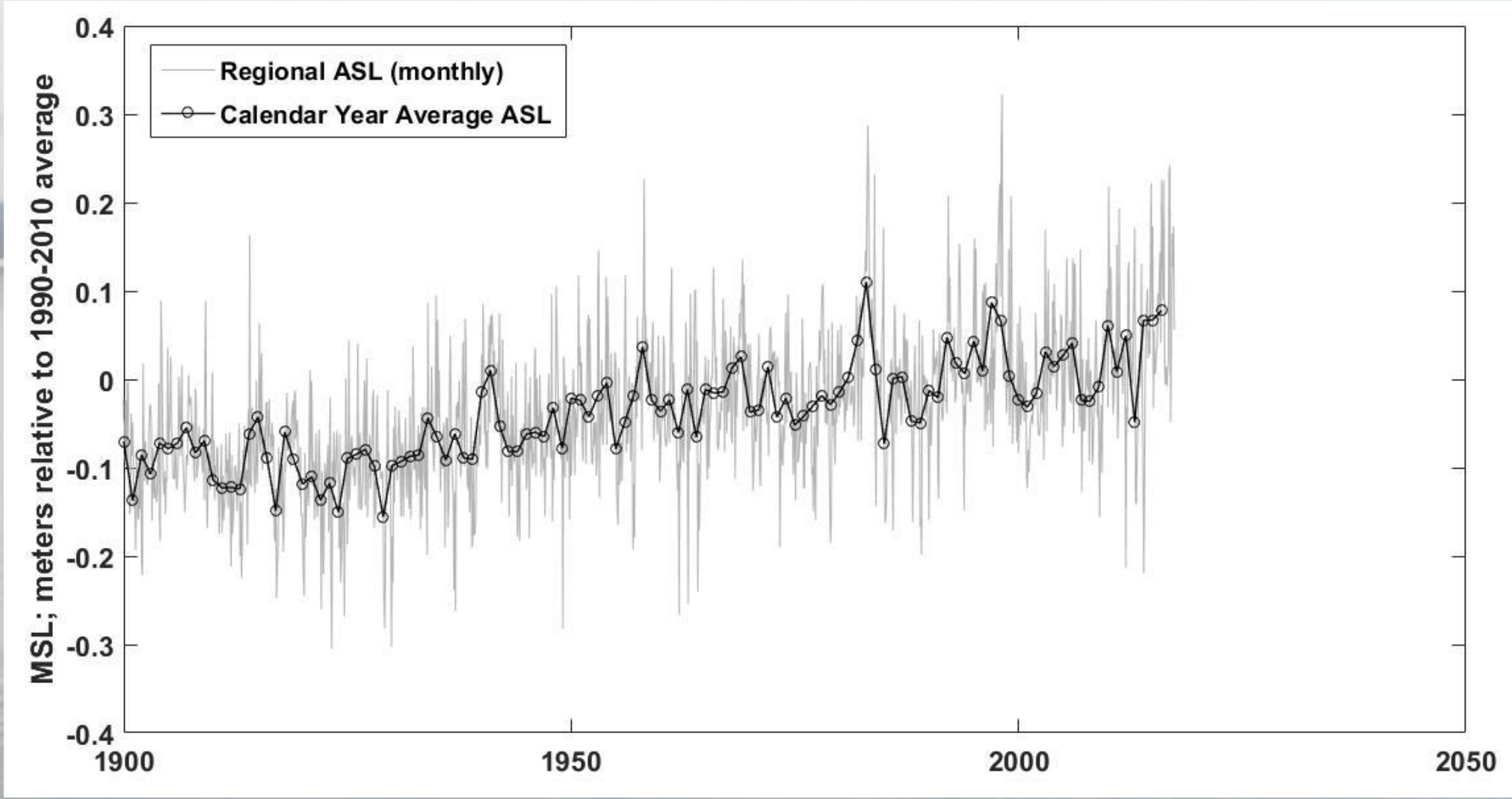
Seattle: Where subsidence exacerbates the regional SLR pattern

Neah Bay: where VLM is Outpacing historic sea level rise



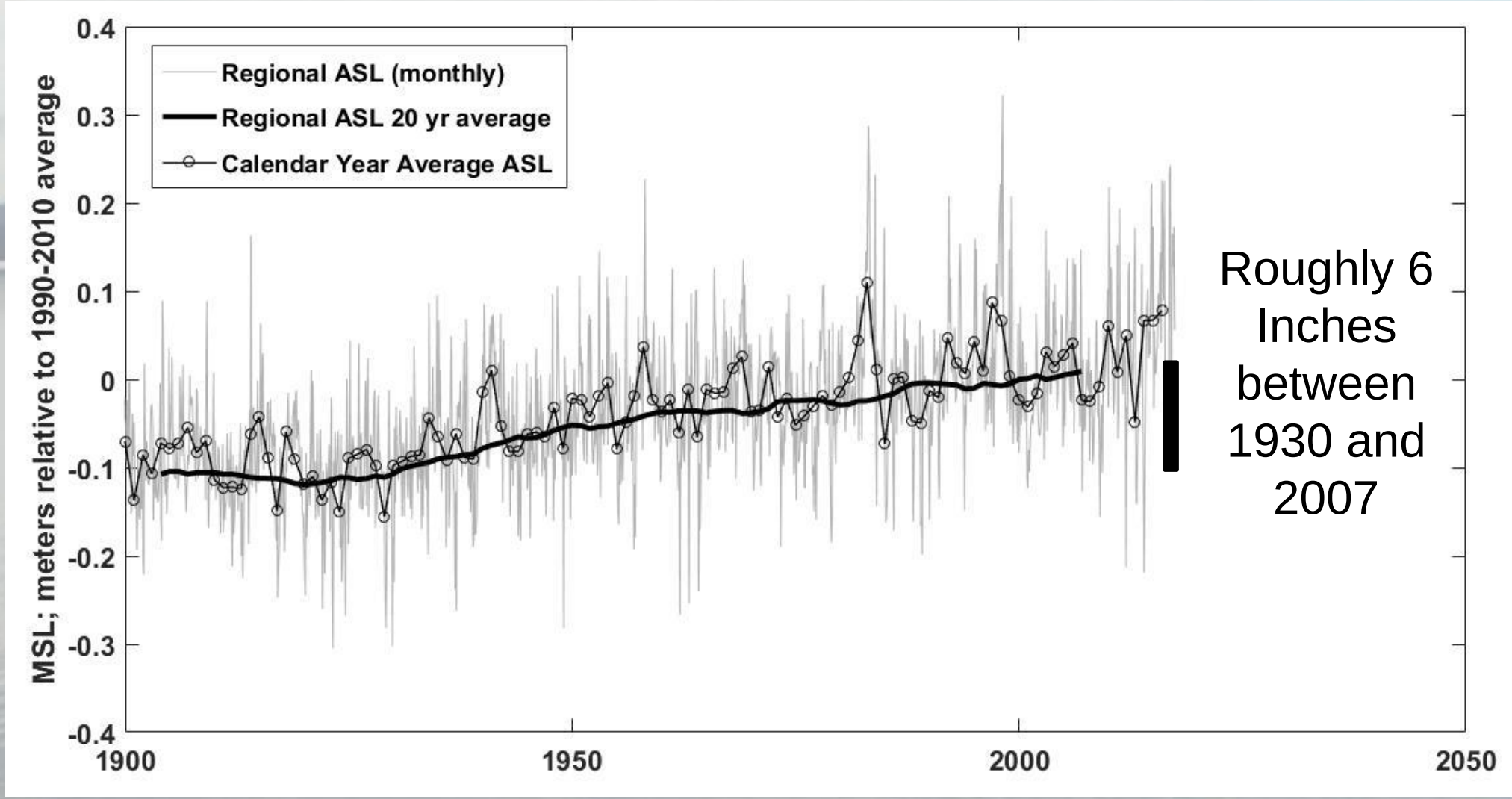
Plots from NOAA CO-OPs

And if we pull out the seasons and the land…



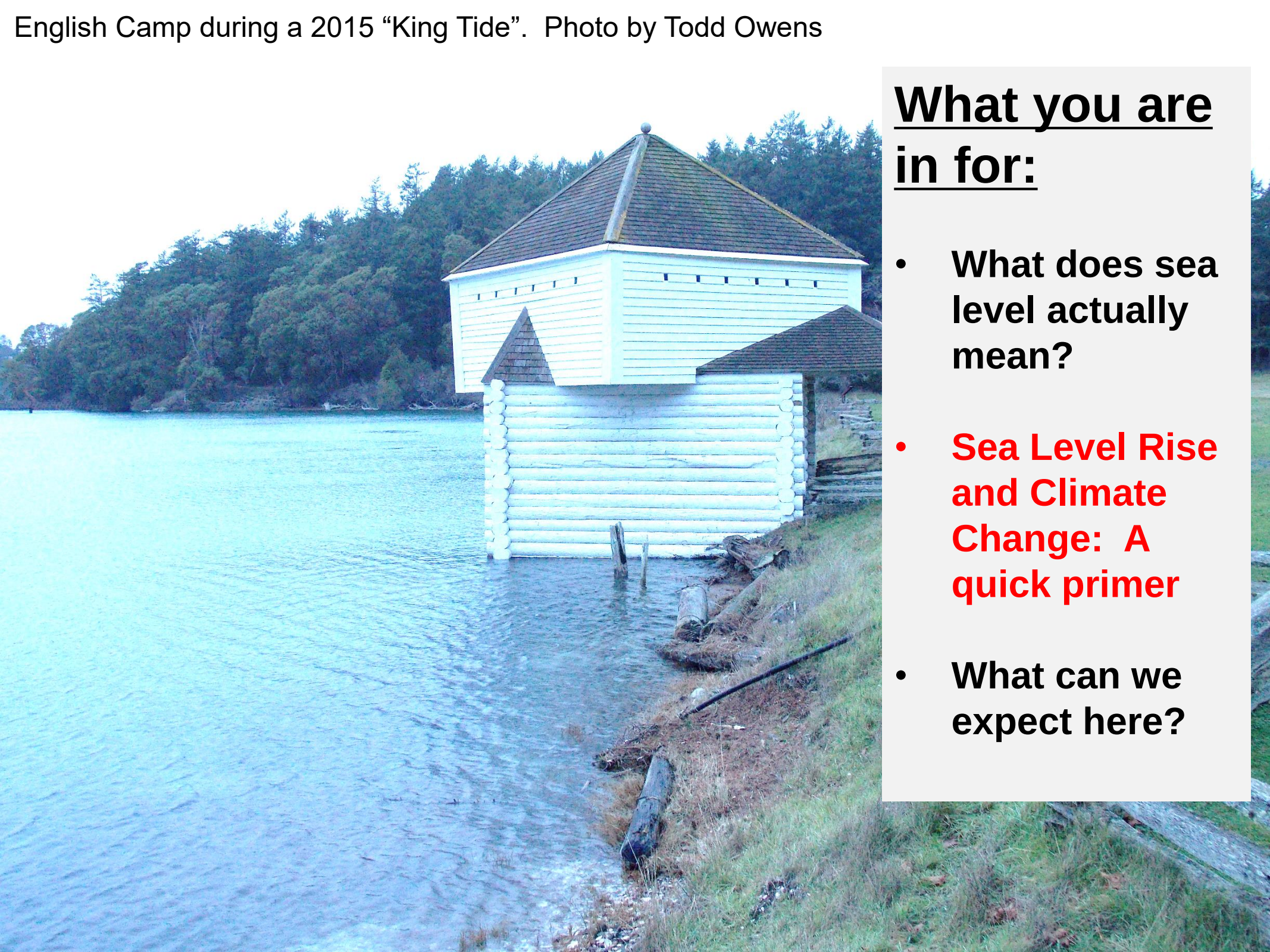
…we find all sorts of annual variability

Lets look at long-term averages…



…to find a clear pattern of “real” sea level rise!

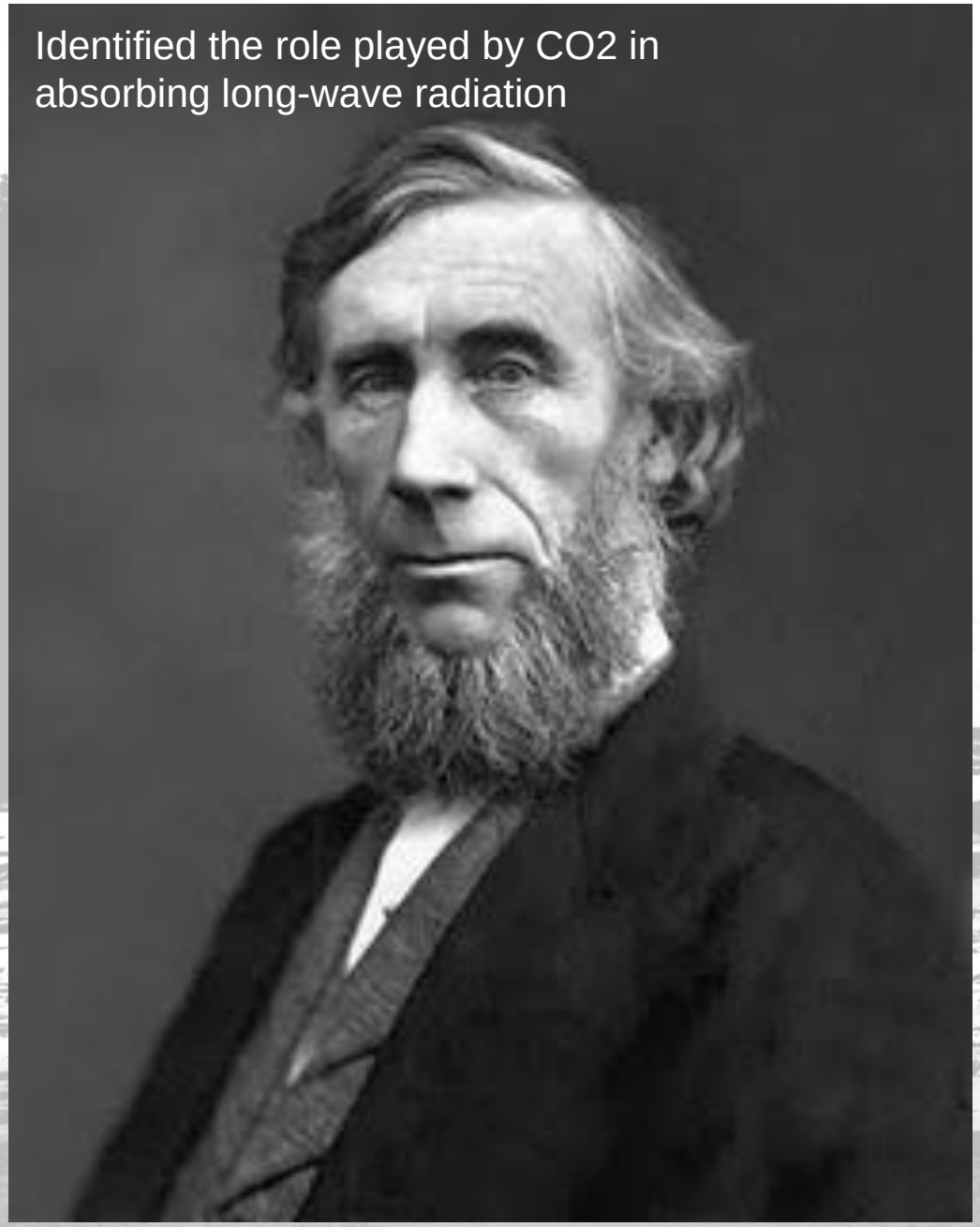
English Camp during a 2015 “King Tide”. Photo by Todd Owens



What you are in for:

- What does sea level actually mean?
- Sea Level Rise and Climate Change: A quick primer
- What can we expect here?

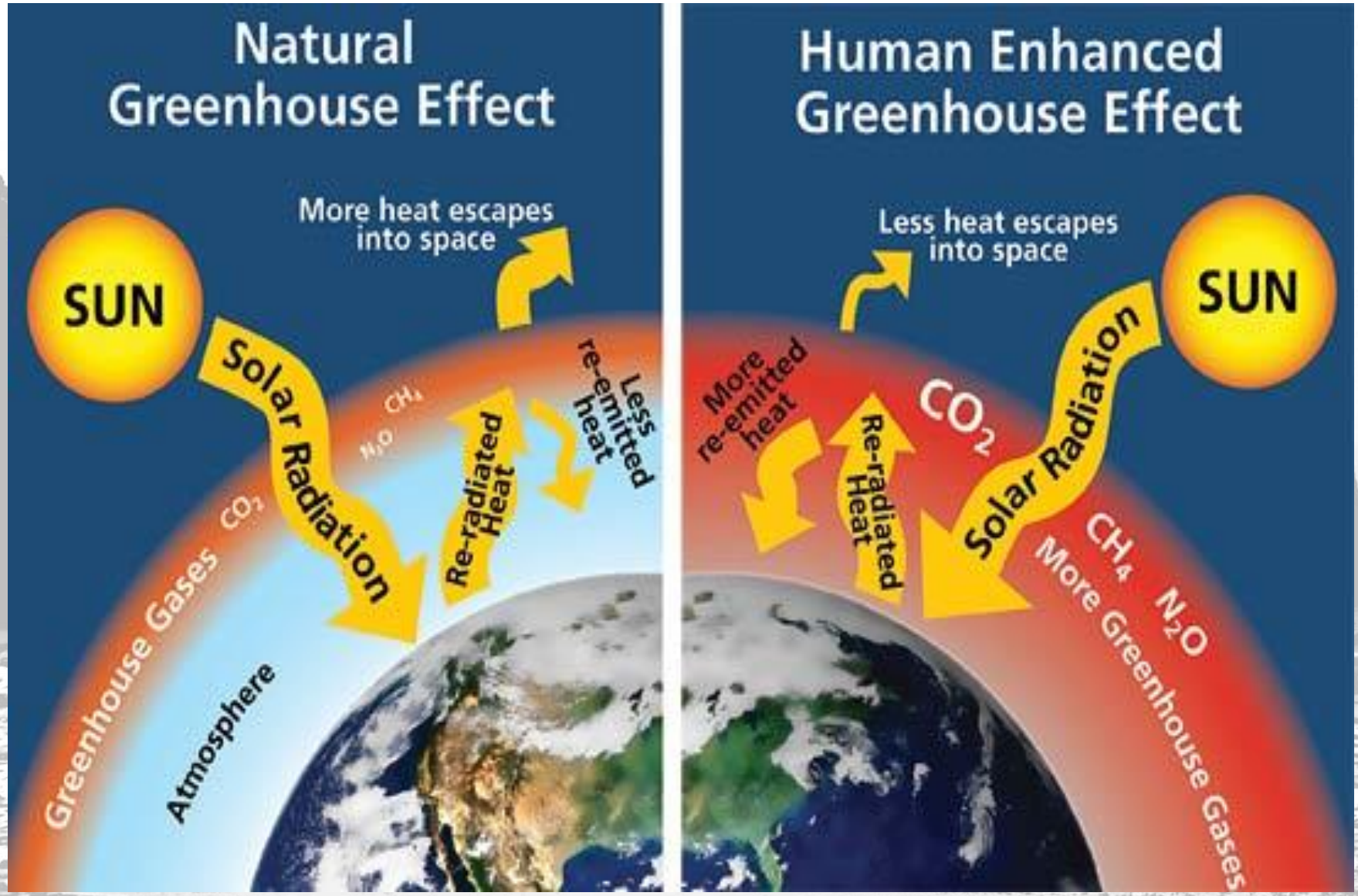
Blame These Fine Looking Gentleman



John Tyndall, 1864

Svante Arrhenius, 1894

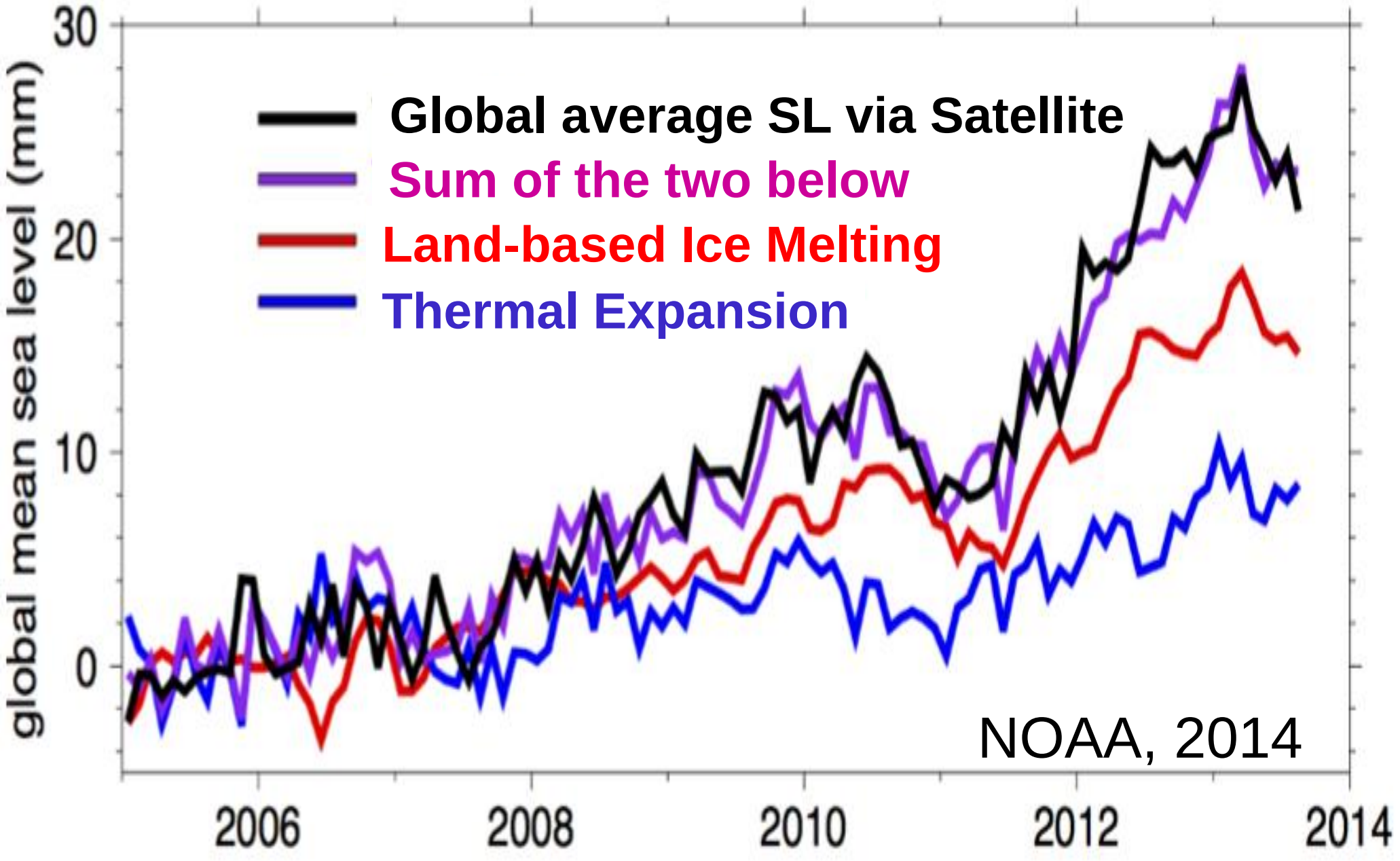
Fundamental Concept: Energy Imbalance



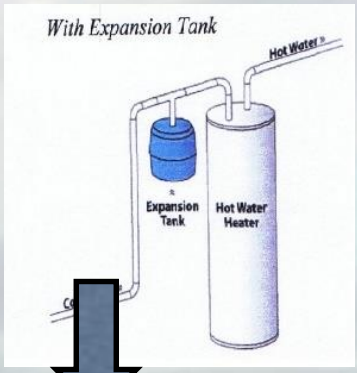
$Q=mc\Delta T$

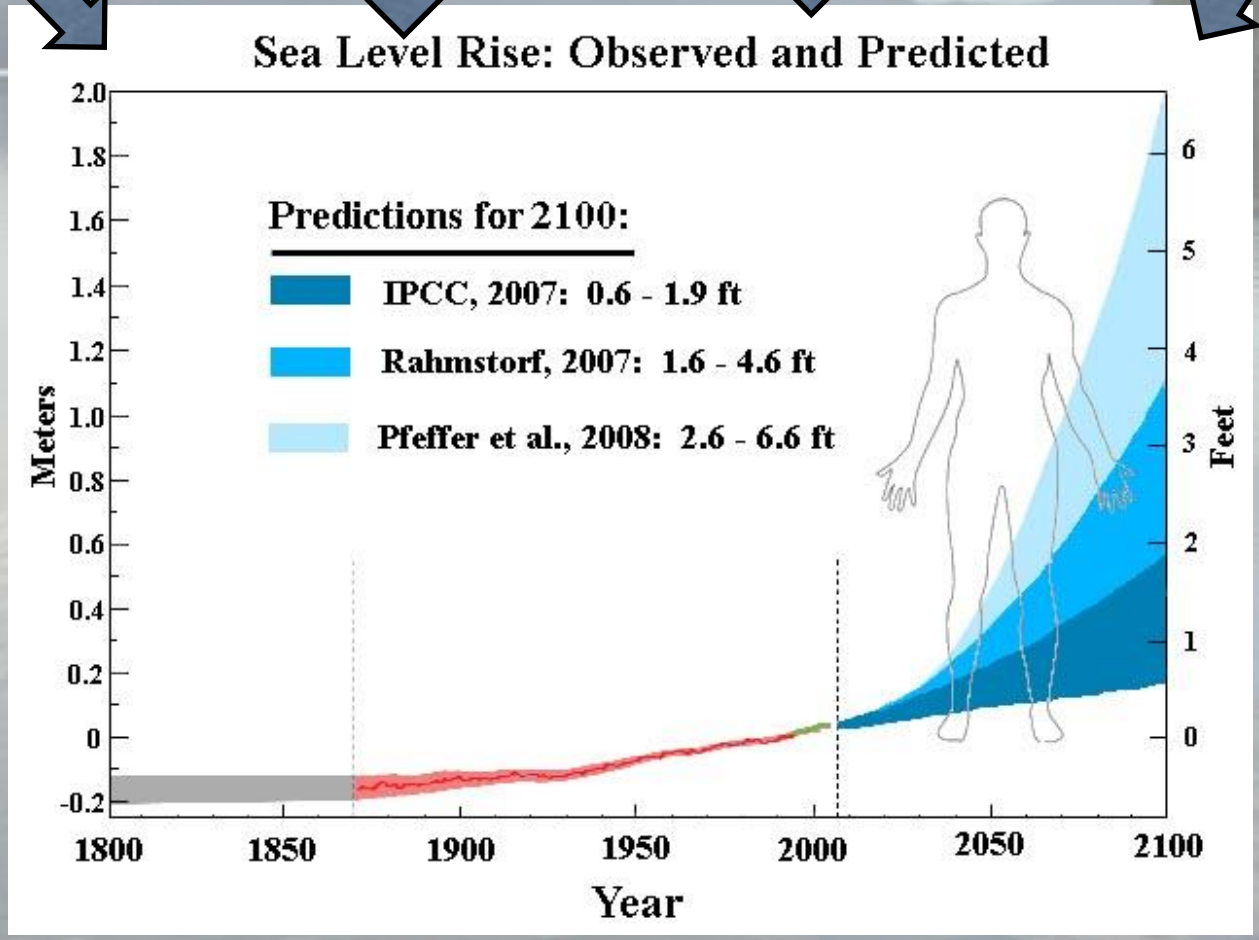
Yet another service brought to you by the ocean…

Observed Global SLR is due to heat



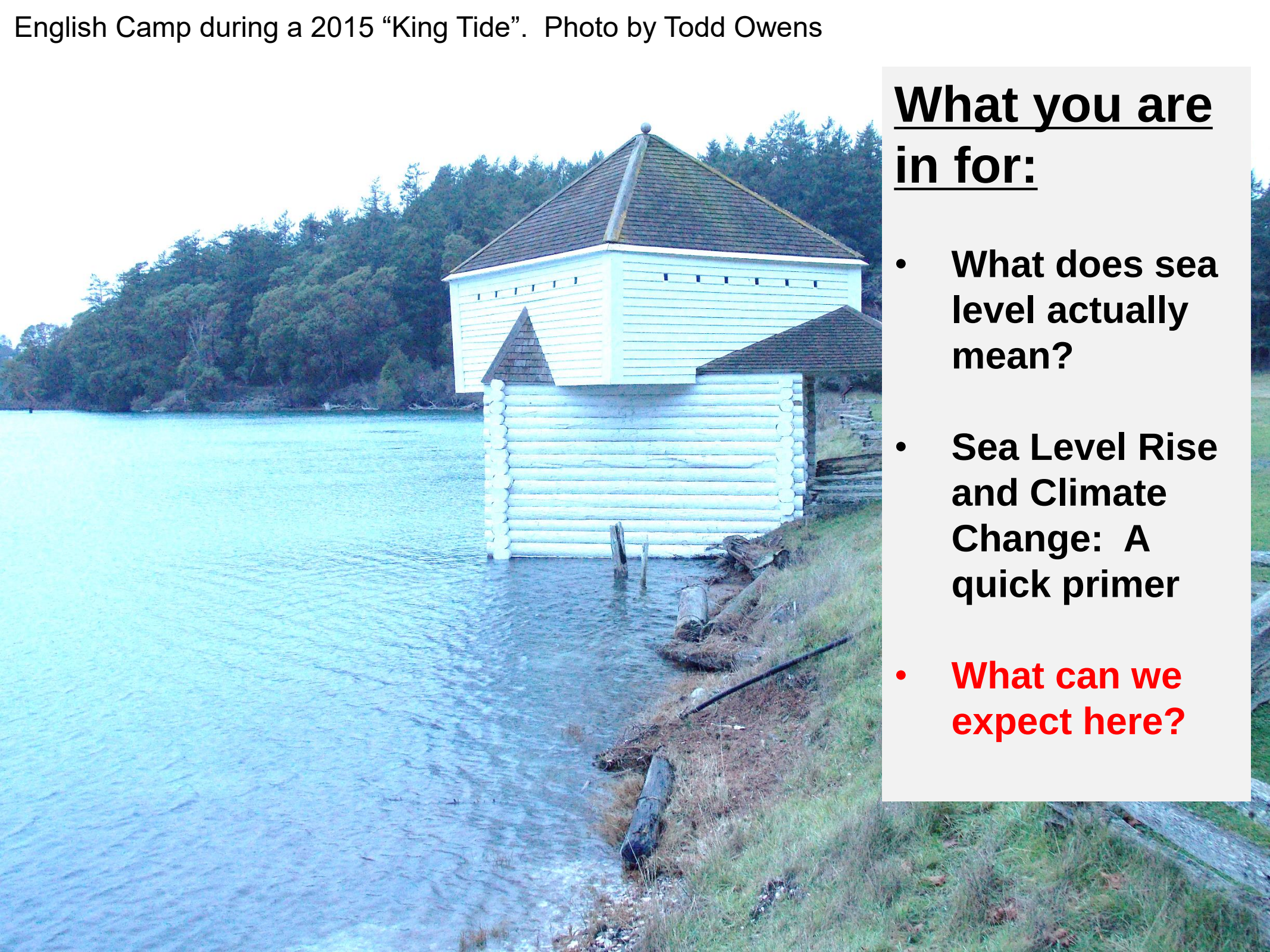
Building Projections





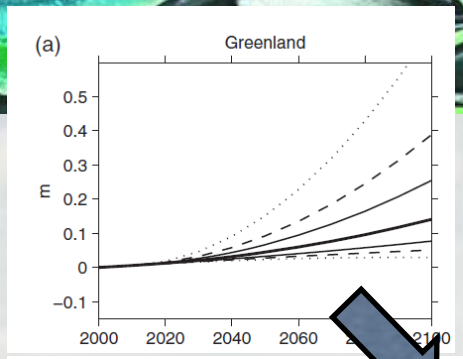
Note the Uncertainty!

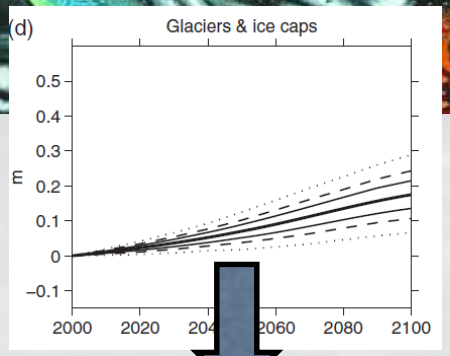
English Camp during a 2015 “King Tide”. Photo by Todd Owens

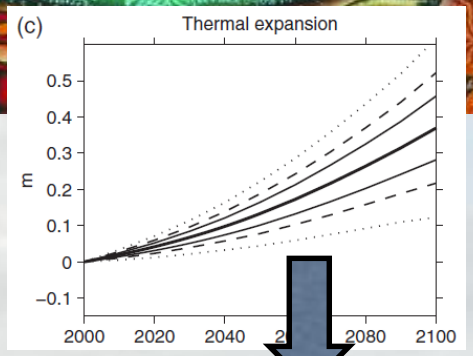


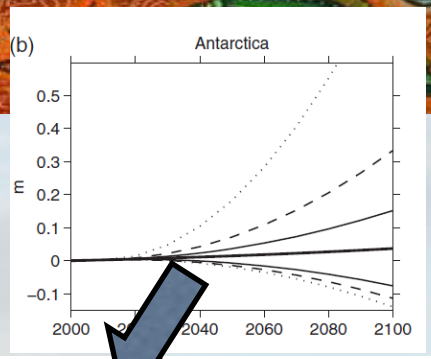
What you are in for:

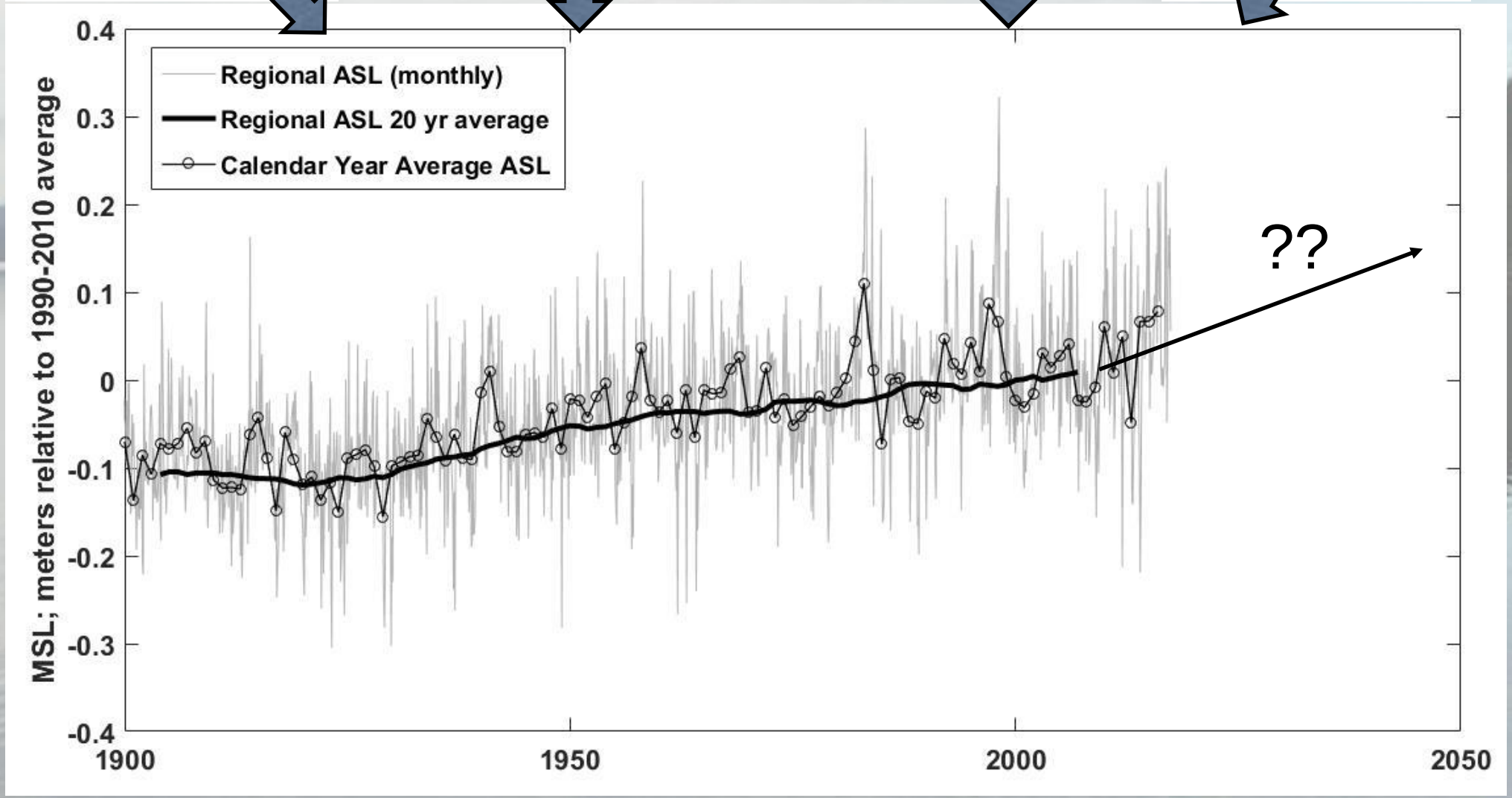
- What does sea level actually mean?
- Sea Level Rise and Climate Change: A quick primer
- What can we expect here?





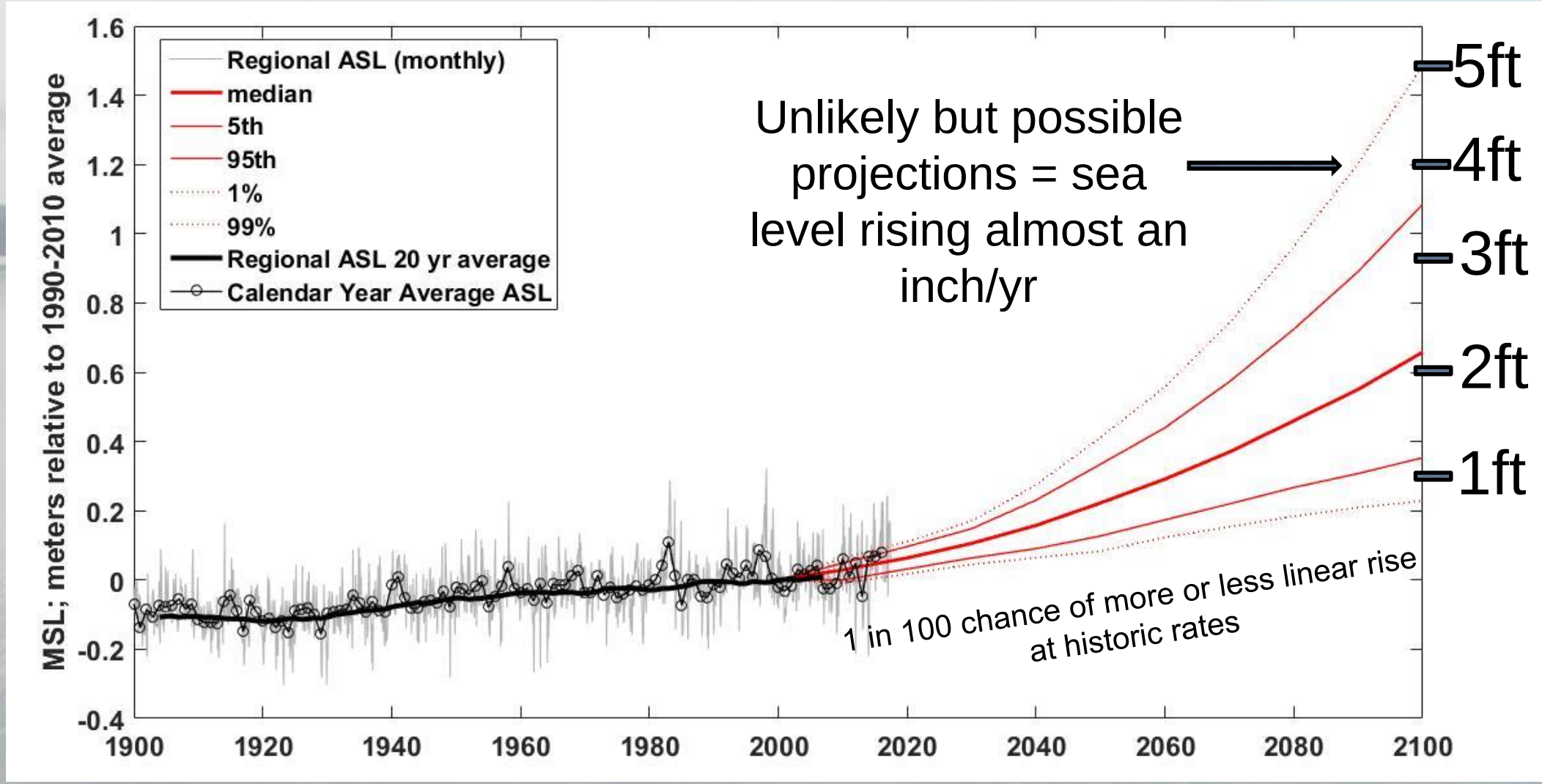






Go back to here and add in sea level components

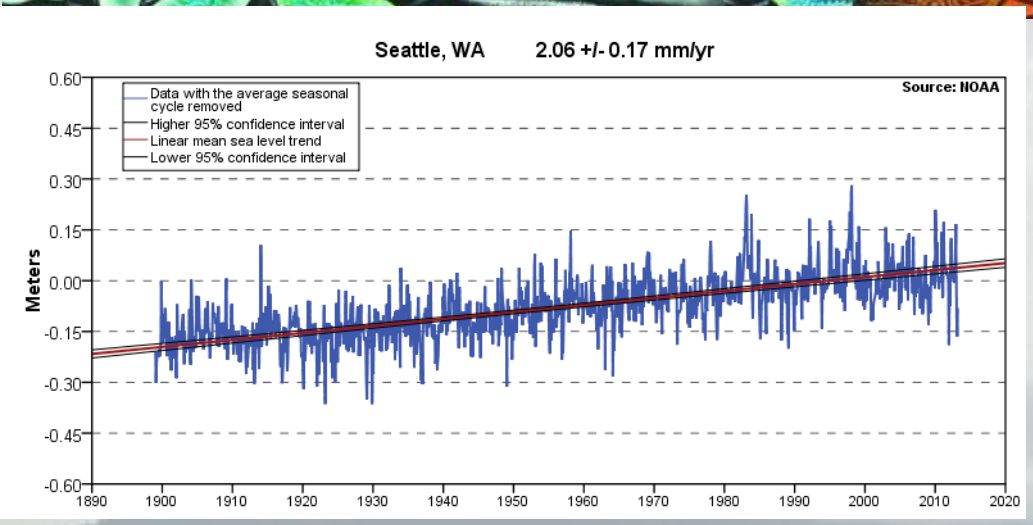
Absolute Projections to 2100



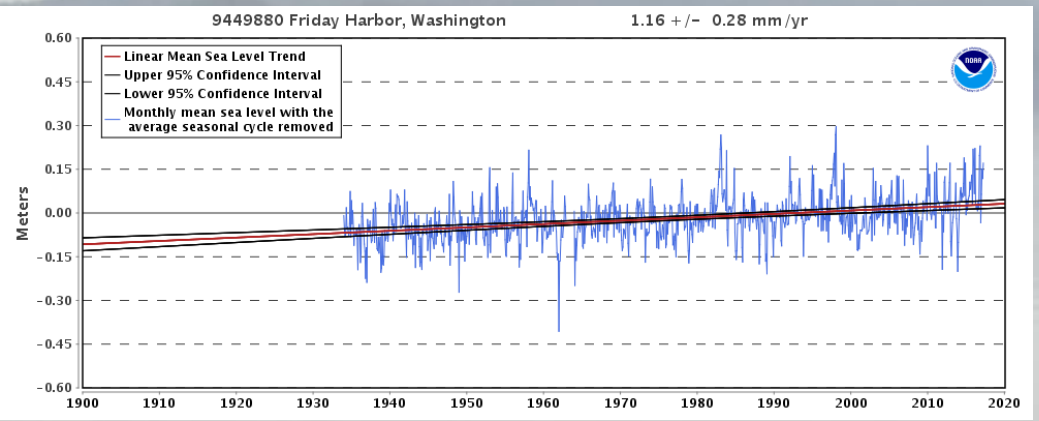
By 2100 (for RCP8.5)

"Localized" Projections

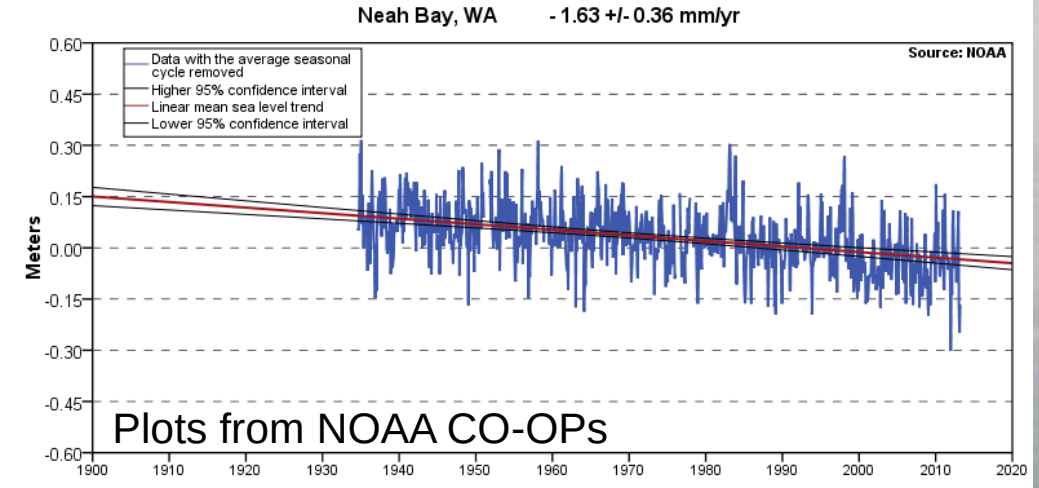
Relative Sea Level = Sea Level + VLM



Seattle: Where subsidence exacerbates the regional SLR pattern



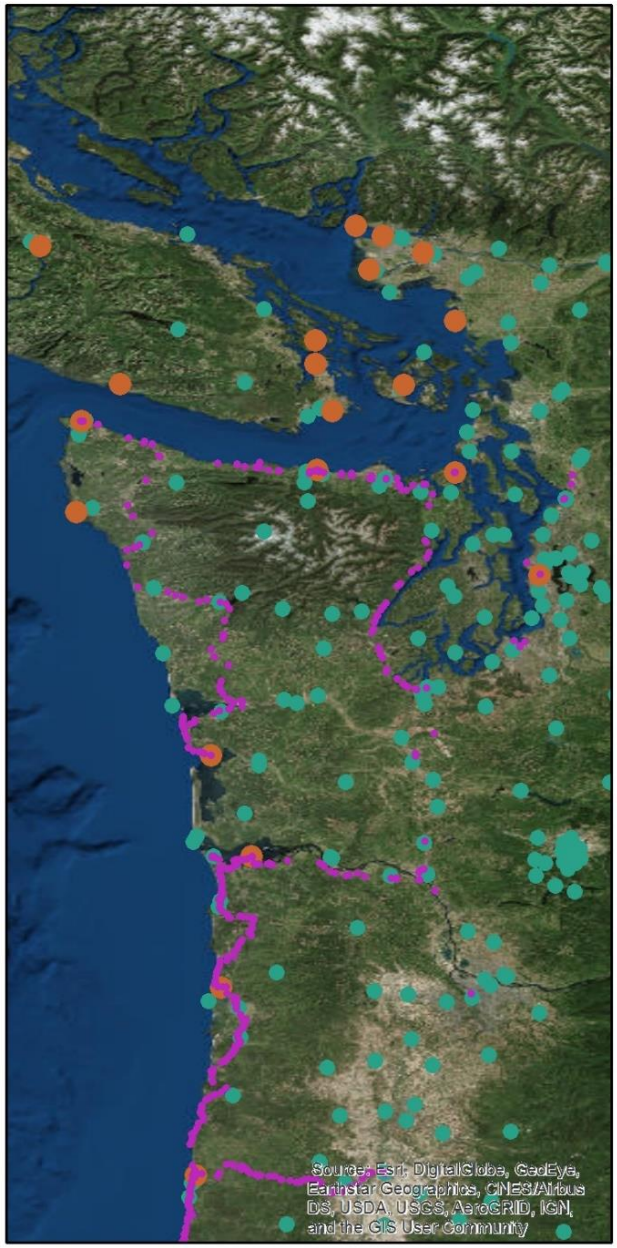
Friday Harbor: Where there appears to be little land movement

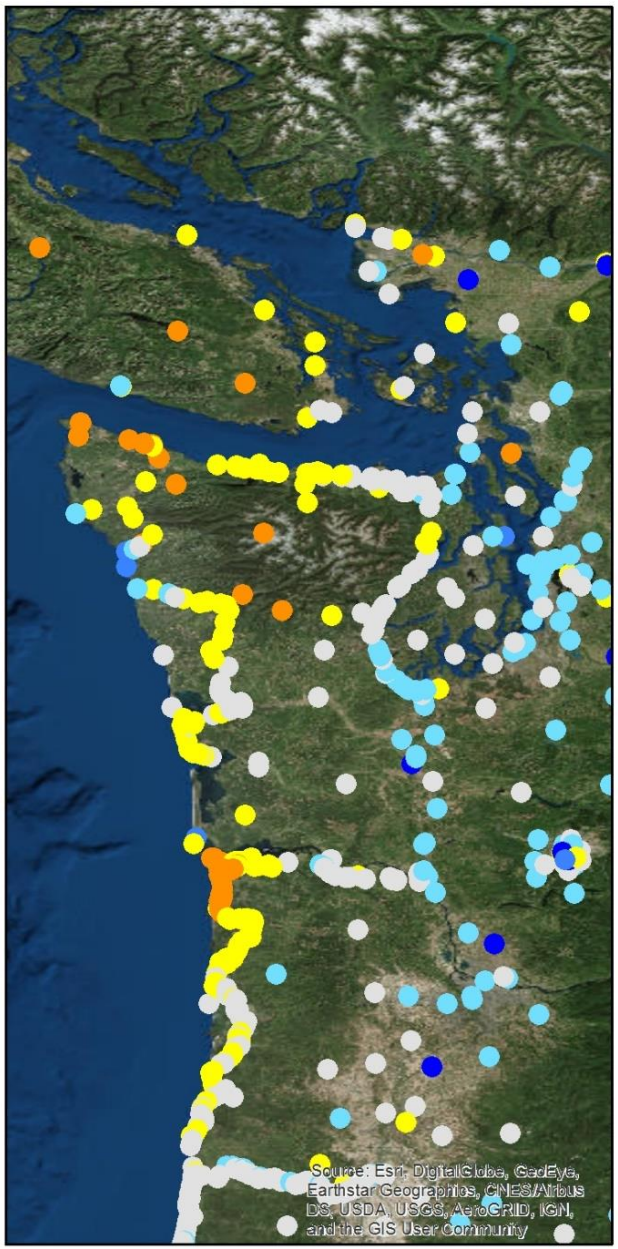


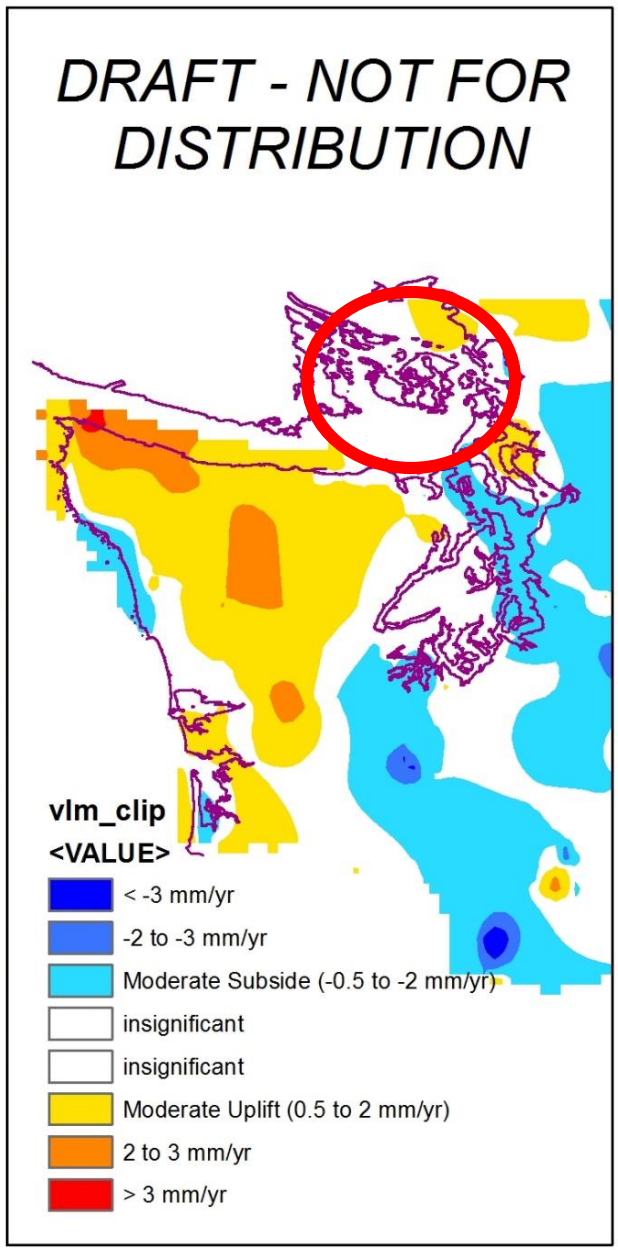
Neah Bay: where VLM is currently outpacing SLR

Plots from NOAA CO-OPs

Vertical Land Movement







Thank you!

Key Points:

1. Sea level has risen historically in Washington State - ~6 inches since 1930 or so

2. Climate change, due to thermal expansion AND new water contributions to the oceans basin, is very likely to accelerate sea level rise in the coming decades.

3. There is little evidence that the San Juans are either moving up or down

4. As a result “likely” sea level rise for the San Juans based on our current assessment suggest another ~6 inches by 2050, and >2 ft by 2100.

5. But higher magnitudes of SLR are possible. >5 ft by 2100

Ian Miller, PhD
Coastal Hazards Specialist
Washington Sea Grant
Olympic Peninsula Field Office
immiller@uw.edu
360 417 6460

Sea Grant
Washington

Additional Resources

- State of Knowledge: Climate Change in Puget Sound (http://cses.washington.edu/picea/mauger/ps-sok/PS-SoK_2015.pdf)
- Recent blog on probabilistic projections (http://www.wacoastalnetwork.com/blog/communicating-probabilities-for-more-informed-decisions-about-sea-level-rise)
- Clallam/Jefferson Climate Change Assessment (http://www.noprcd.org/about2)

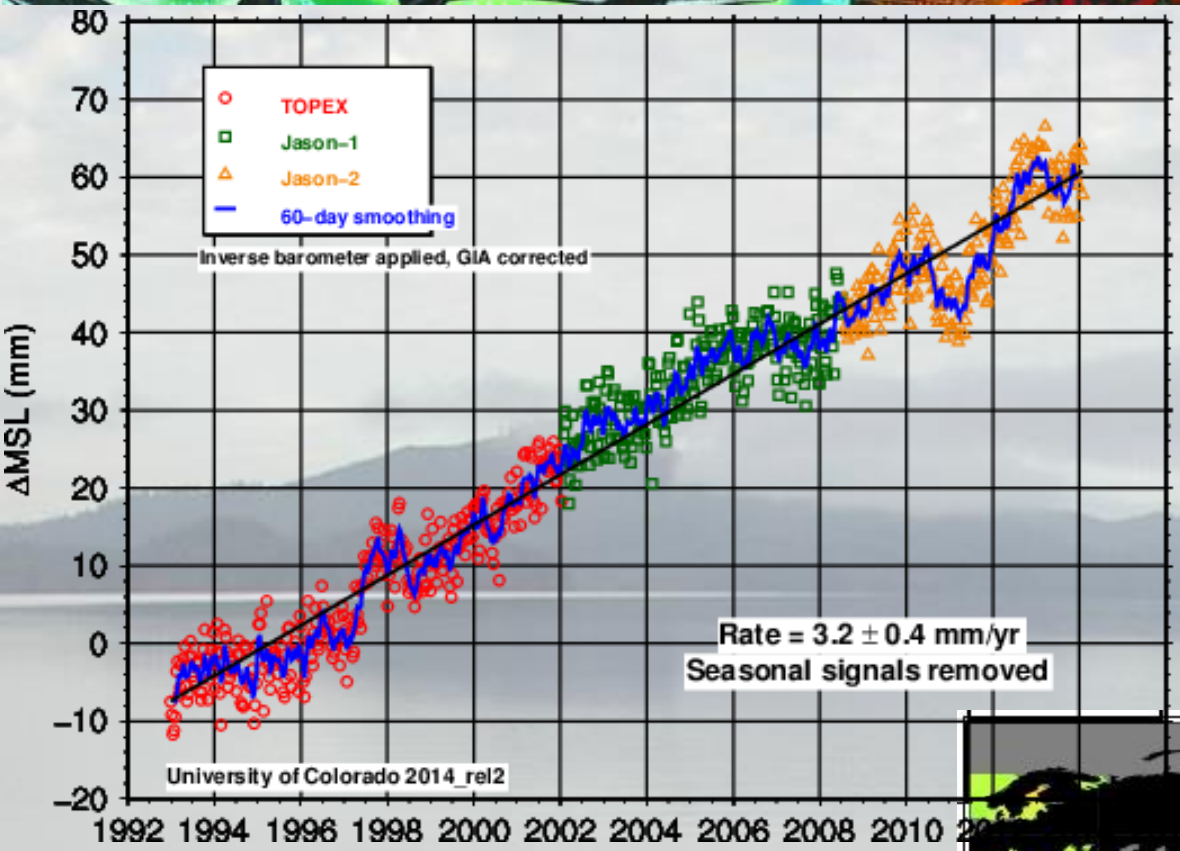
Ian Miller, PhD
Coastal Hazards Specialist
Washington Sea Grant
Olympic Peninsula Field Office
immiller@uw.edu
360 417 6460

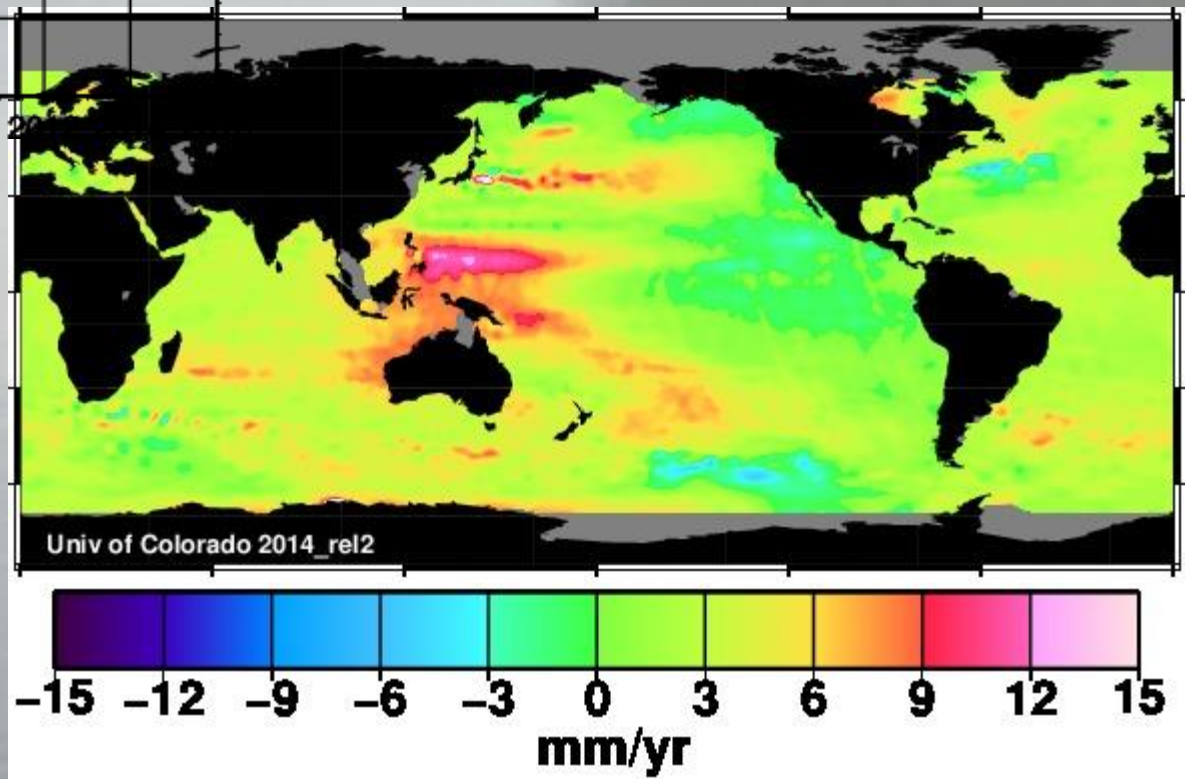
Sea Grant
Washington

Getting Regional

Mean Global Sea Level (1993-present) is rising….

Nerem et al. 2010





…but the global distribution of this pattern of SLR is complex, and in the PNW the rate of sea level rise has been SLOWER than the global average