

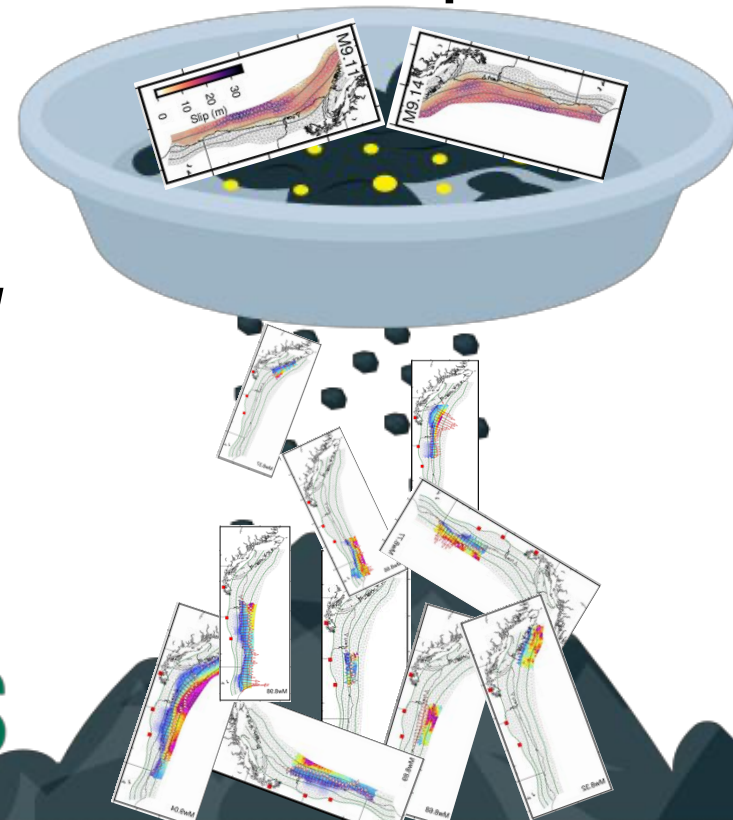
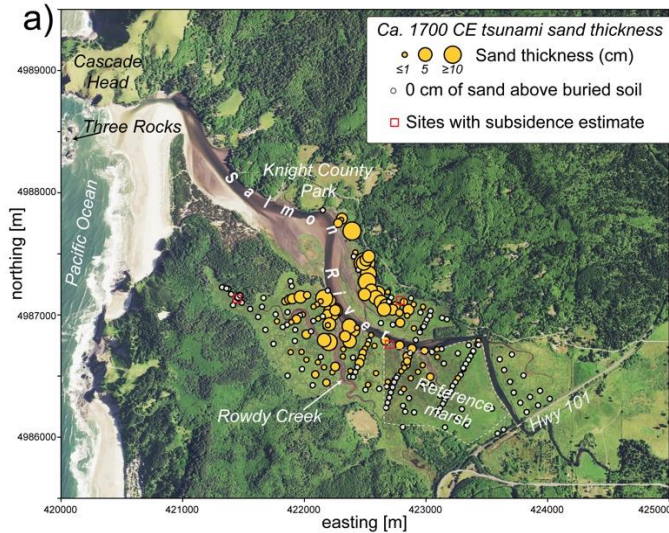
The paleotsunami deposit “sieve”

Minimum estimates of tsunami inundation as constraints on Cascadia Subduction Zone rupture models

~~not SeanPaul La Selle~~

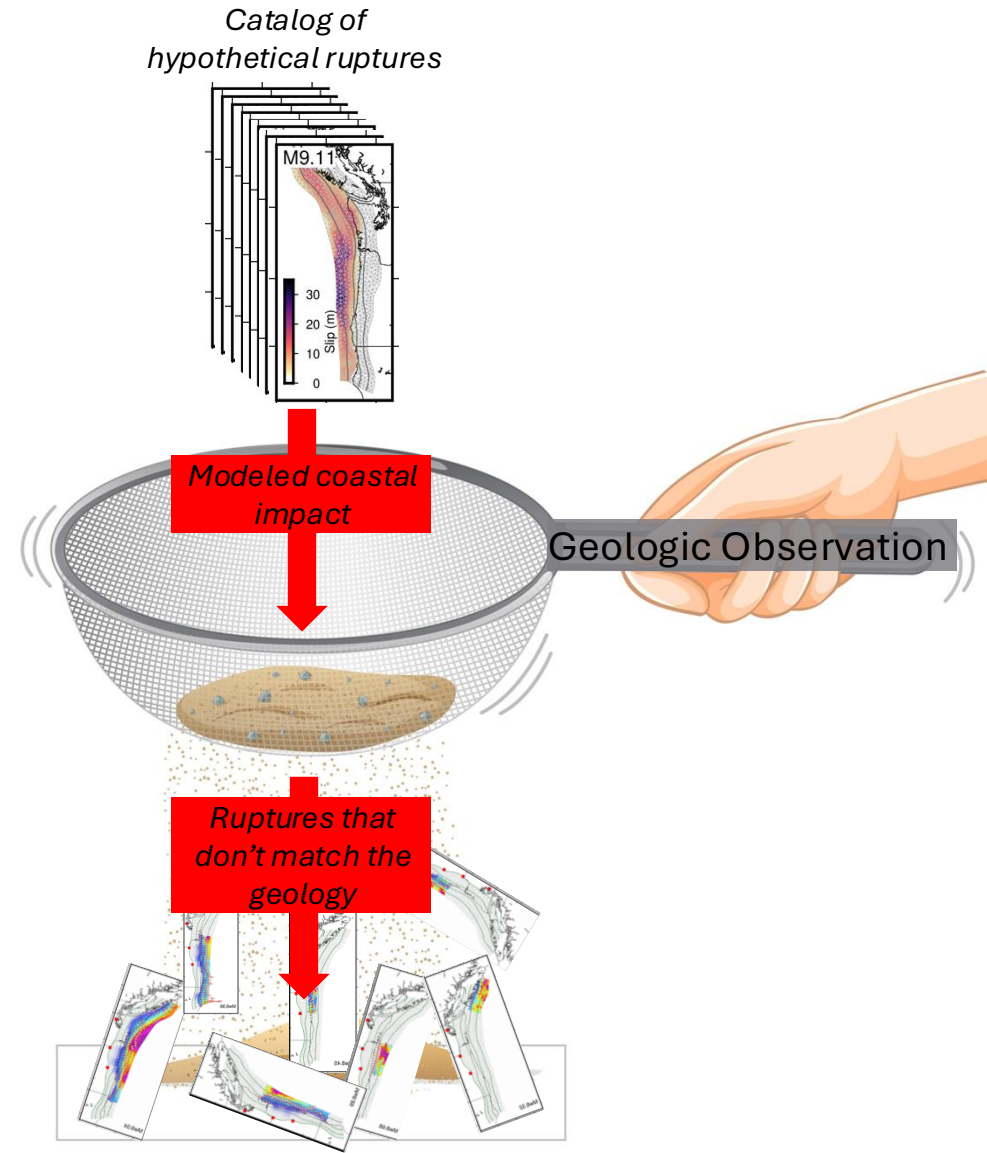
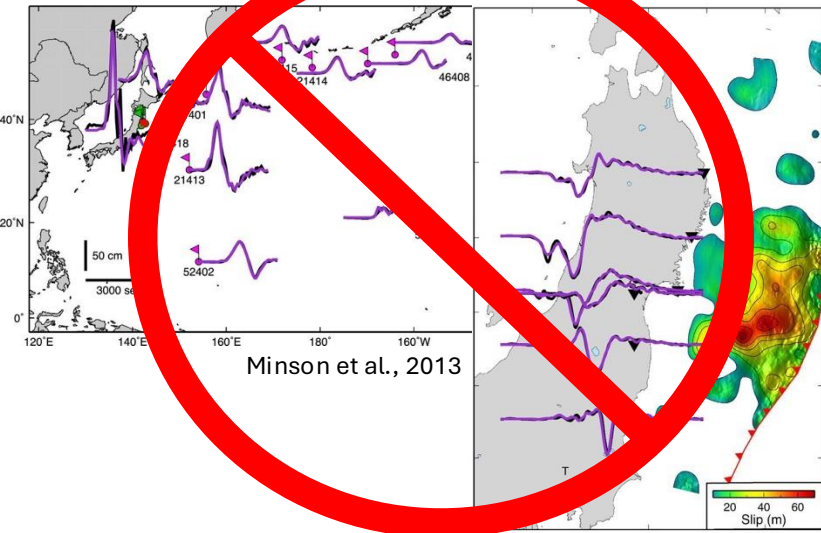
David T. Small

dsmall2@uoregon.edu



The Paleoseismic “Sieve”

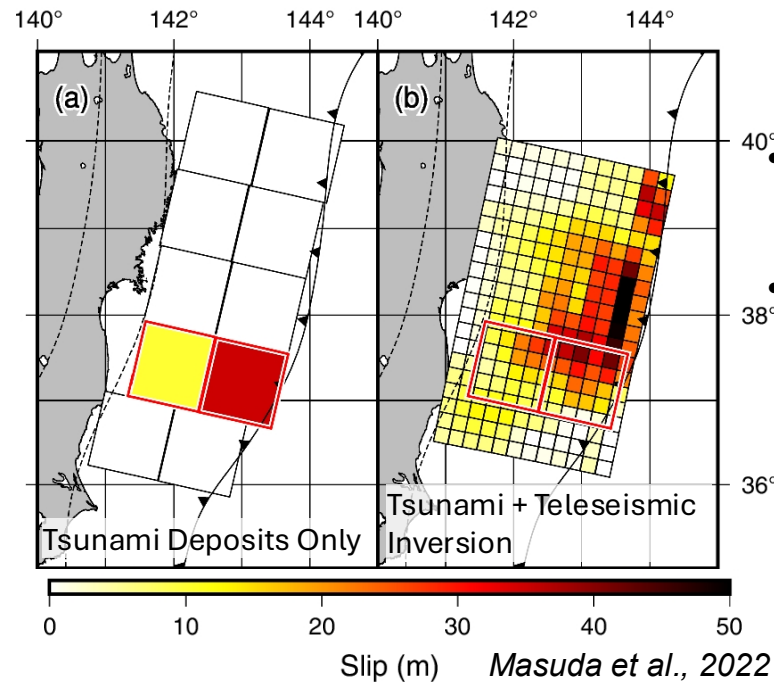
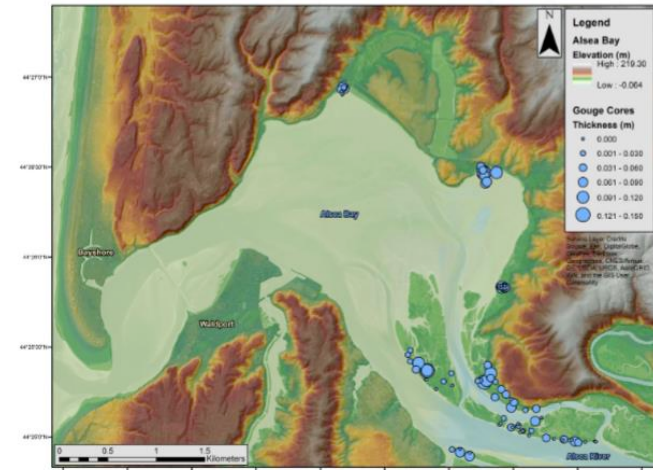
- Without instrumental observations, constraining past events becomes increasingly difficult.
 - Available observations are too simple for inverse modeling ... a work around is needed.



Benefits of mapping paleotsunami deposits

➤ Geology can be used to inform models

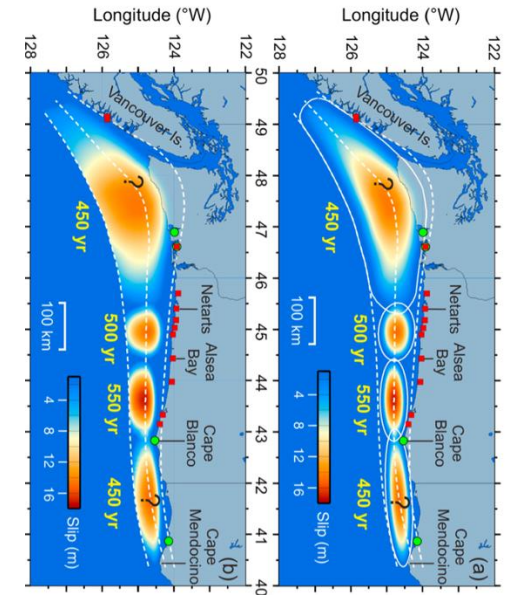
- Demarcate minimum inundation limits
- Improve confidence in depositional mechanism (i.e. tsunami vs storm or flooding)
- Inherently maps the paleoenvironment



Coastal PNW is great at preserving earthquake proxies

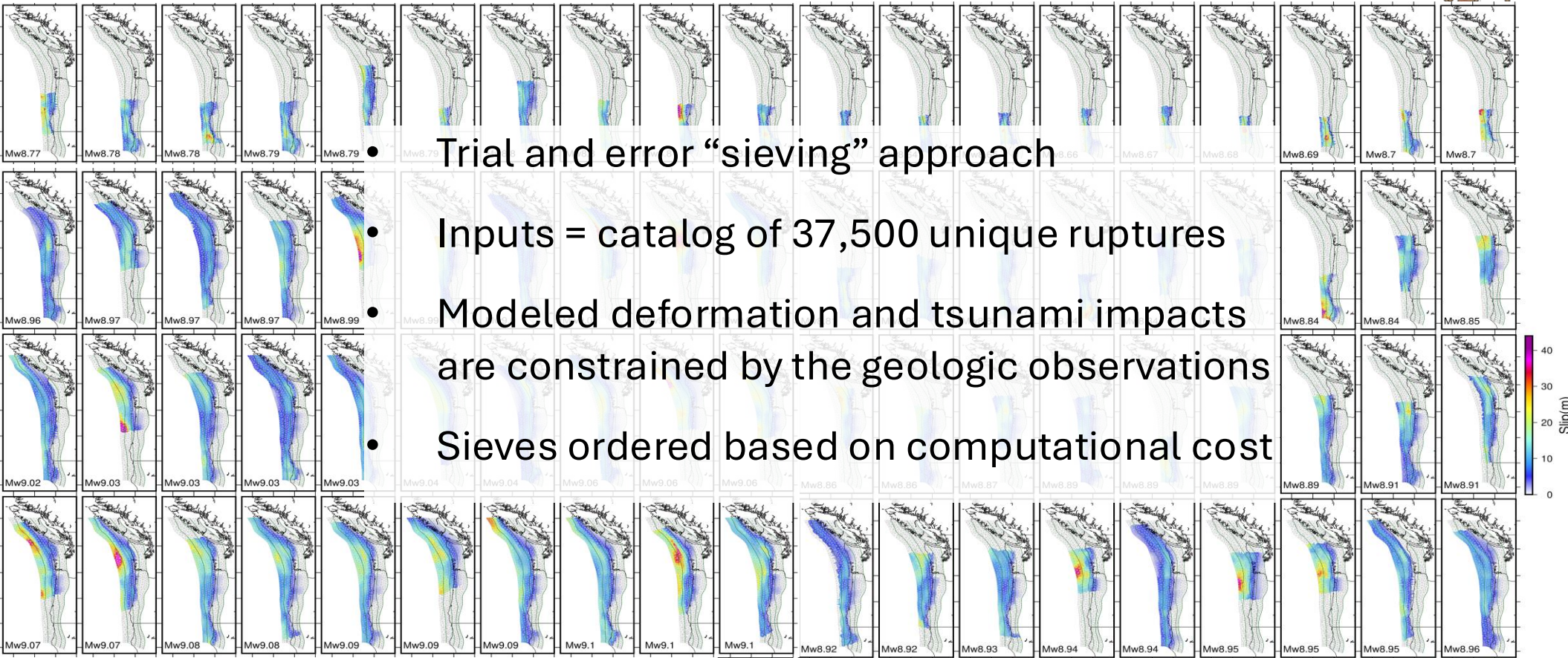
Slip models have been tested for 1700 before (e.g., Witter, Gao, Satake)

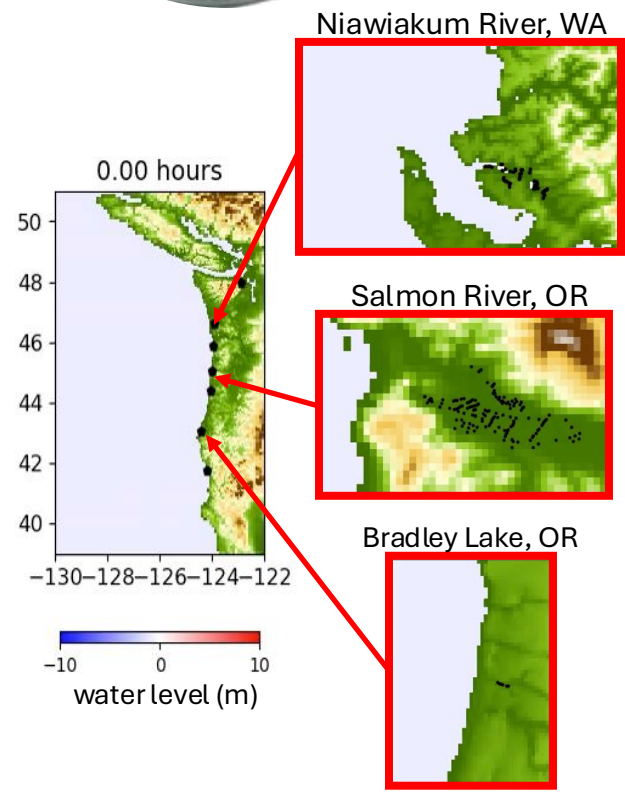
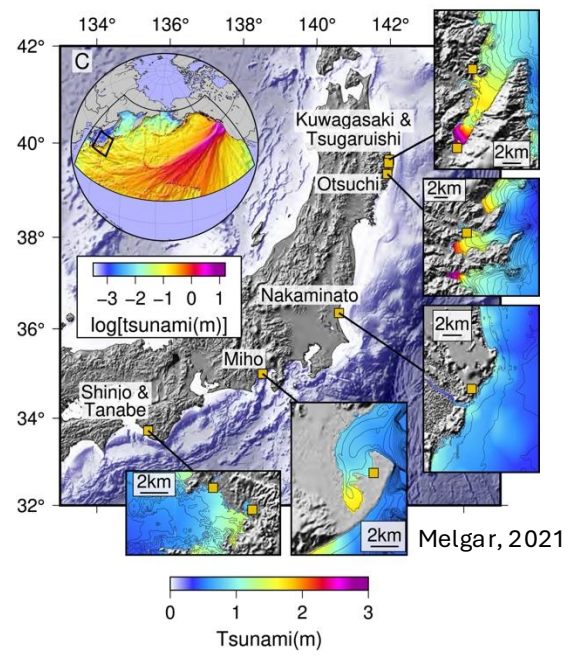
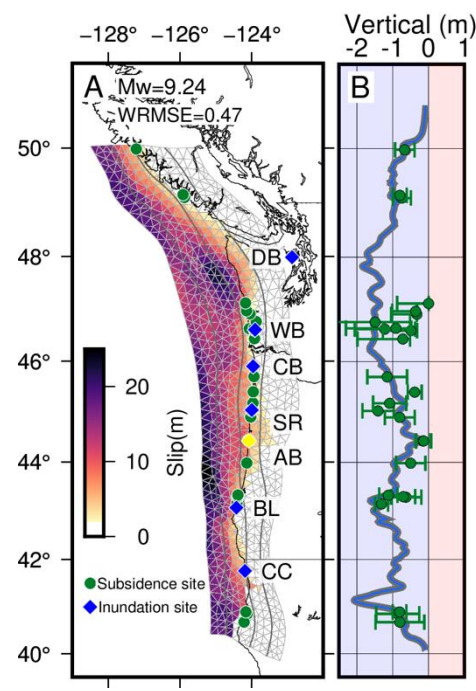
- Coastal subsidence is a primary constraint
- These do not include multisite tsunami deposits as constraint
- Slip patterns based on depth dependencies and SDR

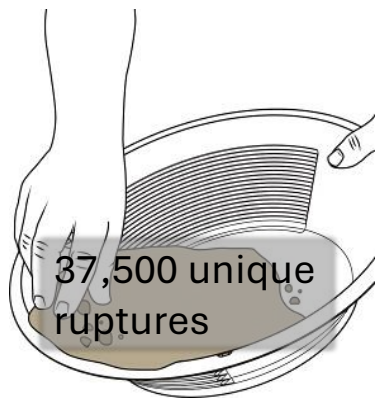


Wang et al., 2013

Can we sieve these ruptures to find 1700?







37,500 unique ruptures



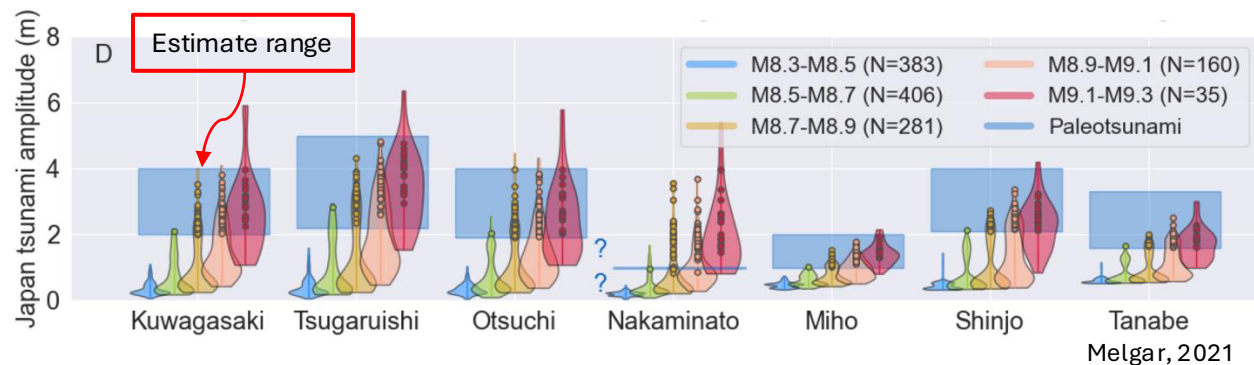
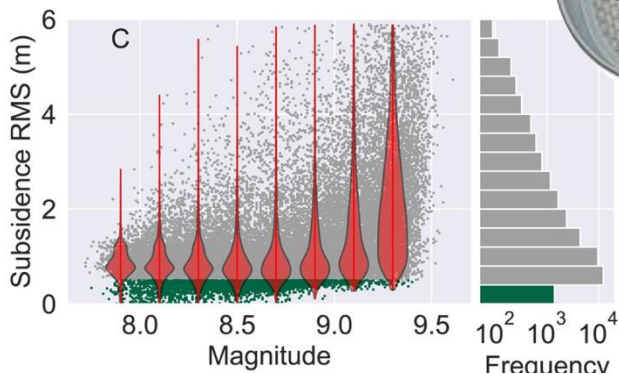
- 1,600 ruptures match the local subsidence records
 - **260** full margin events

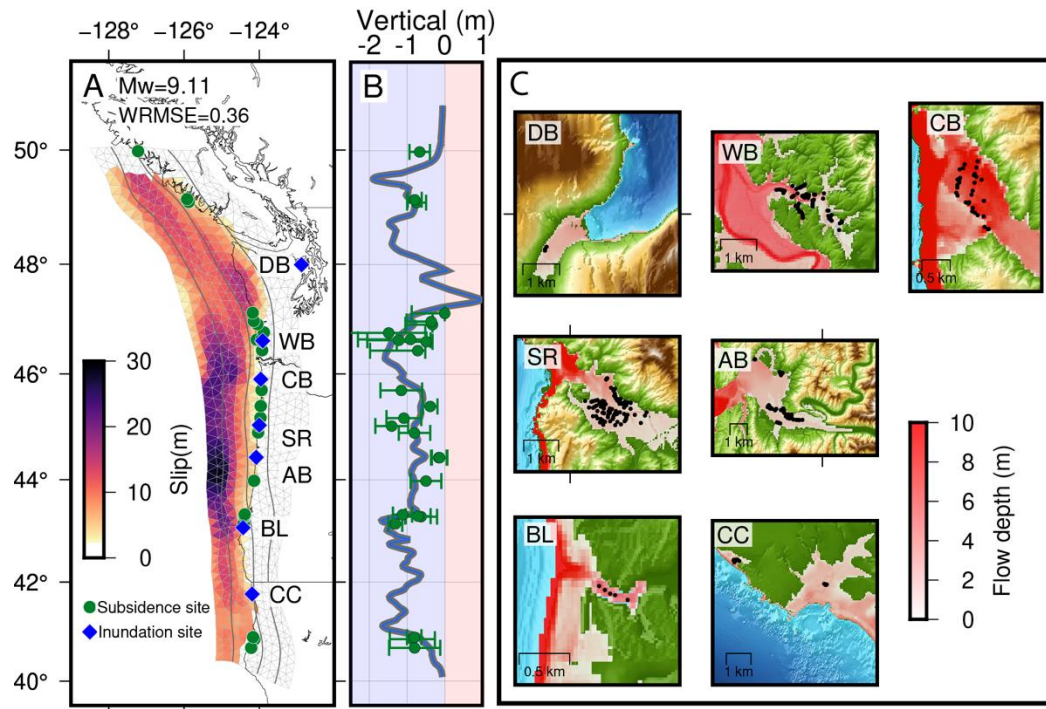


- 100 ruptures match the estimated tsunami arrival heights in Japan
 - **27** are full margin events

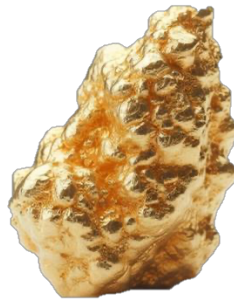


- **1*** event can adequately inundate all the deposit sites!
 (*6 others technically pass the sieve constraint)

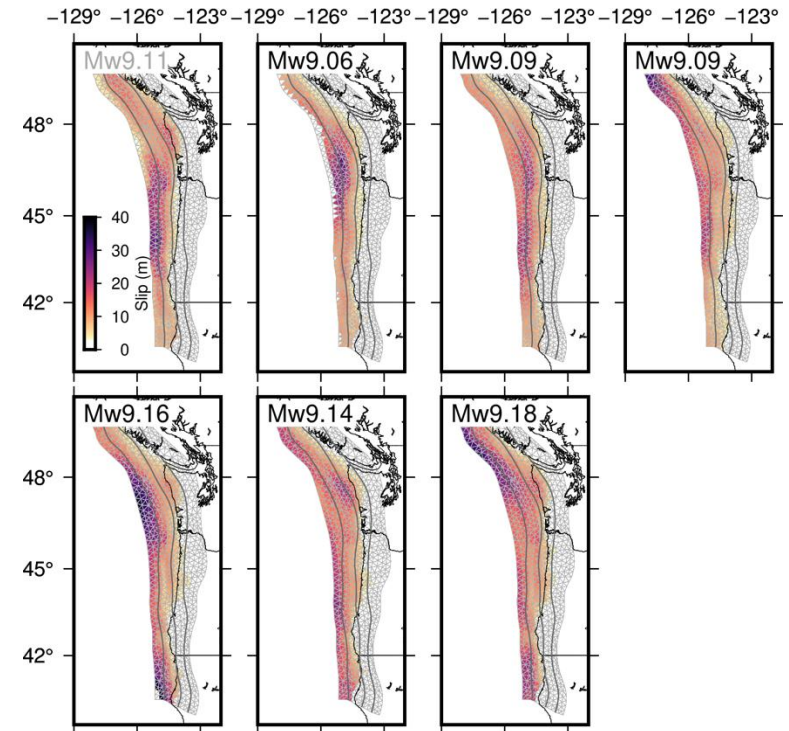


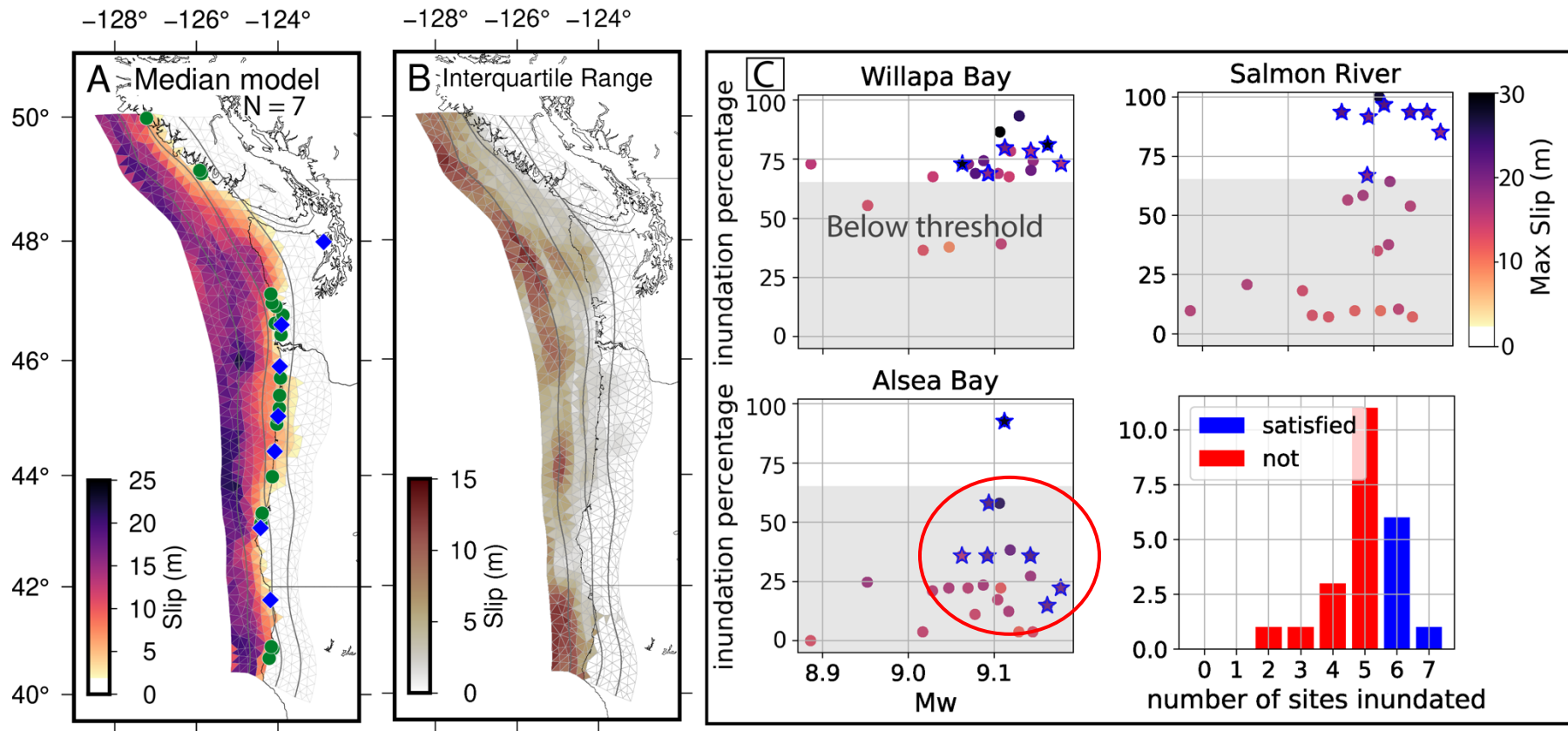


Did we find gold?



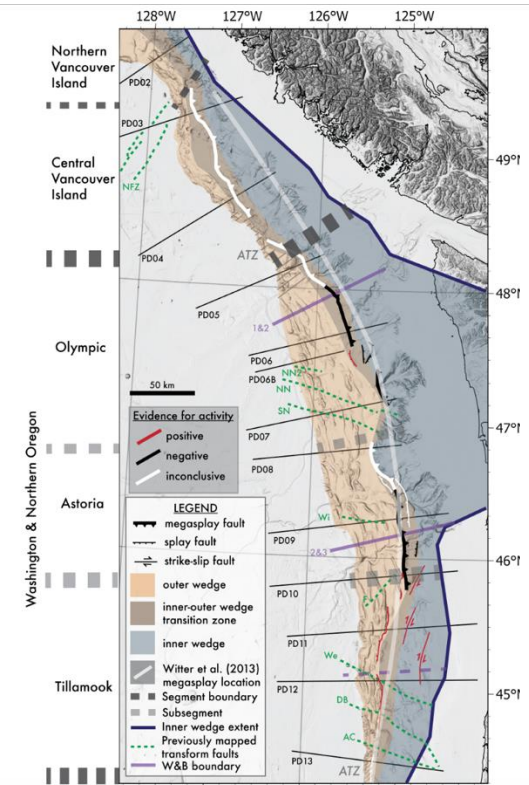
- Only rupture to submerge all 7 sites above the inundation threshold
 - >90% of all deposits submerged beneath 0.5 m of water at 6/7 sites
 - Slip concentrated around Central Oregon



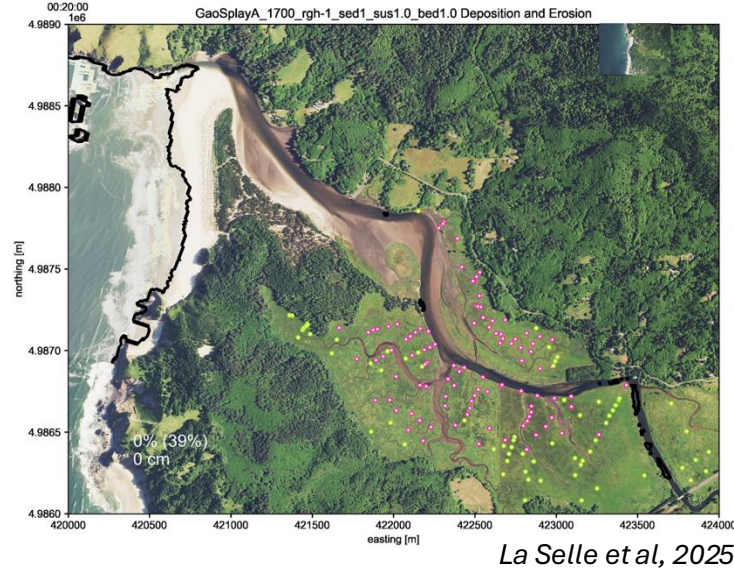


- The 7 candidate models share similar characteristics:
 - Median Mw 9.1
 - ~20m of shallow slip
- Well mapped paleotsunami deposit sites = greatest impact on constraining models
- Alsea Bay adequately inundated by 1 full margin rupture!
 - Slip assumptions might need to be adjusted?

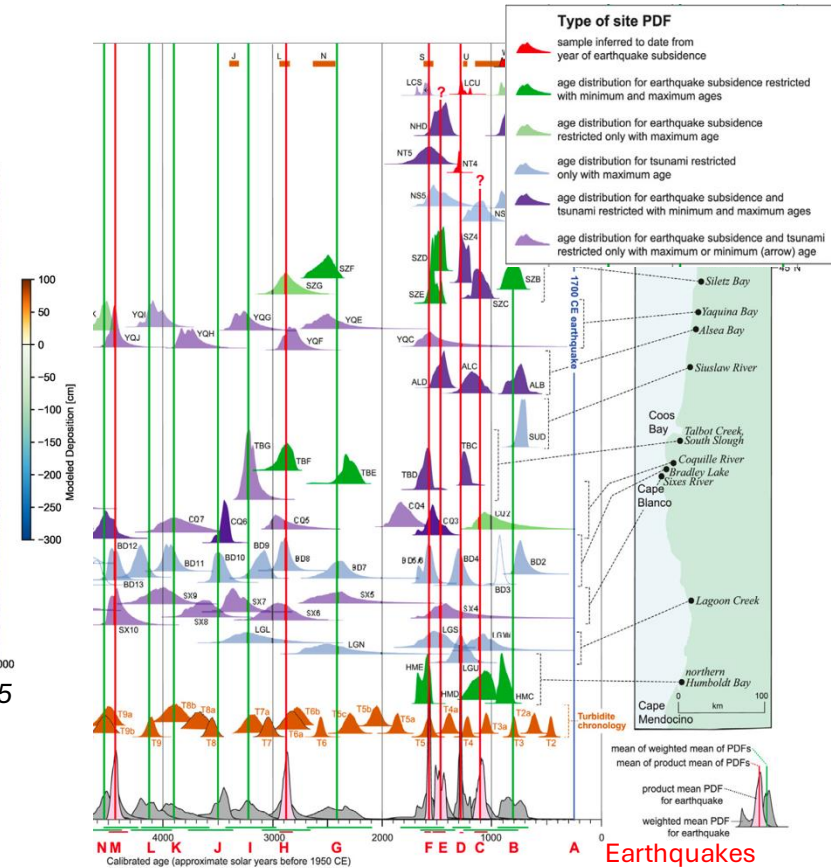
Is this it? Or what's next... Modeling?



Lucas et al., 2025

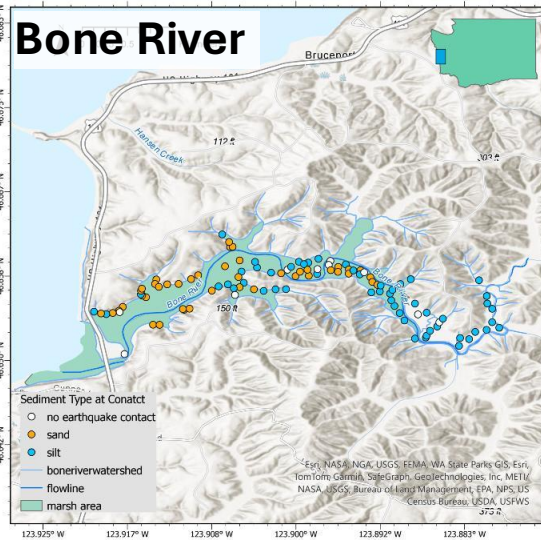
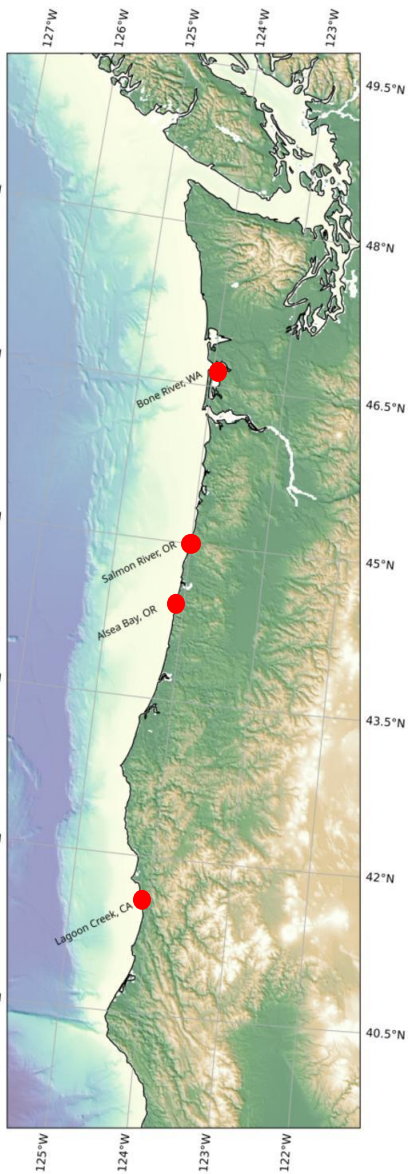


La Selle et al., 2025



Nelson et al., 2021

New 1700 CE tsunami deposit mapping and analyses



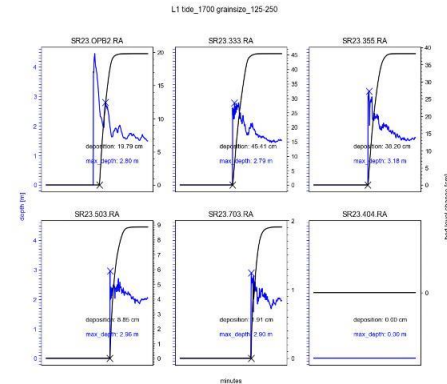
Mira Anderberg, University of North Carolina - Wilmington

Lagoon Creek

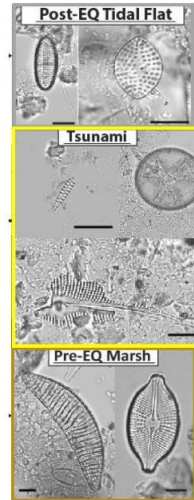


Bering Tse, University of Washington

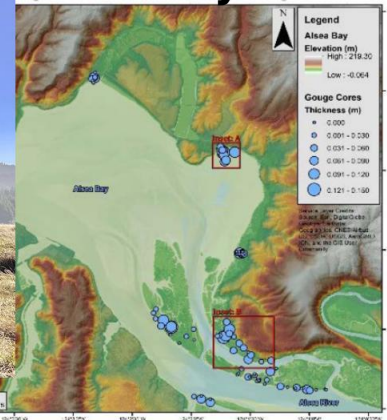
Salmon River



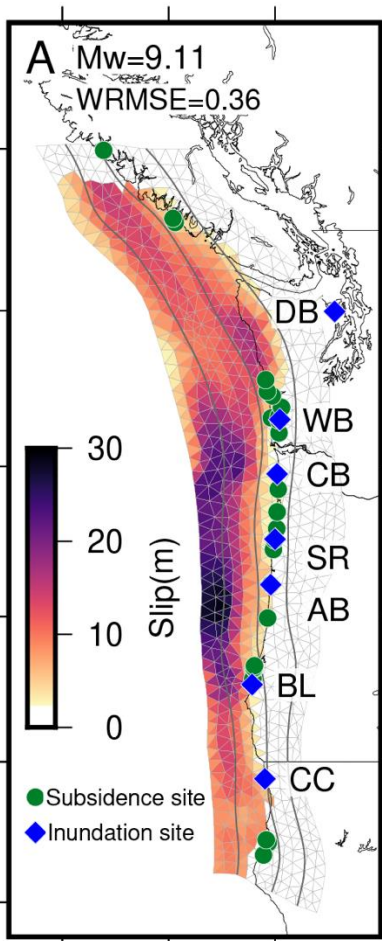
Brandon Hatcher, Virginia Tech



Alsea Bay



Spruell & Meigs, 2018



Thanks!



