Investigating Drivers of Compound Flooding in Willapa Bay and Grays Harbor, Washington

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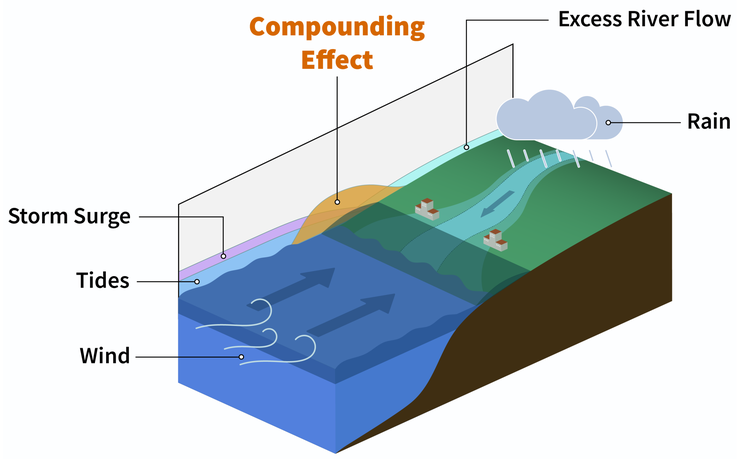
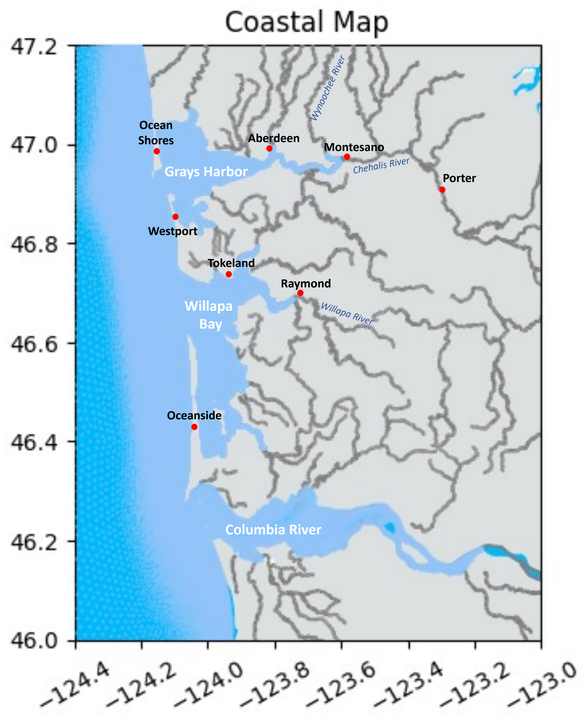
Background and Motivation

The frequency and intensity of atmospheric rivers in the Pacific Northwest are projected to increase with climate change, leaving coastal communities more susceptible to compound flooding events. The main challenge in predicting the frequency and magnitude of compound flooding arise from nonlinear interactions between fluvial and oceanic processes.

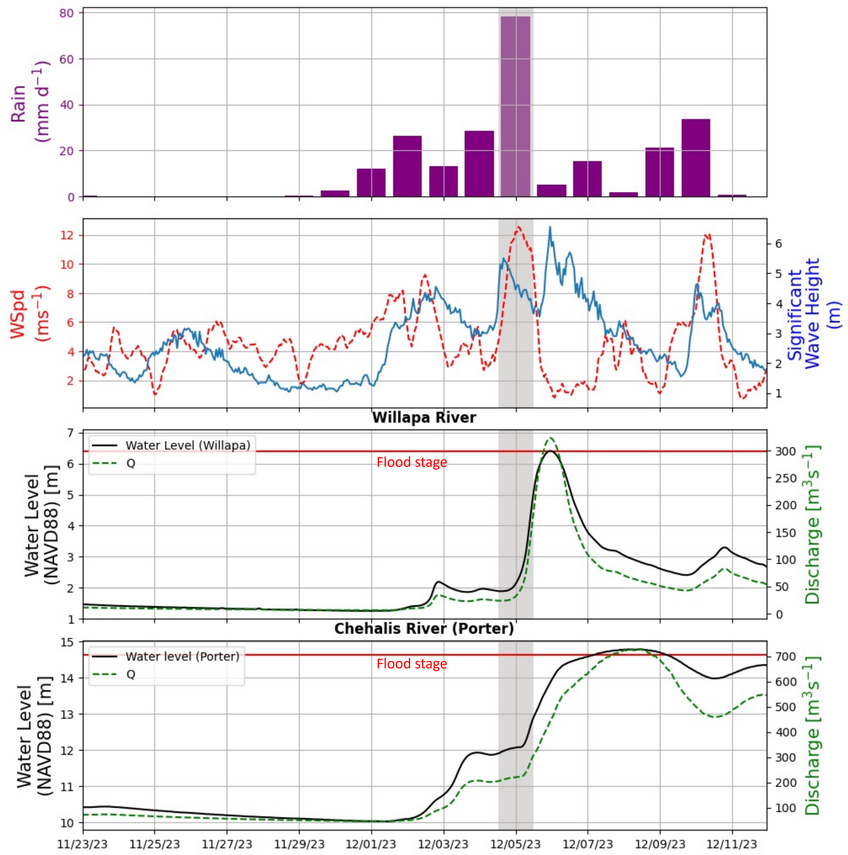
Compound Flooding



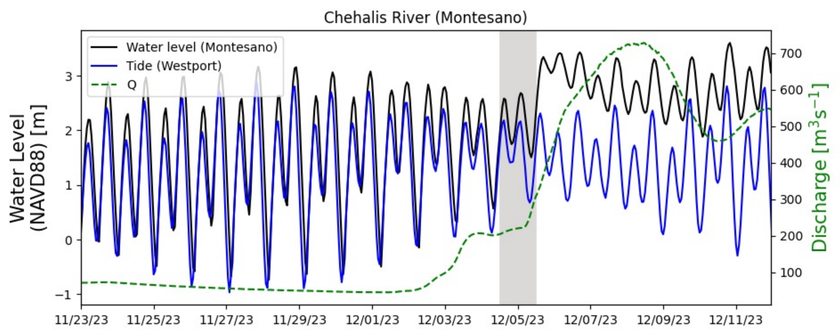
To better understand the relationship between each component in compound flooding, we are investigating the importance of each forcing in observed atmospheric river events using a 2D numerical model (*Delft3D-Flexible Mesh*) for the Washington coastline.



December 2023 Atmospheric River



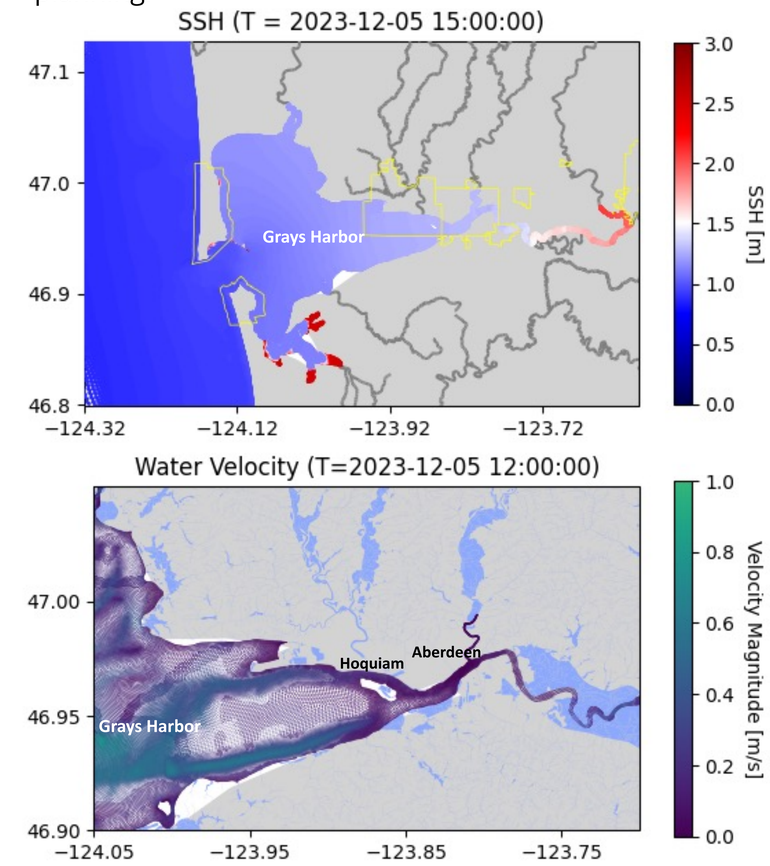
Peak precipitation and wind was observed on December 05 (vertical gray bars), with peak water levels and discharge in Willapa River and Satsop River <1 day later. Both rivers reached near or exceeded flood stages.



Chehalis River at Montesano (*black*) is normally tidally dominated and reflects modulations observed at NOAA's Westport tide gauge (*blue*). A combination of peak significant wave height, excess river flow (*green*), and neap tides all contributed to an elevation and sustaining of water levels during this atmospheric storm event. Neap tides limit flushing while high discharge (>500 m^3s^{-1}) continues to keeps water levels elevated for at least 3 days after peak outflow.

Products

Modeled sea surface height and water velocity (details in Lou et al.'s poster) can be used to determine coastal flooding extents, transport, and circulation patterns within both estuaries. Mapping the spatial extent of inundation can highlight vulnerable communities affected by compound flooding during intense storms or projected sea level rise, and aid in hazard mitigation planning.



Future Work/Collaborations

- Optimizing our model for the Twin Harbors will support future development of CoSMoS for this region.
- Investigate morphodynamic changes within the estuaries and along the shoreline (accretion, erosion, outwash, etc).
- Model changes in hydrodynamics due to sea level rise scenarios (RCP 4.5 and RCP 8.5).
- Incorporate vertical land motion (+~3.5 mm/year) to future conditions.

Acknowledgements

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