The next generation of the San Francisco Bay-Delta Community Model

Public domain modeling in support of flood protection and forecasting (Hydro-CoSMoS)

Kees Nederhoff, Babak Tehranirad, Liv Herman, Li Erikson, Patrick Barnard, Mick van der Wegen, Rohin Saleh

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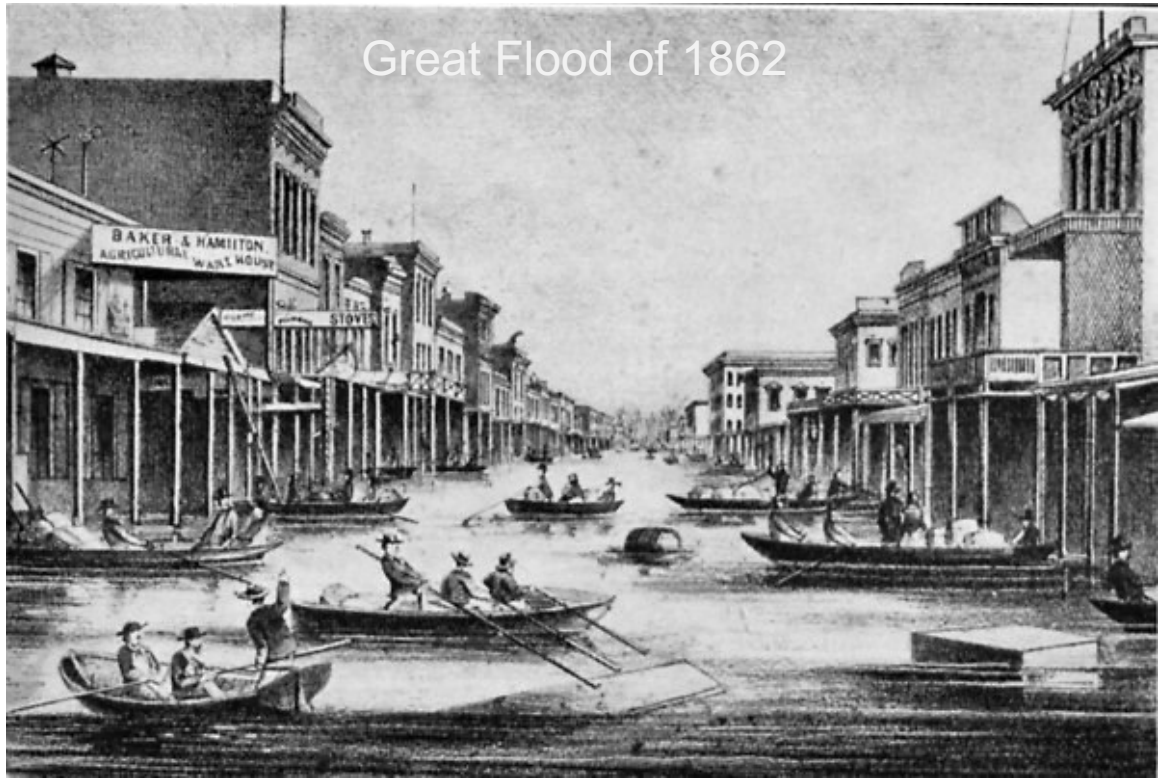
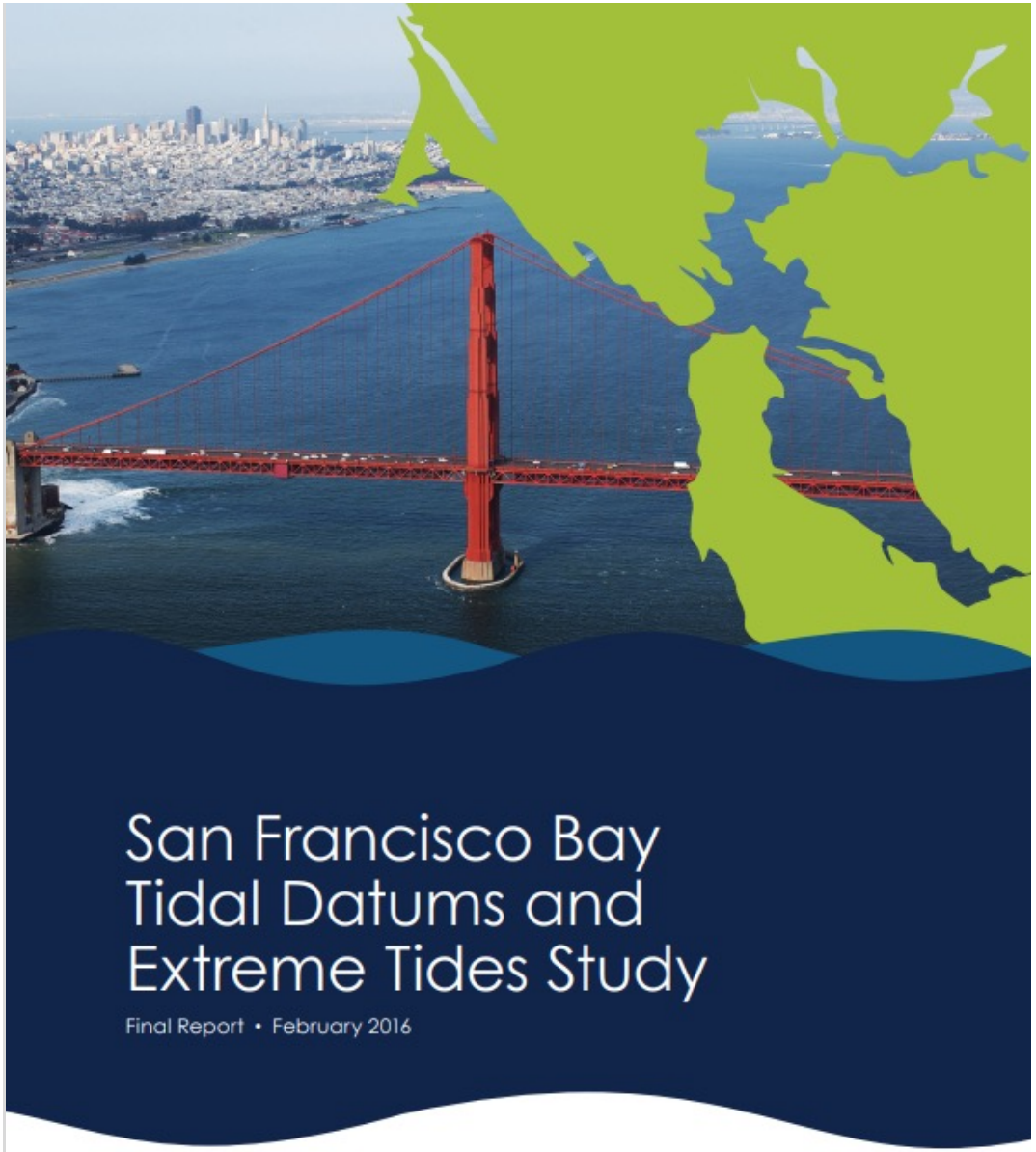
Managing urban flood risk in the San Francisco Bay and Delta: an ongoing challenge



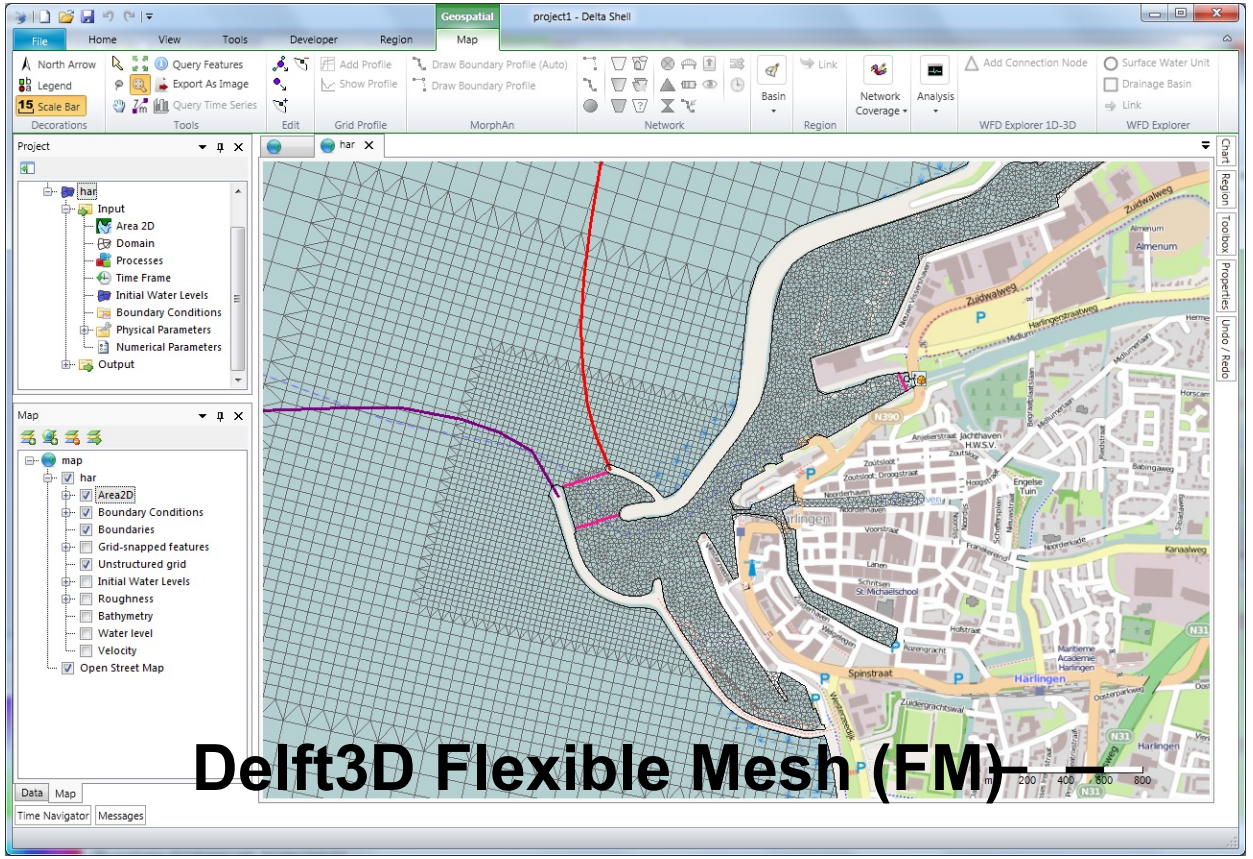
Complication with previous model efforts

- A lot of different numerical models have been developed to study complex hydrodynamics in the San Francisco Bay and Delta (SFB&D).

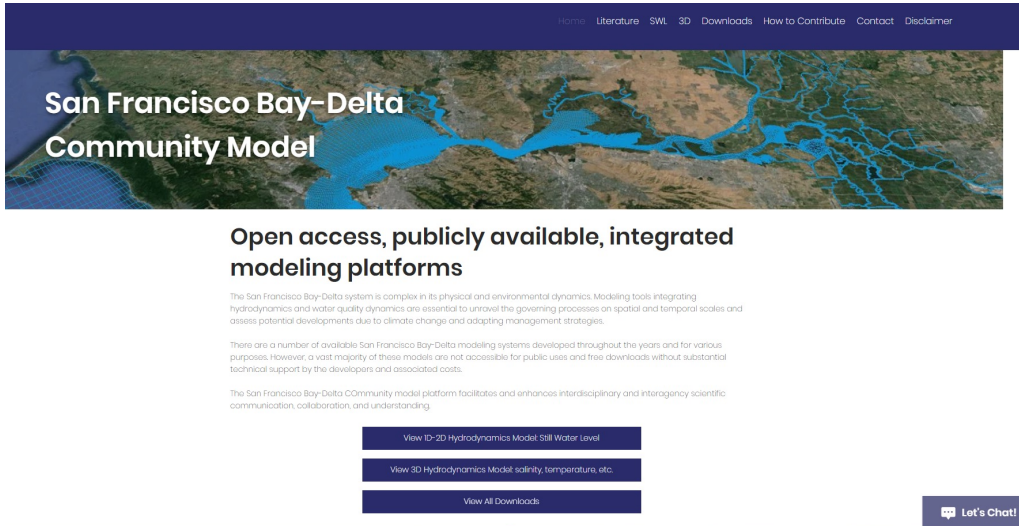
- However, existing models are limited by:
  - Proprietary software
  - Limited support/maintenance
  - Model extent
  - Private model schematizations
  - Not designed for flood protection



Solution: open-source software and public domain model schematizations with access to the public



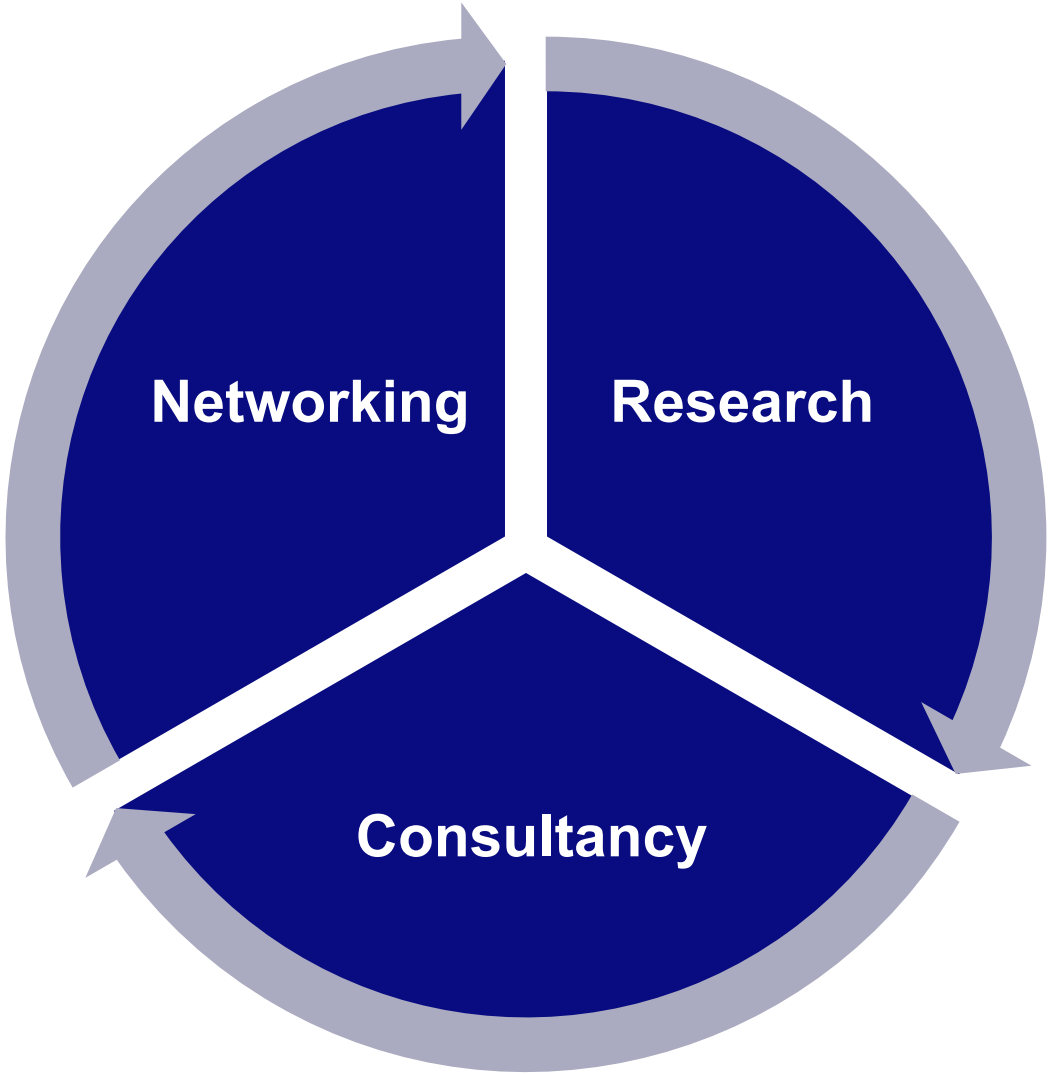
Delft3D Flexible Mesh (FM)



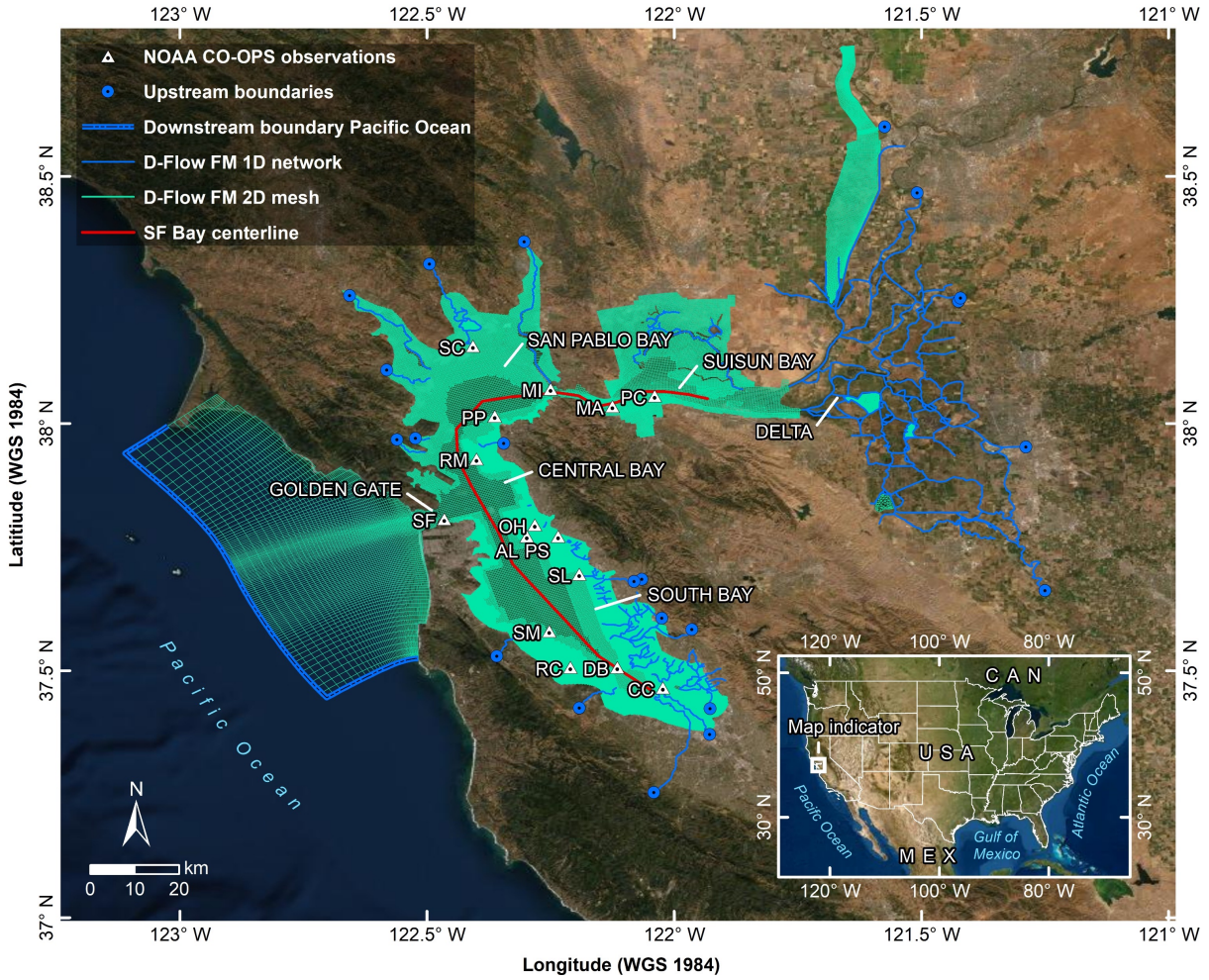
https://www.d3d-baydelta.org/

Concept of the community model

- The community model concept creates a standard model setup for everyone.
- **Research :** Open-source and open-access developments + Scientific feedback and progress
- **Consultancy:** Scientific basis for sound consultancy
- **Networking**: Involvement of several institutes & continuous building with multiple discipline and parties



Next generation of the Community Model



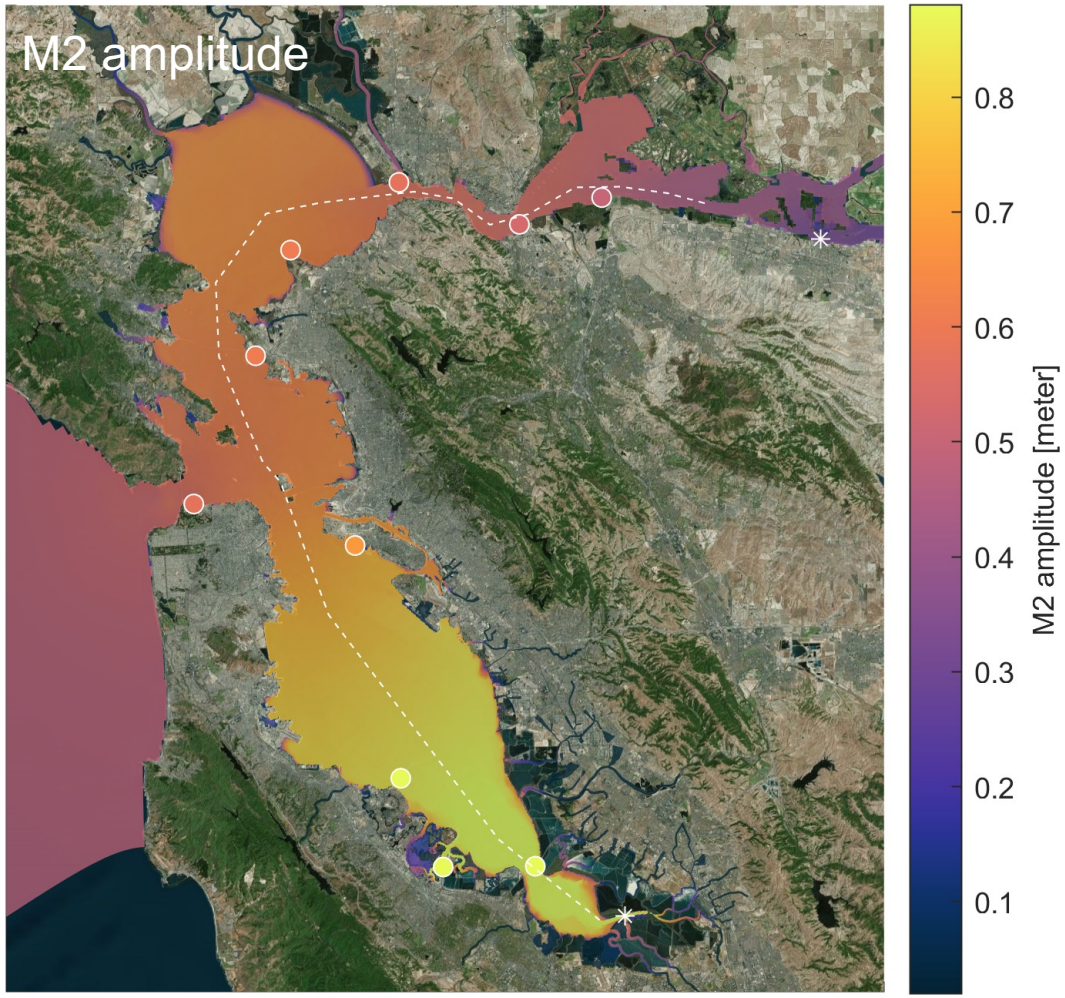
Nederhoff, K., Saleh, R., Tehranirad, B., Herdman, L., Erikson, L. H., Barnard, P. L., & van der Wegen, M. (2021)

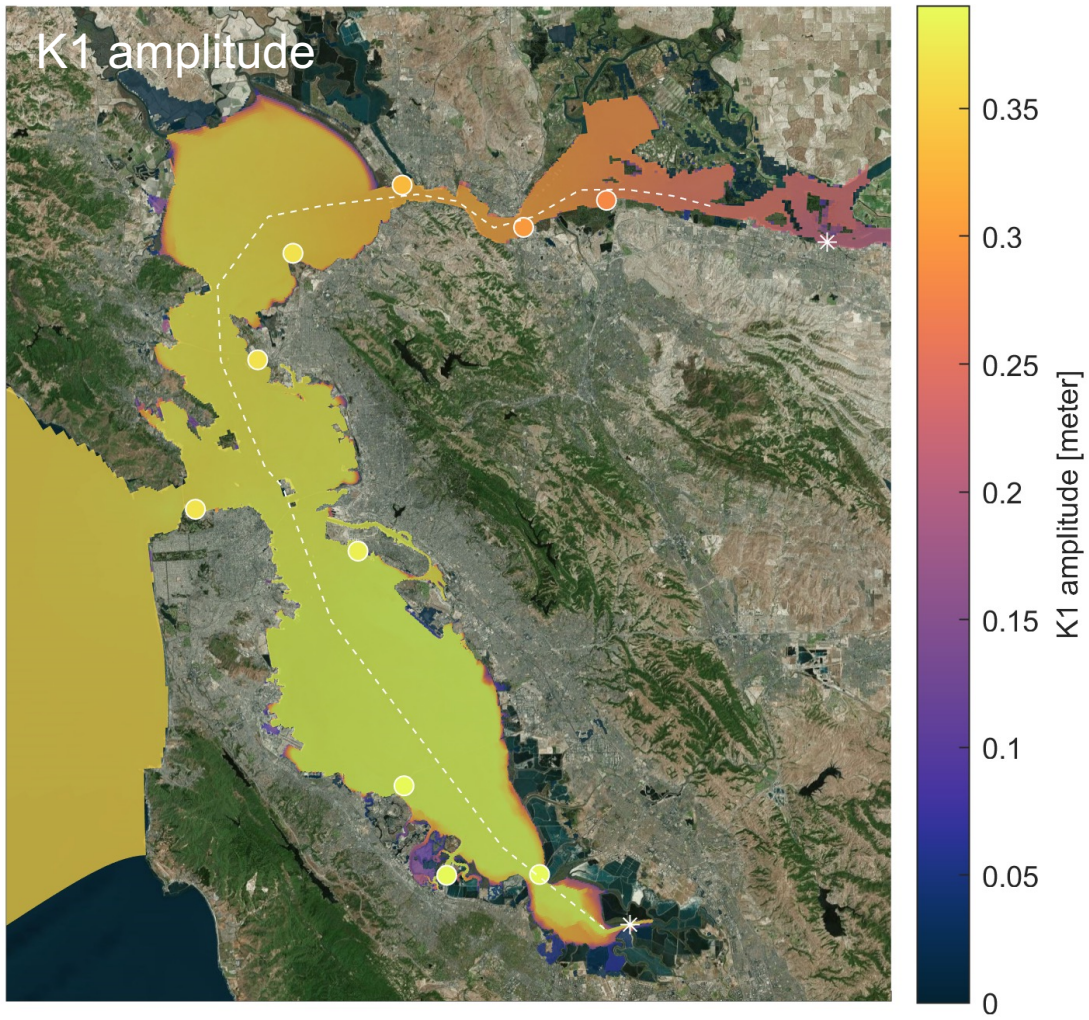
Drivers of extreme water levels in a large, urban, high-energy coastal estuary – a case study of the San Francisco Bay

Coastal Engineering, 170, 103984. https://doi.org/10.1016/j.coastaleng.2021.103984

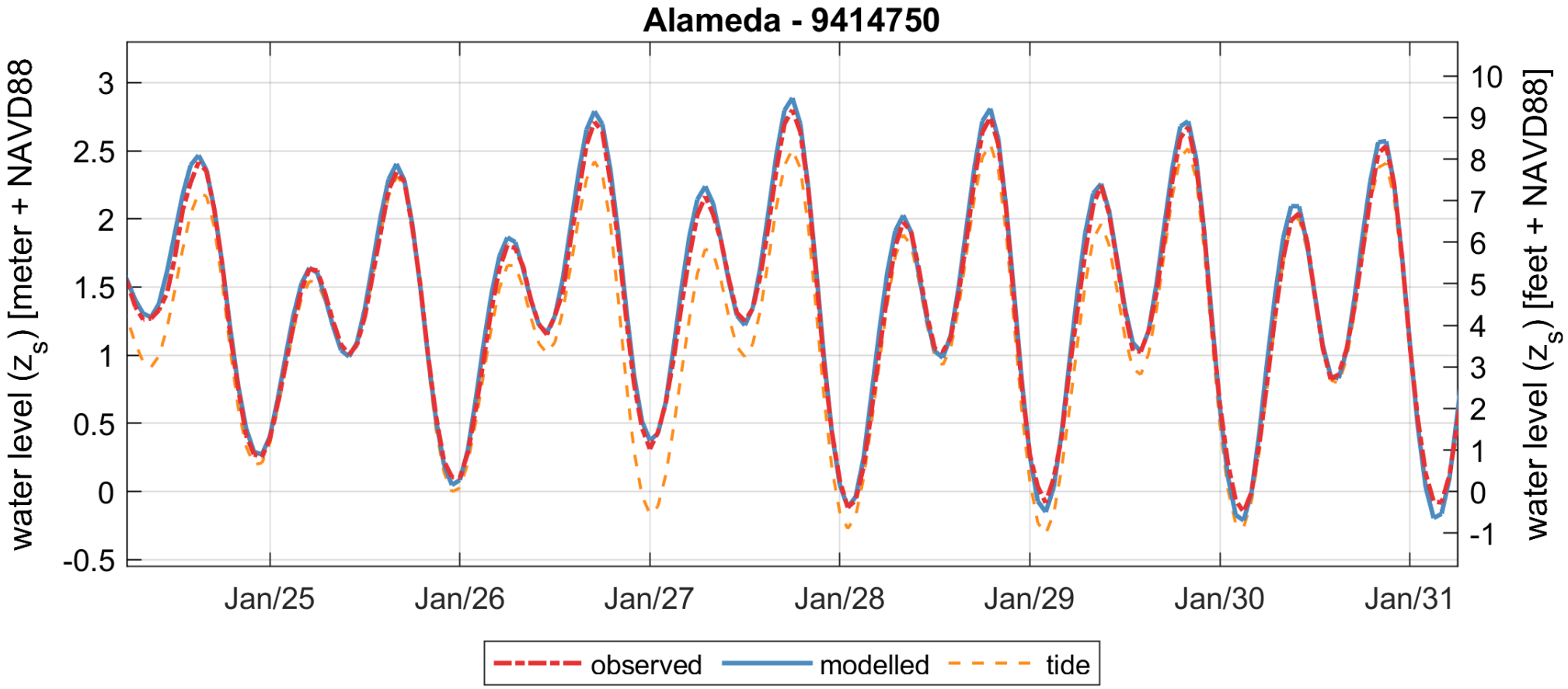
Read Article

Tides across the Bay calibrated and validation

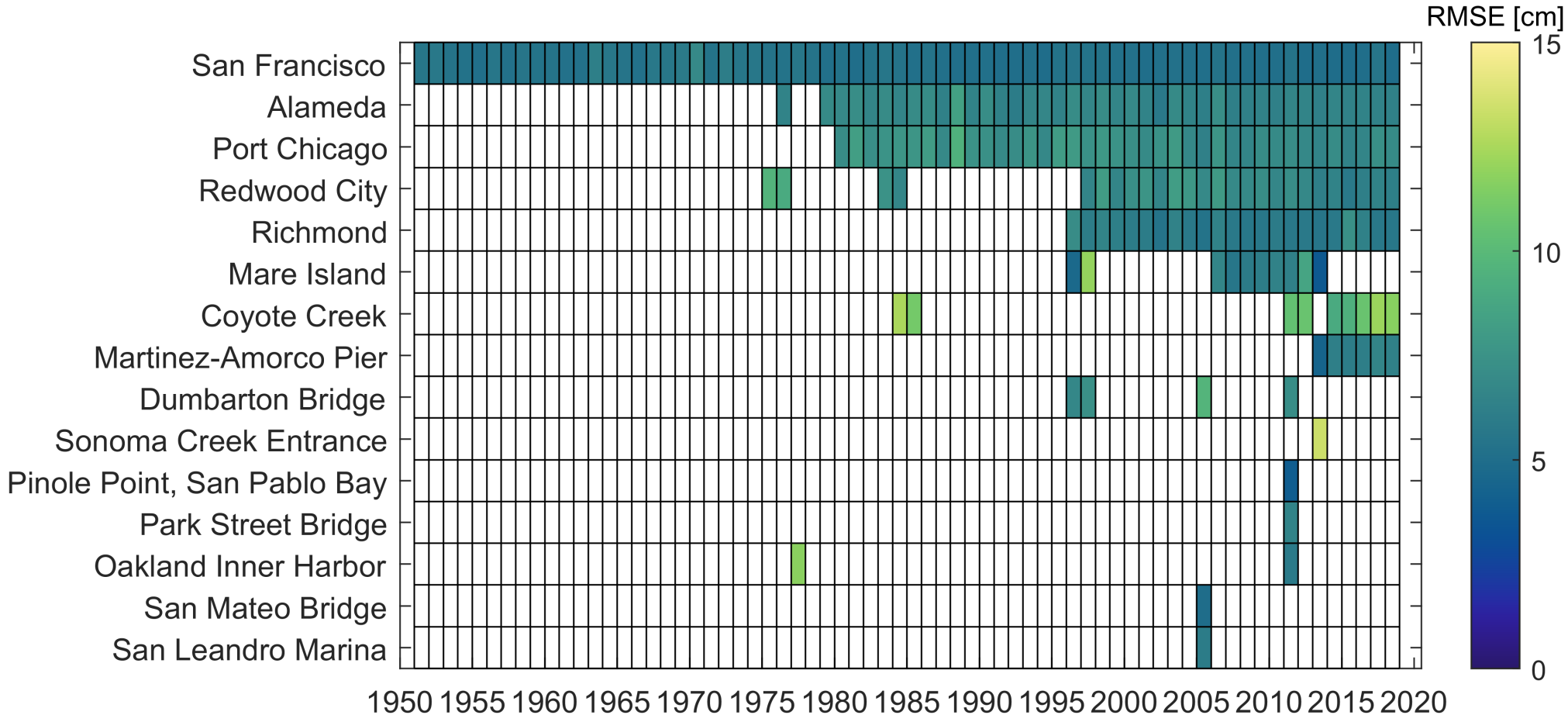




Extreme water level in the Bay are the result of high tide with surge (NTR) and validate well too



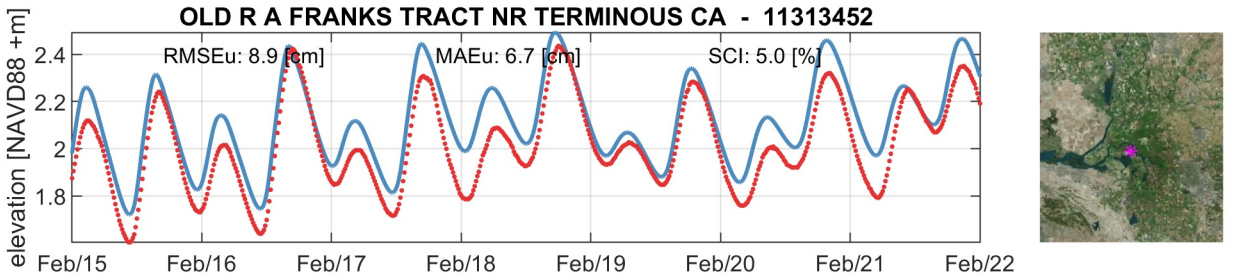
Validation shows that stations reproduced without any bias and with errors <10 cm or <4 inches



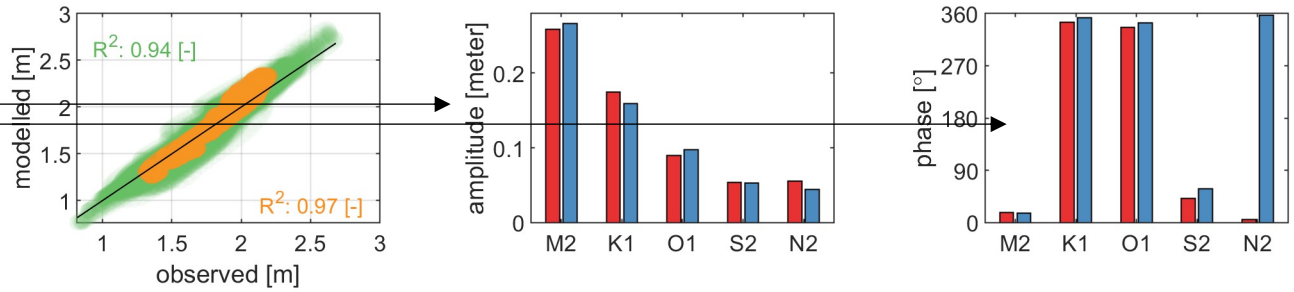
Regional focus, but validation of the 1D component in Bay and Delta looks also sufficient

WY2017

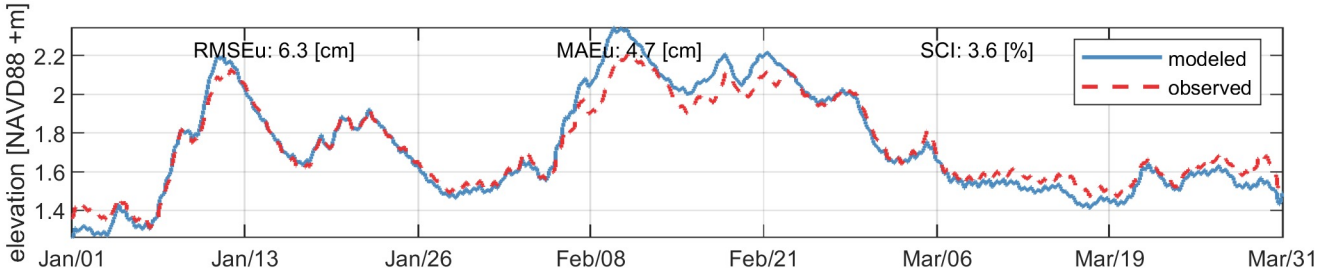
instantaneous gauge height



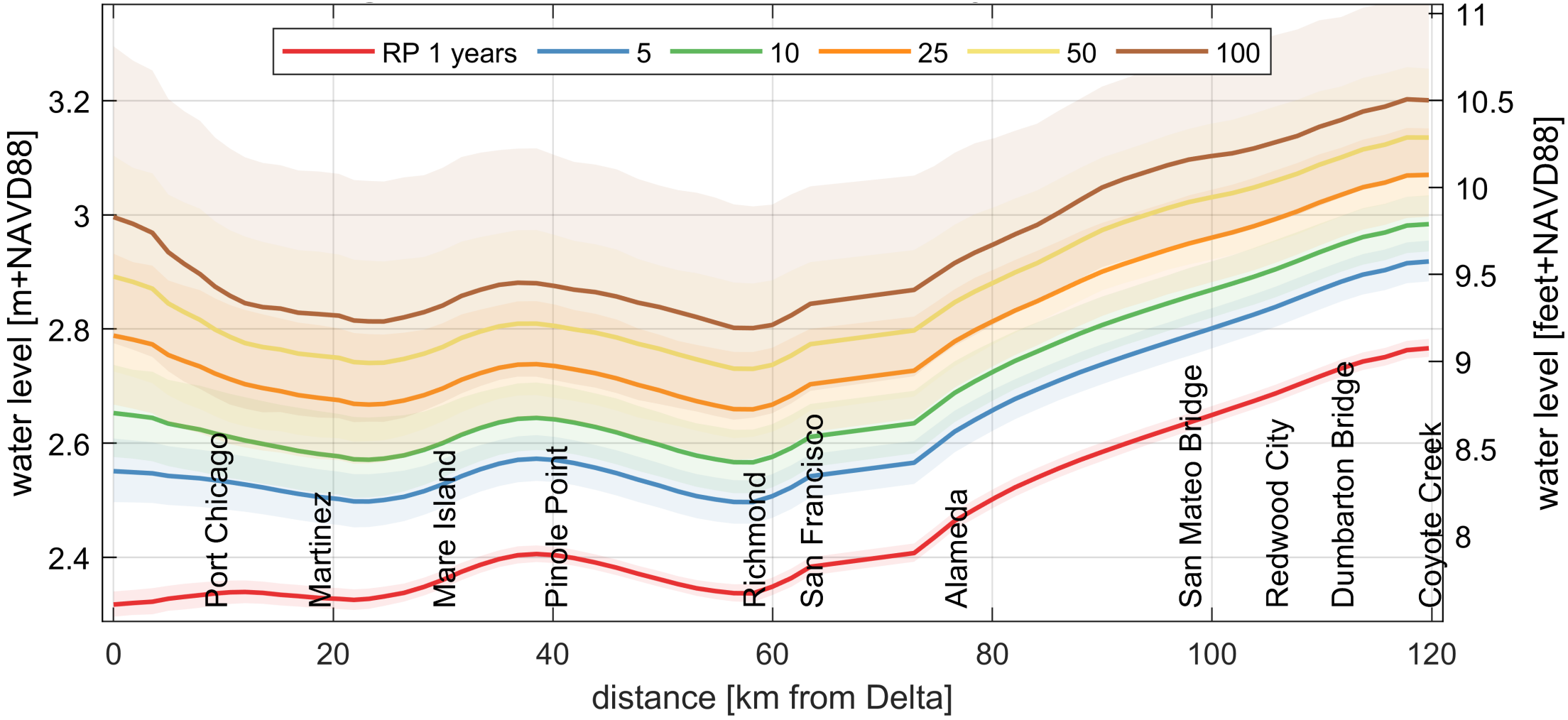
tidal reproduction



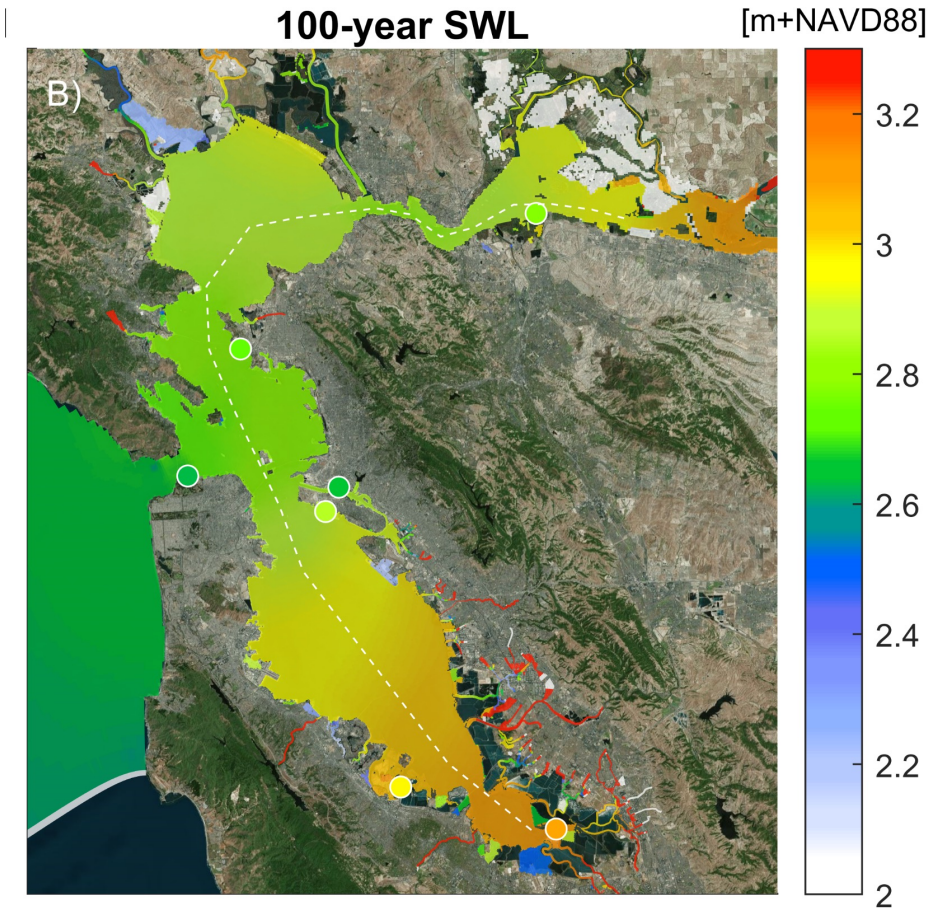
daily-averaged gauge-height

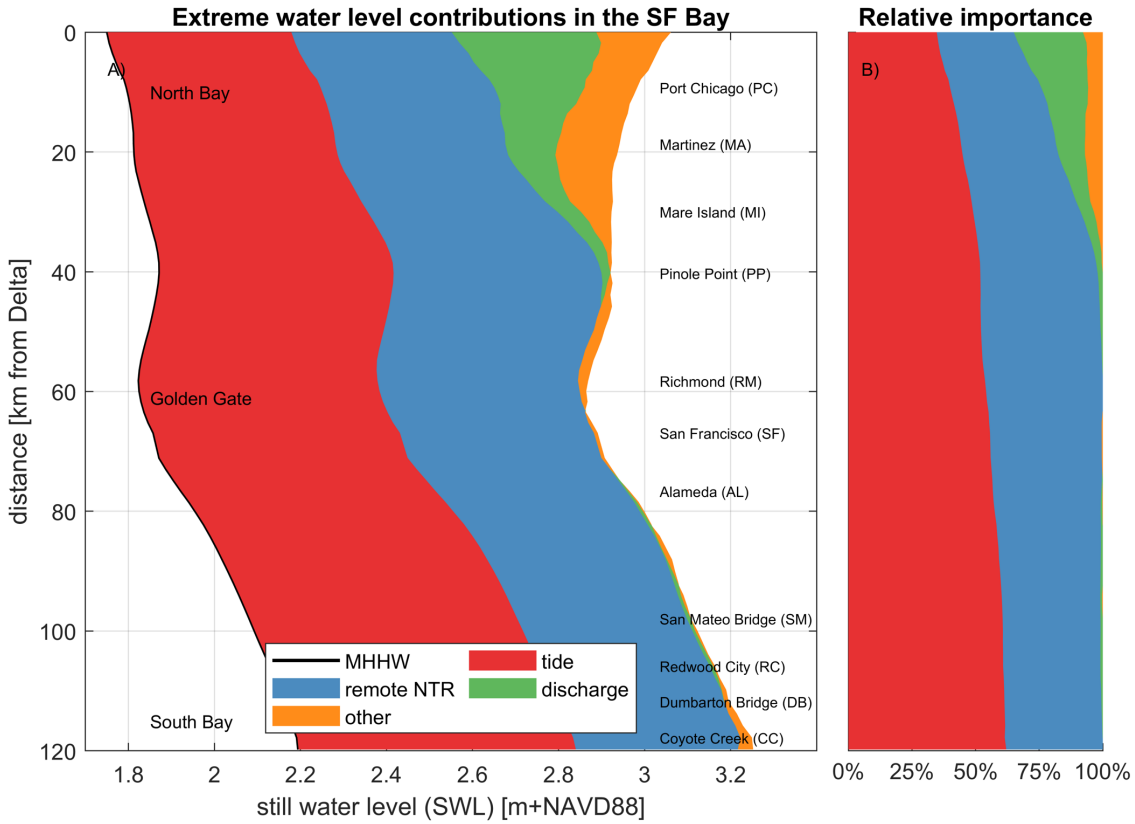


Extreme estimates across Bay based on POT/GPD

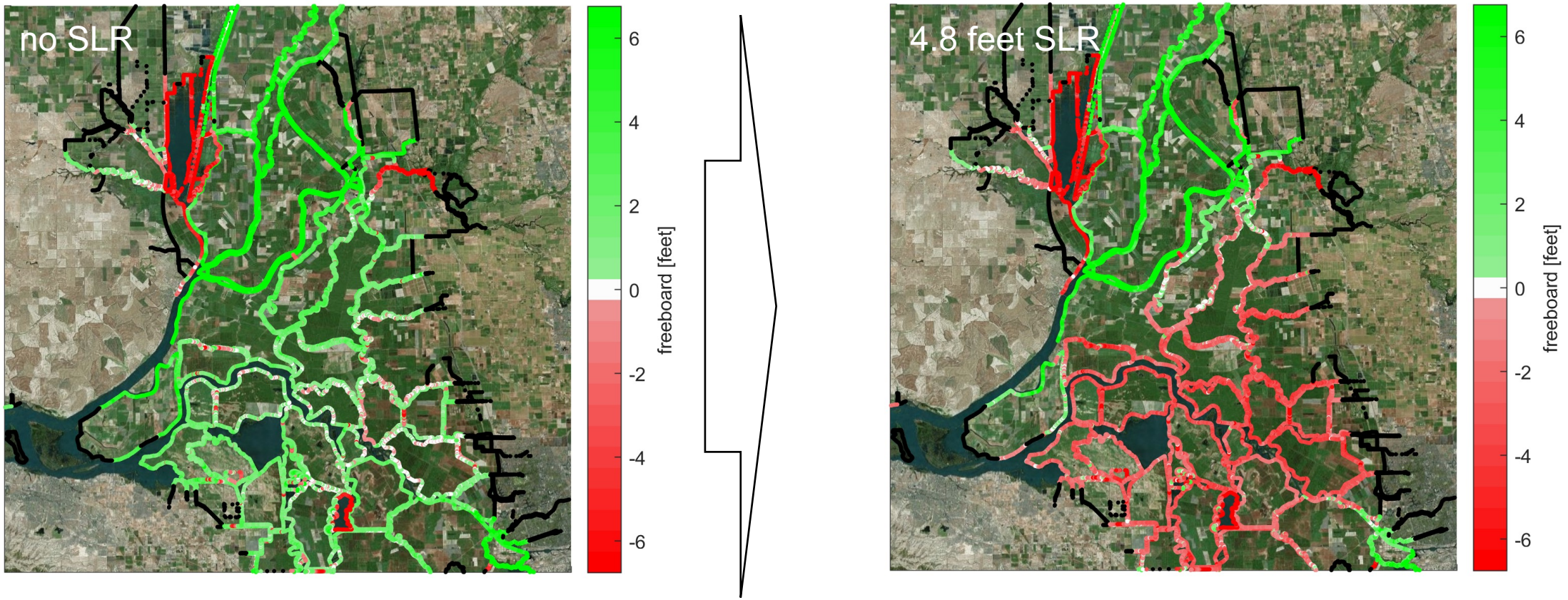


1–100-year extreme reaches 2.8 – 3.2m and is largely driven by tide and *remote* sea level anomalies (NTR)

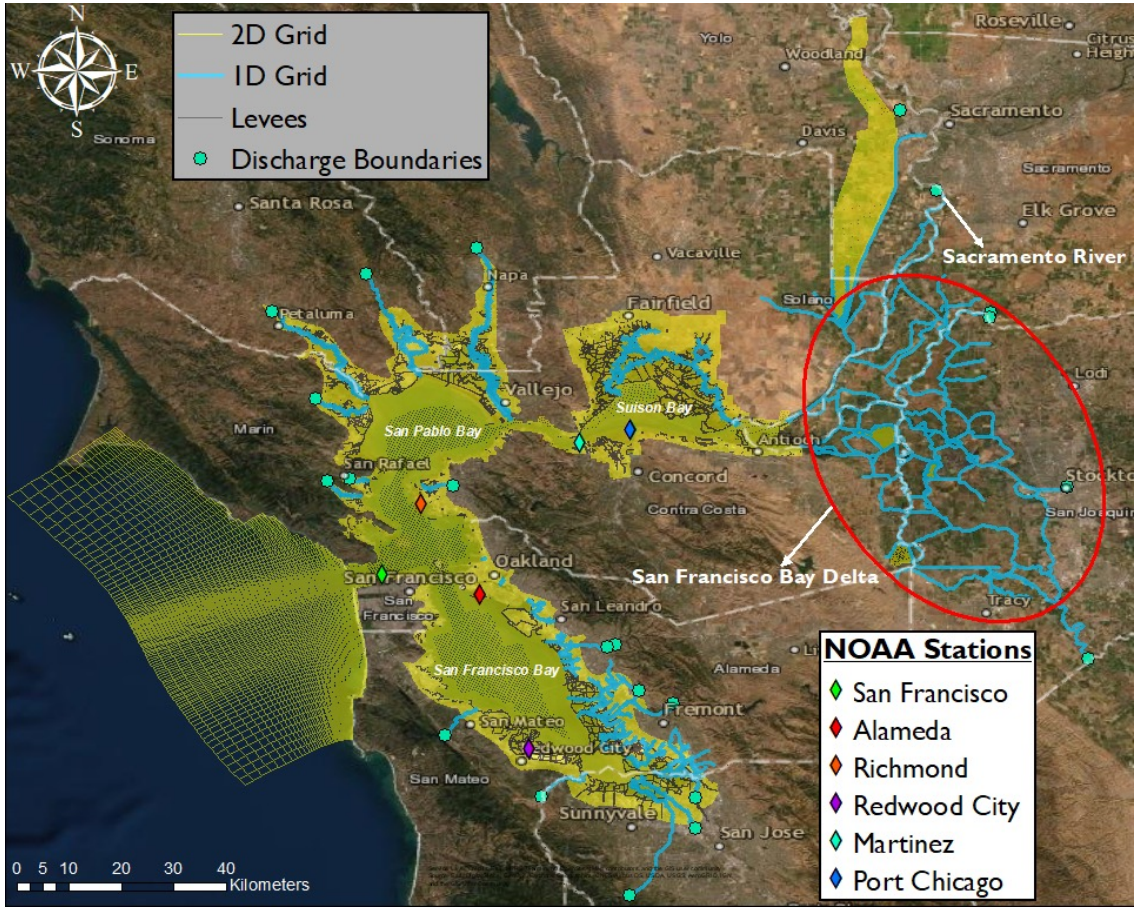


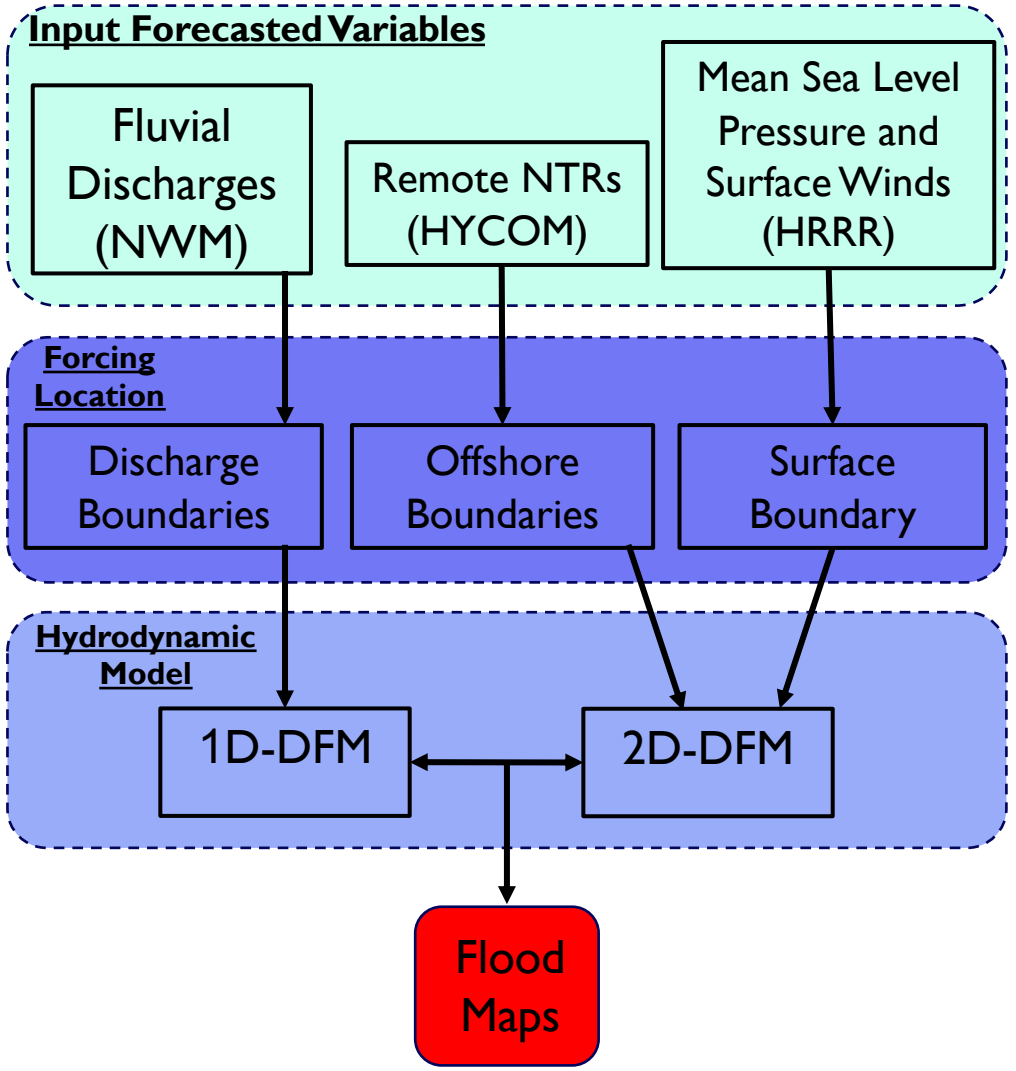


Extreme water levels (1-100 year) in the Delta will start to overtop more-and-more existing levees due to SLR



Same schematization used for real-time forecasting of still water level across the Bay with USGS and NOAA





https://psl.noaa.gov/aqpi/

Conclusions

- Current models for the San Francisco Bay and Delta, have limitations such as usage of proprietary software, limited support/maintenance, model extent and not designed for flood protection purposes in the current and future climate.

- Open-source software based on Delft3D-FM and community modelling (public domain) ensures public access for all and is therefore beneficial for research, consultancy and networking across the San Francisco Bay and Delta .

- Model results for 70 years validate well during daily tidal and episodic storm conditions. Subsequent extreme value analysis based on POT/GPD can inform resilient design of flood protection features.

- The next generation of the San Francisco Bay & Delta Community Model is released. For more information and for all the data and science, please visit www.d3d-baydelta.org. Anyone can use the model as a backbone for their planning studies.

The next generation of the San Francisco Bay-Delta Community Model

Public domain modeling in support of flood protection and forecasting

Contact Kees Nederhoff for more information on Kees.Nederhoff@deltares-usa.us

CWEMF annual meeting 2022

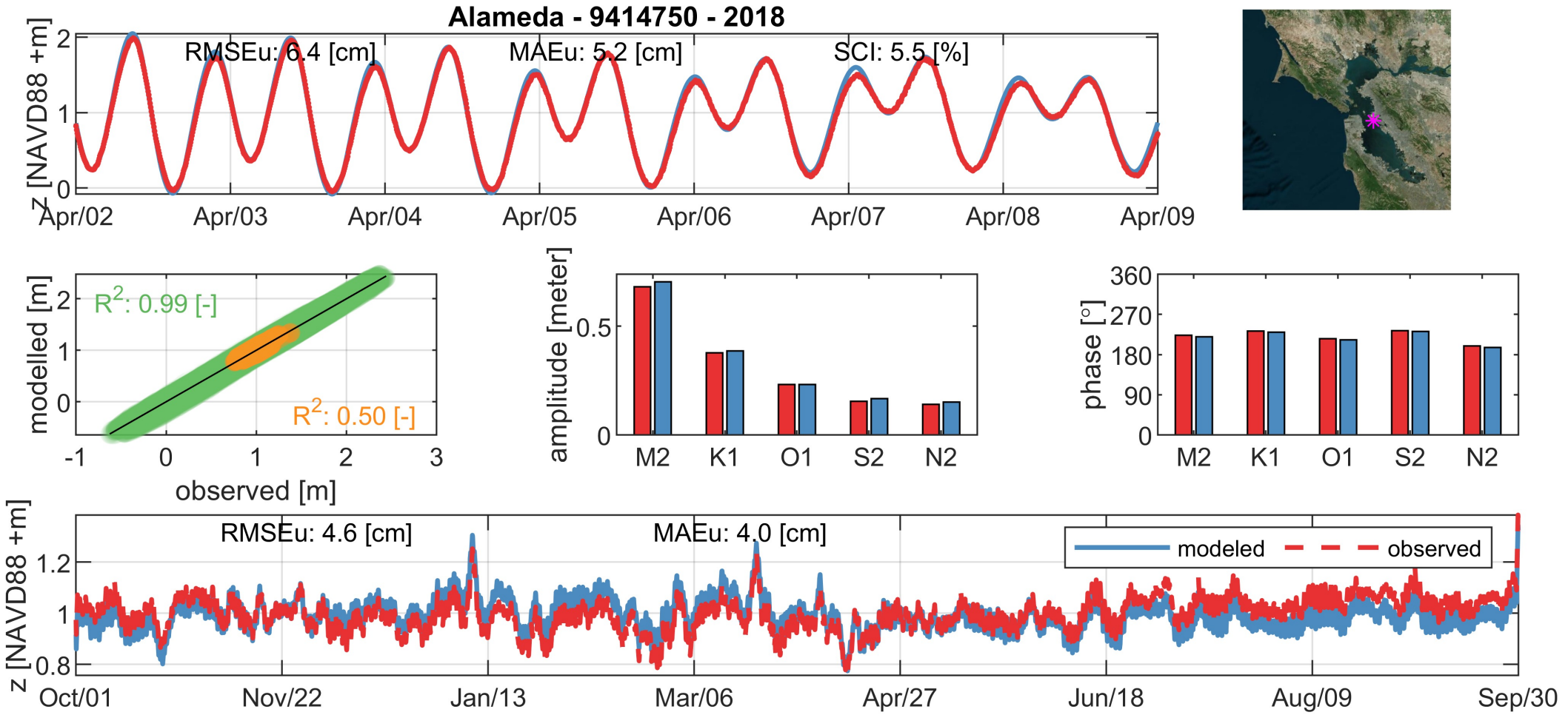
Next steps

- Move discussion to resilience planning across the San Francisco Bay and Delta
  - Discover the effectiveness of different adaptation strategies (*on going work*)
  - CIrcle: Critical Infrastructures: Relations and Consequences for Life and Environment.
  - Dynamic Adaptive Policy Pathways (DAPP) approach to support the development of an adaptive plan that is able to deal with conditions of deep uncertainty (sea level rise)

- Joint probability analysis of marine and fluvial drivers of extreme water levels in local tributaries and riverine system in the San Francisco Bay and Delta to inform planning purposes across County and State efforts

- Connect regional hydrodynamic model with sewer systems with Delft3D-Urban
  - *Pilot with Alameda Flood Control District*

Still water levels are reproduced well across the Bay



Extreme value analysis to determine high water levels are based on POT/GPD instead of AM/GEV