

A Numerical Model Analysis of the San Francisco Bay and Sacramento-San Joaquin Delta

Drake Abrahamsson

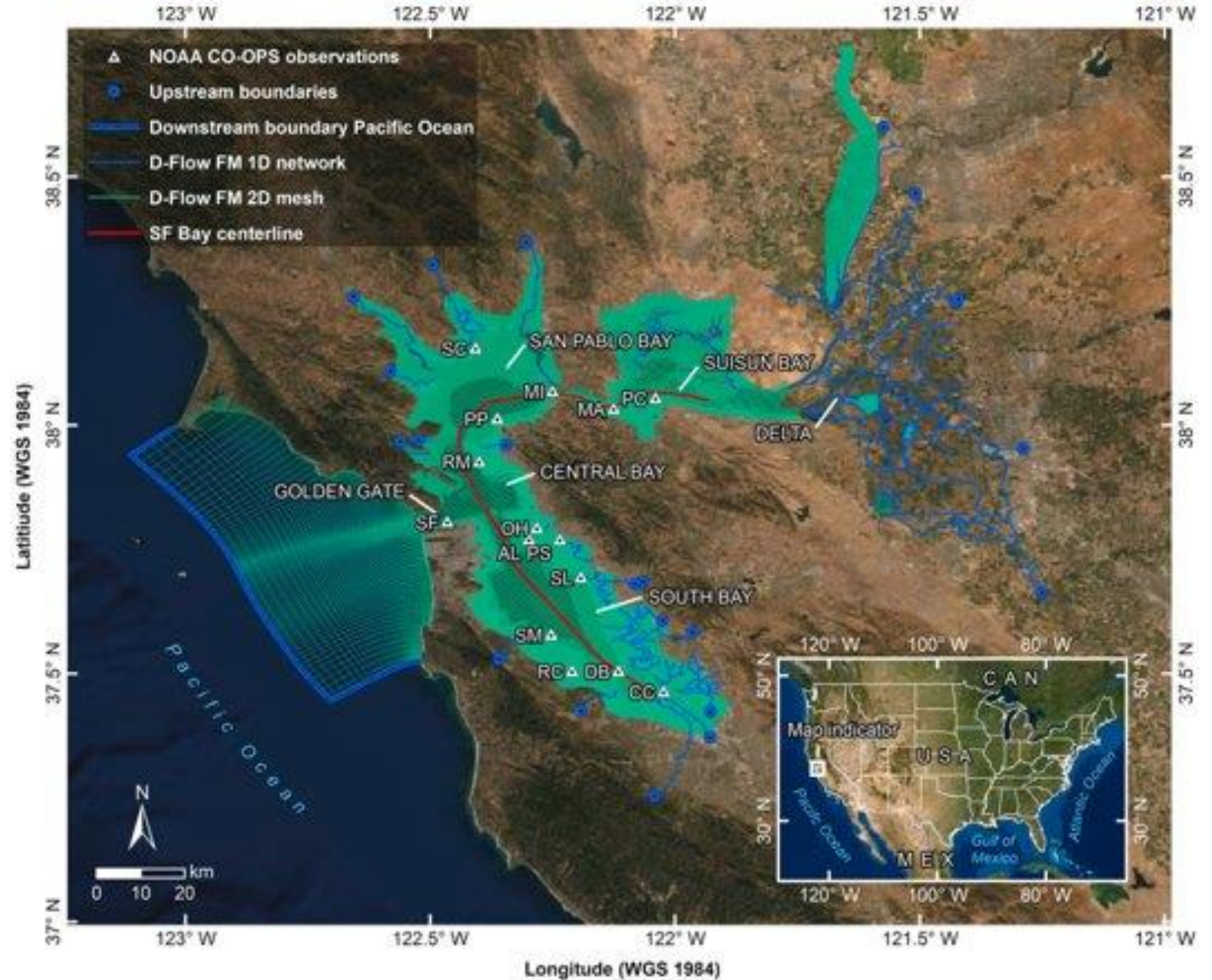
Dr. Stefan Talke
Dr. Serena Lee

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Department of Civil
& Environmental
Engineering

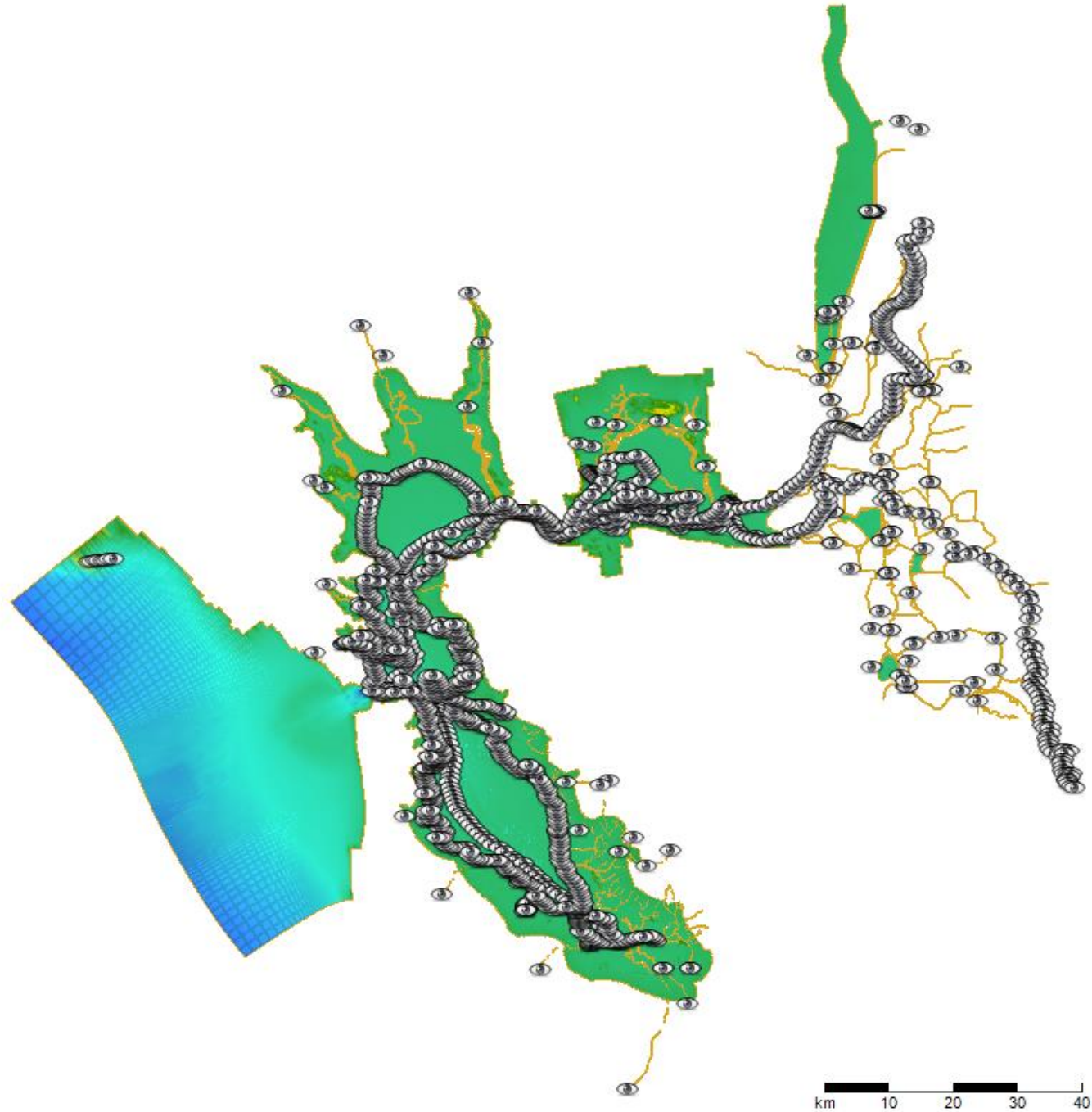
CSU-Water
March 13th, 2023

Delft3D- 1D 2D Flexible Mesh Model



Nederhoff et. Al, Drivers of extreme water levels in a large, urban, high-energy coastal estuary – A case study of the San Francisco Bay, Coastal Engineering, Volume 170, 2021

Delft3D- 1D 2D Flexible Mesh Model



Processes

Tides



NOAA

Processes

Tides



NOAA

River & Creek Flow



ABC10 News

Processes

Tides



NOAA

River & Creek Flow



ABC10 News

Wind



Twitter.com/SFBayFerry

Processes

How do these processes lead to flooding at both small and large watersheds in the San Francisco Bay/Delta system?

Tides



NOAA

River & Creek Flow



ABC10 News

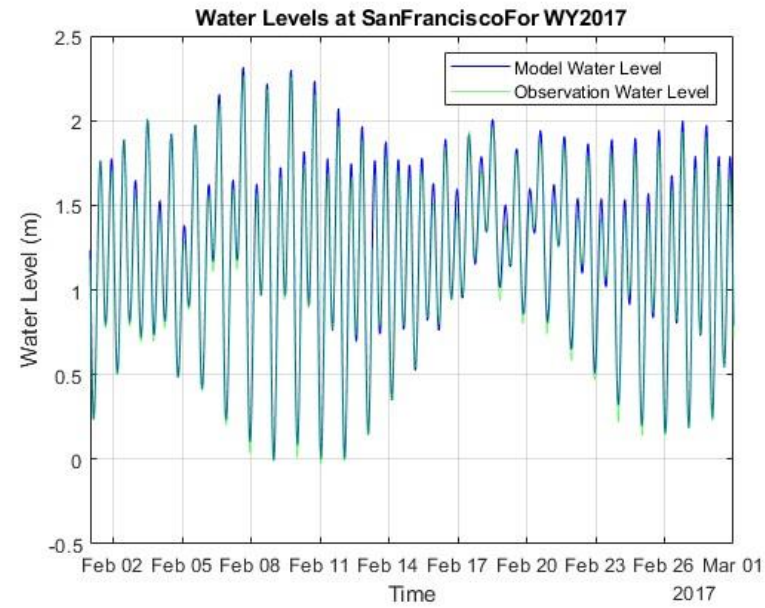
Wind



Twitter.com/SFBayFerry

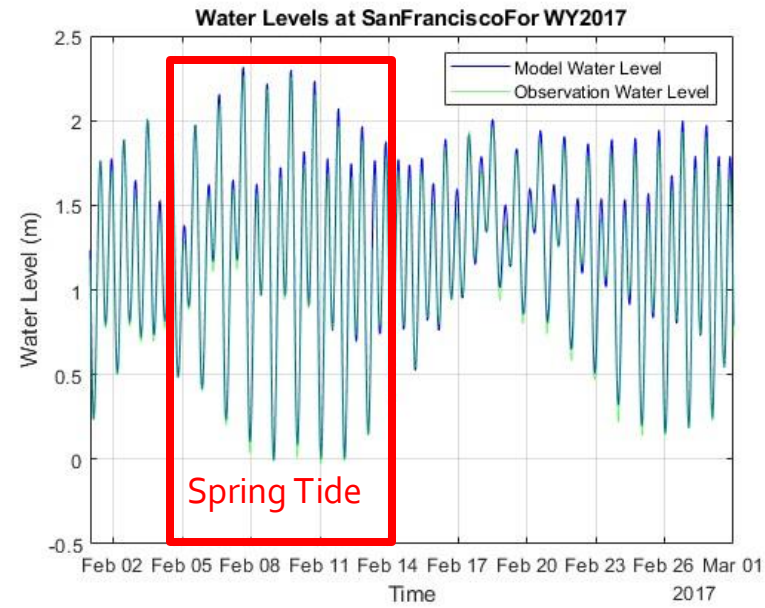
Model Verification

Water Levels



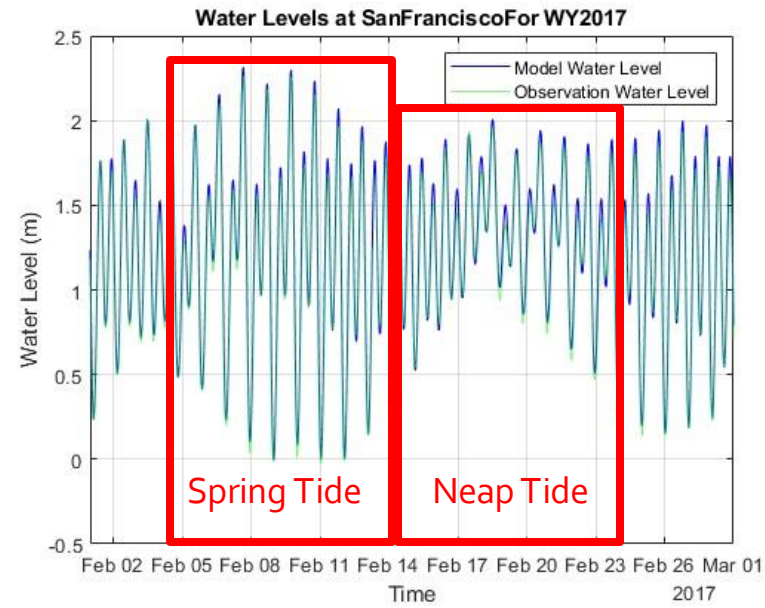
Model Verification

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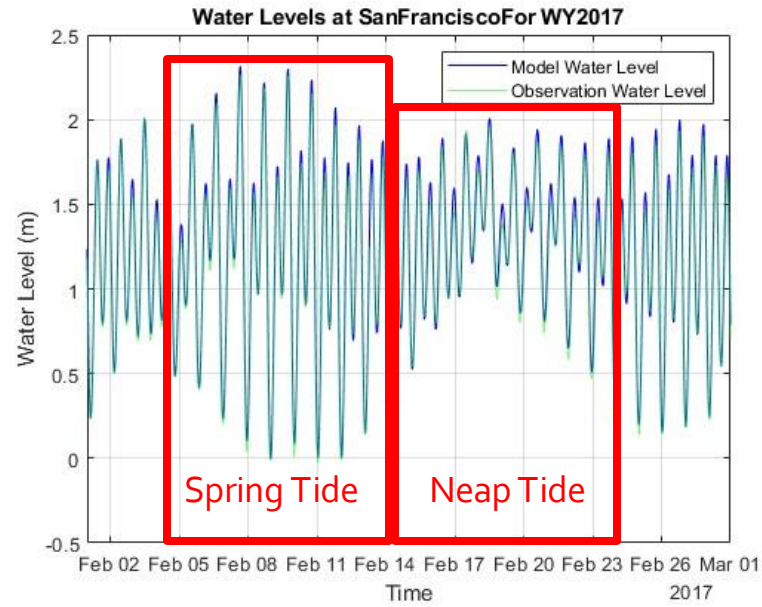
Model Verification

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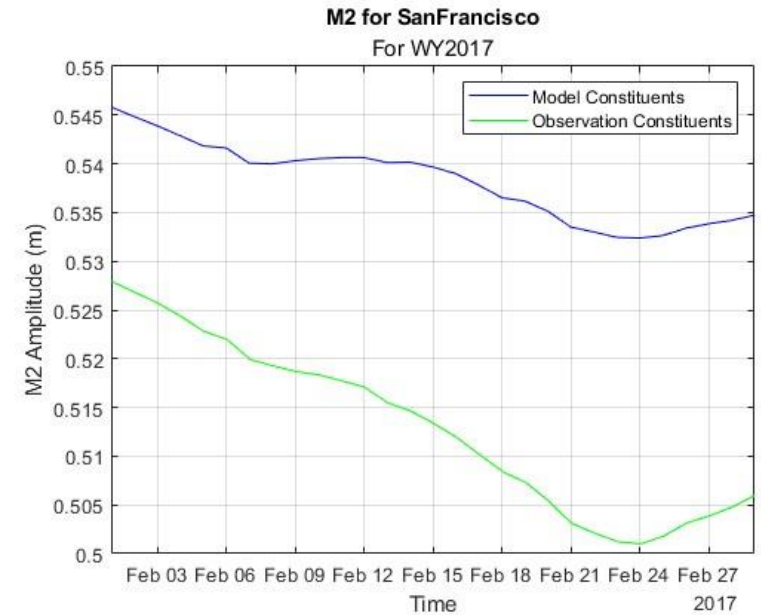


Model Verification

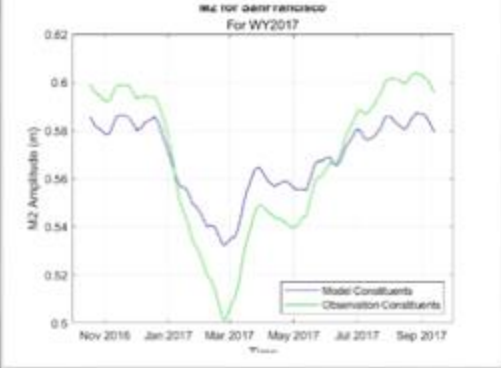
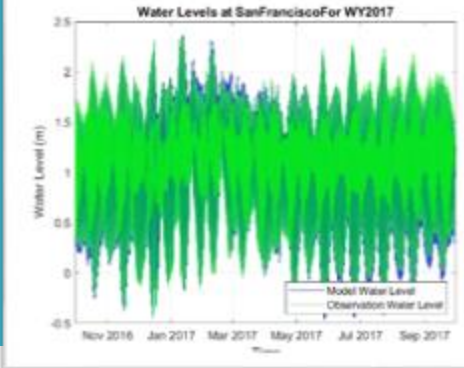
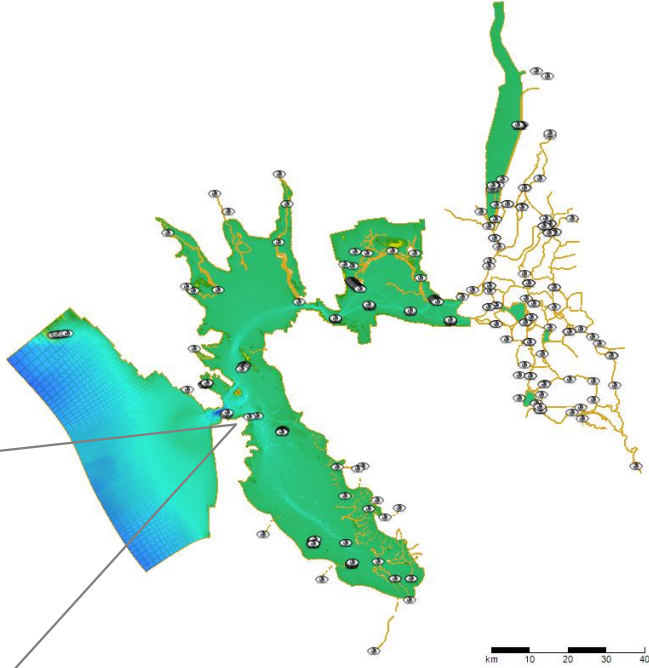
Water Levels



Tidal Constituent M2

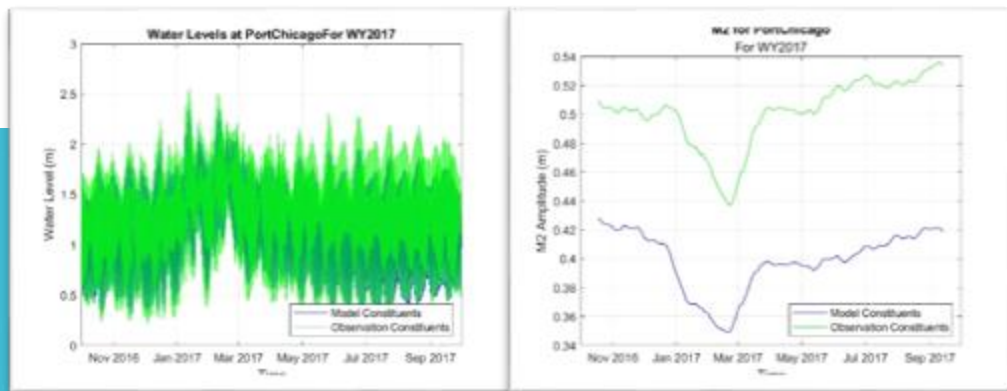


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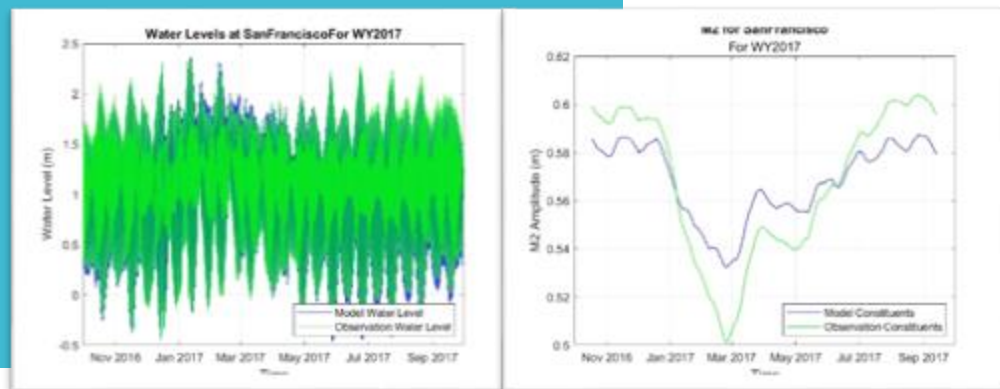
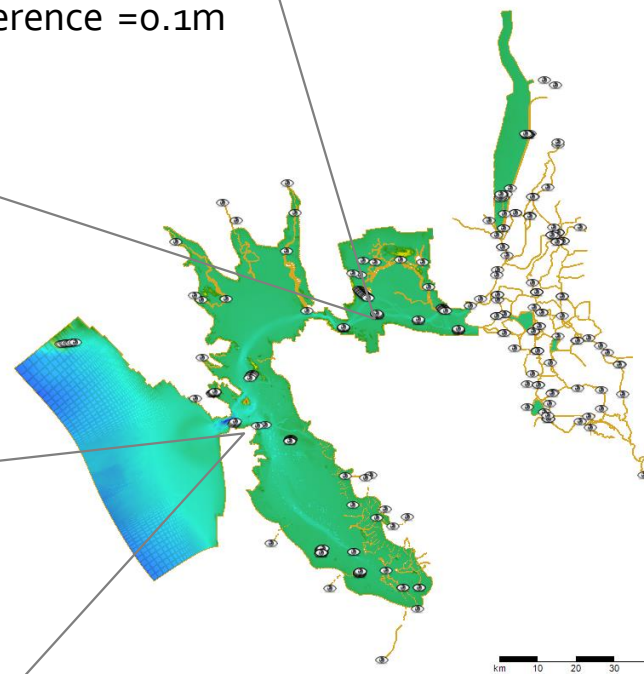


Average M2 Amplitude Difference = 0.03m

Model Verification

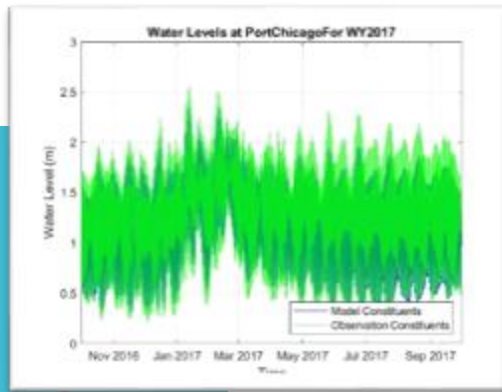


Average M2 Amplitude Difference = 0.1m

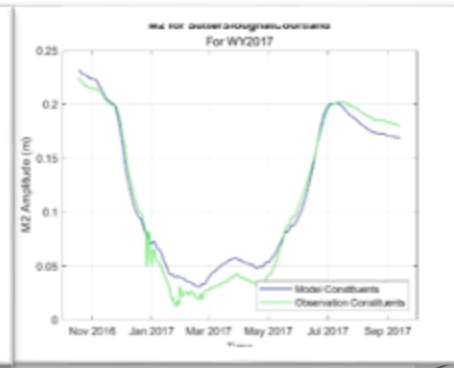
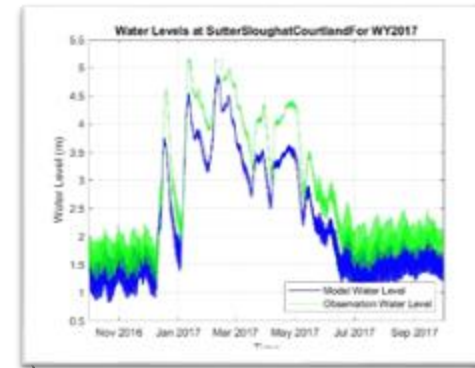


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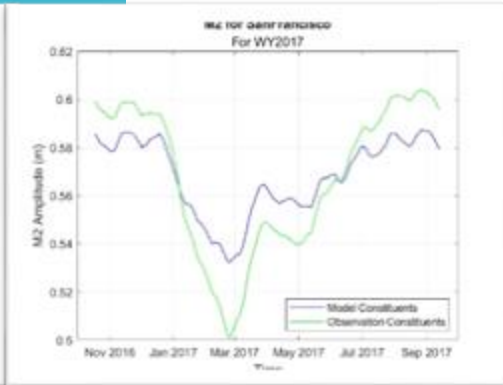
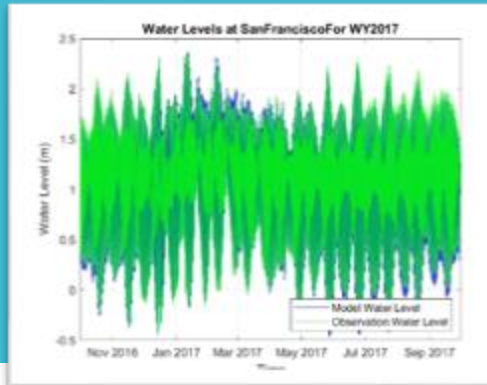
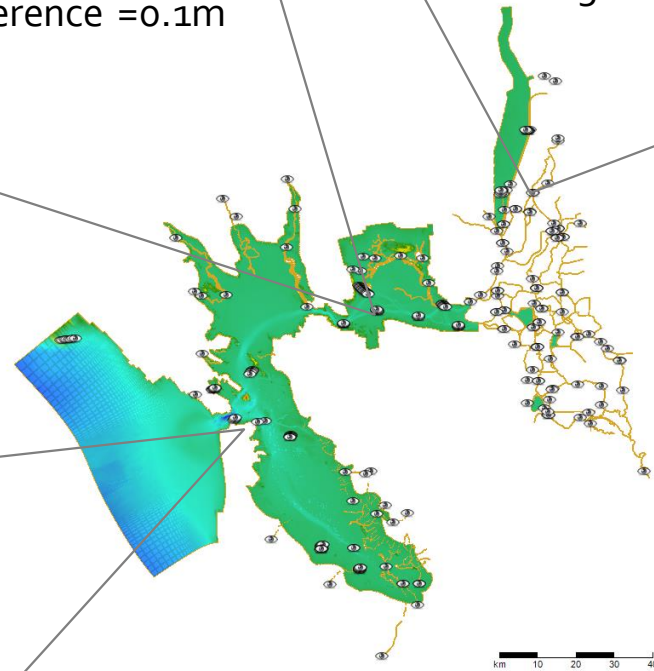
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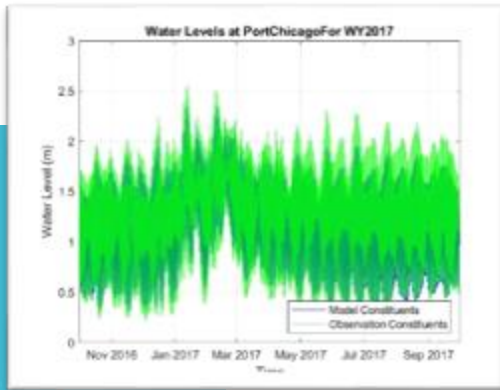


Average M2 Amplitude Difference = 0.01m
Average WL Difference = 0.5m

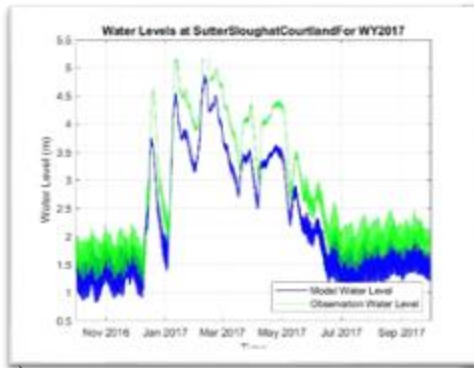


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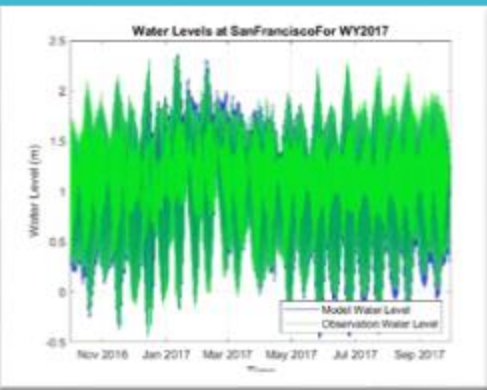
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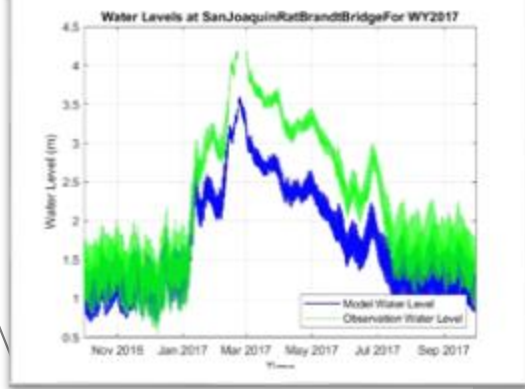
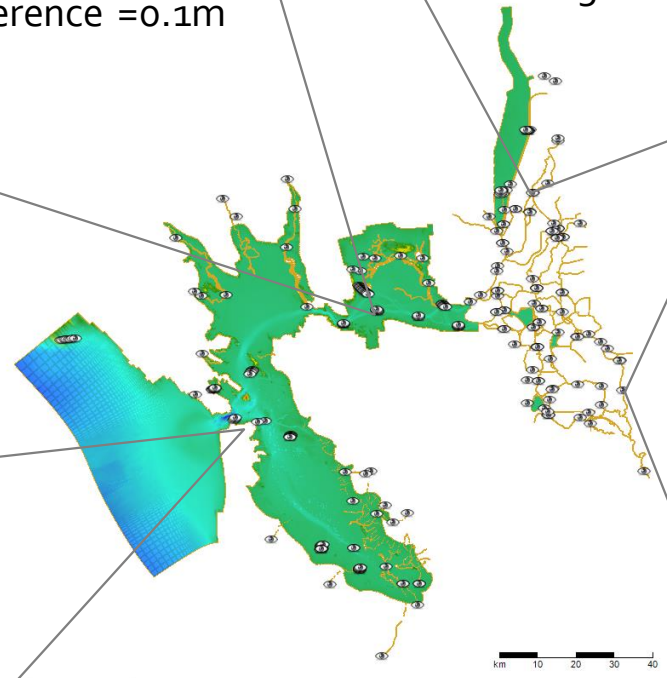
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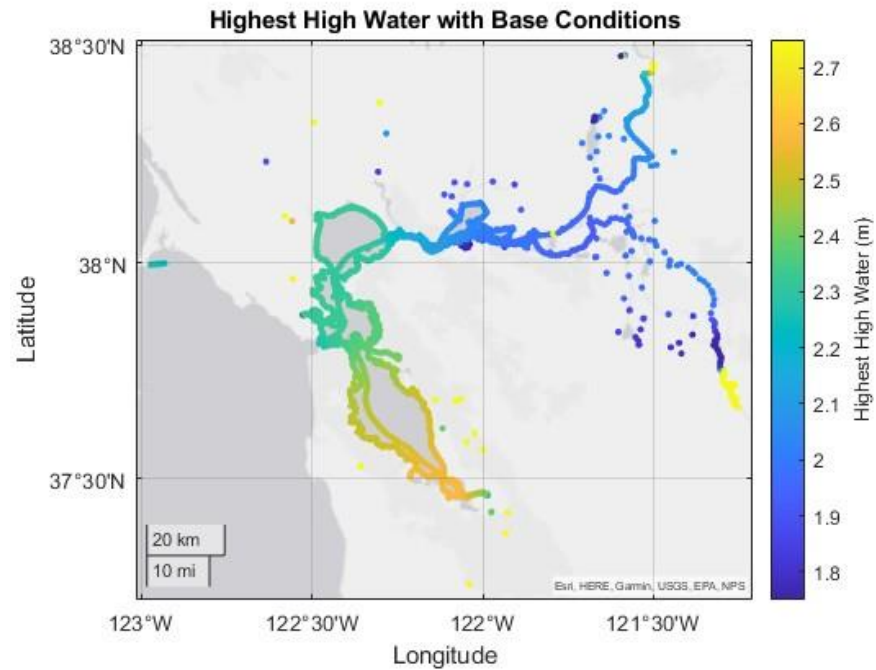


Average M2 Amplitude Difference = 0.03m



Average M2 Amplitude Difference = 0.025-0.80m
Average WL Difference = 0.75m

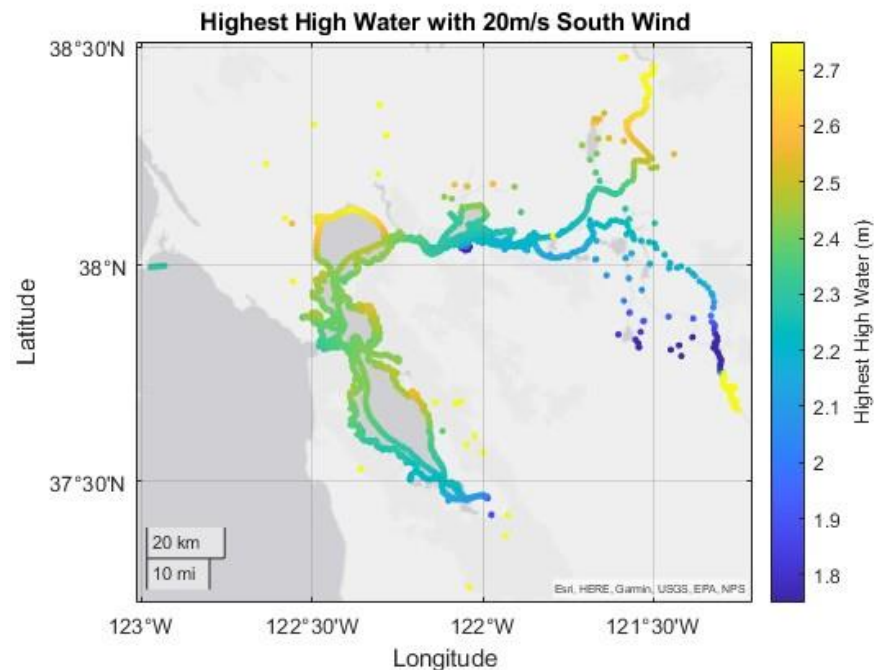
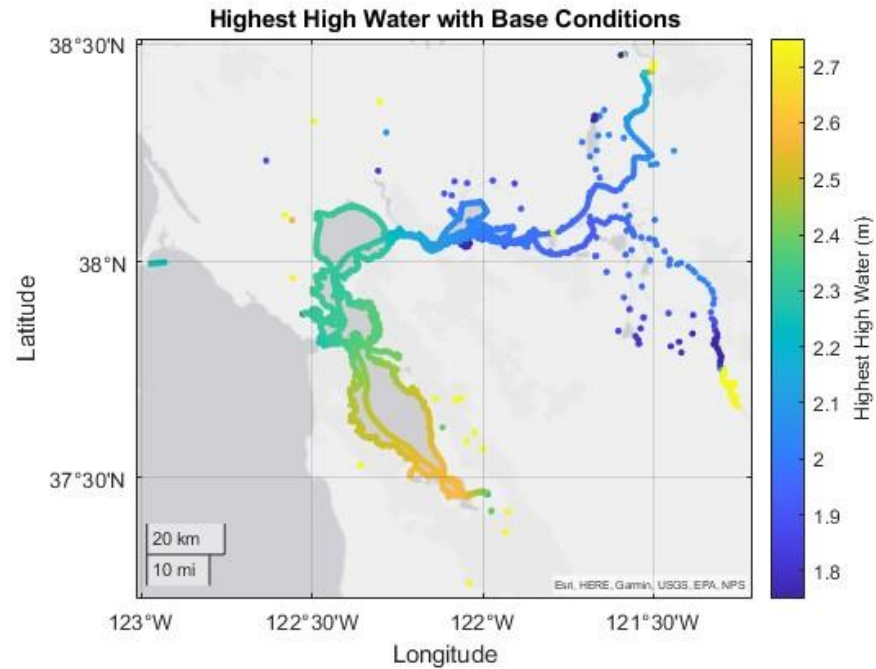
Experiments: Adding 20m/s of South Wind



Base Conditions:

- Real tidal conditions from 2017
- 300 m³/s river flow in the Sacramento River
- No wind
- Creek flow from smaller tributaries in the bay area

Experiments: Adding 20m/s of South Wind



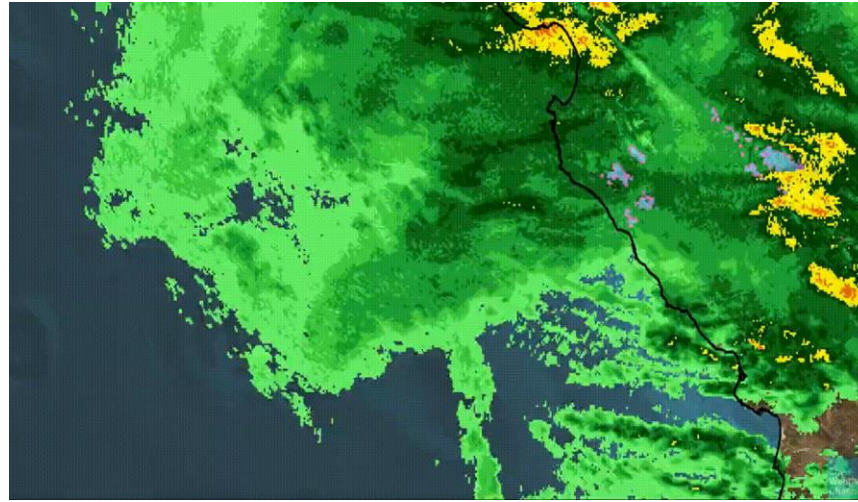
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South Wind Conditions:

- Base flow kept same
- 20 m/s (30 kts) of uniform Southerly wind added

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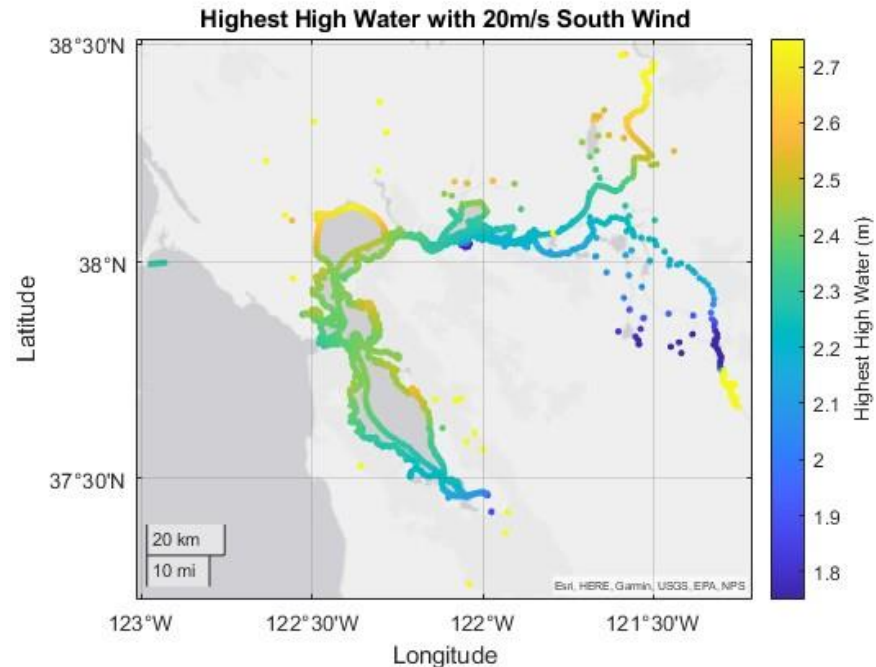


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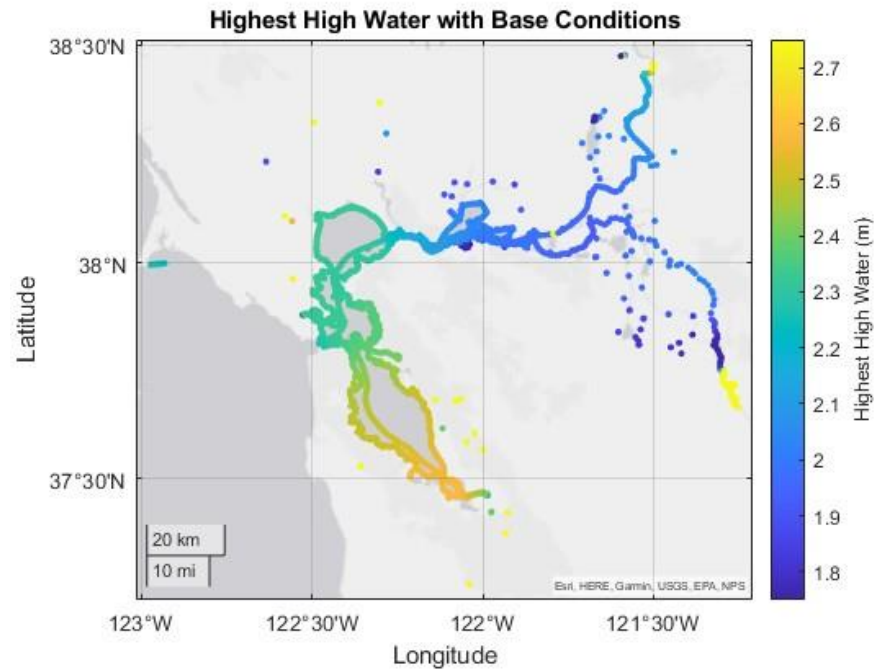
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Highway 37, CBS News

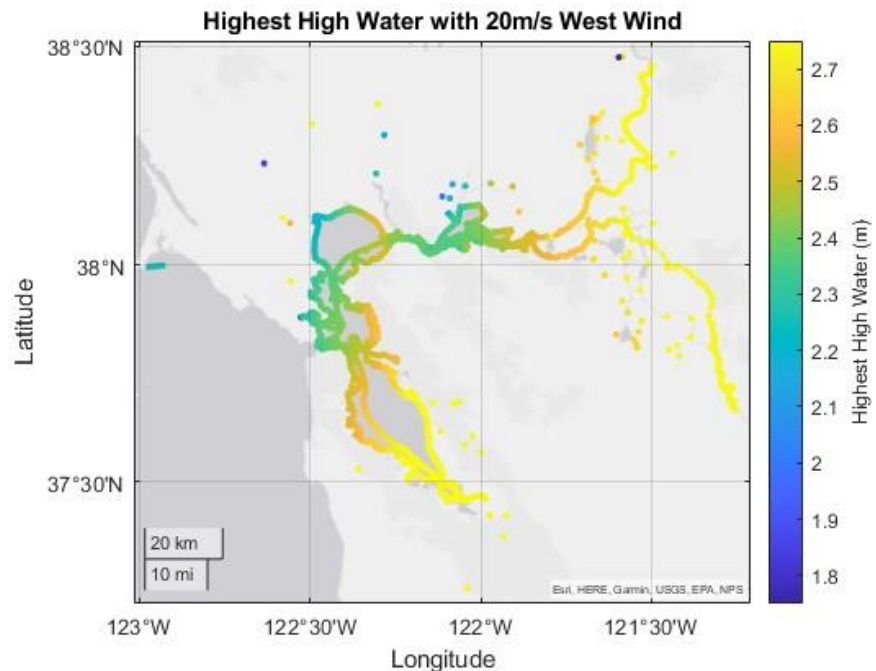
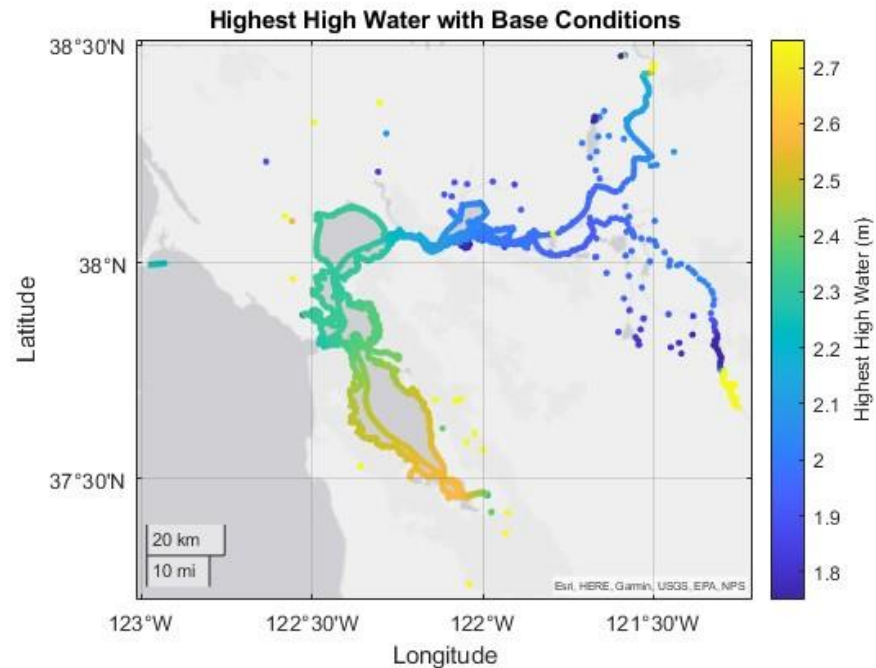
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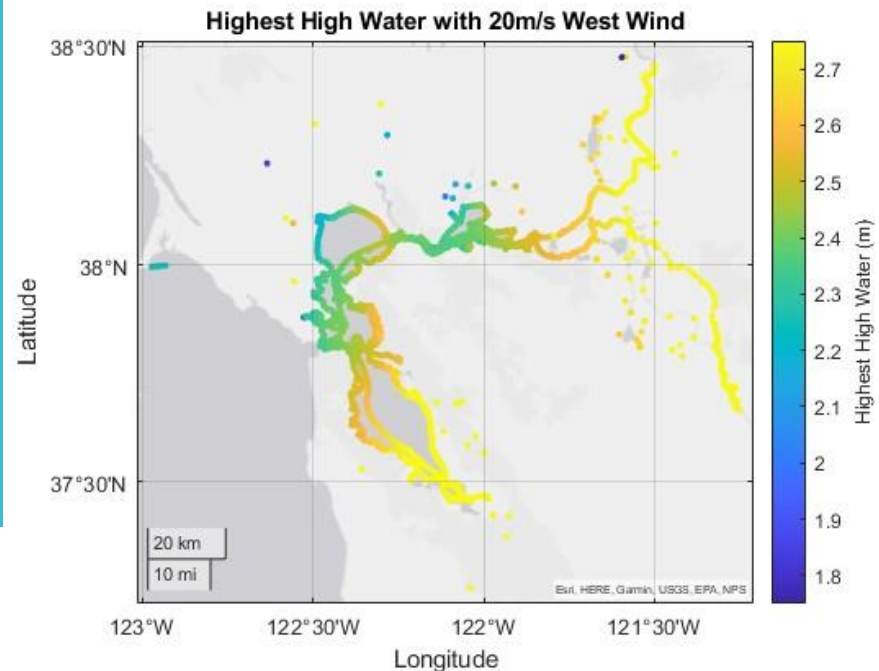
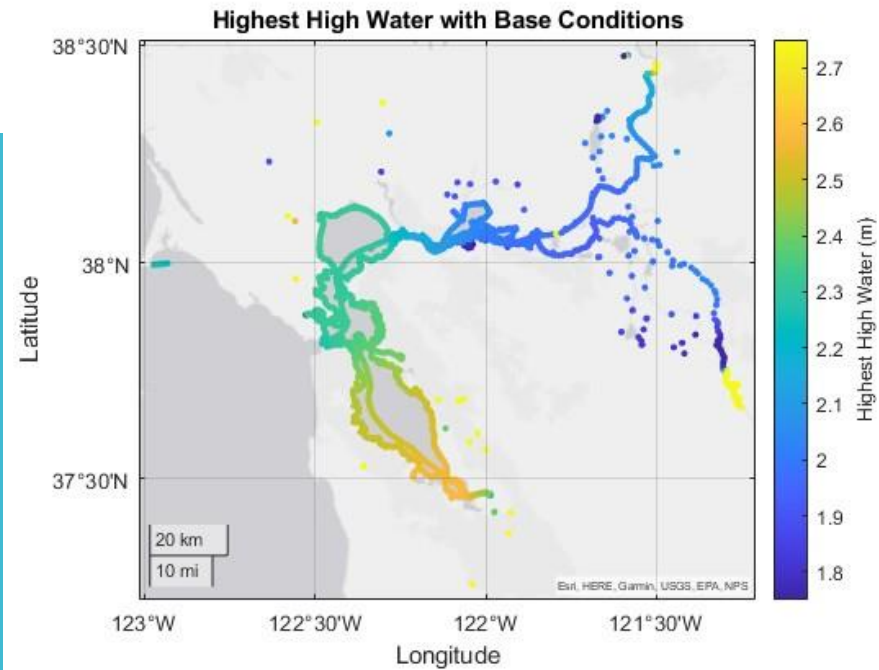
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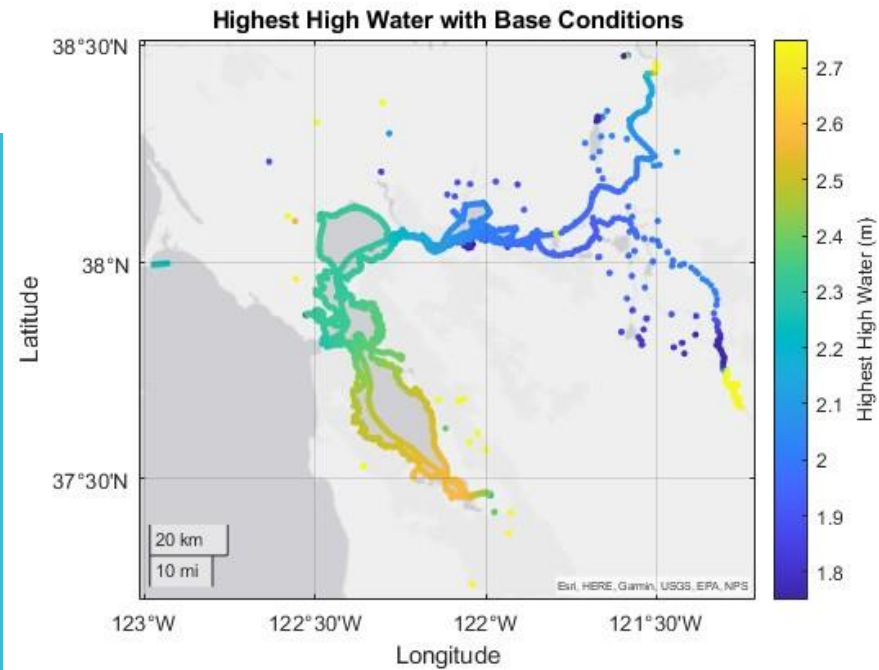
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[flickr.com/photos/guy_incognito](https://www.flickr.com/photos/guy_incognito/)

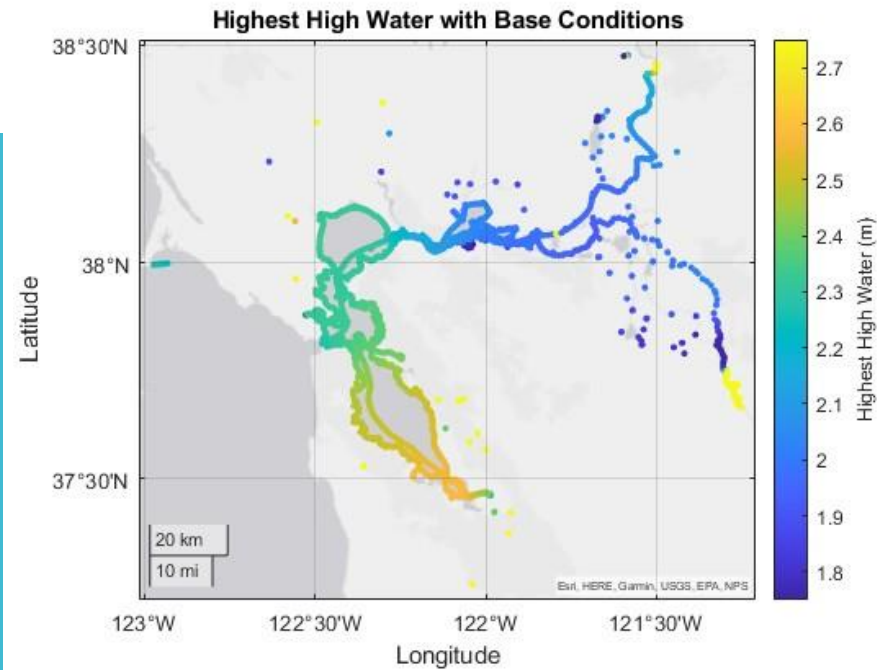
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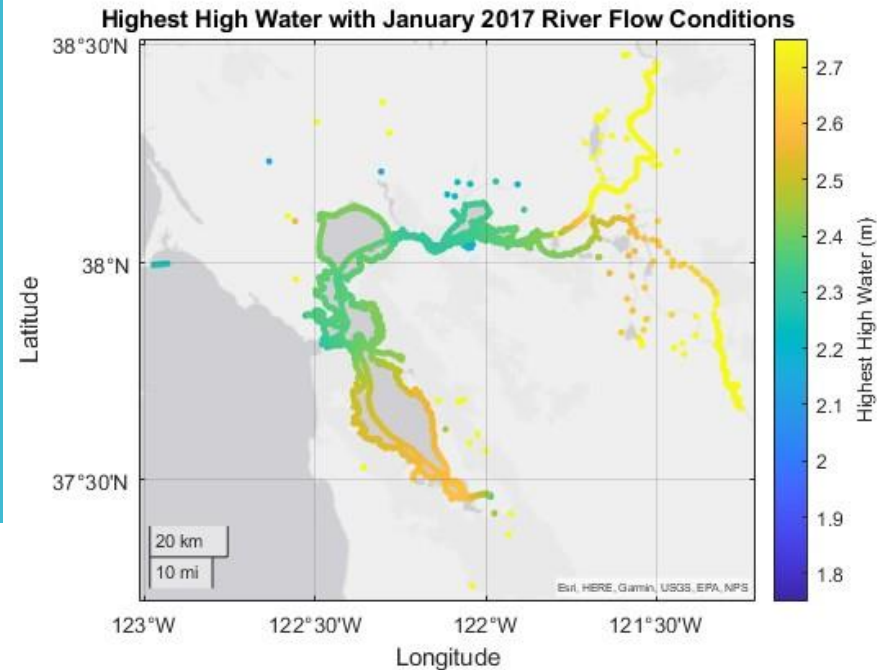


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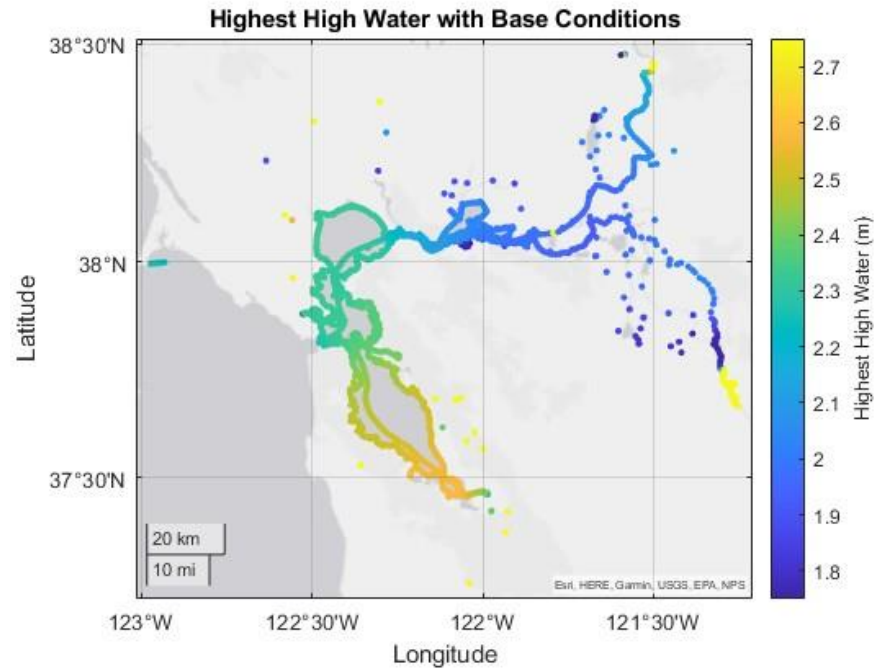
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WY2017 Conditions:

- Real river flow conditions from WY2017



Experiments: Adding River Flow from 2017

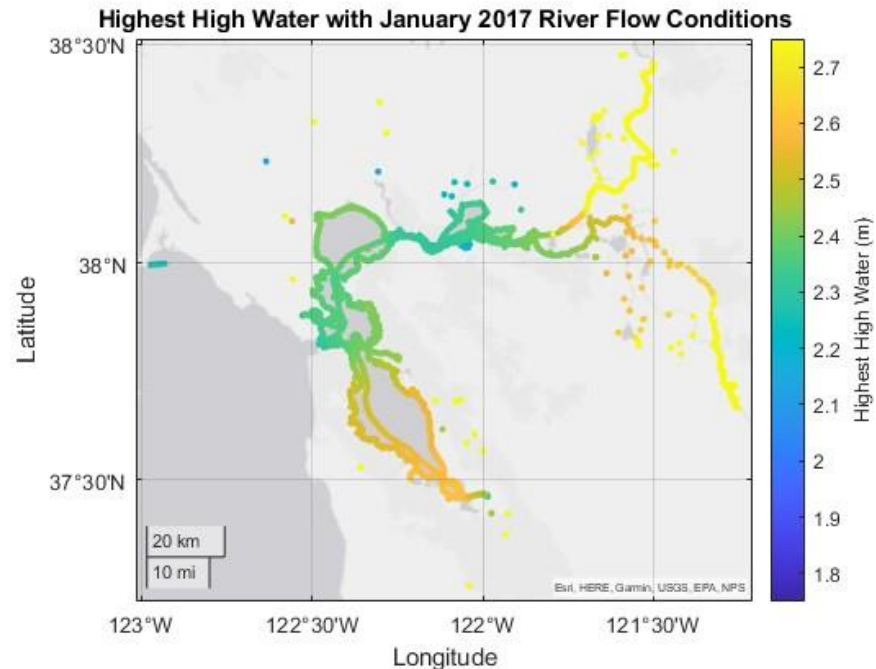


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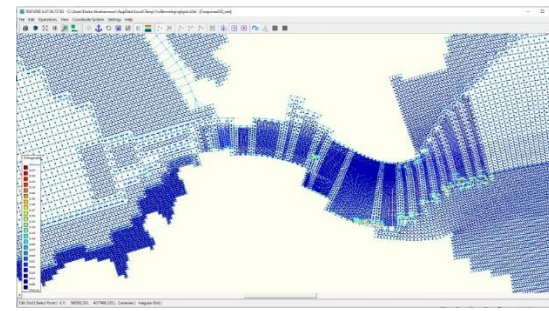
- Real river flow conditions from WY2017



Near Antioch, The East Bay Times

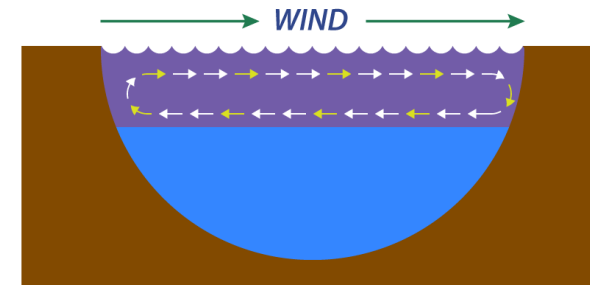
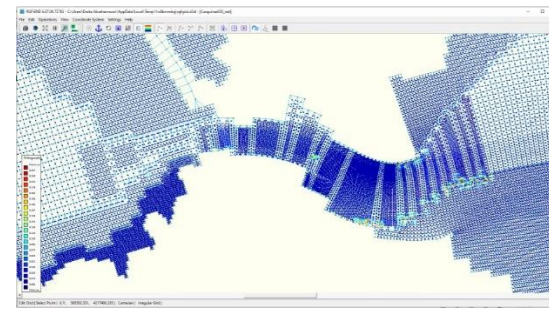
Topics to Be Explored...

- Increased Grid Resolution



Topics to Be Explored...

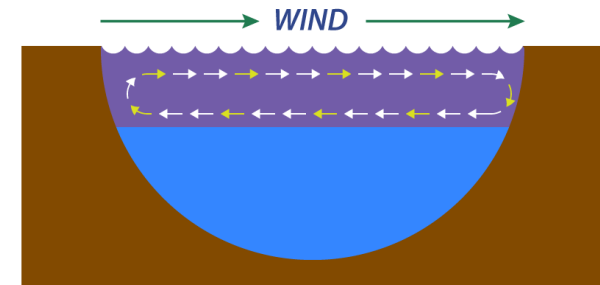
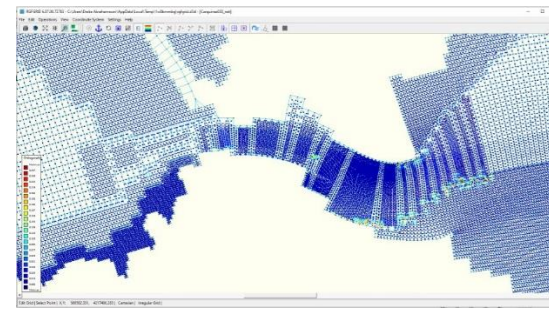
- Increased Grid Resolution
- Density Stratification Effects



AWEBGeo.com

Topics to Be Explored...

- Increased Grid Resolution
- Density Stratification Effects
- Delta Management



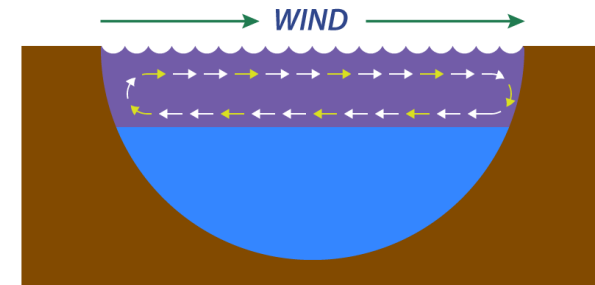
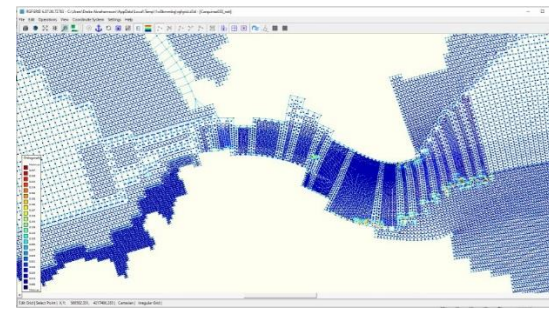
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Yolo Bypass, CA DWR

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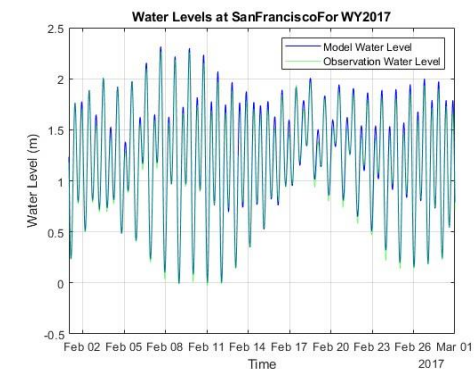
- Increased Grid Resolution
- Density Stratification Effects
- Delta Management
- Spring and Neap Tides



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Yolo Bypass, CA DWR



Thank you!

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