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

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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



<image><image>

River & Creek Flow



ABC10 News

Processes



NOAA

River & Creek Flow



ABC10 News

Wind



Twitter.com/SFBayFerry

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

Processes



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ABC10 News

Wind



Twitter.com/SFBayFerry











Water Levels



Tidal Constituent M2





Average M2 Amplitude Difference =0.03m



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Average M₂ Amplitude Difference =0.03m



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



37°30'N

20 km 10 mi

122°30'W

122°W

Longitude

123°W

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2

1.9

1.8

Eurl, HERE, Gamin, USGS, EPA, NP

121°30'W

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South Wind Conditions:

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

Experiments: Adding 20m/s of South Wind





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Highway 37, CBS News

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flickr.com/photos/guy_incognito

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WY2017 Conditions:

• Real river flow conditions from WY2017

Experiments: Adding River Flow from 2017







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Near Antioch, The East Bay Times

• Increased Grid Resolution



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• Density Stratification Effects



AWEBGeo.com

• Increased Grid Resolution

• Density Stratification Effects

• Delta Management





AWEBGeo.com



Yolo Bypass, CA DWR

• Increased Grid Resolution

• Density Stratification Effects

• Delta Management

• Spring and NeapTides





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Thank you!

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