Supplementary Material

Modeling the Impact of Hydraulic Reconnection on Estuary Hydrodynamics

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The following supplementary material is included: **Table S1** Sensitivity Analysis; **Table S2** Model Database; **Table S3** Summary of surface water elevations (m) and comparison between baseline and reconnection (Condition 2: Sea Level Rise); **Table S4** Summary of surface water elevations (m) during the hours of 0000–1300 of the November 12, 2020, storm event (Condition 3: Extreme Weather); **Fig. S1** Surface water elevations for baseline and reconnection simulations over a 24-h period at (a) Ohara, (b) Flamingo, and (c) Como (Condition 1: 2021–2022 Weather); **Fig. S2** Surface water elevations for 2021–2022 weather and SLR at (a) Ohara, (b) Flamingo, and (c) Como (Condition 2: 2040 Sea Level Rise); **Fig. S3** Comparison of surface water elevations at (a) Ohara, (b) Flamingo, and (c) Como during Hurricane Eta (Condition 3: Extreme Weather).

Supplementary Figures and Tables

Table S1 Sensitivity analysis

		Horizontal Eddy Diffusivity Changed	Horizontal Eddy Viscosity Changed	Manning Coefficient Changed	Base Case
Model Setup Physical Parameter Values	Horizontal Eddy Diffusivity	1	0.1	0.1	0.1
	Horizontal Eddy Viscosity	0.1	1	0.1	0.1
	Manning Coefficient	0.023	0.023	0.01	0.023
	Percent change	900	900	57	0
Water Level RMSE (m)	Knox	0.0001	0.0028	0.0723	-
	Como	0.0001	0.0020	0.0720	-
	Site C	0.0001	0.0018	0.0699	-
	Gulfspray	0.0001	0.0018	0.0674	-
Velocity RMSE (m/s)	Knox	0.0003	0.0400	0.0447	-
	Como	0.0009	0.0467	0.0751	-
	Site C	0.0011	0.0799	0.1449	-
	Gulfspray	0.0002	0.0403	0.0839	-

Table S2 Model database

Data Type	Description	Notes	Citation
Land boundary	Detailed polyline of the Charlotte Harbor coastline	Used for model land boundary	(FFWCC, 2021)
Digital Elevation Model (DEM)	Bed levels in Charlotte Harbor and Peace River	3 - second resolution. Used for bathymetry at Peace River boundary	(NOAA NCEI, 2021)
Digital Elevation Model (DEM)	Bed levels in Charlotte Harbor	9th arc sec resolution (3 m cell size). Used for model bathymetry	(CIRES, 2014)
Bathymetry	Bed levels in MW collected at dredging sites	Used for model bed levels	(Atkins Engineering, 2020)
Bathymetry	Bathymetric cross-sections in the MW	Used for model bed levels	This study
Water levels and temperature	Database with water levels and temperature for Peace River	Used for model Peace River boundary	(USGS, 2021b)
Water levels	Database with water levels for Myakka River	Used for Myakka River boundary	(USGS, 2021a)
Water levels, temperature, and salinity	Field data at select sites within the MW	Used for model validation	This study
Water temperature and salinity	Water quality database for Charlotte Harbor	Used for Myakka River and Harbor boundaries	(CHNEP Water Atlas, 2021)
Water levels	HYCOM generalized coordinate ocean model	Used for Charlotte Harbor boundaries	(Naval Research Laboratory, 2022)
Wind	Meteorological observations for Fort Myers	Used to prescribe wind forcing to model	(NOAA, 2021a)

Table S3 Summary of surface water elevations (m) and comparison between baseline and reconnection (Condition 2: Sea Level Rise)

Site	Statistic	Baseline	Reconnection	% Difference from BL
Ohara	max	1.32	1.32	0.27
	min	-0.07	-0.28	317.71
	range	1.39	1.60	15.42
	avg	0.50	0.46	-8.74
Flamingo	max	1.34	1.34	-0.01
	min	-0.04	-0.23	408.93
	range	1.38	1.56	13.27
	avg	0.50	0.46	-9.14
Como	max	1.28	1.29	0.32
	min	-0.10	-0.26	167.83
	range	1.38	1.55	12.04
	avg	0.50	0.47	-5.78

Table S4 Summary of surface water elevations (m) during the hours of 0000–1300 of the November 12, 2020, storm event (Condition 3: Extreme Weather)

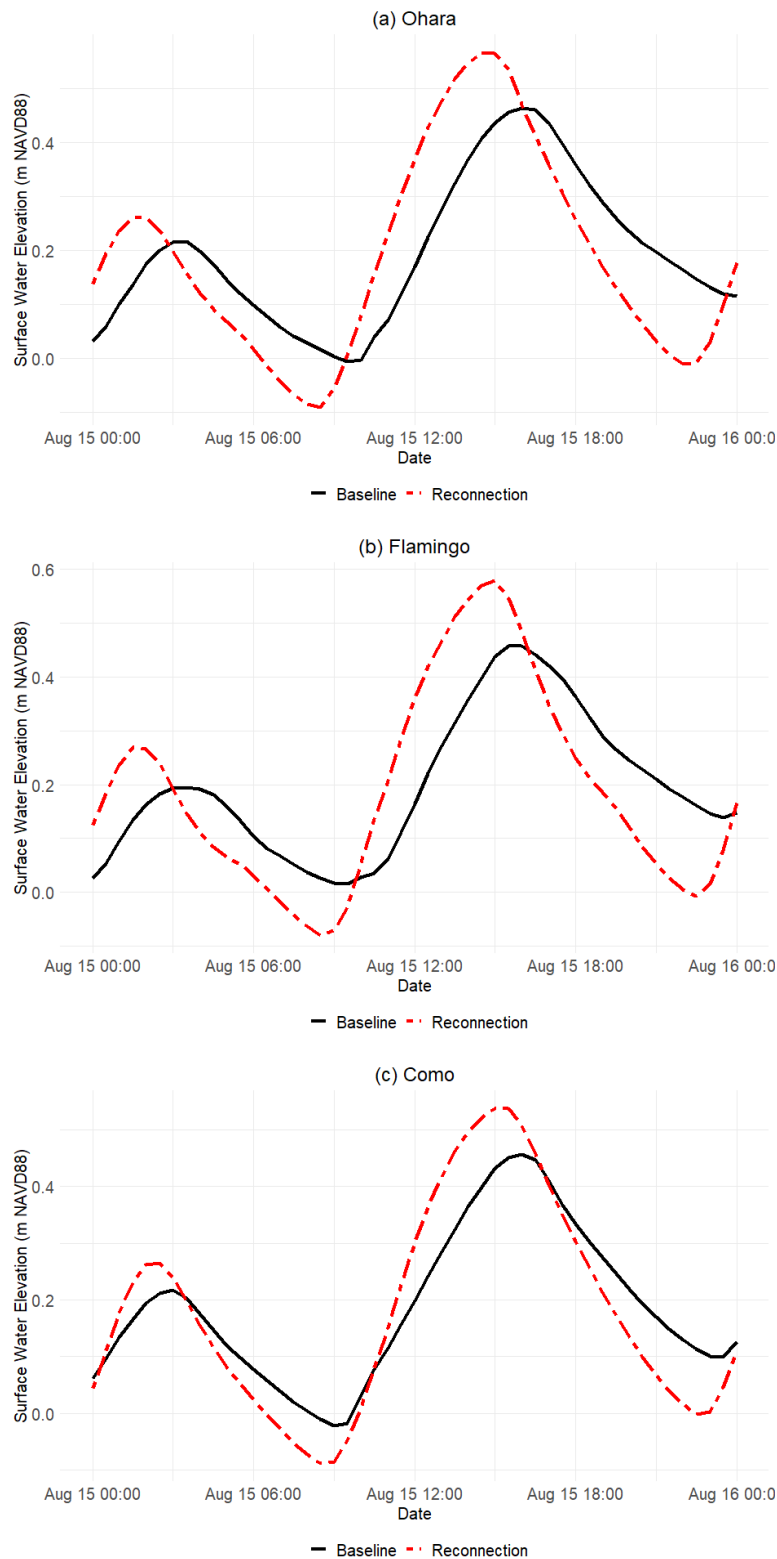| Site	Statistic	Baseline	Reconnection	% Difference from BL
Ohara	max	1.40	1.40	0.06
	min	0.56	0.40	-28.45
	range	0.84	1.00	19.06
	avg	0.94	0.92	-1.84
Flamingo	max	1.41	1.41	-0.18
	min	0.58	0.39	-32.77
	range	0.83	1.02	22.46
	avg	0.94	0.92	-1.96
Como	max	1.33	1.33	0.21
	min	0.55	0.55	-0.35
	range	0.78	0.78	0.61
	avg	0.92	0.92	0.14

Fig. S1. Surface water elevations for baseline and reconnection simulations over a 24-hour period at a) Ohara, b) Flamingo, and c) Como (Condition 1: 2021–2022 Weather).
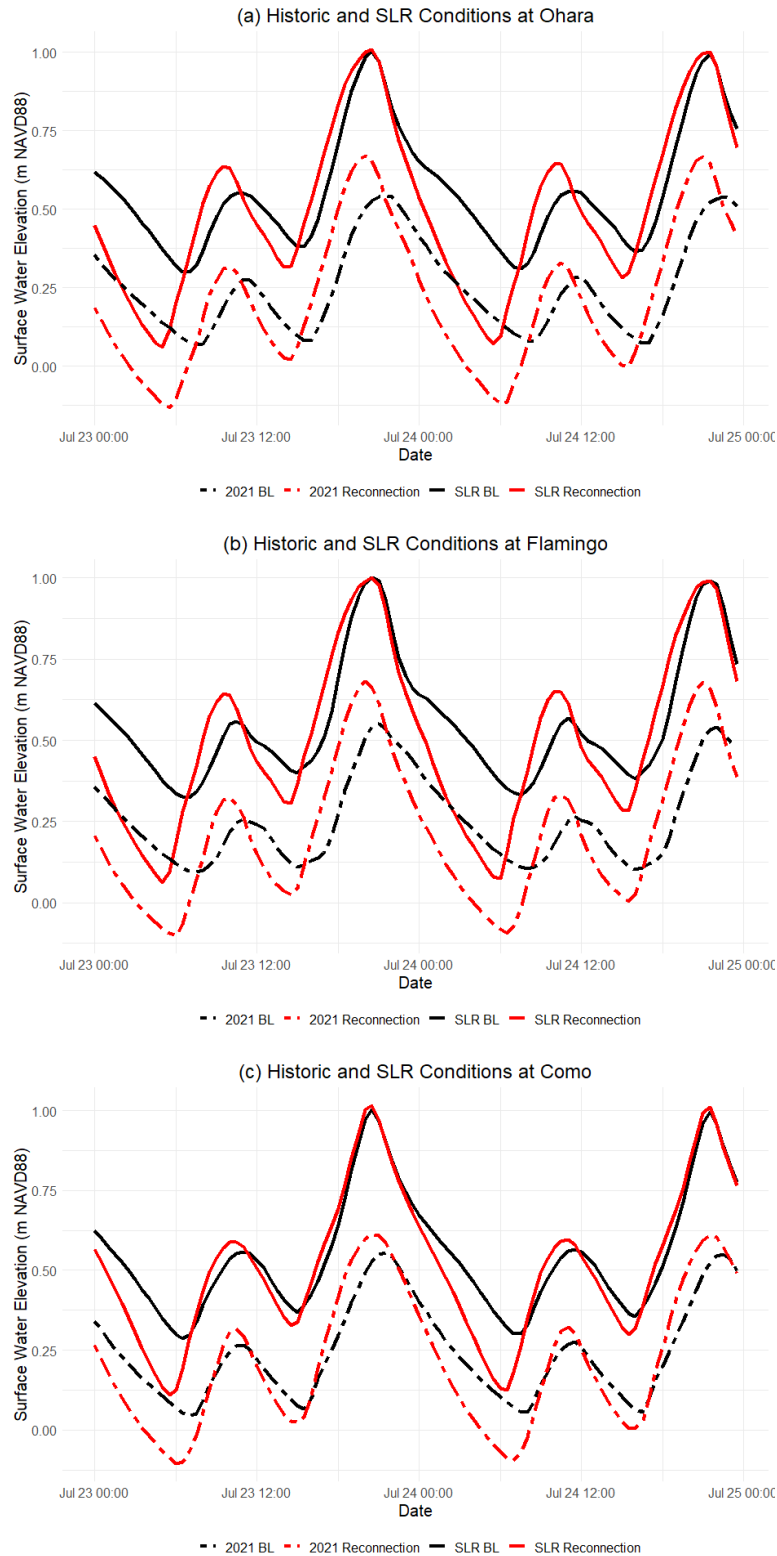
Fig. S2. Surface water elevations for 2021–2022 weather and SLR at a) Ohara, b) Flamingo, and c) Como (Condition 2: 2040 Sea Level Rise).
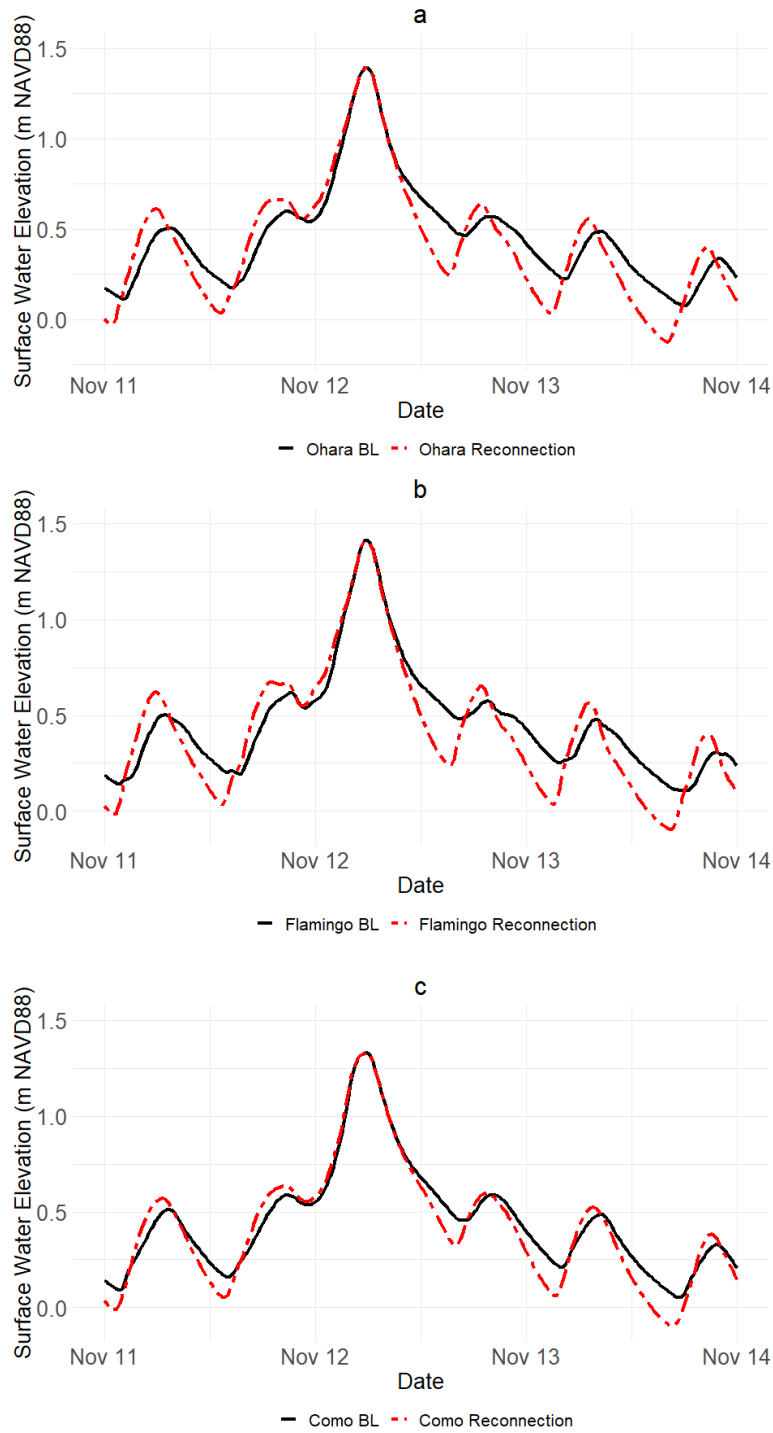
Fig. S3. Comparison of surface water elevations at a) Ohara, b) Flamingo, and c) Como during Hurricane Eta (Condition 3: Extreme Weather).