



2023 COASTAL MASTER PLAN
COMMITTED TO OUR COAST

STORM SELECTION ICM AND RISK MODELS

DAVID R. JOHNSON



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OVERVIEW

STORM SELECTION

- JPM-OS and Storm Updates
- Storm Selection
 - Storm Sequence for the ICM
 - Reduced Storm Set for CLARA

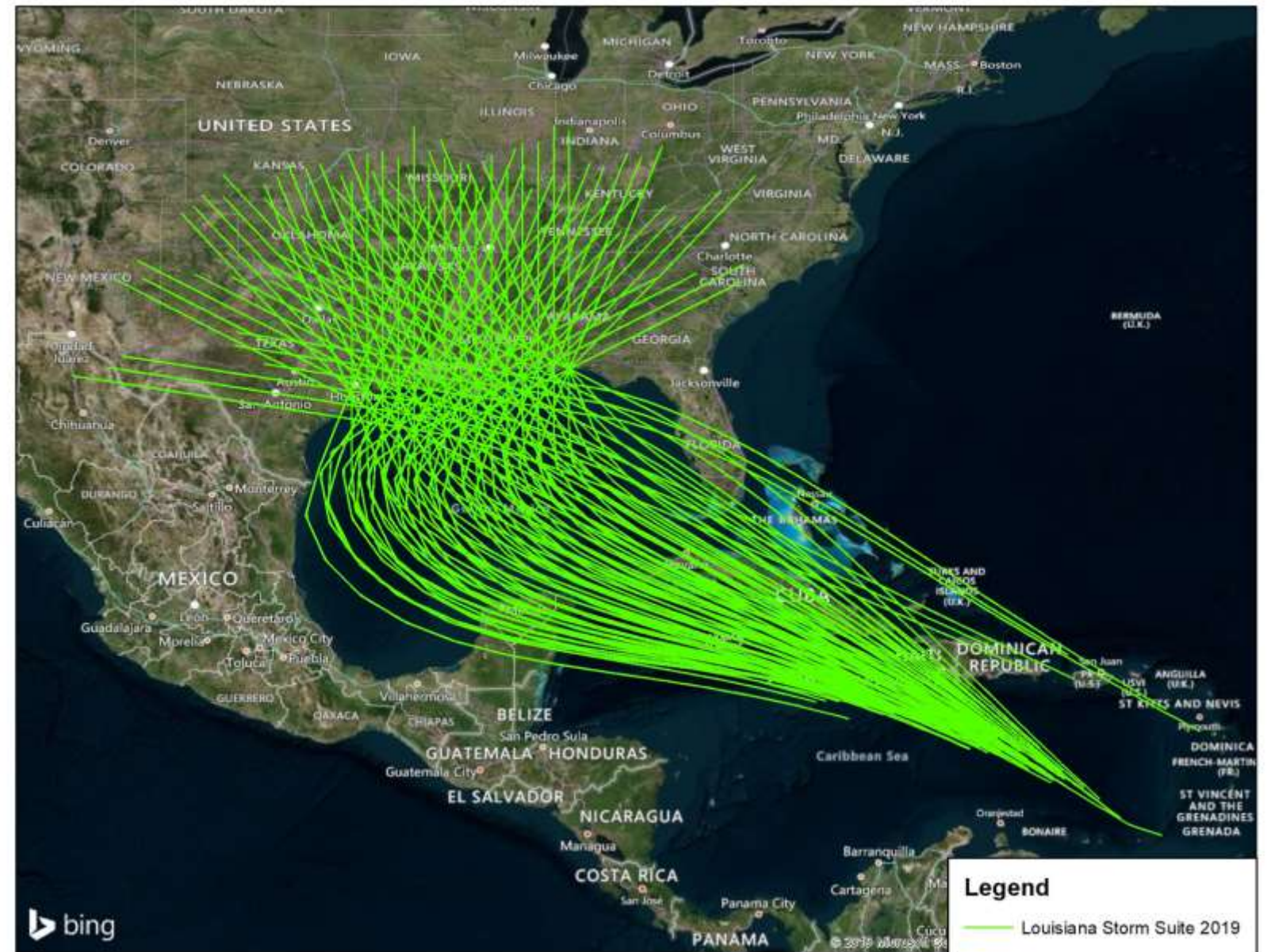


JPM-OS AND STORM UPDATES

NEW SUITE OF AVAILABLE SYNTHETIC STORMS

HAZARD CHARACTERIZATION

- Transitioned from 446-storm suite to 645 synthetic storms
- More variation in storm parameters
 - c_p - 865 to 1005 millibars
 - r_{max} - 4.3 to 76.3 nautical miles
 - v_f - 4.3 to 27 knots
 - 60 kilometer track spacing
 - 20 degree intervals for heading

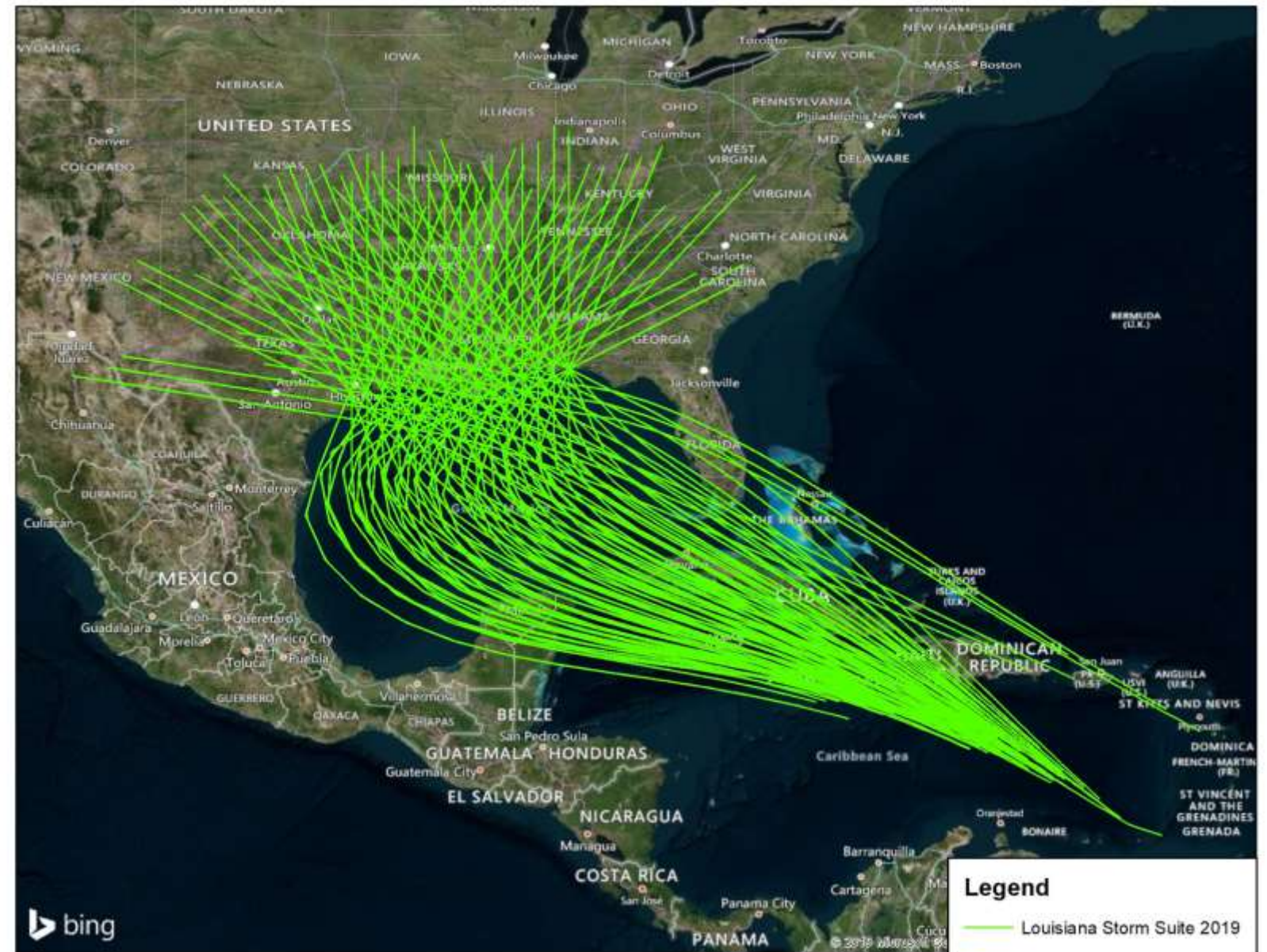


Updated synthetic storm tracks for 645-storm suite

UPDATES TO JPM-OS METHODOLOGY

HAZARD CHARACTERIZATION

- HURDAT record augmented by ERDC to impute missing values of r_{max} and c_p for some storms
- Added a linear drift term allowing c_p to vary over time
- Changed distribution for r_{max} to a log-normal



Updated synthetic storm tracks for 645-storm suite



STORM SELECTION: ICM

STORM SEQUENCES

STORM SELECTION FOR THE ICM

- Goal was to identify sequences with specific characteristics:
 - Synthetic storms that closely resemble past 50 years (parameters and sequence)
 - Storms producing water surface elevations matching 10-, 50-, and 100-year exceedances at 33 locations
- Sample from 645-storm suite
- Exceedances estimated under 2017 Coastal Master Plan's current conditions landscape

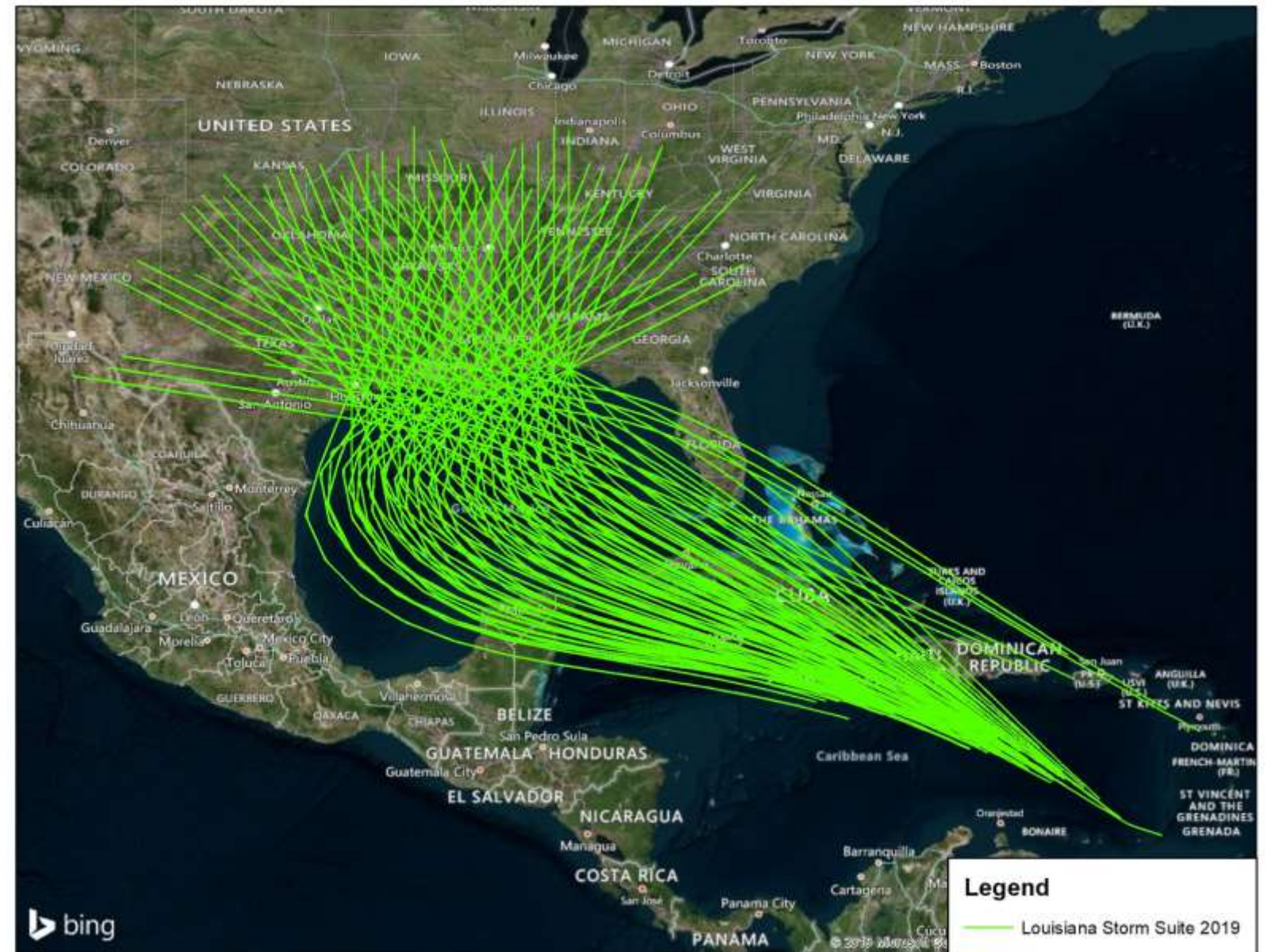


Locations sampled for determination of ICM storm sequences based on water surface exceedances

MATCHING HISTORIC STORM EVENTS

STORM SELECTION FOR THE ICM

- Identify storm tracks proximal to 61 historic storms at landfall (1970-2019)
- Select the storm on those tracks with minimal Euclidean distance to historic landfall c_p , r_{max} , and v_f parameters
- Sequence synthetic storms over 50 years in the same way



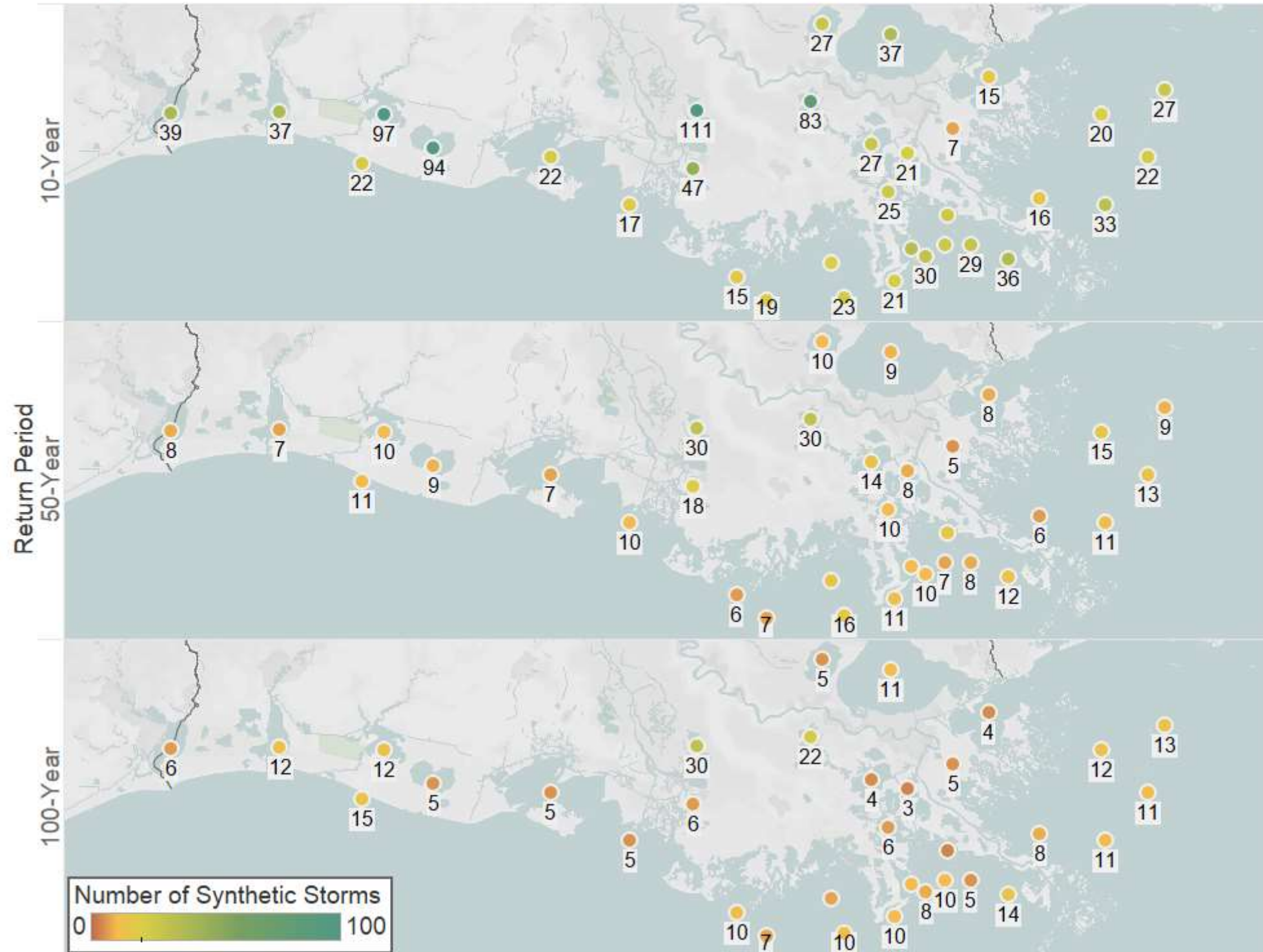
Updated synthetic storm tracks for 645-storm suite

MATCHING WATER SURFACE EXCEEDANCES

STORM SELECTION FOR THE ICM

- WSE exceedances calculated using our previous JPM-OS method applied to new suite of 645 storms
- Algorithm added storms to a sequence that match as many values as possible
- Able to generate “balanced” sequences over all points and return periods
 - Same number of storms as historical record

Number of Storms Matching Specified Return Period (+/- 0.25 ft)





**STORM
SELECTION:
CLARA**

IDENTIFYING A HIGH-PERFORMING REDUCED STORM SET

STORM SELECTION FOR CLARA

- US Army Corps of Engineers used a genetic algorithm to identify 95 storms that best replicate surge elevation exceedances associated with the full 645-storm suite
 - 427 sample points
 - 2- to 10,000-year return periods (50% to 0.0001% annual exceedance probability)



Return Period	Depth RMSE	Elevation RMSE
10-Year	0.44	0.79
50-Year	0.73	1.17
100-Year	0.64	1.13
500-Year	1.22	1.61

Sample points used to evaluate reduced storm subsets

IDENTIFYING A HIGH-PERFORMING REDUCED STORM SET

STORM SELECTION FOR CLARA

- We calculated surge exceedances with 645 storms using updated CLARA JPM-OS
- Greedy algorithm adds or subtracts storms that best improve the comparison
 - Started with 90 storms provided by USACE
 - Maintained a total of 90 storms by adding and subtracting until convergence
 - Final recommended set contains 38 storms not in original ERDC set



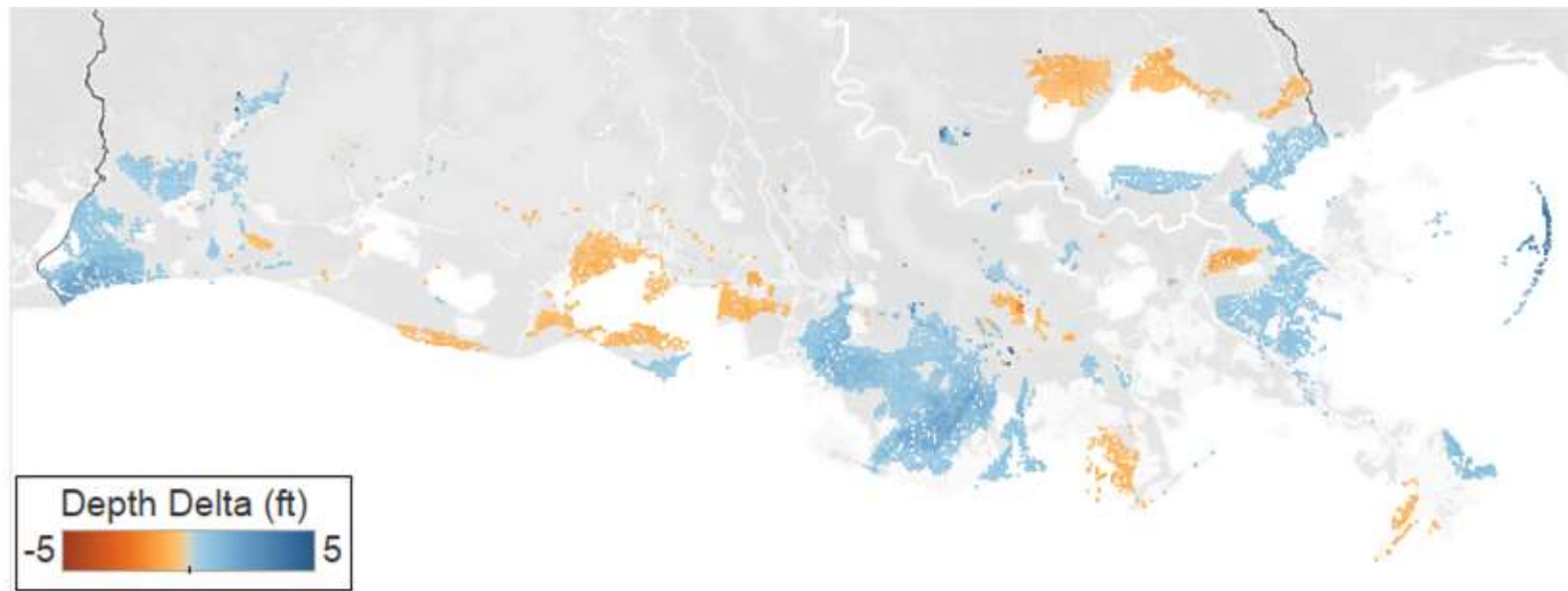
Return Period	Depth RMSE	Elevation RMSE
10-Year	0.03	0.11
50-Year	0.13	0.20
100-Year	0.17	0.33
500-Year	0.18	0.29

Difference in 100-year surge depths (CLARA)

COASTWIDE COMPARISON OF RECOMMENDED SET TO FULL SUITE

STORM SELECTION FOR CLARA

- No systematic bias or clear spatial patterns of bias relative to 645-storm suite
 - Differences less than 0.5 ft not shown
- Root mean squared error (RMSE) over all unenclosed grid points considerably smaller than that from 2017 storm selection process



Difference in 100-year surge depths (CLARA 2023, 90 storms minus 645 storms)

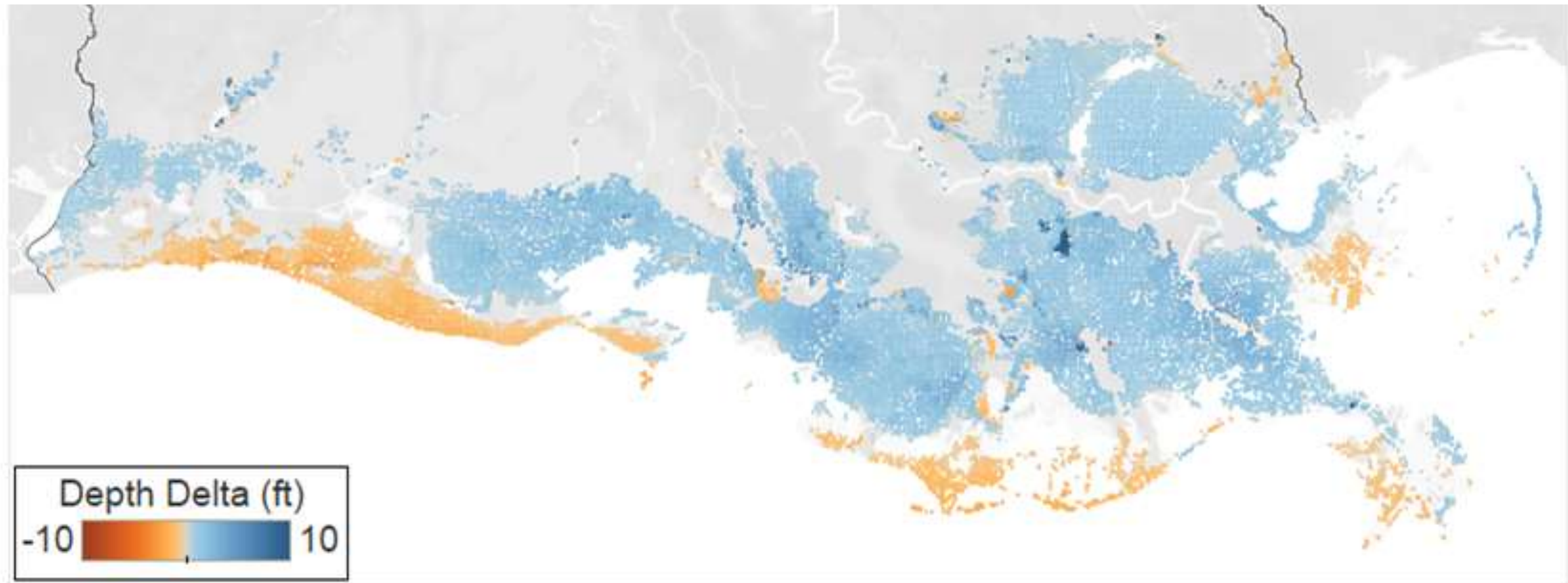
Return Period	
10-Year	0.28
50-Year	0.36
100-Year	0.43
500-Year	0.64

RMSE (ft) over all unenclosed grid points

COMPARISON TO 2017 COASTAL MASTER PLAN

STORM SELECTION FOR CLARA

- Estimated exceedances are generally greater than those produced in 2017
 - Differences less than 0.5 ft not shown
- Attributable to inclusion of less intense but higher-frequency storms, JPM-OS updates



Difference in 100-year surge depths (CLARA, 2023 - 2017)



THANK YOU