Multi-hazard modeling in Coastal Systems

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- Risk = Hazard × Exposure × Vulnerability

- ✓ Hazard: probability/intensity of damage-producing events

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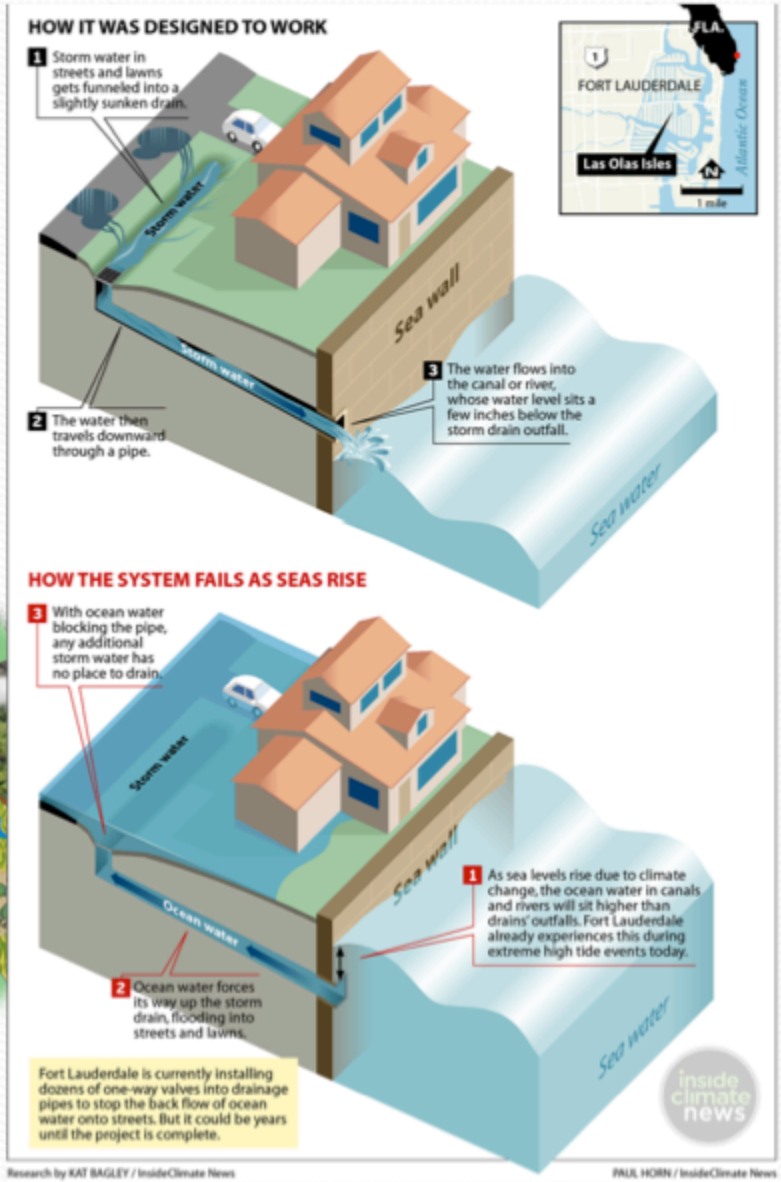
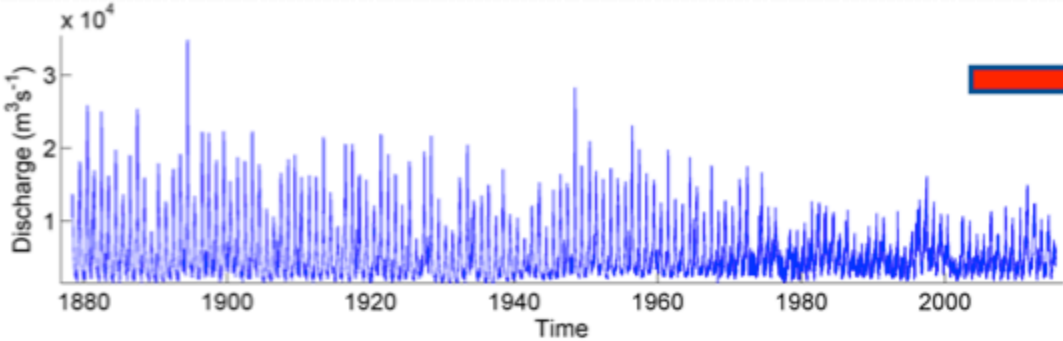
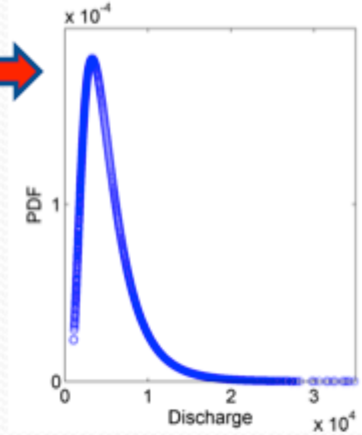
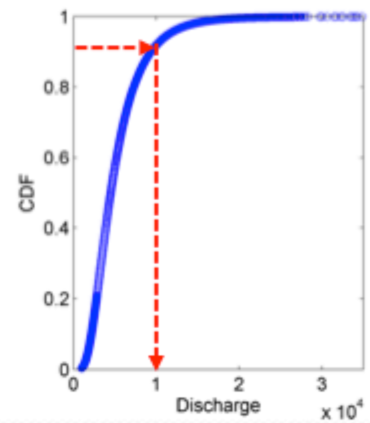


Univariate Frequency Analysis

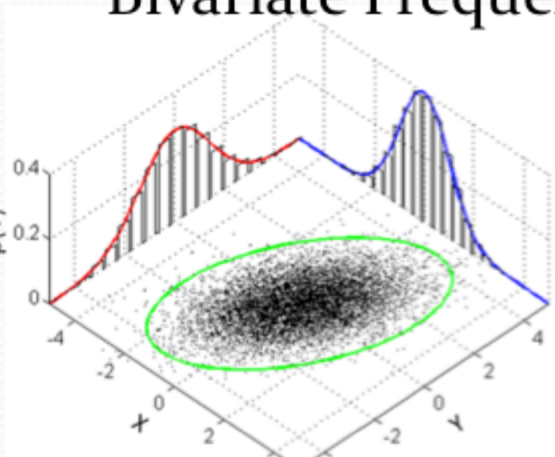




$$EP = \frac{1}{RP} = 1 - CDF$$



Bivariate Frequency Analysis



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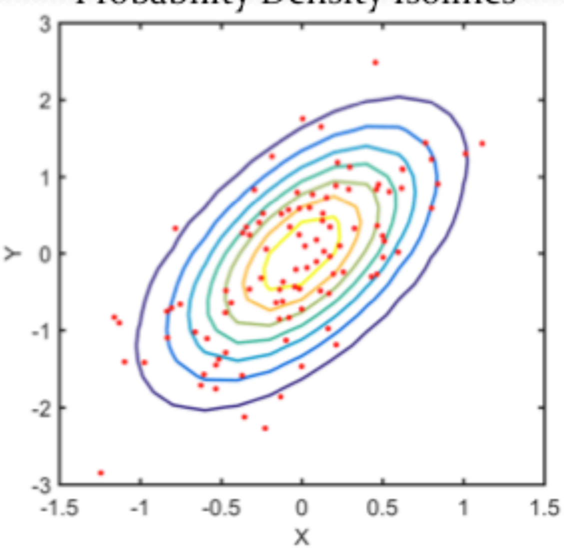
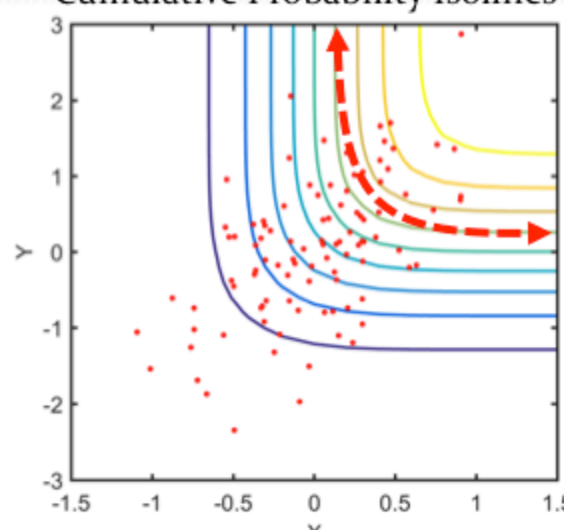
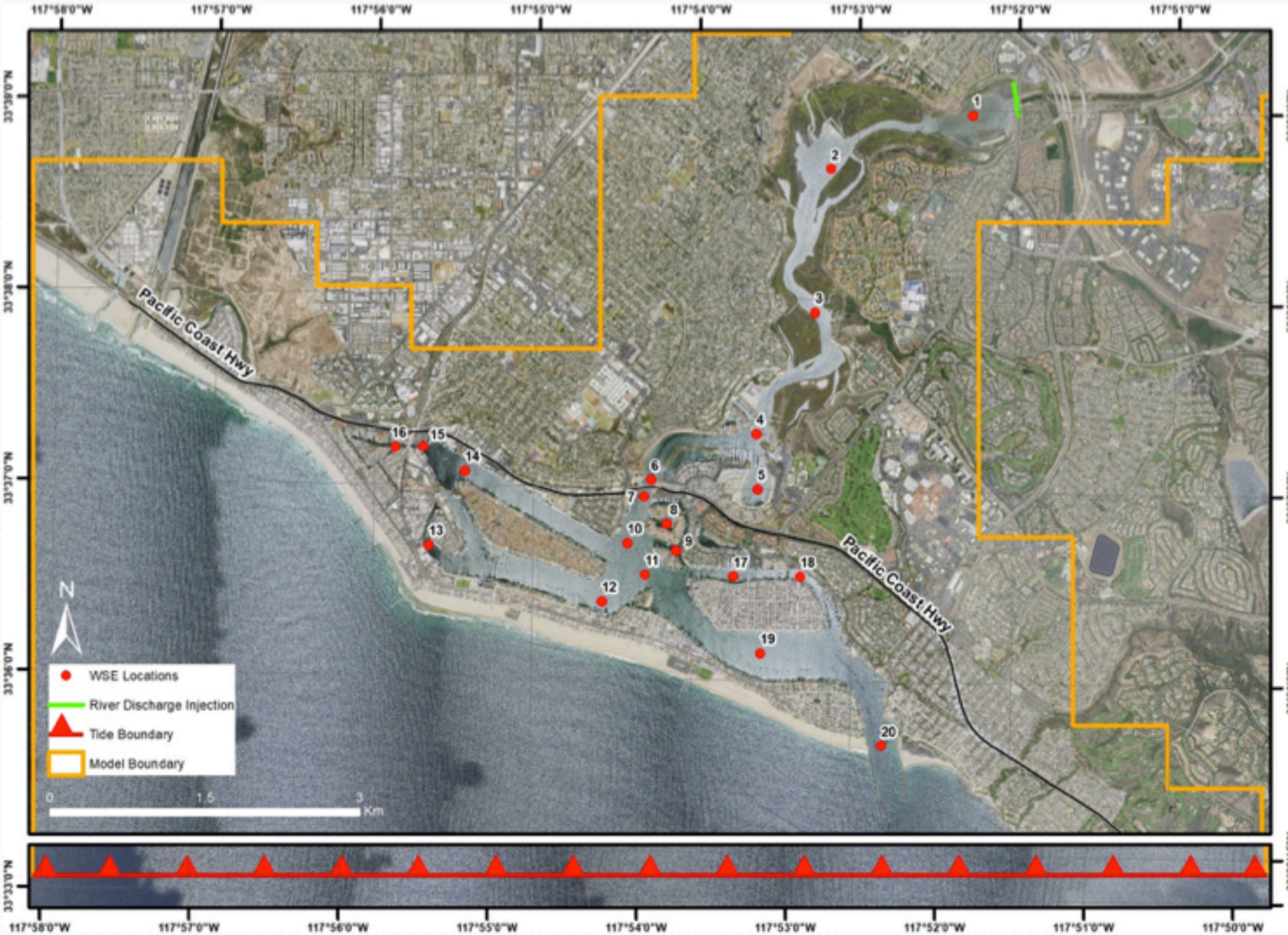
Probability Density Isolines



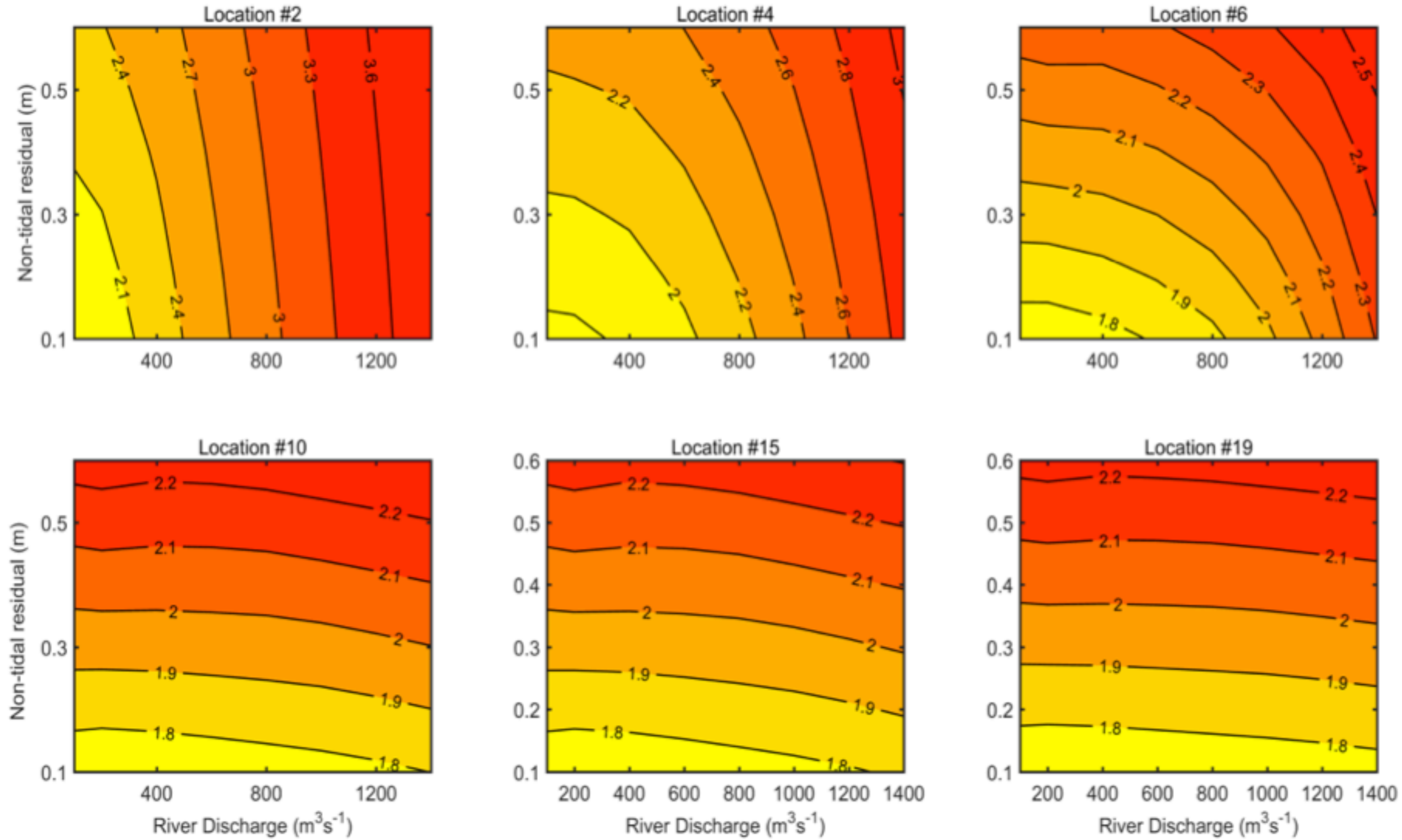
Cumulative Probability Isolines



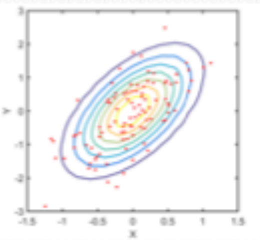
2D shallow water flow solver BreZo [Gallien et al., 2011, 2014; Begnudelli et al., 2008]

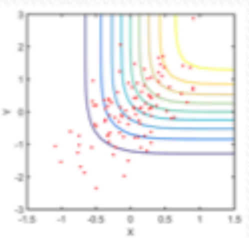


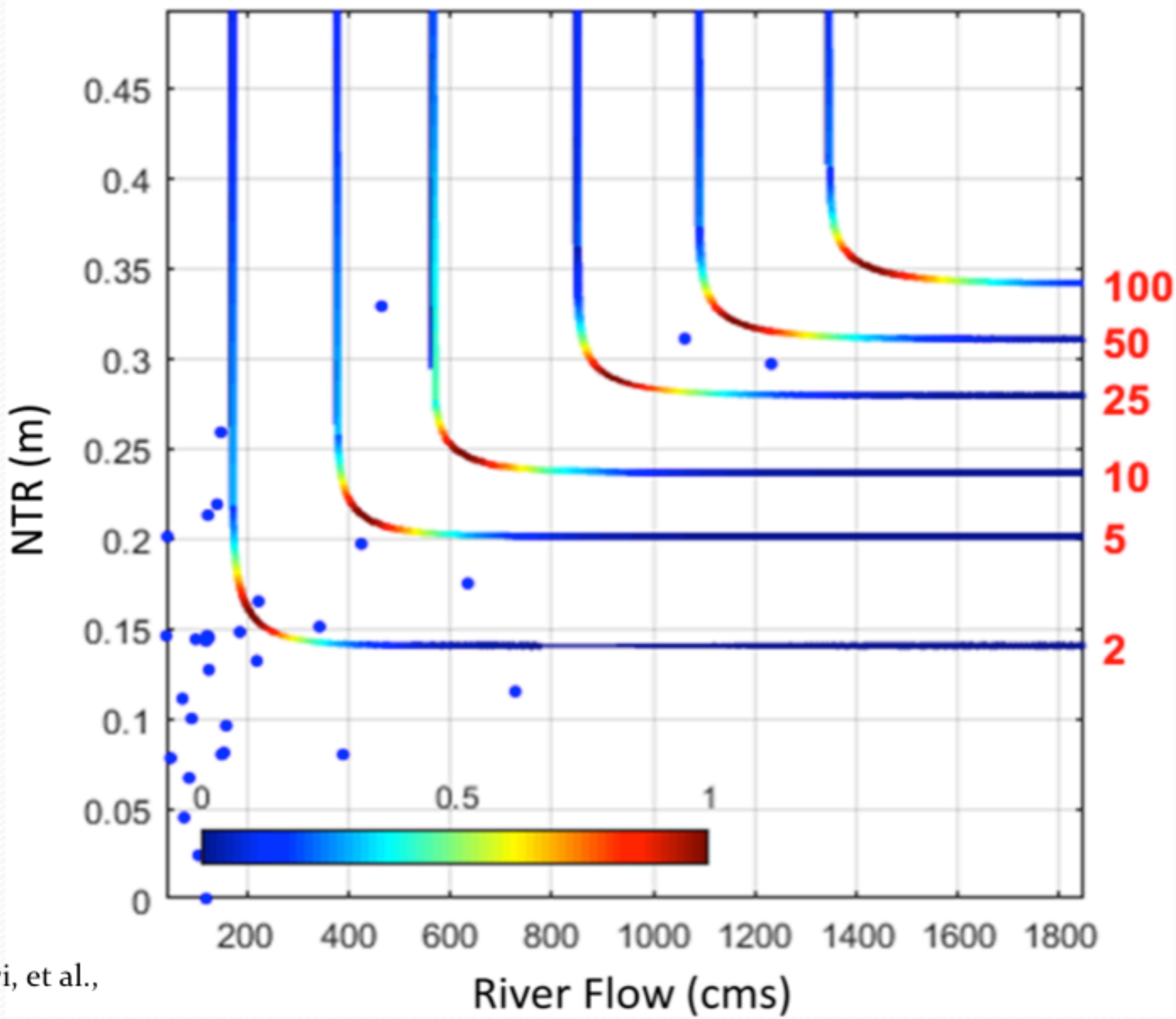
Water Level Dynamics



Hazard Scenario Generation

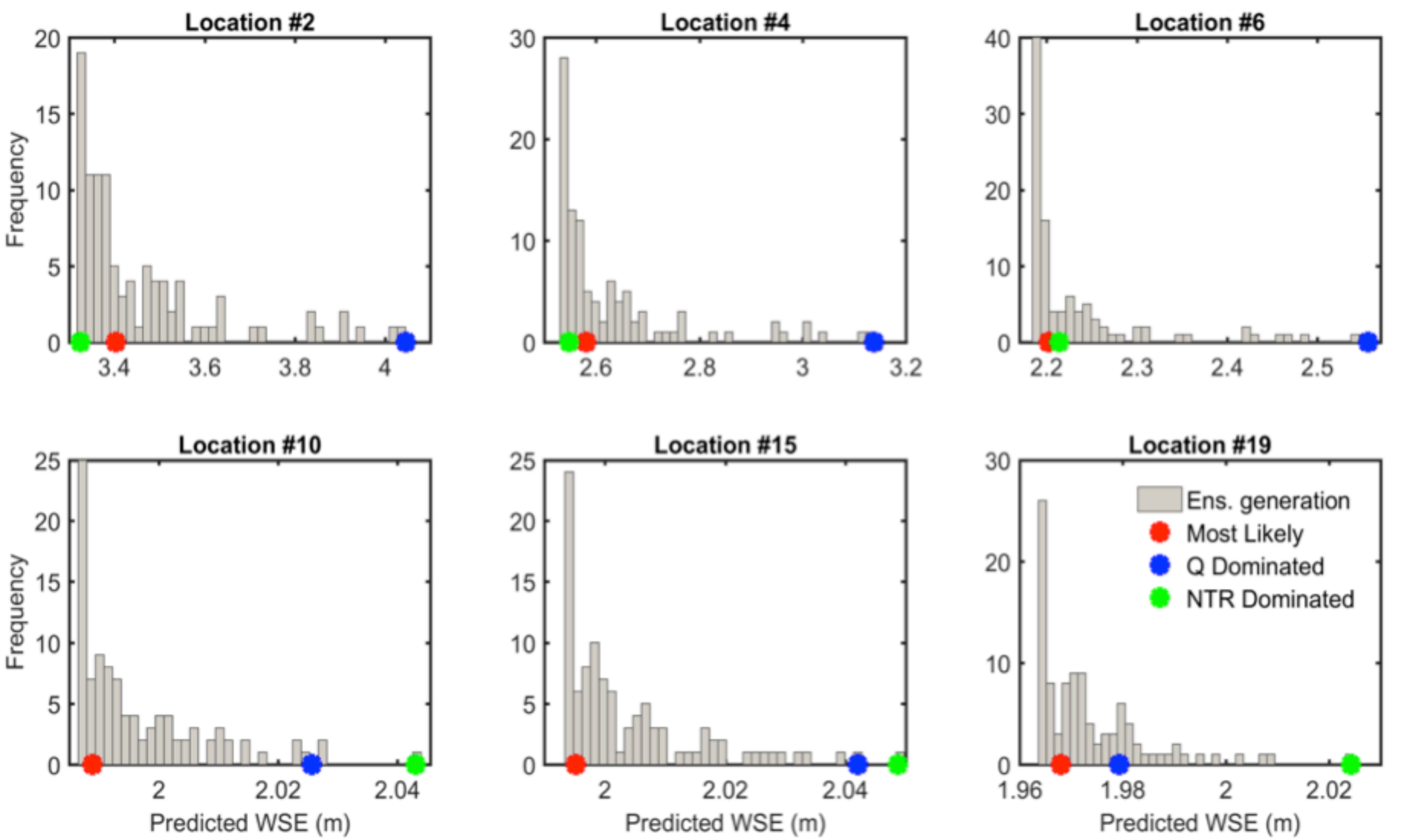






Sadegh, Moftakhari, et al.,
GRL, in revision

Hazard Scenario Analysis



Conclusions:

- ✓ We here present a framework for the assessment of compound flood hazards in freshwater-influenced coastal systems

- ✓ The proposed approach help systematically reduce the dimensionality of the problem and so more efficiently run computationally expensive models

- ✓ The commonly used “most likely” scenario is not an appropriate scenario to accurately capture maximum potential water surface elevation

- ✓ If wisely chosen, the “one-dominant driver” scenario can well represent the extremes in the estuary

➢ Bibliography

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Thank You!

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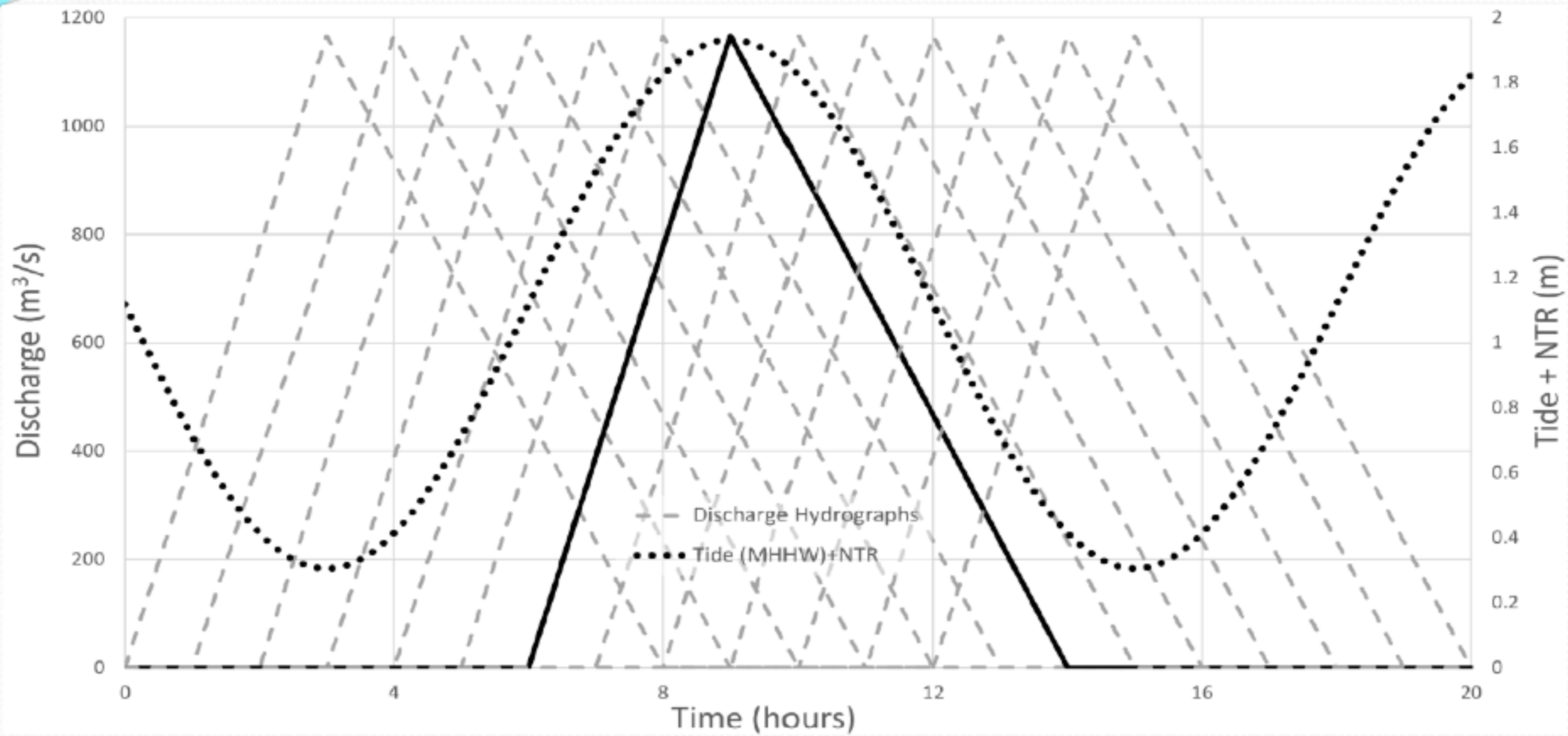
Lag-time Scenario Analysis



Scenario	Number of Runs	Normalized Density	Discharge Peak (m^3/s)	NTR (m)	Peak relative shift Δt (hr)
Ensemble	100	0.05-1	1090-1692.31	0.311–0.38	0
Most Likely	1	1	1166.71	0.32	0
Dominant Driver	2	0.05	1090.11, 1692.31	0.311, 0.38	0
Sensitivity Analysis	39 (36)	0.05, 1	1090.11, 1166.71, 1692.31	0.311, 0.32, 0.38	-6 to +6

Sensitivity Analysis