Presentation Abstracts – Concurrent Session 5

*Presenters and their associations are highlighted.

❖ Kristen M. Thyng, **Robert Hetland**, Scott A. Socolofsky, Nelun Fernando, Evan L. Turner, Caimee Schoenbaechler

Department of Oceanography, TAMU

Hurricane Harvey Caused Unprecedented Freshwater Inflow to Galveston Bay

Abstract:

Hurricane Harvey heavily impacted Texas in August 2017 due to an extreme amount of rainfall, especially in the large metropolitan area in and around Houston. There was an offshore storm surge associated with Harvey, and while it raised the water level in the bay, possibly prolonging flooding in the Houston area by slowing drainage, it was not responsible for flooding. Salinity measured near the mouth of the San Jacinto river dropped to 0 from 15 psu in 1.5 days after the start of storm-related outflow from the bay; the whole bay was fully freshened in 3.6 days. Depth-averaged outflow from the entrance channel reached 2 m/s. Using publicly-available oceanographic data within Galveston Bay, we estimate the amount of freshwater that flowed into the bay from this rainfall to be 22 km^3 (18 million-acre feet), or about 6 times the volume of Galveston Bay itself. This compares well with the 23 km^3 of rain that was estimated from Doppler radar to have accumulated in the drainage basins contributing to the bay. By comparison, the freshwater inflow estimates by the Texas Water Development Board (TWDB) predicts 13 km^3 (11.5 million-acre feet) of inflow to Galveston Bay during Hurricane Harvey. The sparse coverage of the rain gauge network over the ungauged watersheds may have contributed to an under-estimate of the rainfall used for the simulation of runoff in the TWDB inflow estimate, and may explain the discrepancy between the two estimates.

❖ **Hui Liu**, Jillian Gilmartin, Chengxue Li, Michelle Dziewit

Department of Marine Biology, TAMUG

Resilience of Estuarine Pelagic Communities to Extreme Flooding after a Catastrophic Hurricane in Galveston Bay

Abstract:

Rapid response to large-scale natural disasters and subsequent assessment and restoration require long-term baselines of key ecosystem components. Zooplankton are sensitive to climate change and hydrographic conditions with significant ecological implications for fisheries and ecosystem functions. In August 2017, Hurricane Harvey made catastrophic rainfall and extreme flooding in Southeast Texas. Immediately after Harvey, we started monthly sampling of zooplankton and hydrographic factors in Galveston Bay funded by NSF to examine the resilience of pelagic communities to the storm and the flood related damage and restoration of estuarine ecosystems. So far, we have collected an annual cycle of monthly time series of zooplankton, water temperature, salinity, Chl-a, dissolved oxygen and pH. Our data showed that the hydrographic conditions tend to recover quickly, whereas the post-storm data exhibited a relatively slow recovery of zooplankton with a significant decrease in species composition and density. This study has laid the foundation in terms of zooplankton and hydrography fostering response and recovery of estuarine ecosystems to next natural disasters.

- **Gerardo Gold Bouchot**, Samuel Polis
  Department of Oceanography, TAMU
  Effect of Hurricane Harvey on the Biogeochemistry of Chromophoric Dissolved Organic Matter (CDOM) in Galveston Bay, Texas
  Abstract:
  Chromophoric Dissolved Organic Matter (CDOM) was analyzed in water samples taken in Galveston Bay in June, September and November 2017; March, June, September and November 2018; and March and June 2019. Additionally, water samples from the Trinity and San Jacinto river were taken in June 2019. The bay presented high environmental variability. March 2018 being one of the coldest months, but March 2019 was one of the hottest. Trinity river is the main freshwater input into the bay, but based on the spectral properties of CDOM, changes after Hurricane Harvey seem more likely to have come from the San Jacinto river., which is supported by the fact that he flows of the San Jacinto was higher after Harvey than that of the Trinity river. CDOM spectral properties were indistinguishable in November 2017 from those of June 2017, suggesting the bay recovered in two months and the high resiliency of the bay.

- **Abheek Chatterjee**, Astrid Layton
  Department of Mechanical Engineering, TAMU
  Investigating Ecosystems' Mimicry towards Design of Resilient Resource and Infrastructure Networks
  Abstract:
  Resource and infrastructure networks are ubiquitous in modern society and critical to its smooth functioning. While these complex networks are traditionally designed for minimum cost of operations, the importance of their ability to survive and recover from natural disasters must not be overlooked. In this research, we investigate the utility of mimicking the balance between system efficiency and redundancy, prevalent in ecological networks such as food webs, in the design of resilient engineered flow networks. We present the analogy between networks in nature and engineered flow networks and propose the ecological fitness function metric as an objective function in engineering design. A hypothetical electric motor supply chain is designed using this objective function and it is shown that it has a better ability to survive and recover from disruptions compared to a design of the same supply chain aimed at just minimizing the cost of operations.