Salinity and Current Velocity Structure in the Houma Navigation Canal (HNC)

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Objectives

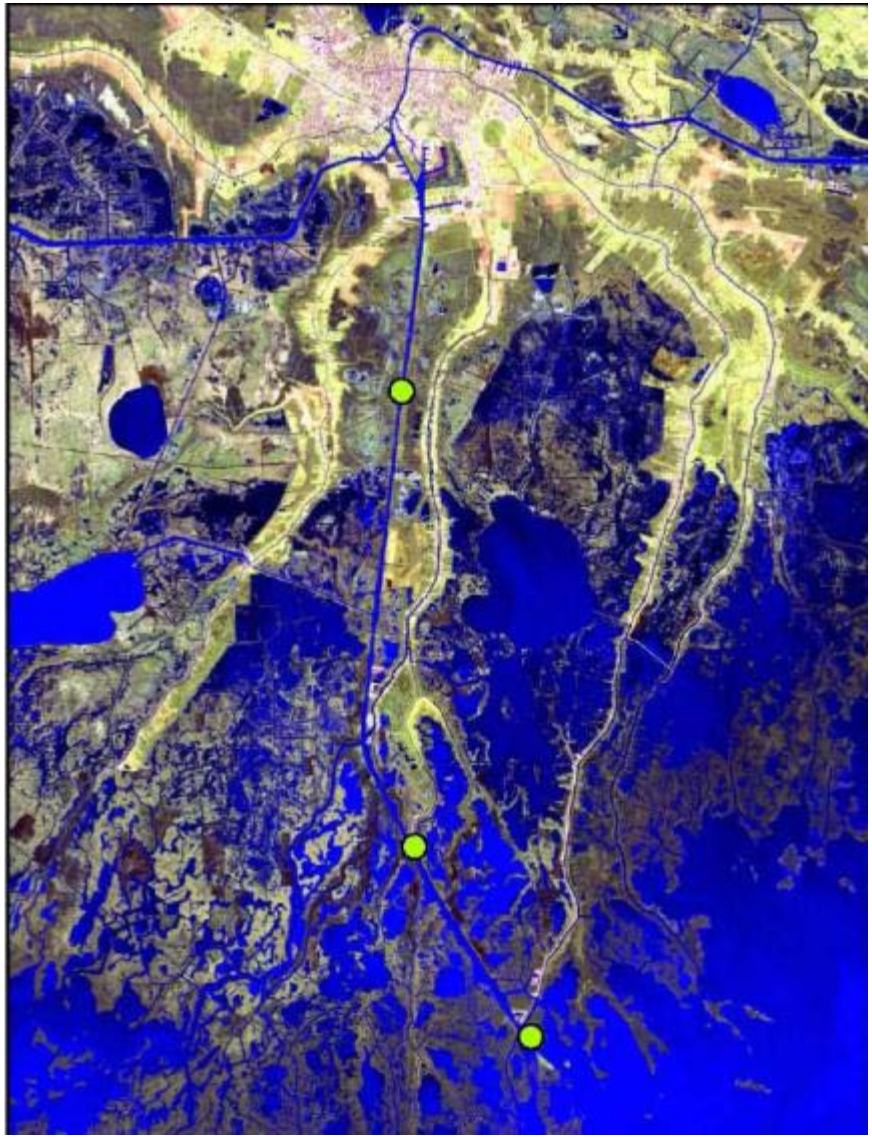
- How is salt transport in Houma Navigation Canal (HNC) governed by buoyancy inputs, wind, tidal stirring, and OCS vessel traffic?
- How does salt flux between HNC and surrounding marsh landscape relate to salt wedge development in the HNC?
- How do salinity fluctuations in surrounding marsh landscapes vary with salt fluxes to / from HNC?

Saltwater Intrusion Processes

- Tidal diffusion
- Wind-driven circulation
  - Winds from east, south push coastal waters inland
  - Results in depth-independent barotropic currents
- Density-driven circulation
  - Results in depth-dependent baroclinic current response
  - Gravity pushes heavier saline water inland under outflowing fresher layer
- Stratification can enhance baroclinic currents and result in further saltwater intrusion

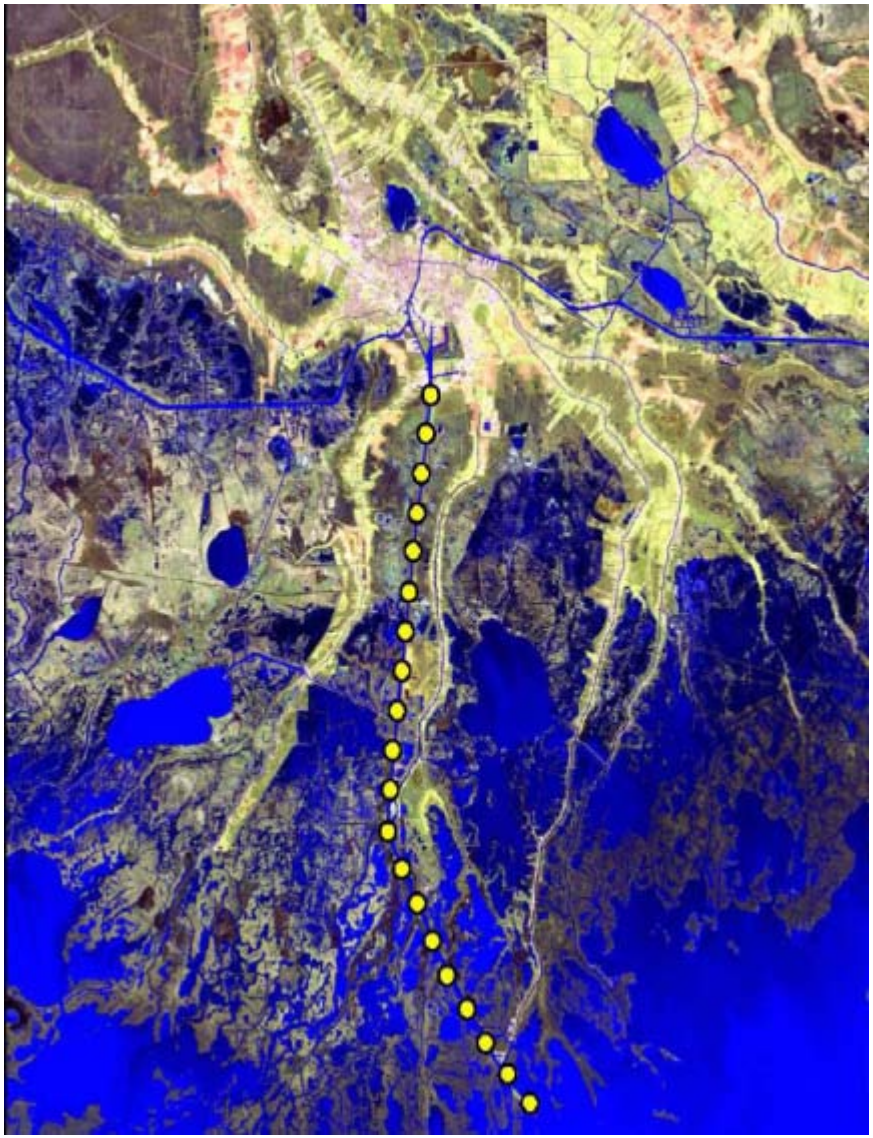
HNC Saltwater Intrusion

- Continuous salinity and current velocity measurements in HNC at 3 locations
- Measuring vertical structure of flow



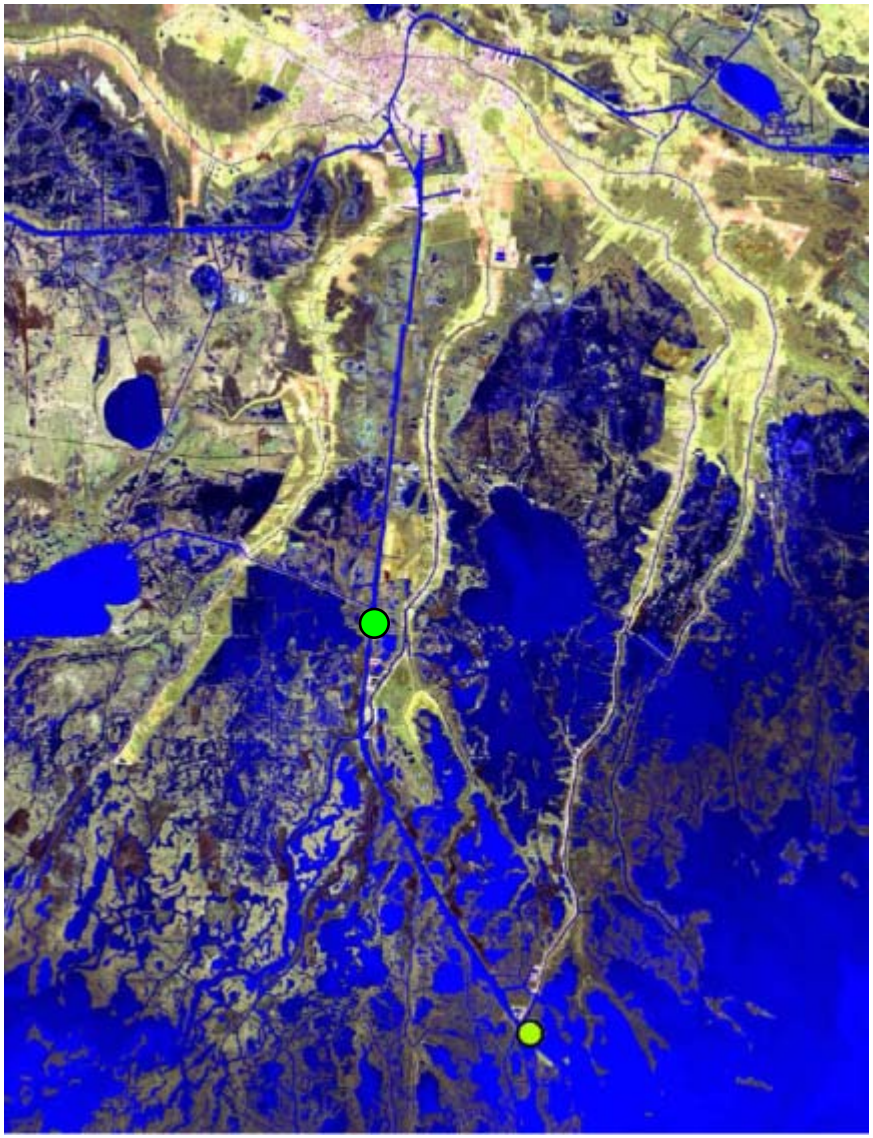
HNC Saltwater Intrusion

- Monthly salt wedge mapping
- 20 salinity measurements every 25 cm from surface to bottom
- Every 2 km



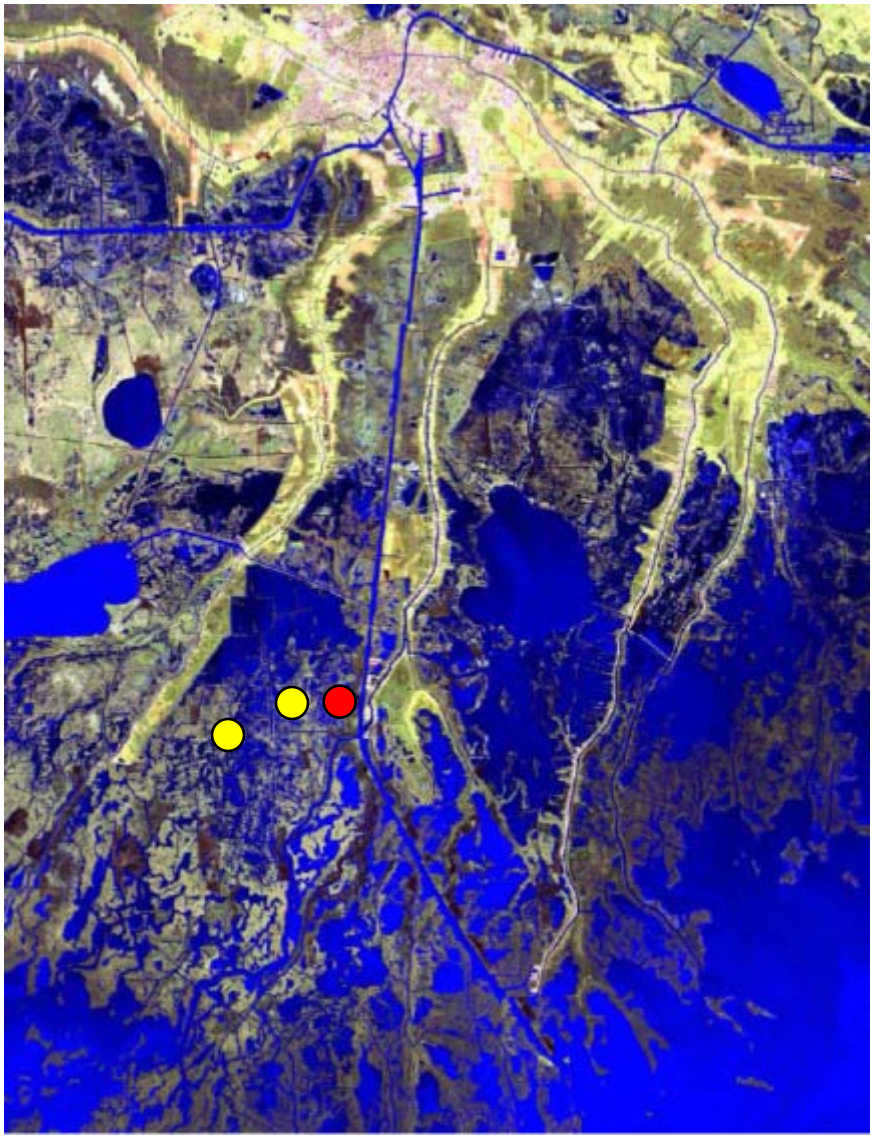
HNC Saltwater Intrusion

- 25-hour synoptic salinity and velocity profiling
- 2 locations
- Fall/spring (low/high river inputs)
- High/low tide range



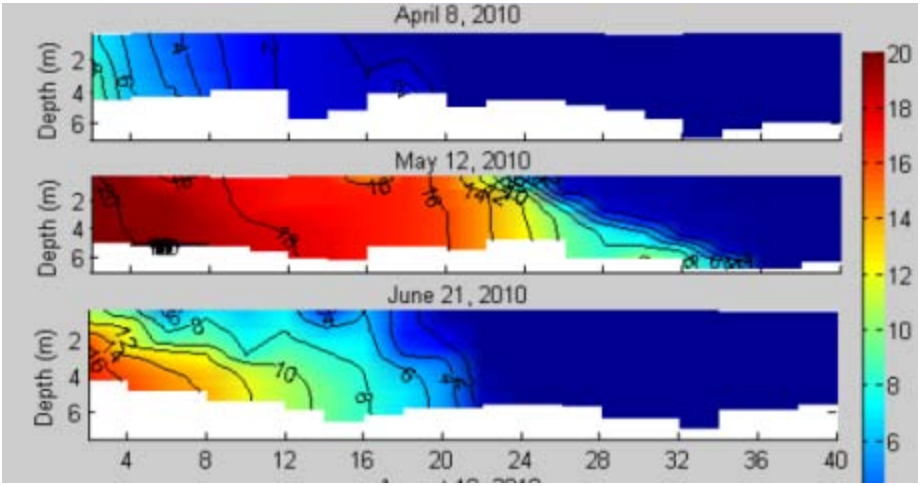
Salt Transport from HNC to Surrounding Marshes

- 1 current meter coupled with salinity probe
- 2 additional salinity probes in marsh

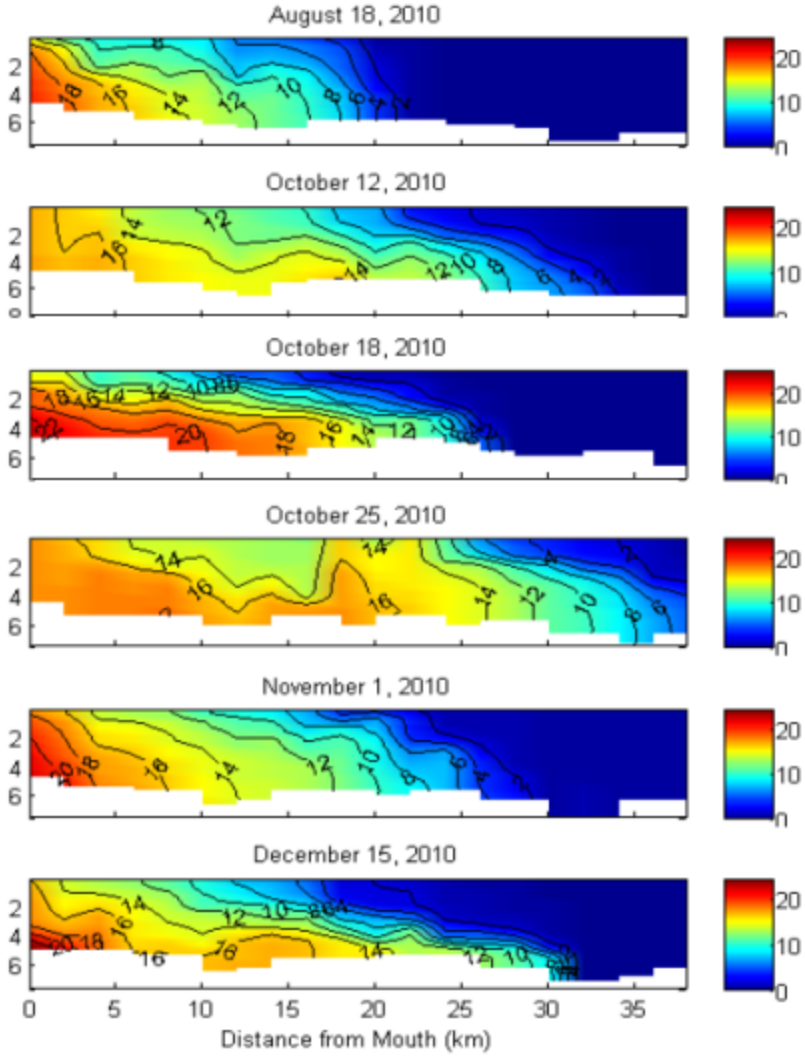


Salinity Transects

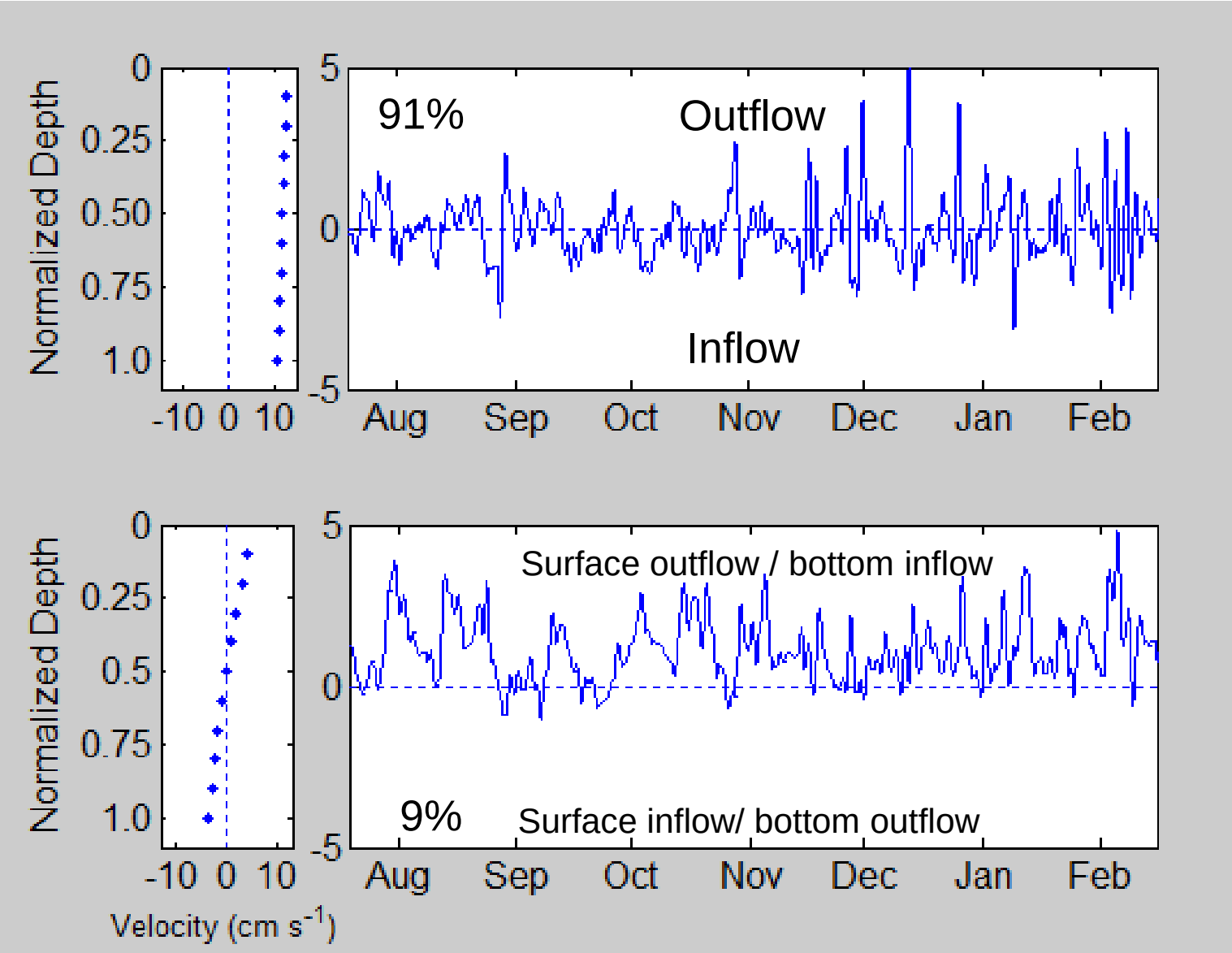
Gulf Houma



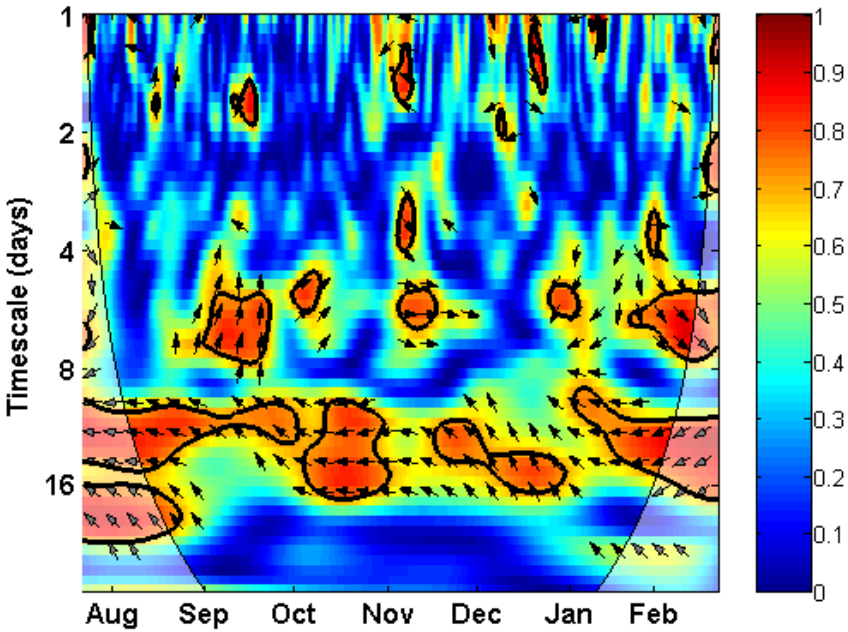
Gulf Houma



Vertical Flow Structure – Station 3



Drivers of Baroclinic Flow



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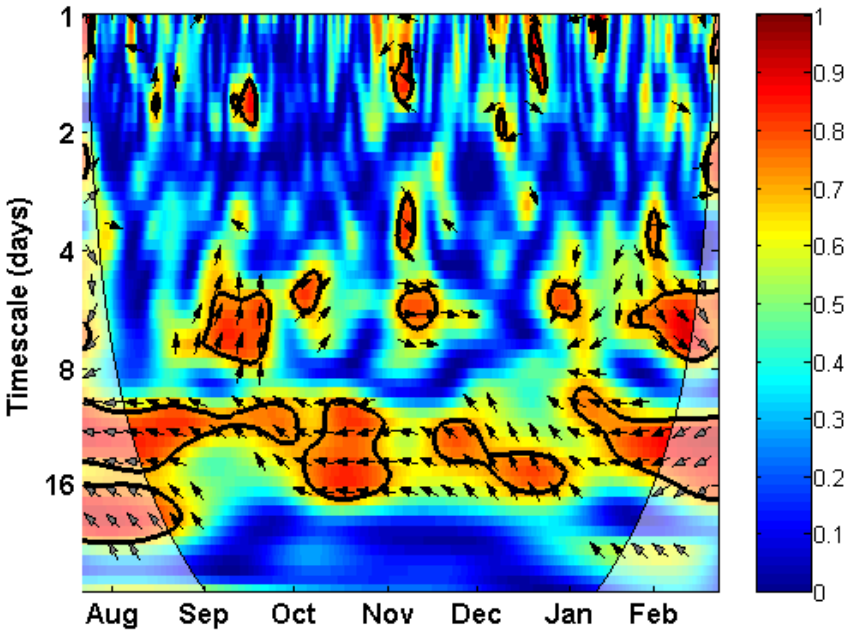
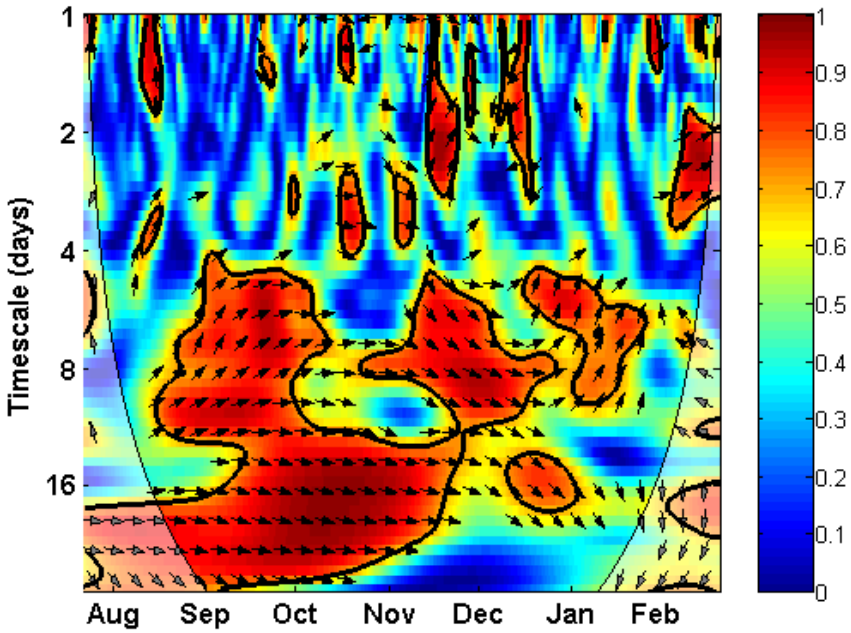
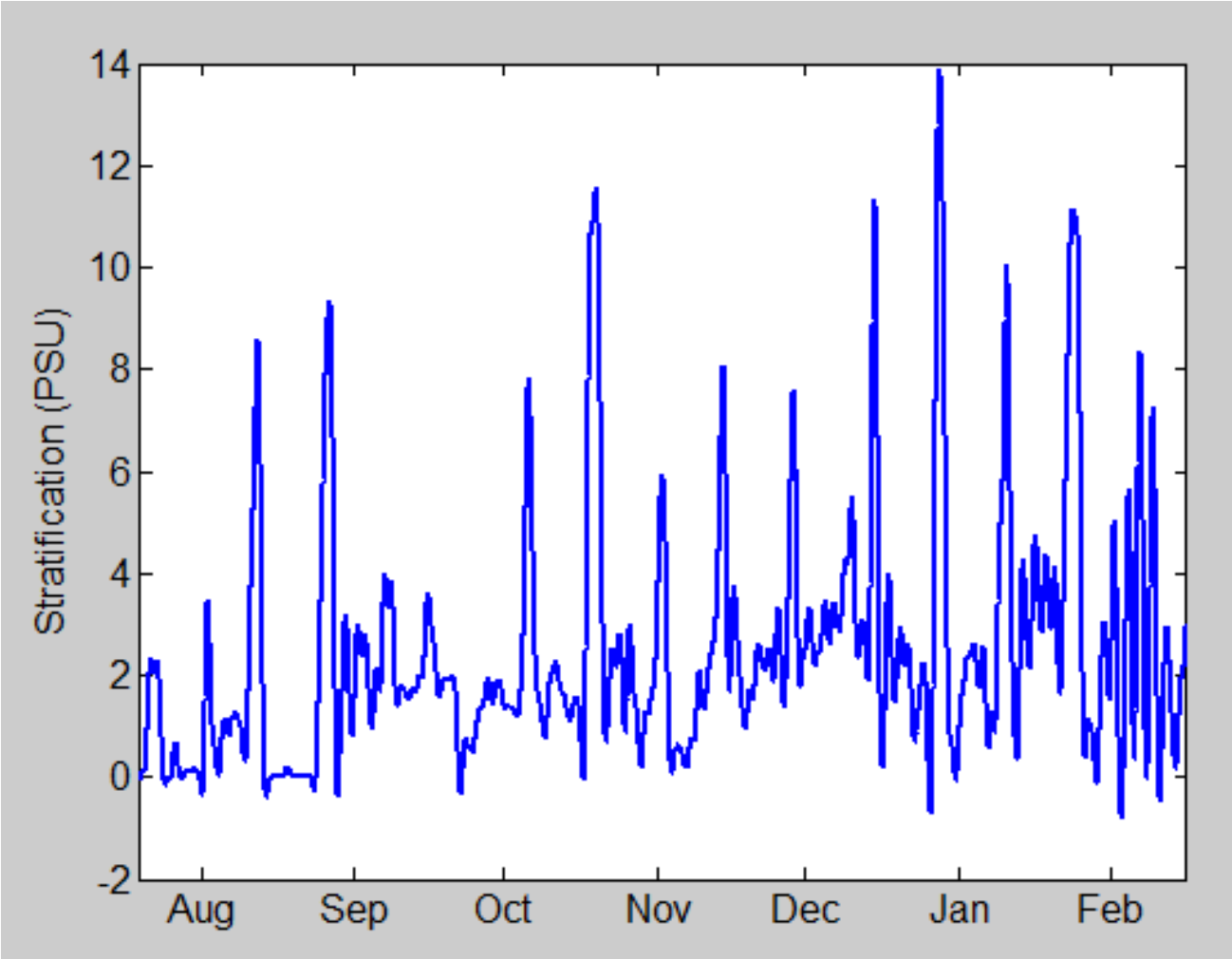
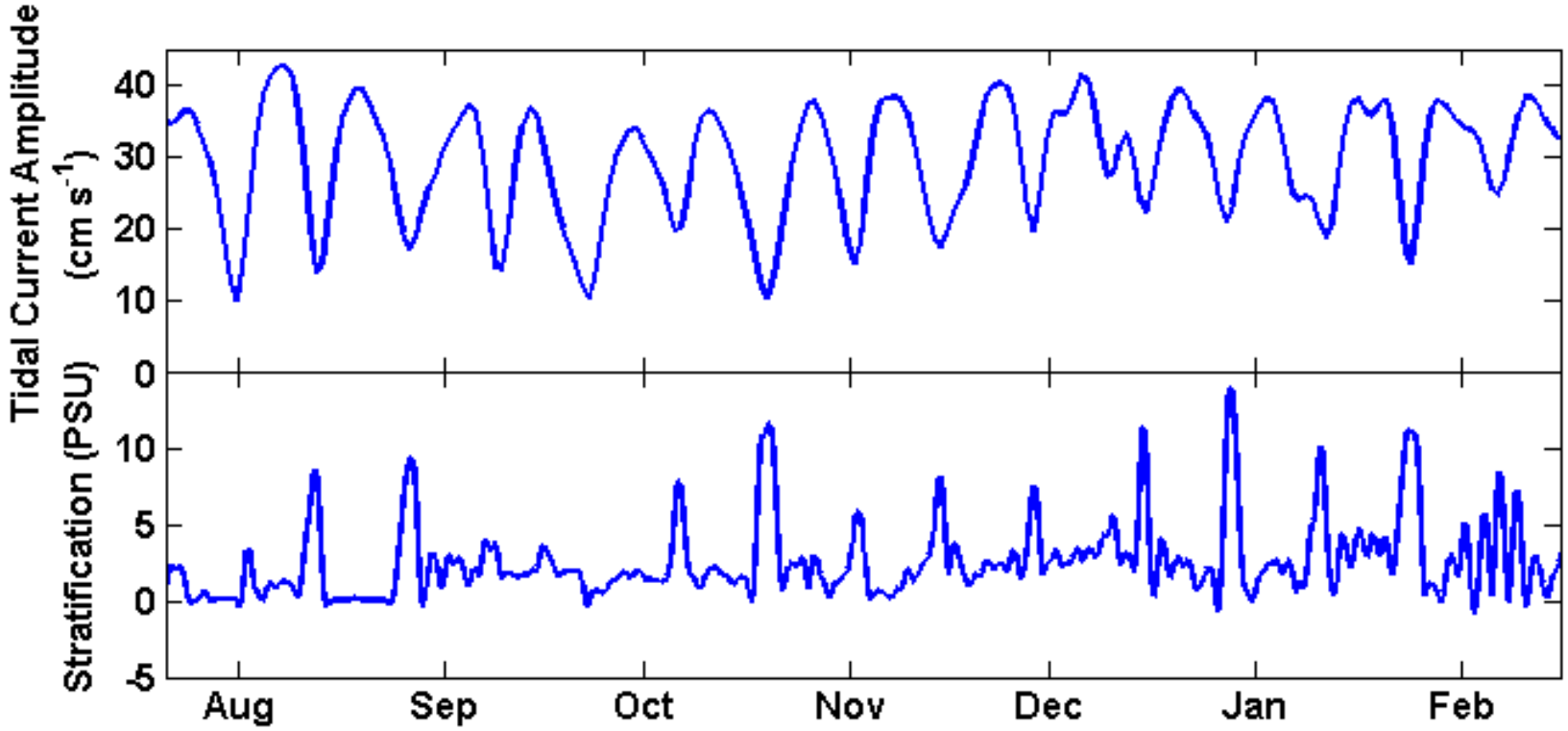




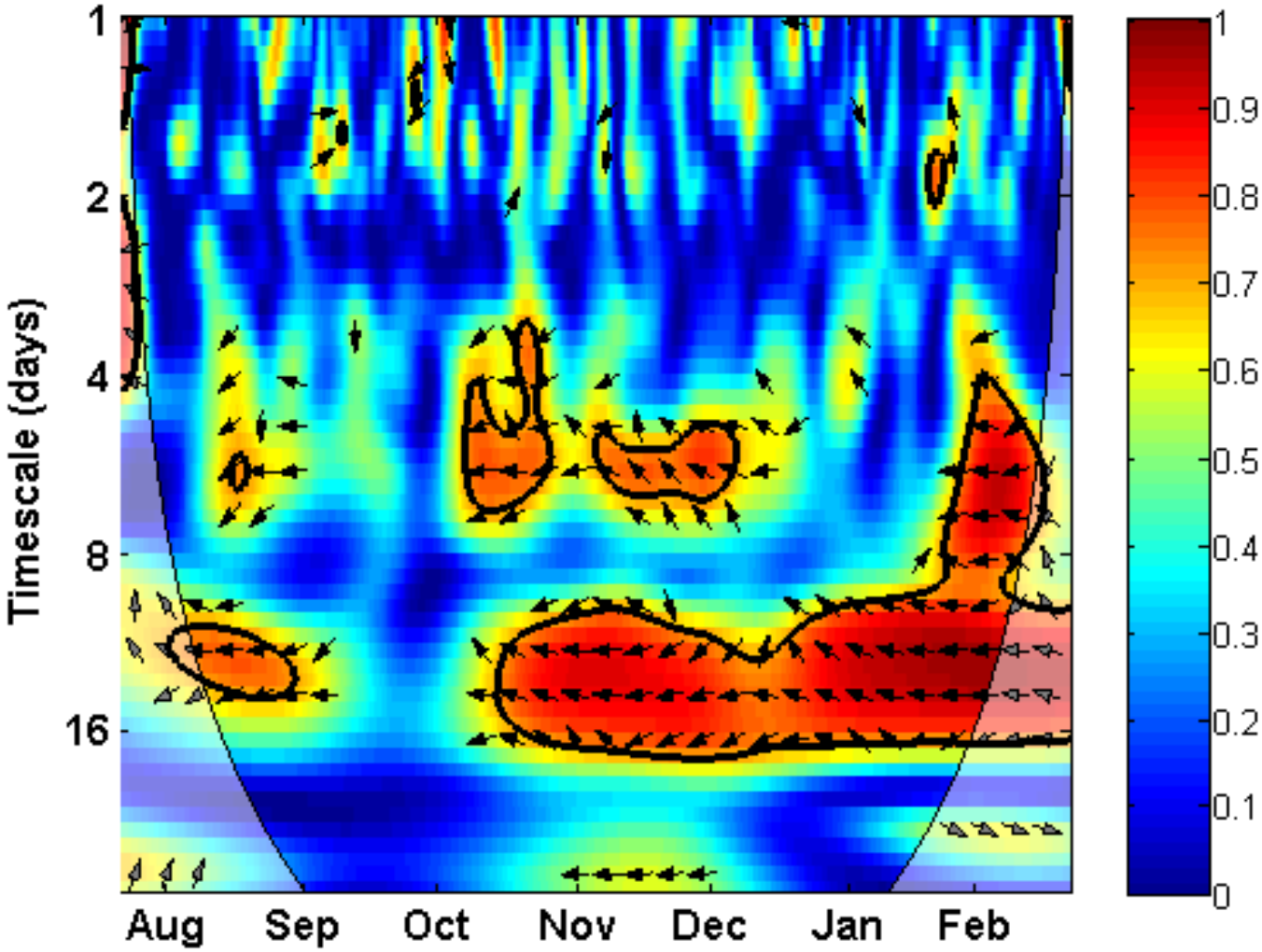
Salinity Stratification



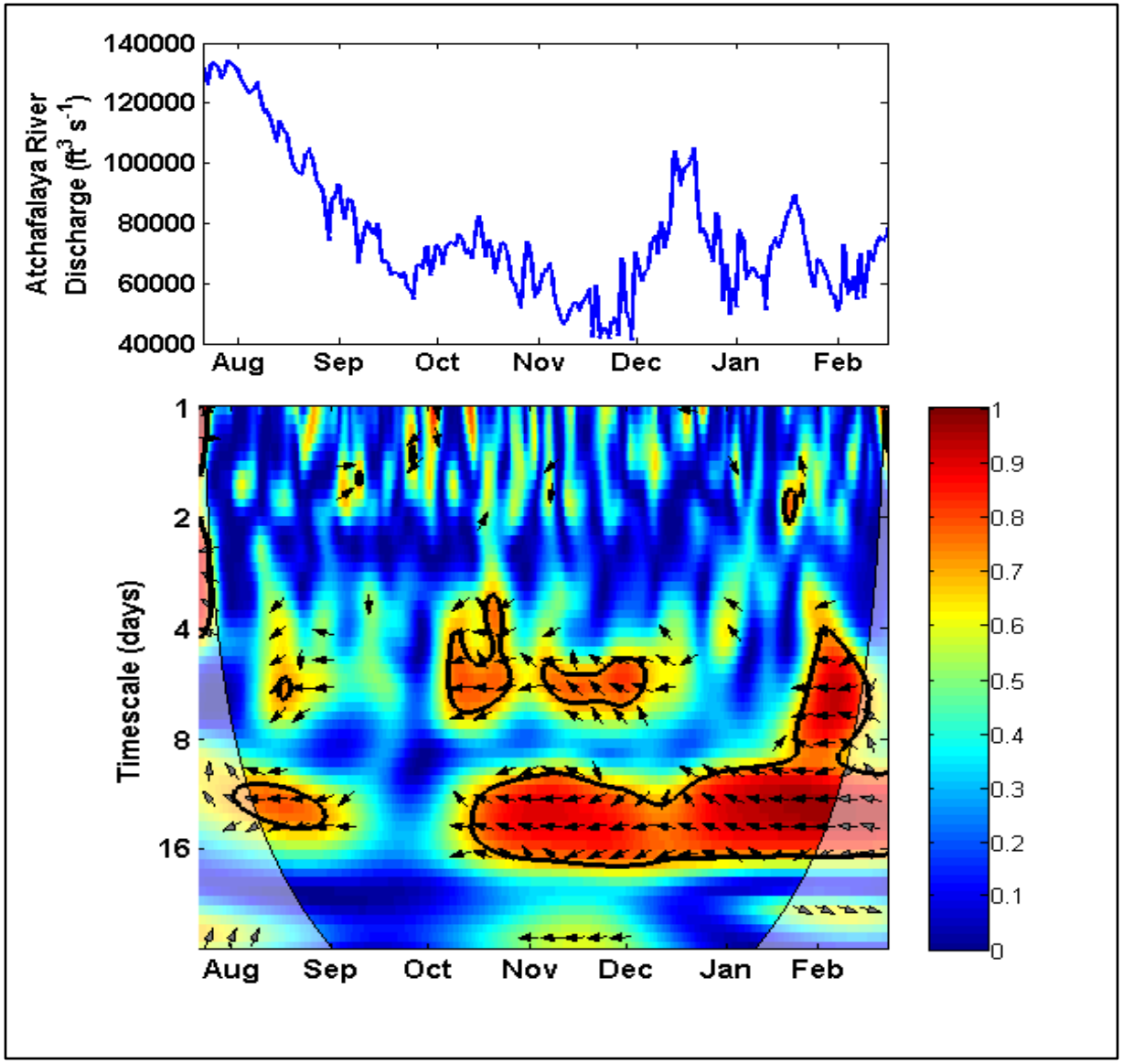
Salinity Stratification vs. Tidal Amplitude



Drivers of Vertical Salinity Stratification



Drivers of Vertical Salinity Stratification



Summary

- Salinity incursion distance and vertical stratification in HNC are highly variable
- Vertically-sheared (baroclinic) flows forced by combination of horizontal density gradient and tidal stirring power
- Vertical salinity stratification is episodic, recurs fortnightly, and only when enough freshwater inflows are present

Remaining Tasks

- Identify relationships between salinity intrusion in HNC and salt flux to and salinity in surrounding marshes
- Complete spring tidal cycle synoptic profiling
  - Decompose total salt flux into advective and dispersive terms
- Identify effects of large vessel traffic on stratification
  - Preliminary analyses suggest this effect is short-lived and negligible