Co-Development of Forecasting Support Tool for Management and Planning – FaST MaP

Laura Manuel Ehab Meselhe
Kelin Hu Barb Kleiss

TULANE UNIVERSITY
SCHOOL of SCIENCE
& ENGINEERING

RESTORE
SCIENCE PROGRAM

Motivation

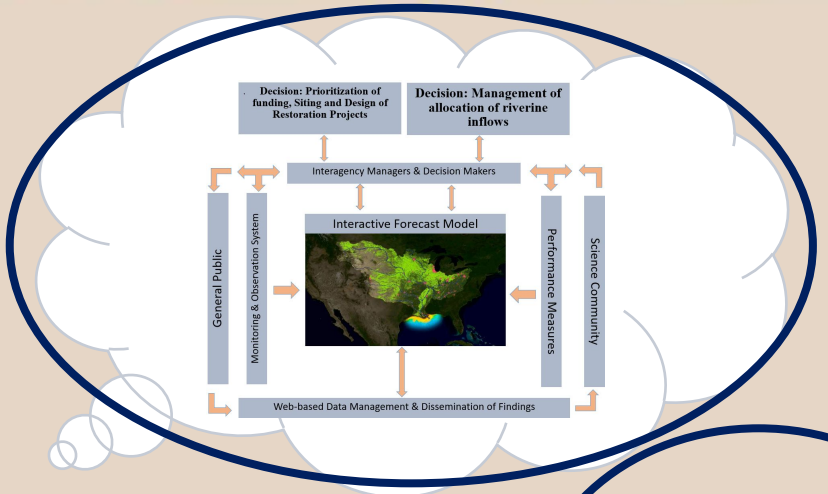
- Managing NGOM limited by our understanding of pathways of riverine waters
- Freshwater releases among controlled MR features and large outlets could be optimized without compromising flood risk and navigation authorizations
- FaST MaP operated by NRM facilitates understanding the trade-offs among strategies and proactively reduce knowledge uncertainties
- NRM and researchers will co-develop all aspects of FaST MaP and will be used through a web-based portal
- FaST MaP is a needs-driven and science-based system that builds capacity for interdisciplinary work through training and engagements

Natural Resources Management Decisions

a) Guide the prioritization of funding, siting and design of proposed restoration projects and incorporation of adaptive management strategies by enhancing managers' systemic understanding of the critical influences of riverine inflows and their impacts on oysters, marine mammals, marsh creation, and other natural resources

b) Guide the management of allocations of riverine inflows to optimize the natural resources of the northern GOM while recognizing the societal constraints of flood risk management and navigation

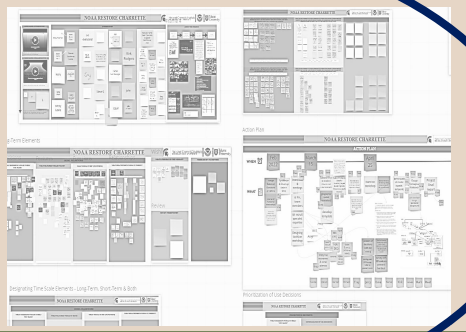
Co-Production Effort



Design Kickoff

Toolbox Dialogue Initiative

Design Charrette



Team Additions

Design Process Timeline

Conceptual Design

Knowledge Sharing

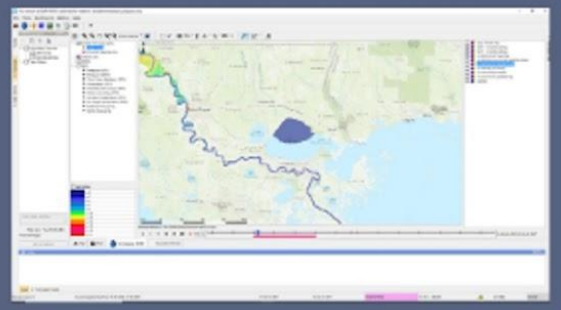
Focus Groups

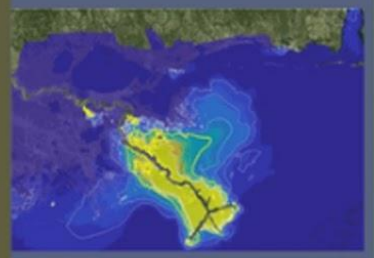
Working Sessions

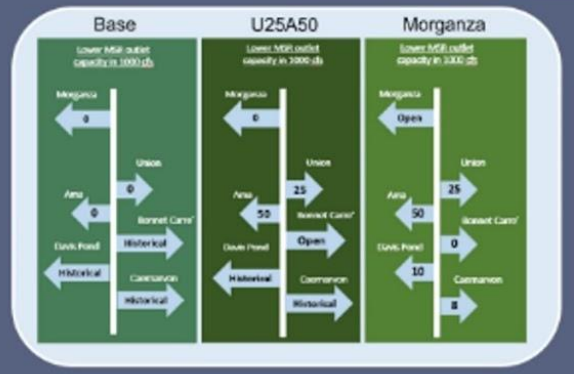
Design Enhancements

A Closer Look

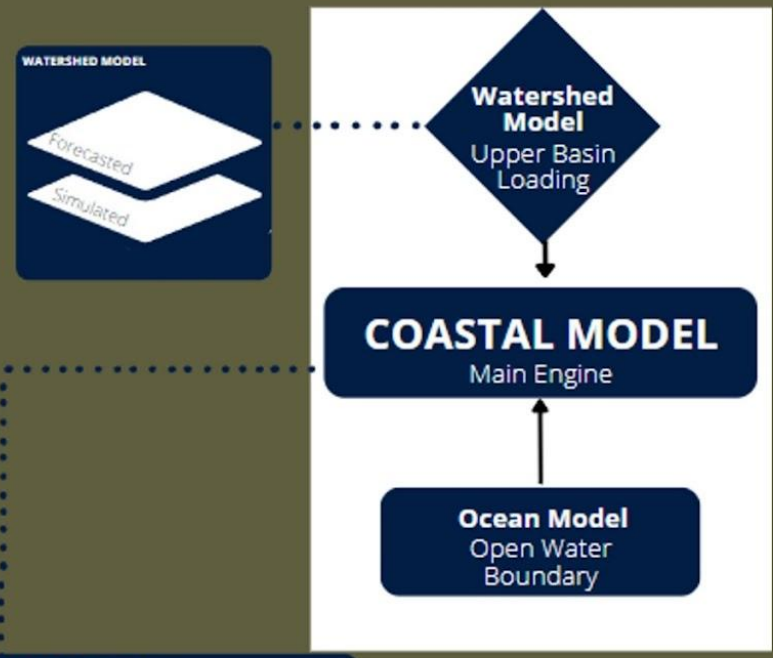
FaST MaP

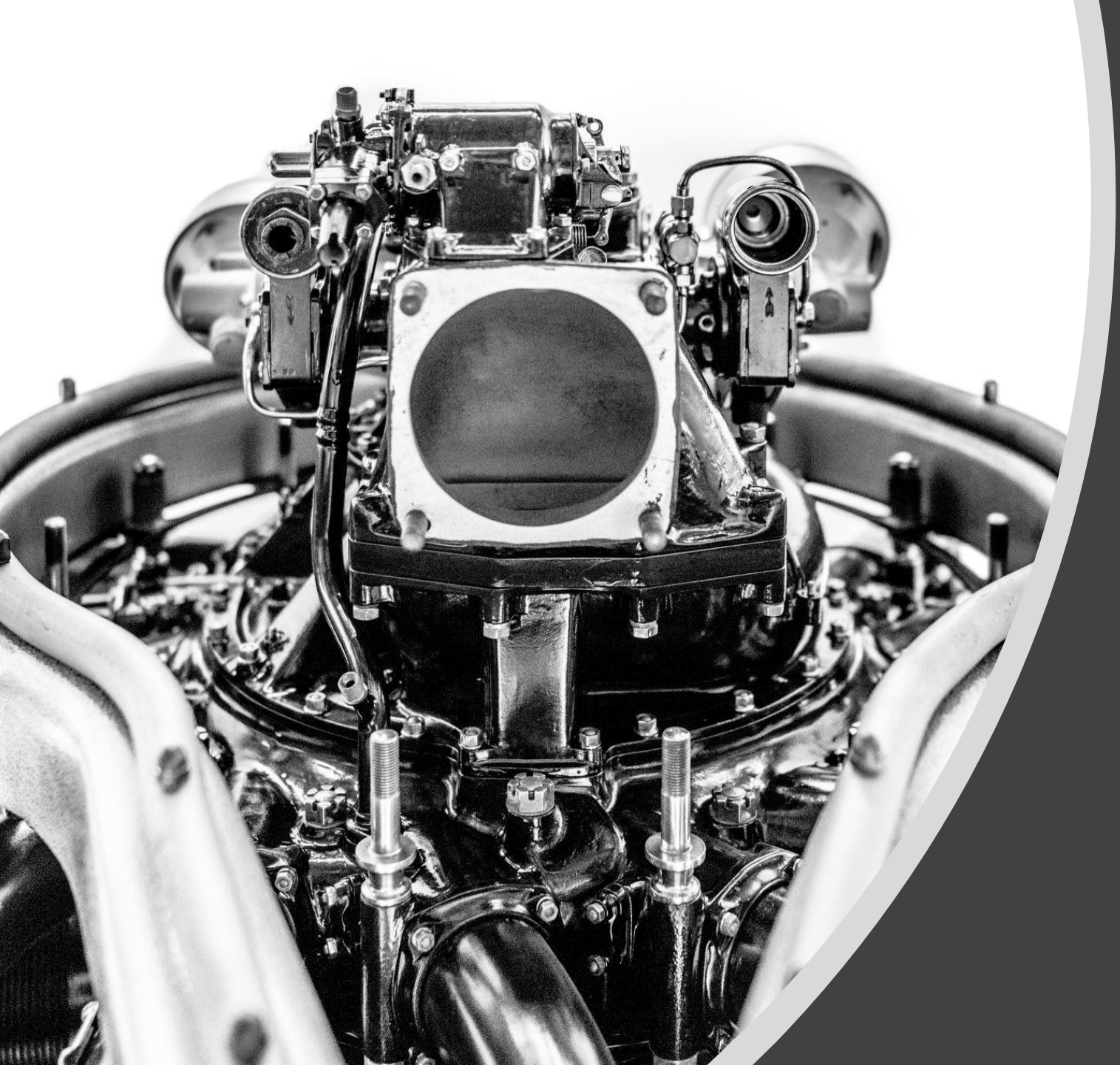






Built Model Framework





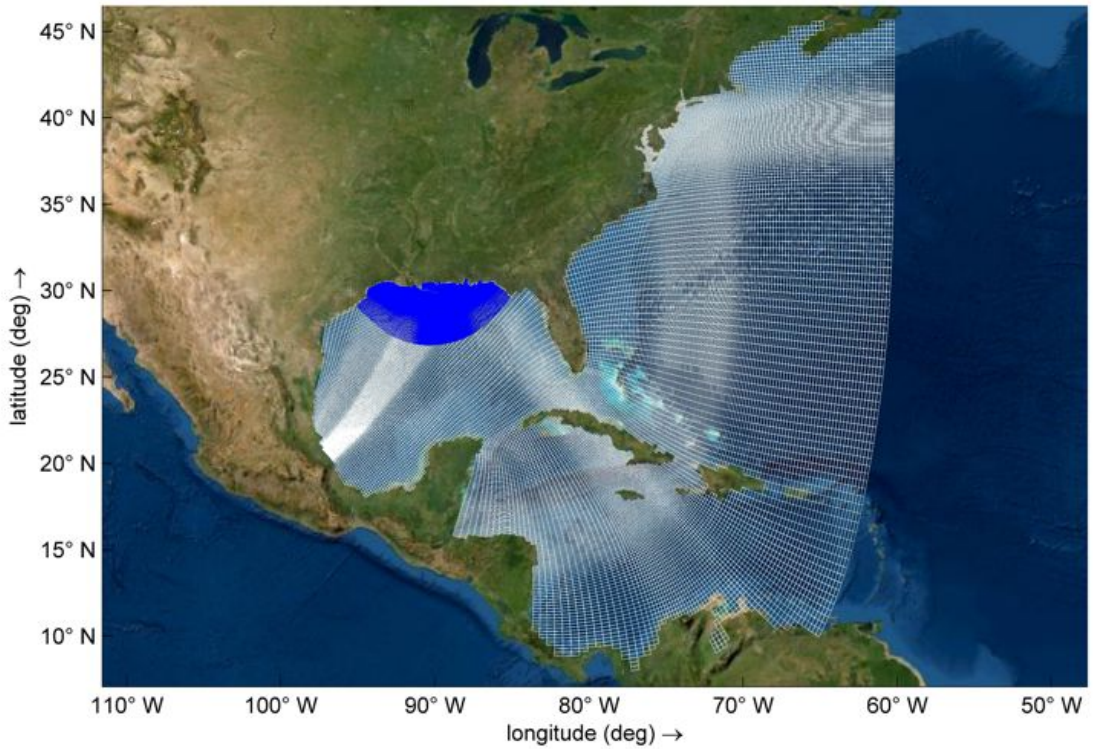
Preliminary Design: Existing Tools

Gulf-Atlantic Model

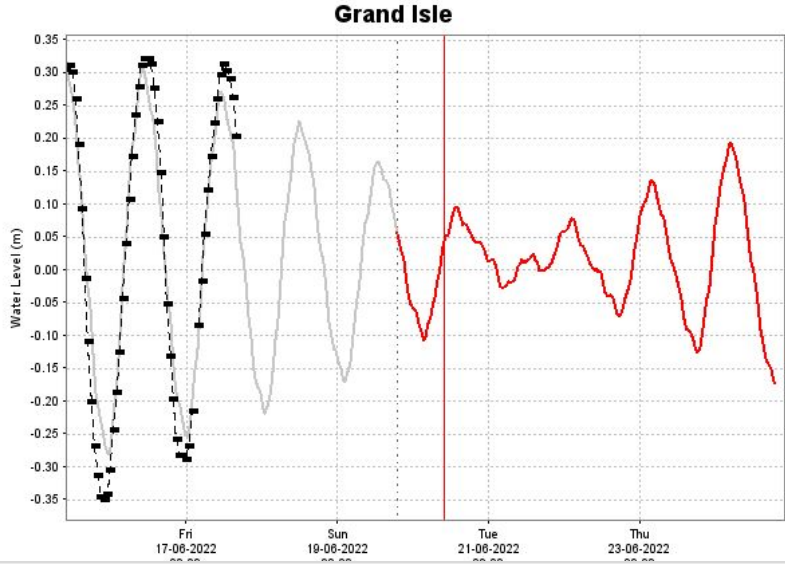
- Size 253 x 238
- Resolution 6 - 40 km
- Time step 6 min

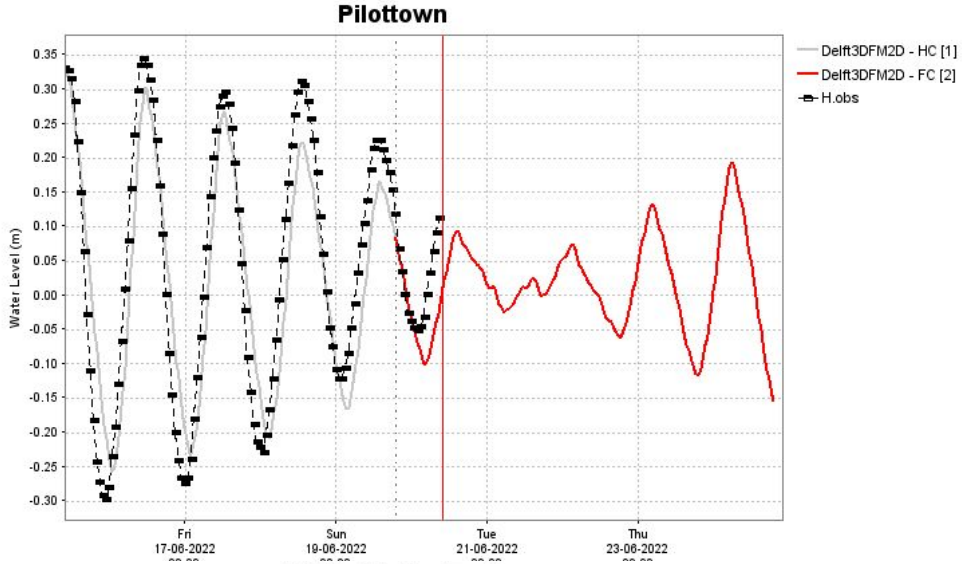
- 3D simulation with 7 vertical sigma layers, [5, 10, 20, 30, 20, 10 and 5]% of total depth.

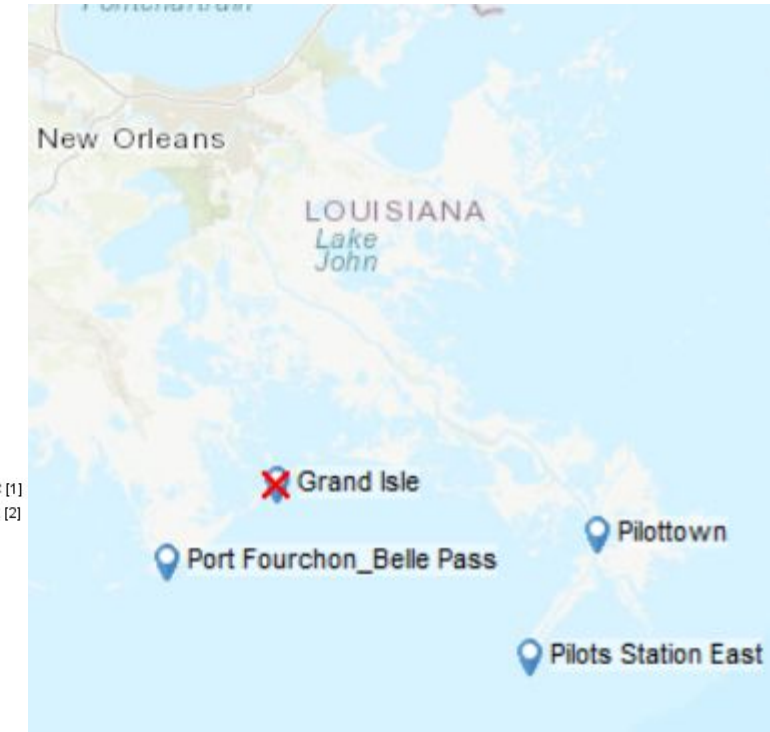
- Run time: 2 hours (10 processors) for a one-year simulation

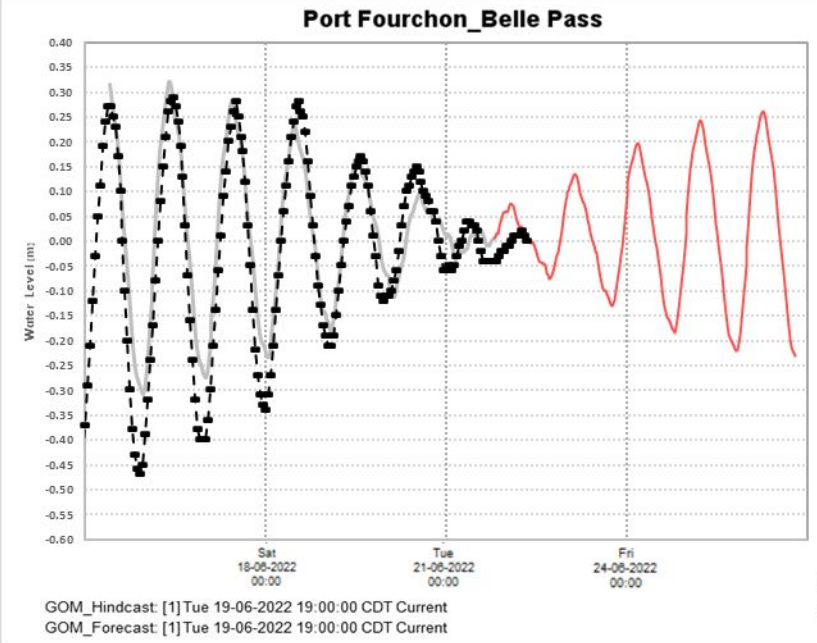


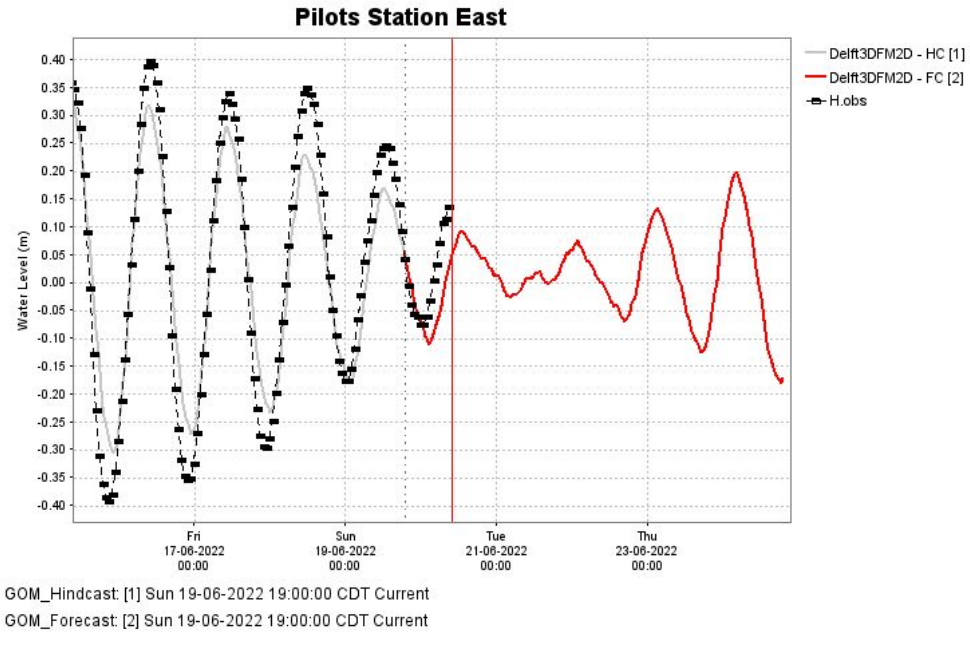
Sample Output at Select Locations of Interest





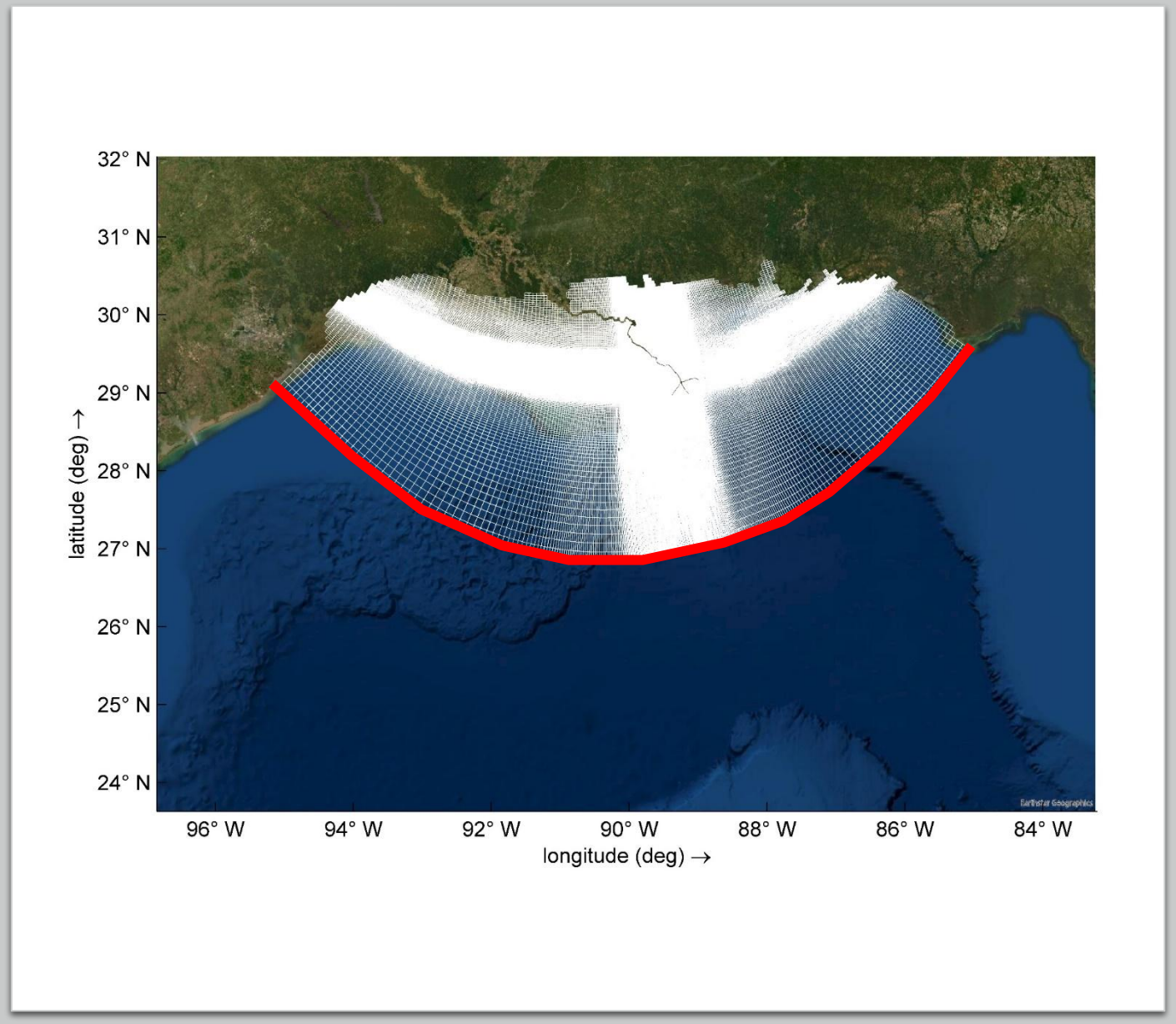




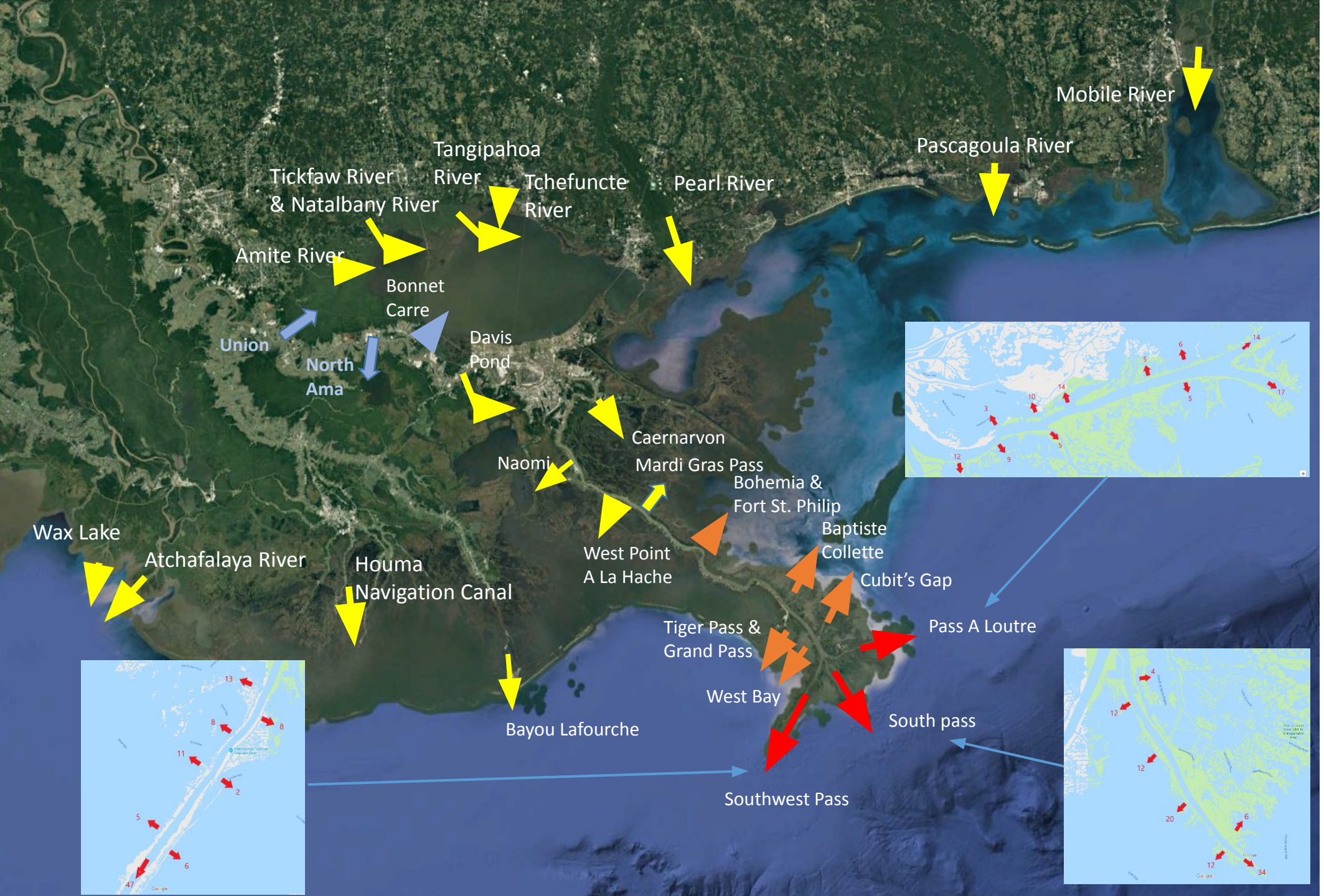


Regional Model

- Size 553 x 403
- Resolution 280m – 7km
- Time step 0.6 min
- Run time 2.3 hrs – 10 day run

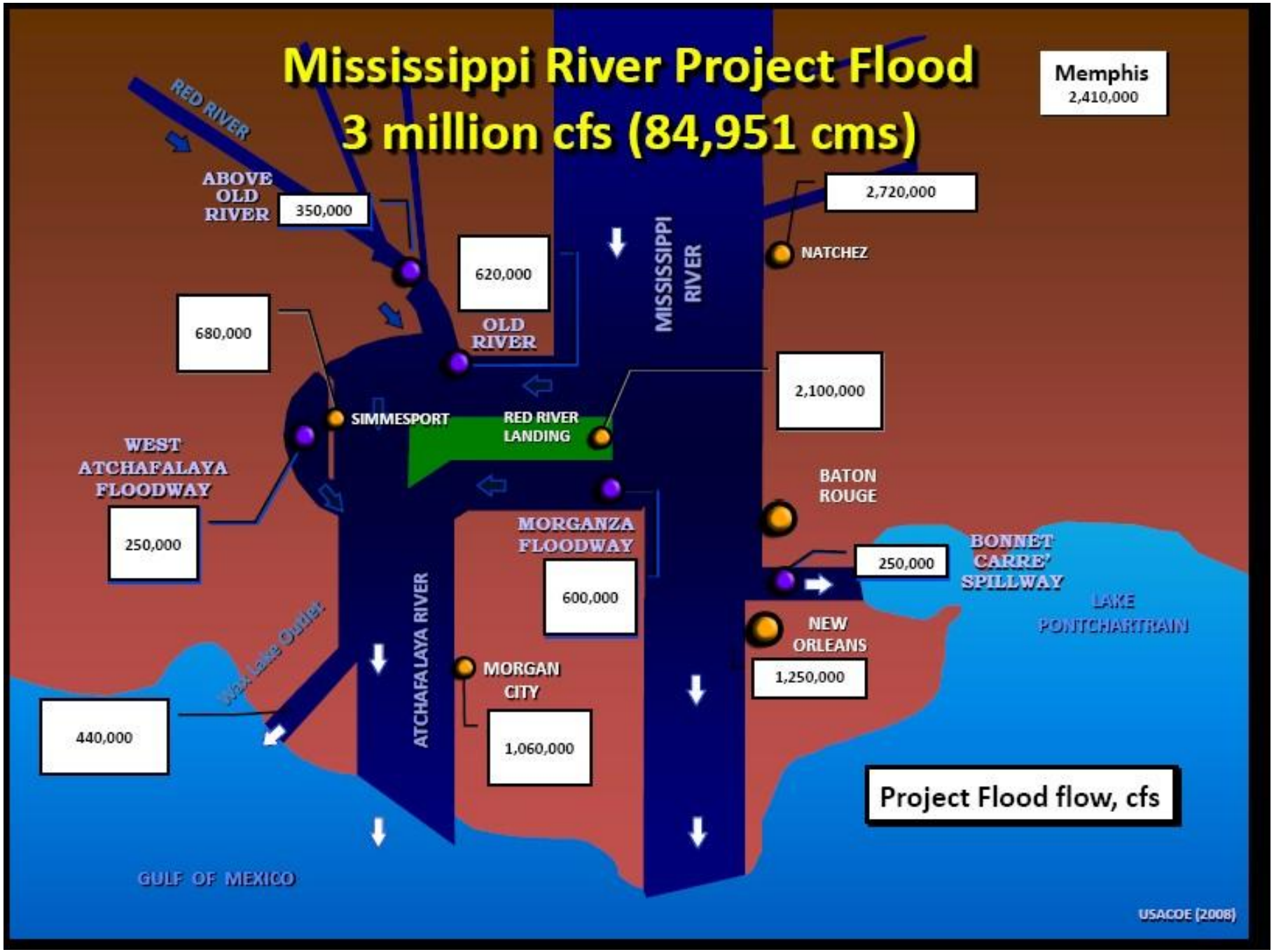


Discharge Sources



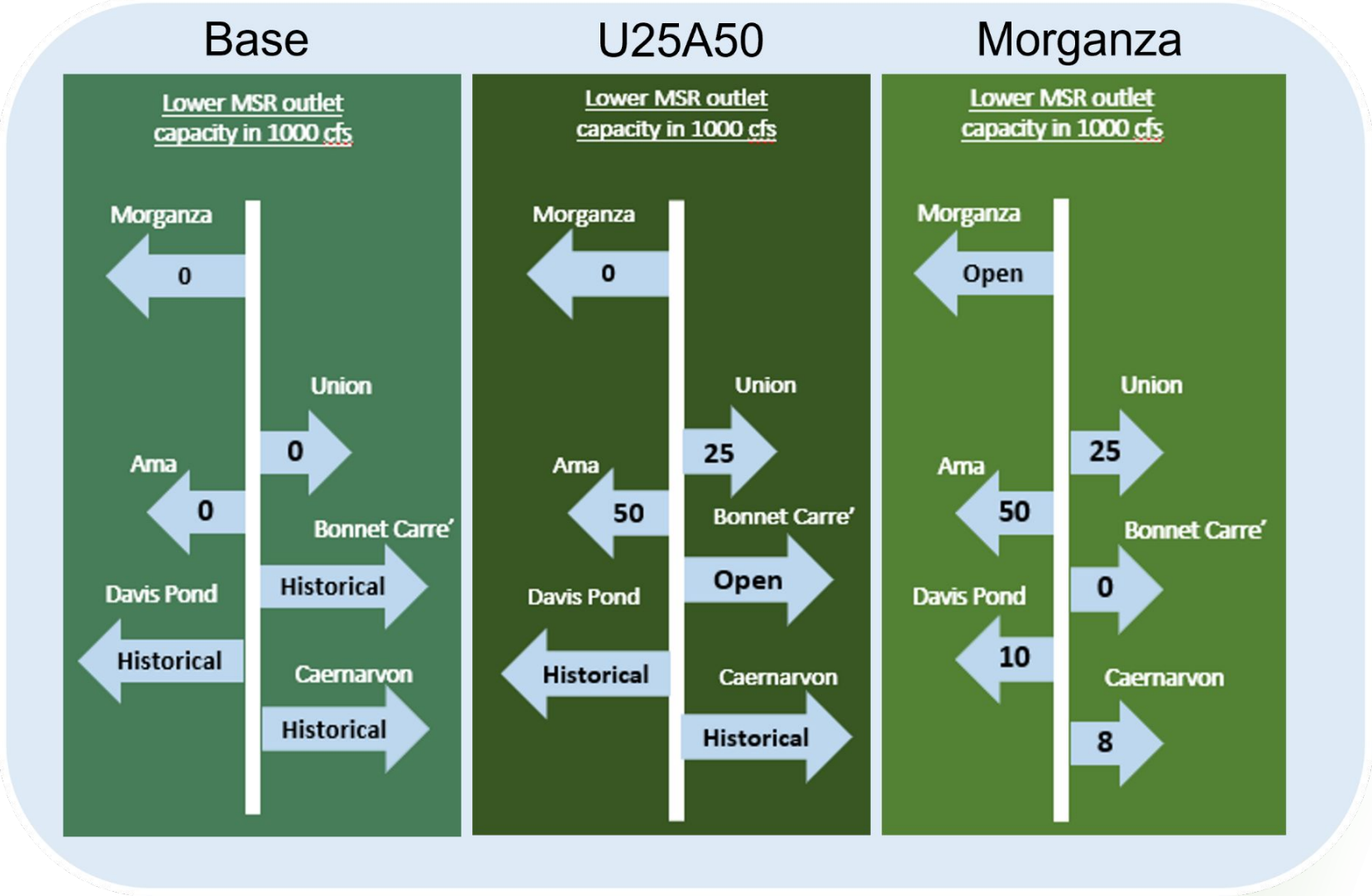
Example Applications

Revisit existing Policies
and Protocols


Mississippi River Project Flood
3 million cfs (84,951 cms)
Memphis
2,410,000
RED RIVER
ABOVE OLD RIVER
350,000
620,000
OLD RIVER
MISSISSIPPI RIVER
2,720,000
NATCHEZ
680,000
2,100,000
SIMMESPORT
RED RIVER LANDING
WEST ATCHAFALAYA FLOODWAY
250,000
BATON ROUGE
MORGANZA FLOODWAY
600,000
250,000
BONNET CARRE' SPILLWAY
LAKE PONTCHARTRAIN
ATCHAFALAYA RIVER
NEW ORLEANS
1,250,000
MORGAN CITY
1,060,000
440,000
GULF OF MEXICO
Project Flood flow, cfs
USACOE (2008)

Flood Risk Management Scenarios

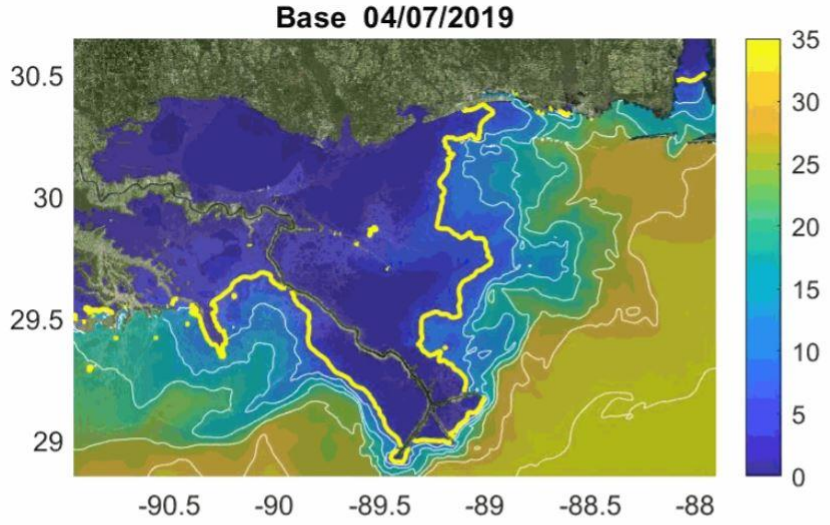
1. Base (*Historical*)
2. U25A50 *(Union at 25k cfs, Ama at 50k cfs, assisted BCS)*
3. Morganza *(Union at 25k cfs, Ama at 50k cfs, Davis Pond at 10k cfs, Caernarvon at 8k cfs, no BCS)*

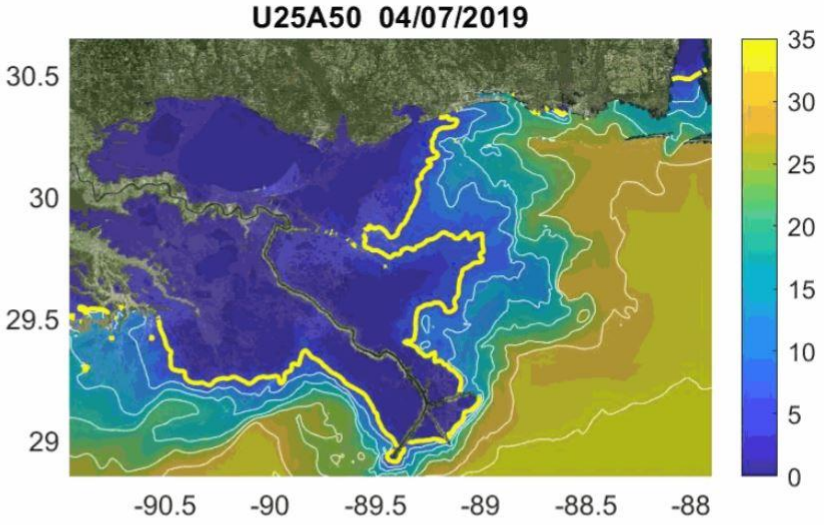


Response of BCS operation to Union Diversion

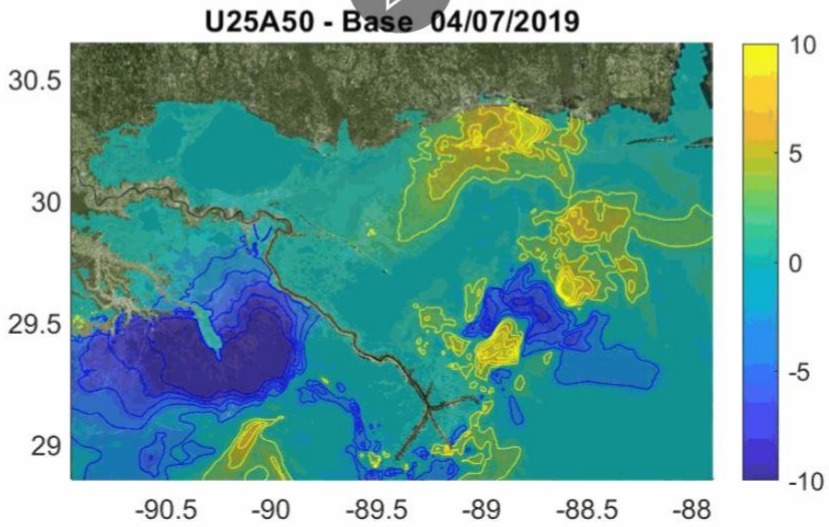
	Unassisted	25K	50K	75K	100K
2070 Duration (days)	29	22	18	15	11
2070 Water Volume Reduction		**24%**	**43%**	**59%**	**70%**
2020 Duration (days)	28	16	12	8	0
2020 Water Volume Reduction		**48%**	**72%**	**91%**	**100%**
2019 Duration (days)	121	117	113	108	96
2019 Water Volume Reduction		**17%**	**35%**	**54%**	**71%**
2018 Duration (days)	22	17	15	14	12
2018 Water Volume Reduction		**20%**	**37%**	**51%**	**66%**
2016 Duration (days)	22	18	18	16	15
2016 Water Volume Reduction		**22%**	**46%**	**58%**	**70%**

Base vs. U25A50



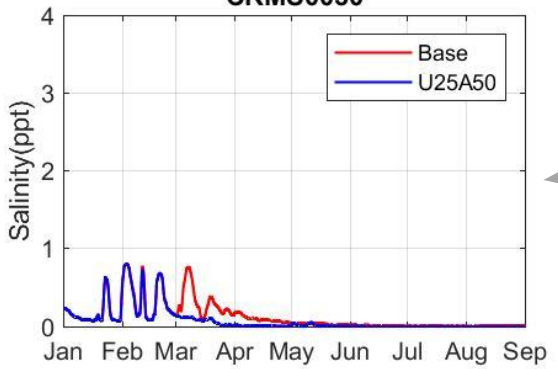


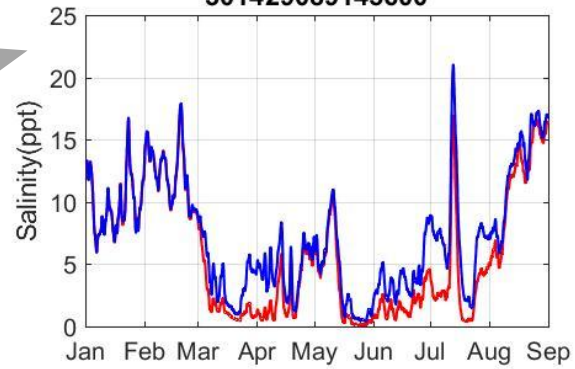
Salinity difference (ppt)

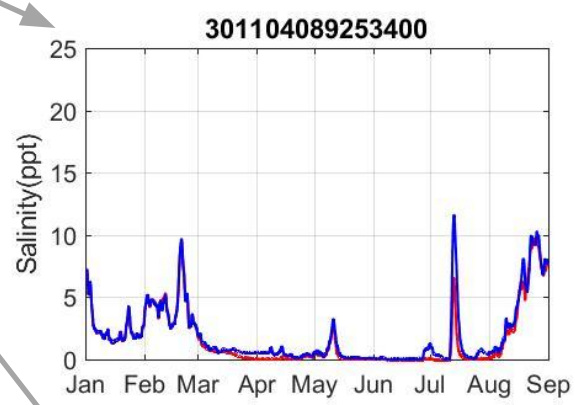


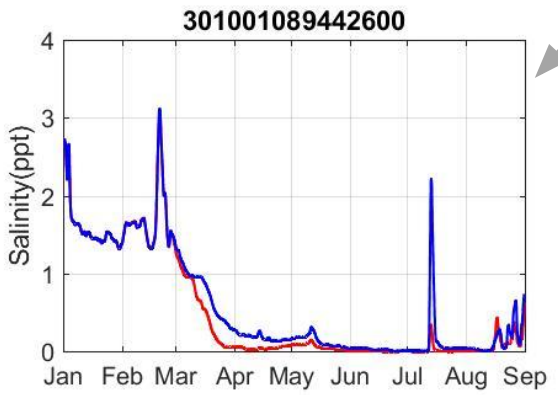
Salinity (ppt)

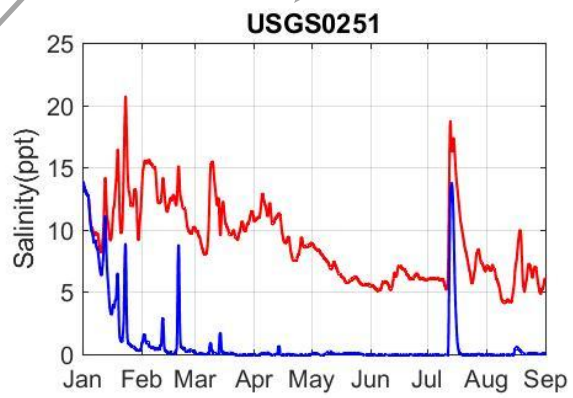
Base vs. U25A50

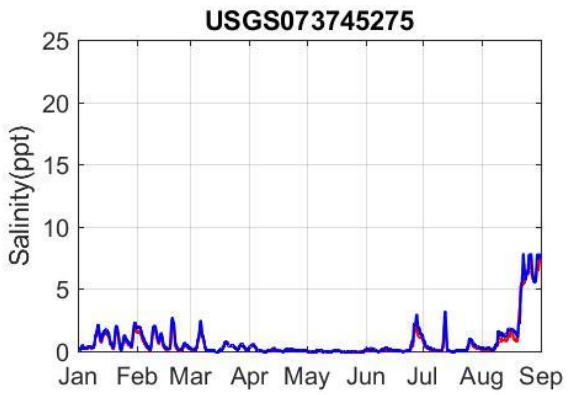


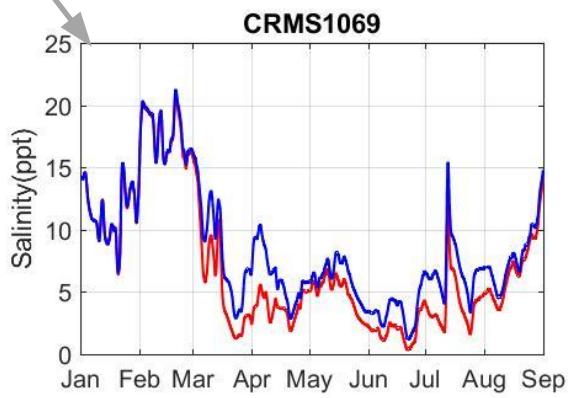






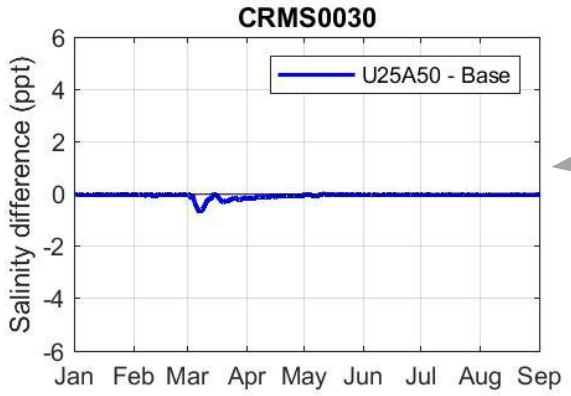


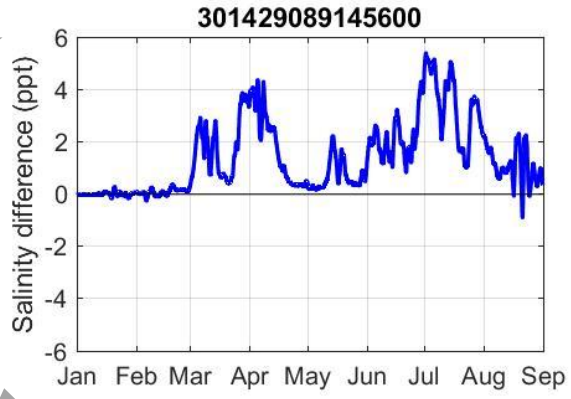


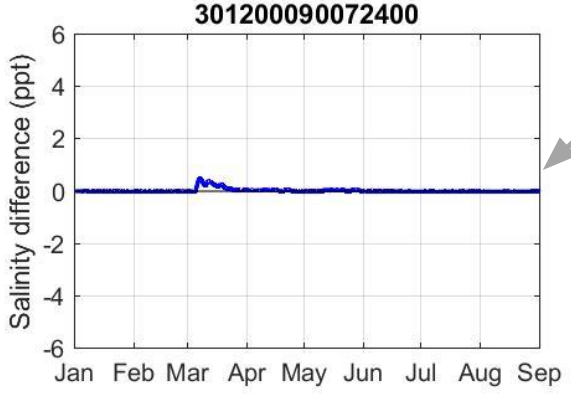


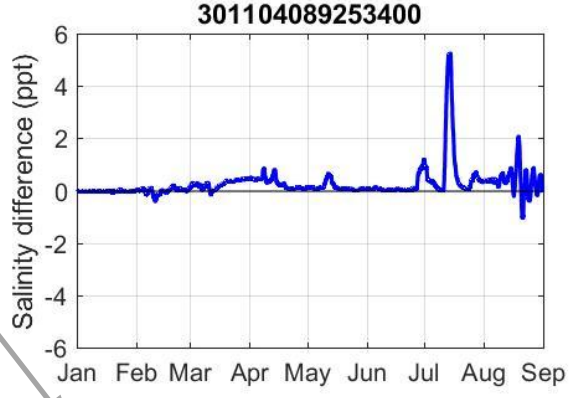
Salinity difference (ppt)

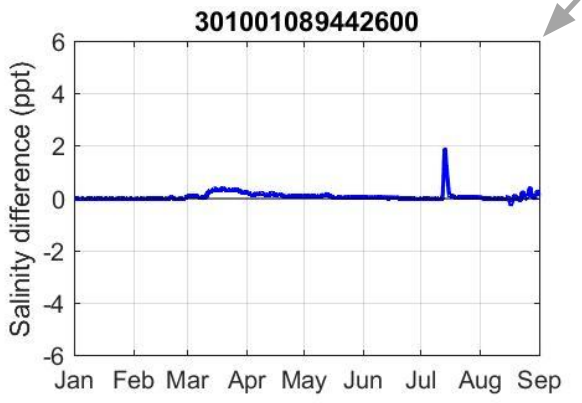
Base vs. U25A50

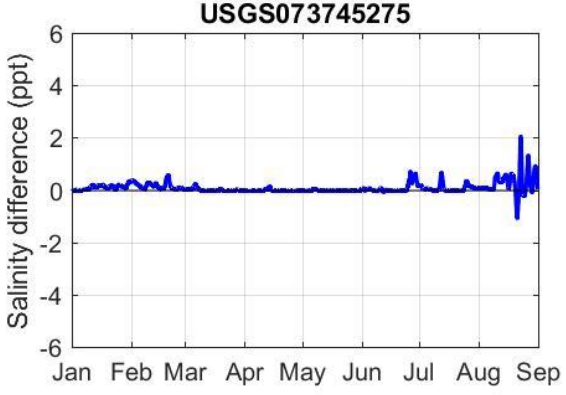


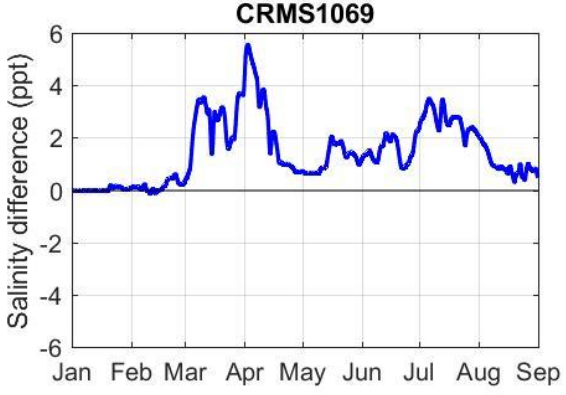




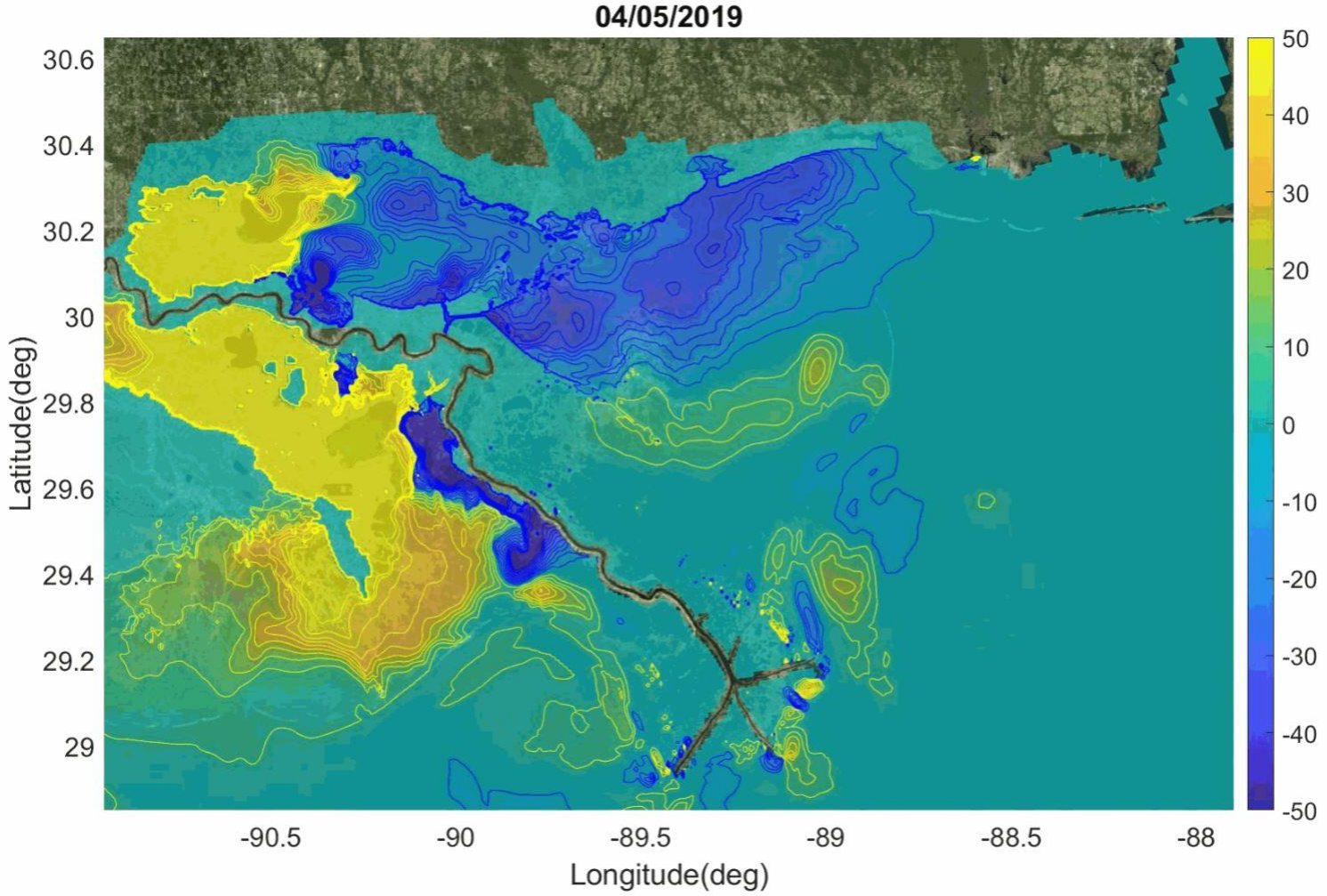






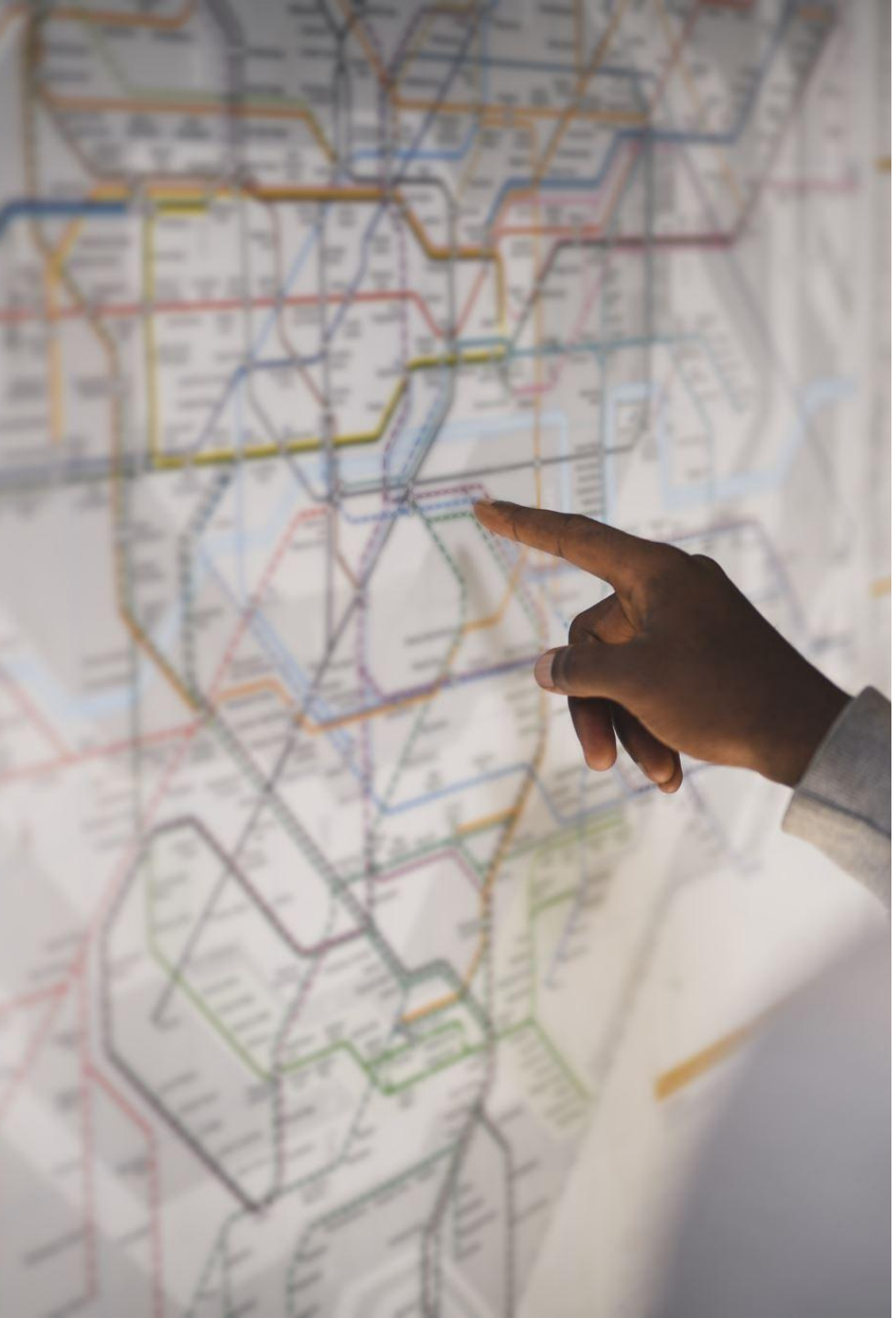


2019 U25A50 SST (mg/l) – 2019 Base SST (mg/l)



Model Use, Storage and Maintenance (MUSM)

- Use: Extensive training program
- Storage: cloud/Web direct access
- Maintenance:
  - Upgradable overall system architecture
  - Seamless process to upgrade engine components
  - Effective approach for periodical upgrade of the web portal
- Financial plan for:
  - Training
  - Housing/storage
  - Maintenance
  - Periodical upgrades



Stakeholder Beta User Group

To successfully apply an agile software development approach FaST MaP, it is necessary to have a group of Natural Resources Managers who represent the needs and interests of the eventual users of the system

Closing Remarks

- Co-development process is a focal point of our approach to produce a viable DSS
- Our primary success metric is to produce a usable system with broad applications to support Natural Resources Managers
- The tool will provide science-based quantitative trade-offs to inform the decision-making process
- Use of adaptation pathways and tipping points help address uncertainties in the decision-making process
- Stakeholders comm essential for buy-in
- Long-term maintenance and upgrade plan is challenging but key to a viable product