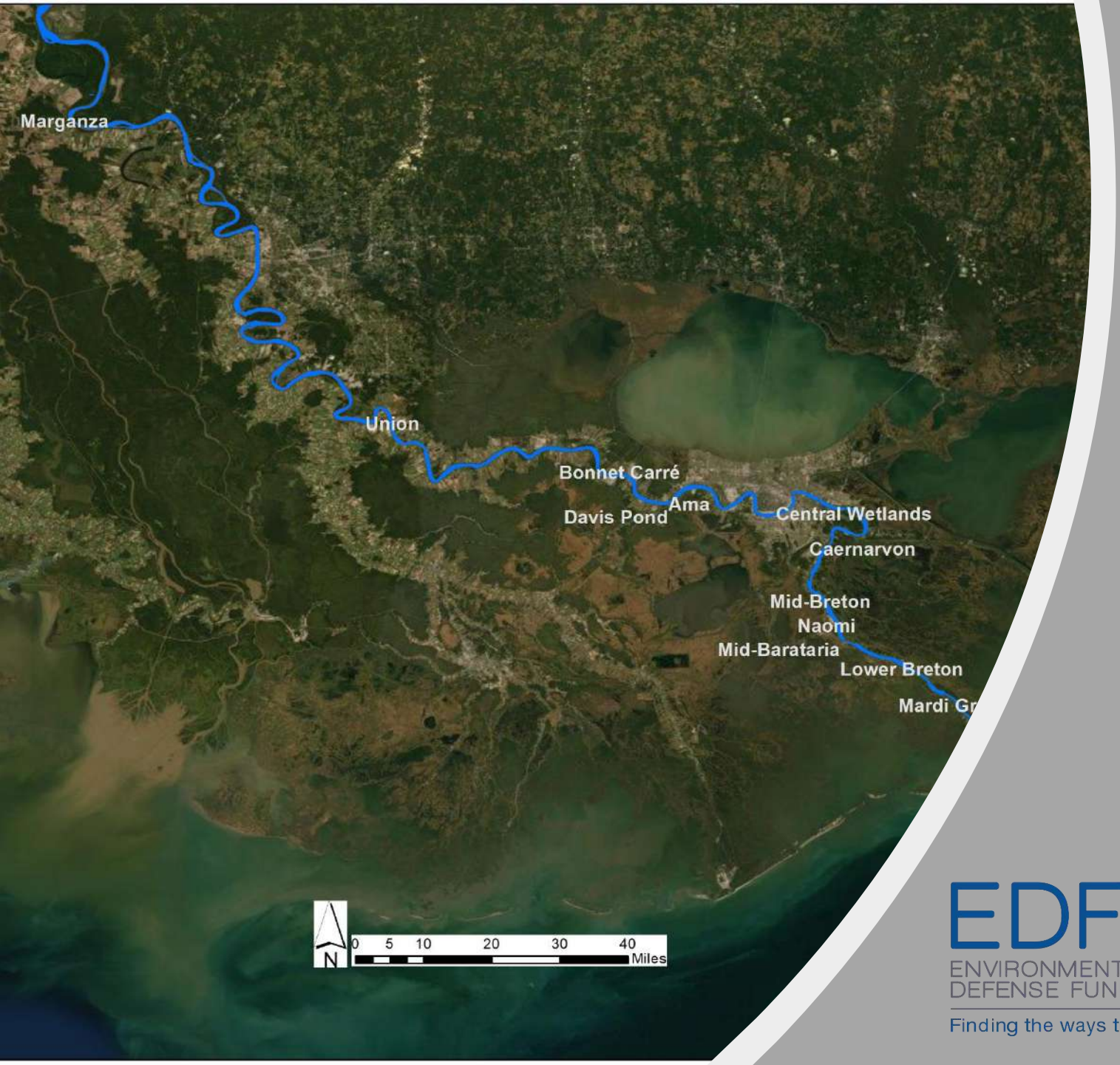


Utilizing Upper Diversions in River Water Management

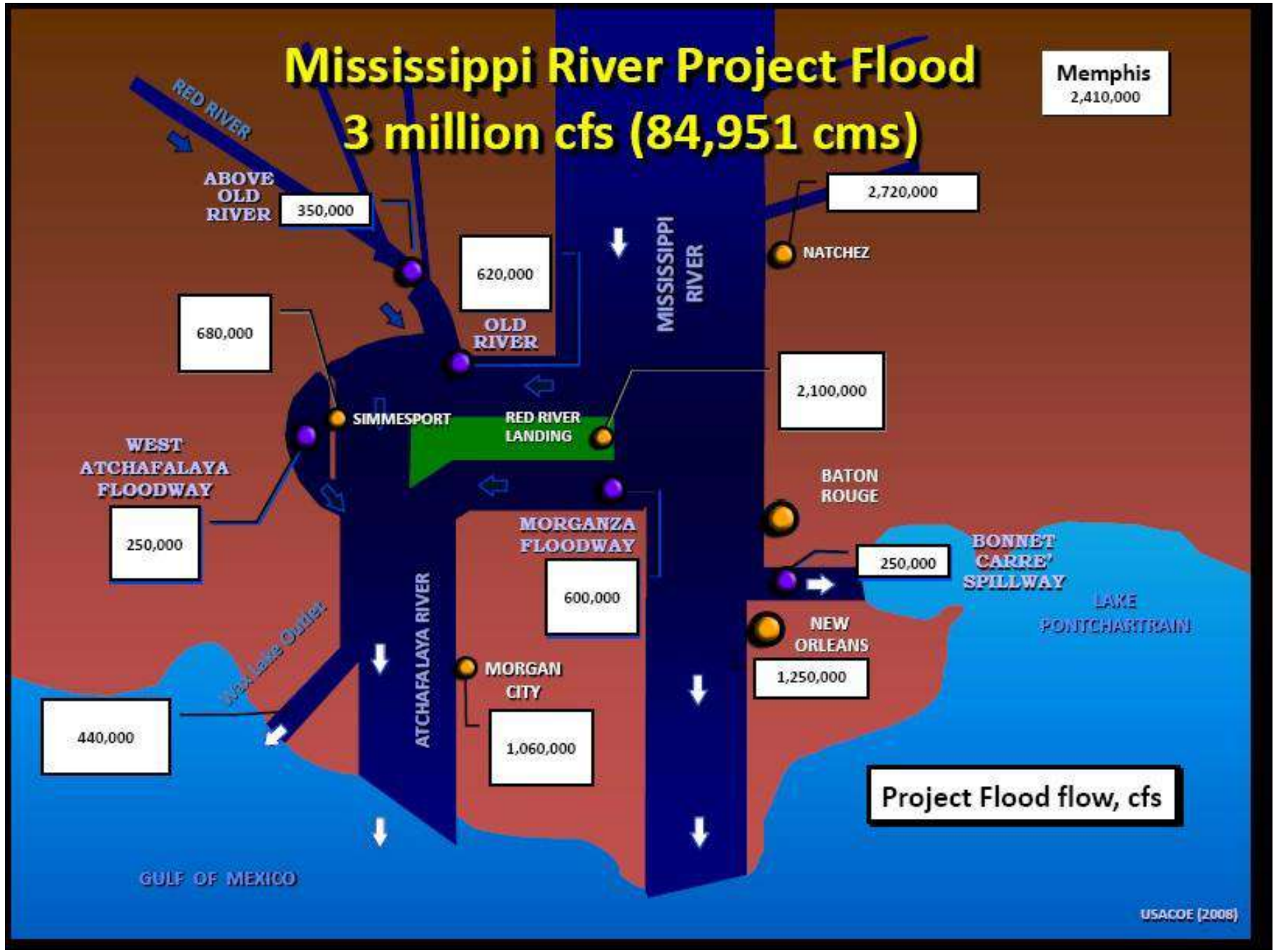
Case Study: 2019 Mississippi Flood Event

EDF ENVIRONMENTAL DEFENSE FUND®
Finding the ways that work

TULANE UNIVERSITY
SCHOOL of SCIENCE & ENGINEERING

Summary

- Bonnet Carré Spillway (BCS) used to manage and reduce flood risk
- Fresh water, sediment, and nutrients are directed into Lake Pontchartrain:
  - Not an optimal use of vital resources and;
  - May induce water quality issues
- Consider alterative strategies to meet the flood risk management needs while maximizing ecosystem benefits
  - Union and Ama along with Bonnet Carré
  - Morganza along with Ama, Union, Davis Pond and Caernarvon
- Use 2019 flood events to examine altering the operation plans for Bonnet Carré


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)

Bonnet Carré Spillway Operation Record

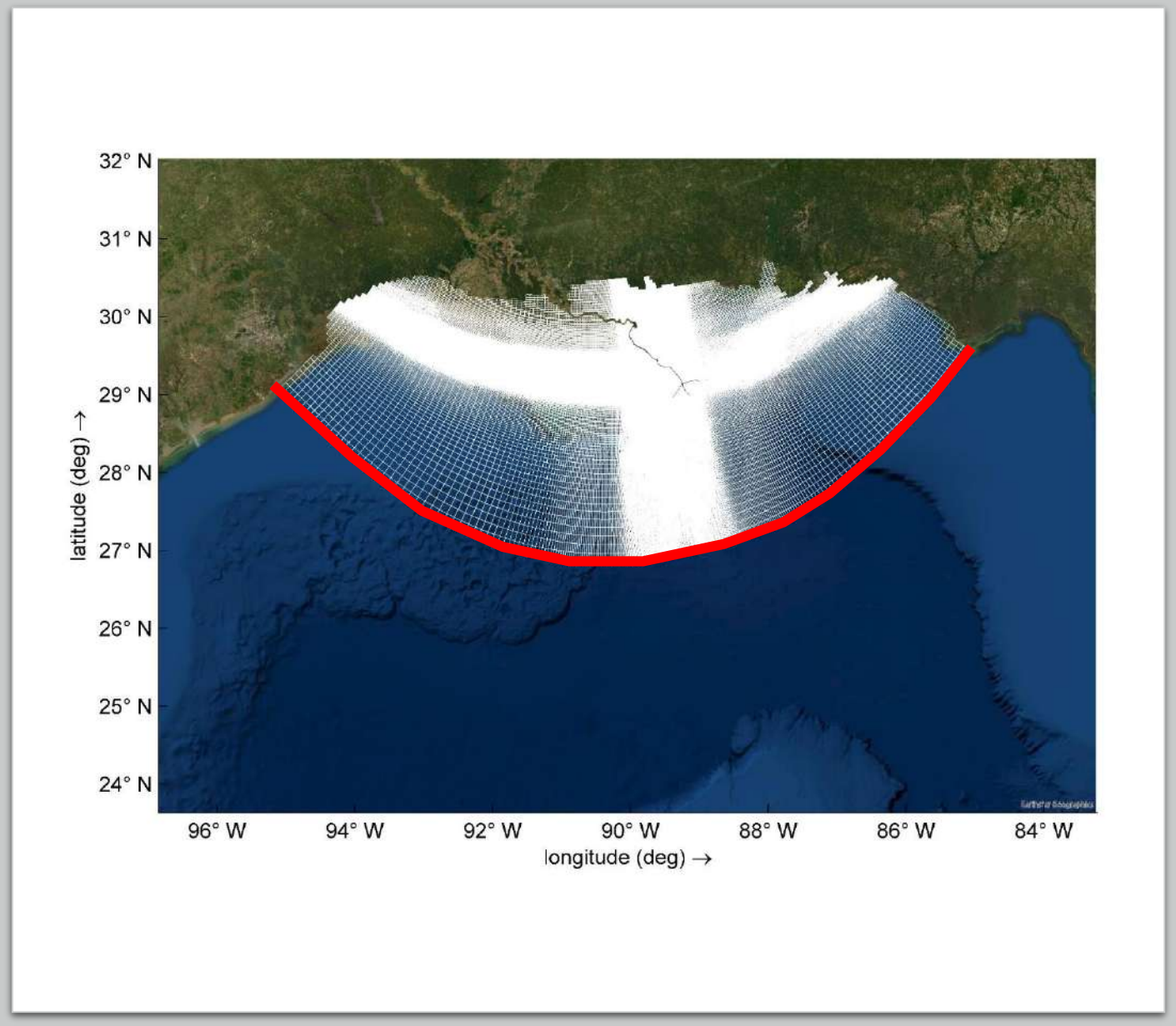
Year	Duration	Max bays opened	Maximum discharge (cfs)
1937	01/28 – 03/16	285	211,000
1945	03/23 – 05/18	350	318,000
1950	02/10 – 03/19	350	228,000
1973	04/08 – 06/21	350	207,000
1975	04/14 – 04/26	225	110,000
1979	04/17 – 05/31	350	228,000
1983	05/20 – 06/23	350	268,000
1994	05/16 – 05/26	30	14,000
1997	03/17 – 04/18	298	243,000
2008	04/11 – 05/08	160	160,000
2011	05/09 – 06/20	330	316,000
2016	01/10 – 02/01	210	203,000
2018	03/08 – 03/30	186	196,000
2019	02/27 – 04/11	206	213,000
2019	05/10 – 07/27	168	161,000
2020	04/03 – 05/01	90	90,000

Outlets and diversions

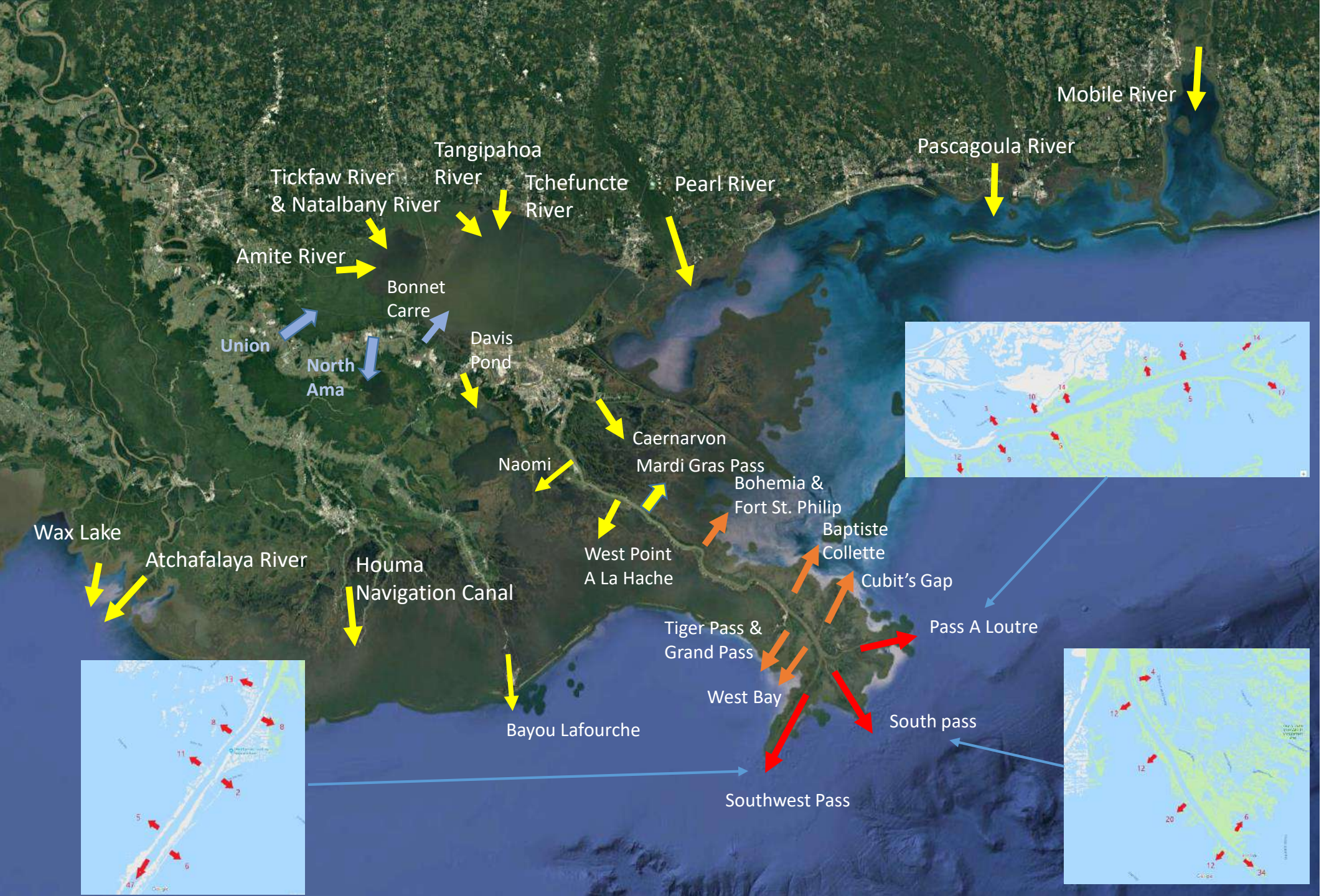
Regional Model

- Regional domain

- Size 553 x 403
- Resolution 280m – 7km
- Time step 0.6 min
- Run time 3.5 days

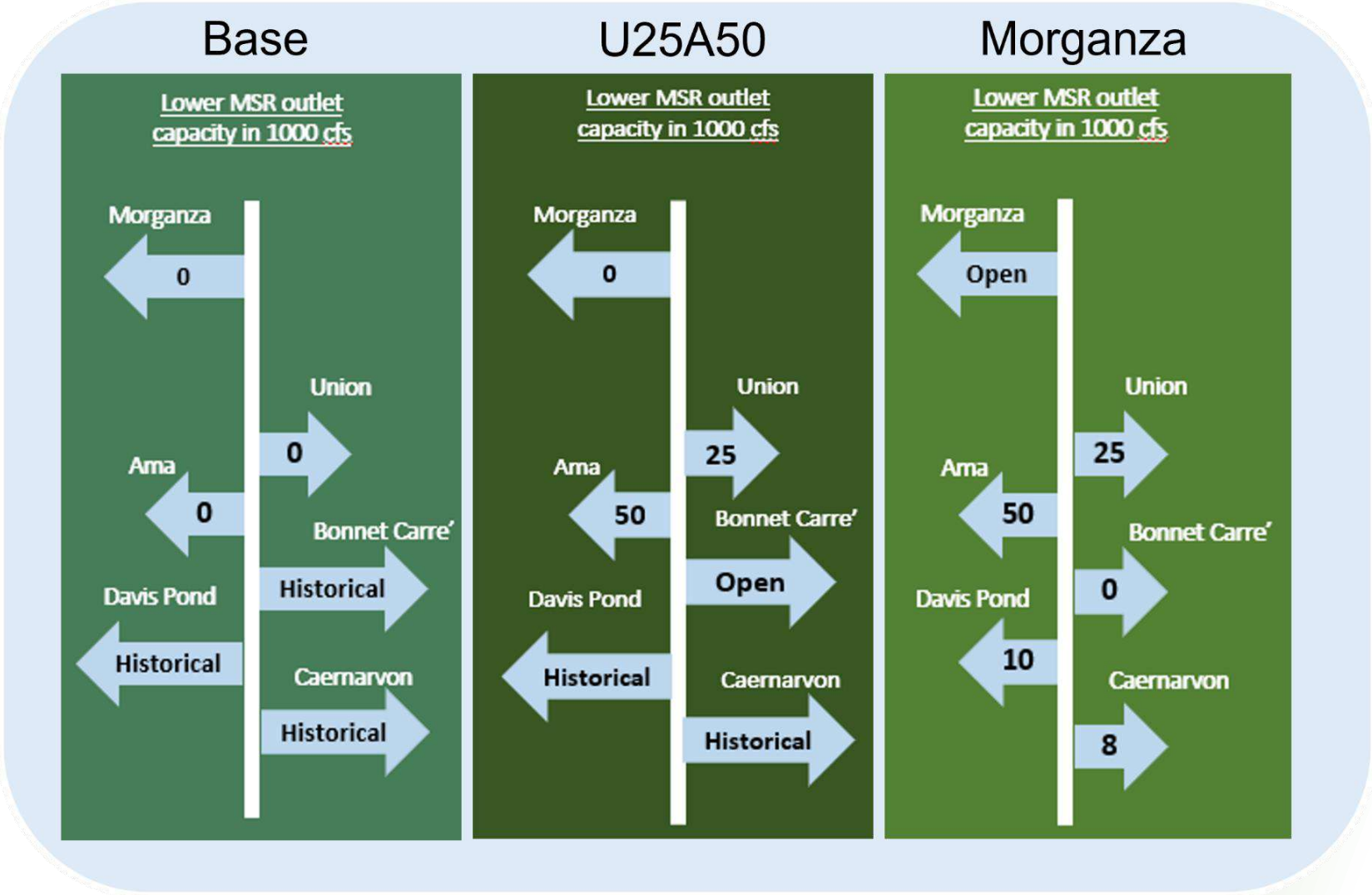


Discharge Sources

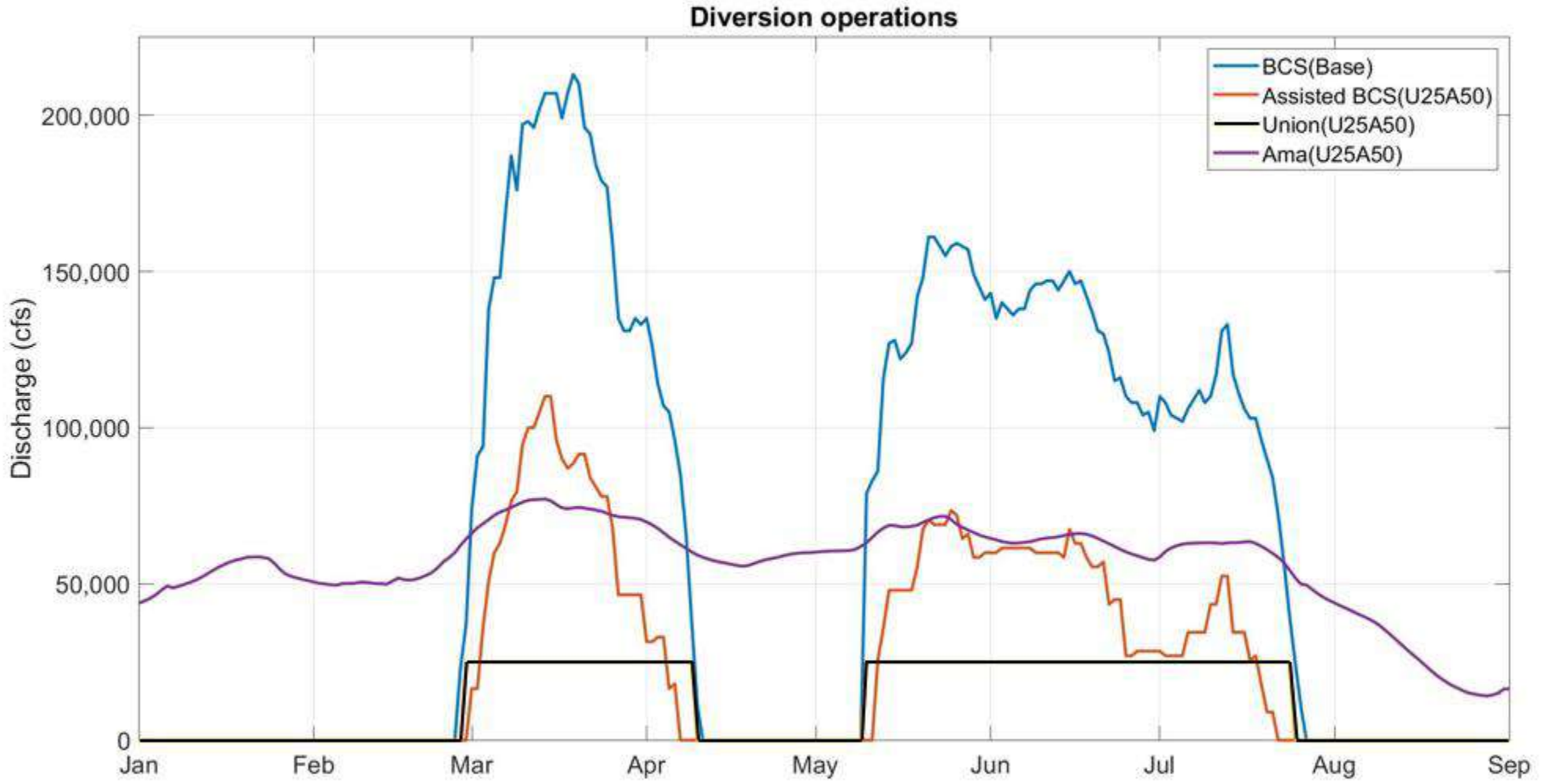


Flood Risk Management Scenarios

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)*

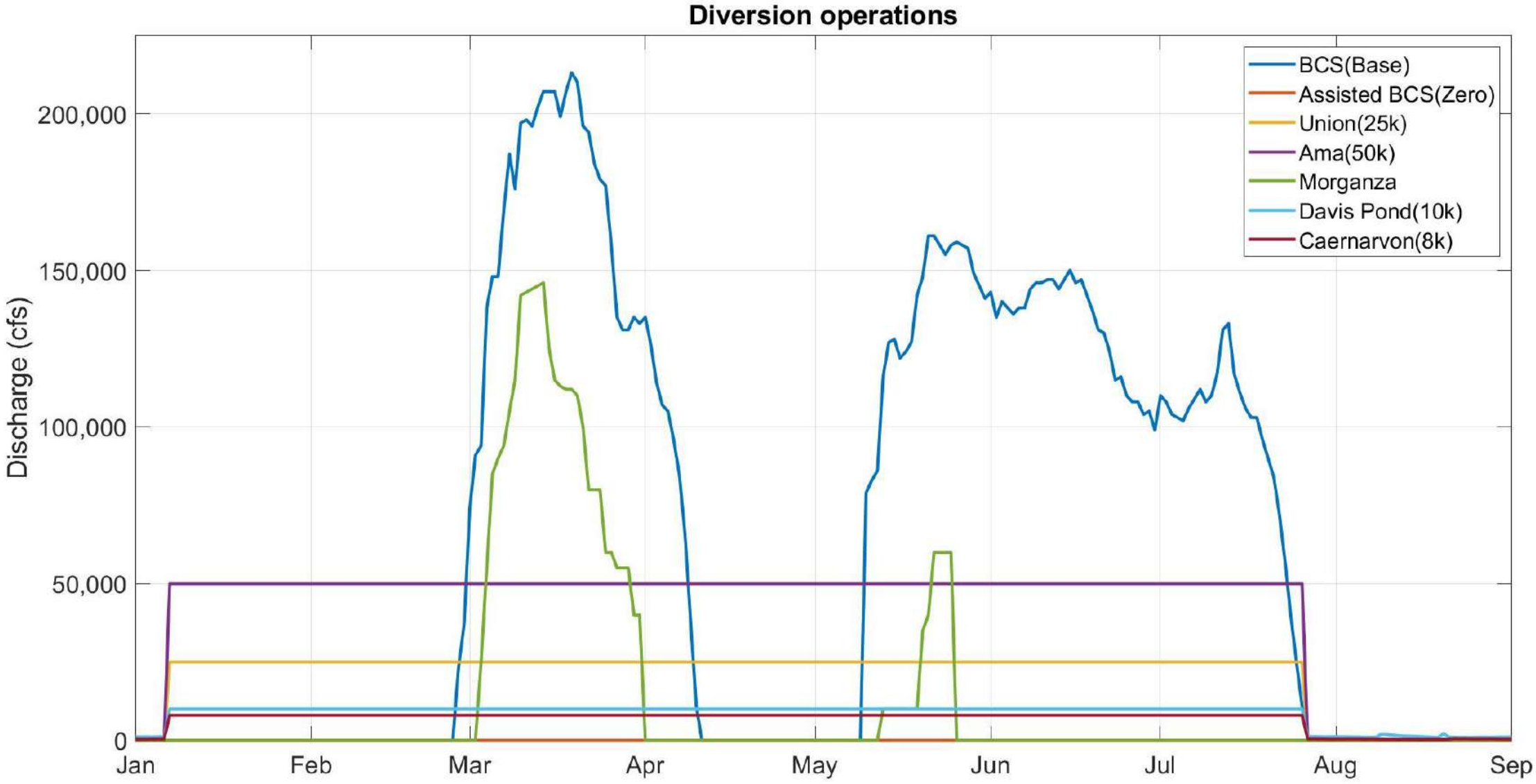


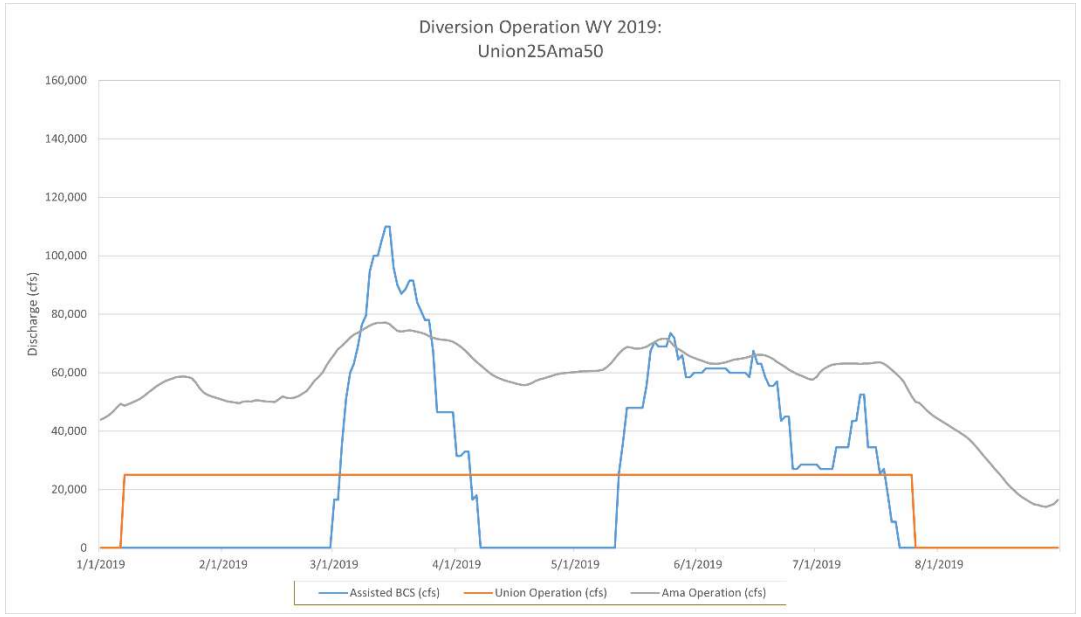
Base vs. U25A50

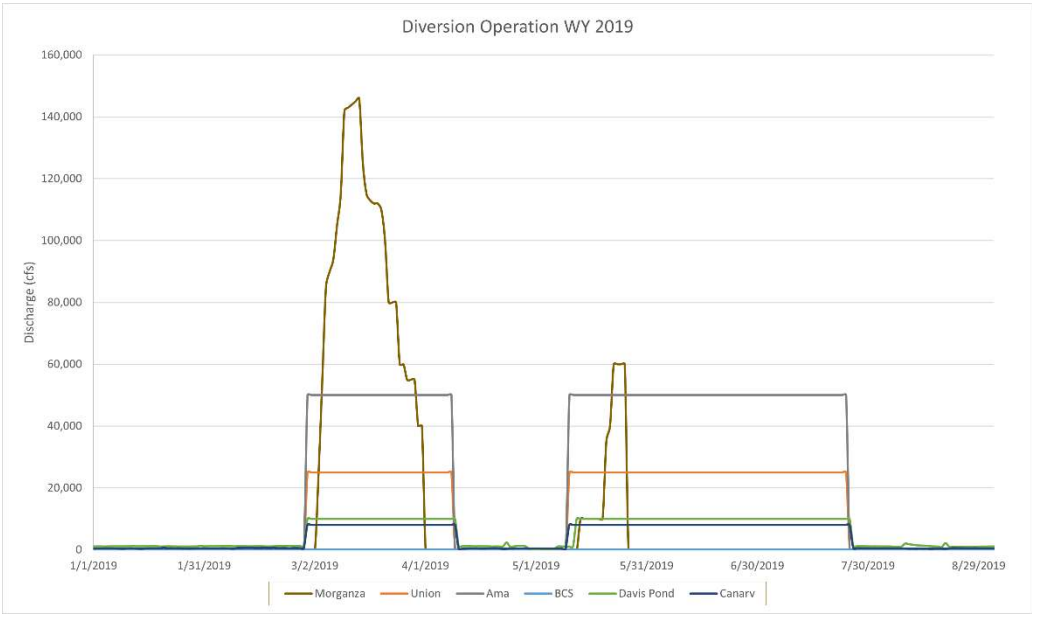


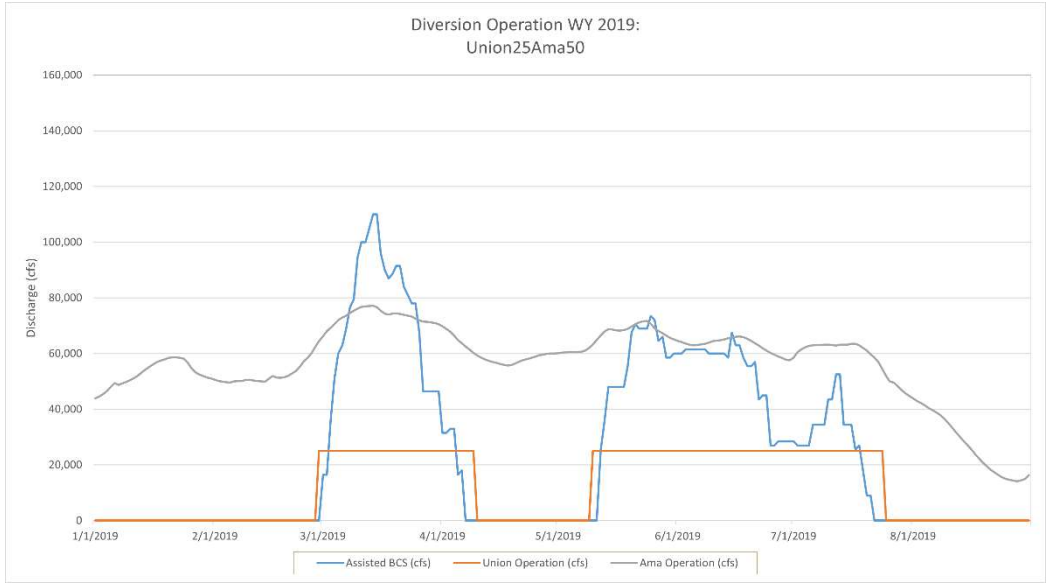
	Bonnet Carre' Spillway	Bonnet Carre' Spillway +Union+Ama
Total Days Open	121	107
Total BCS Diverted Volume ($10^{10} \times ft^3$)	13.4	5.0
Volume Reduction Percentage	-	63%

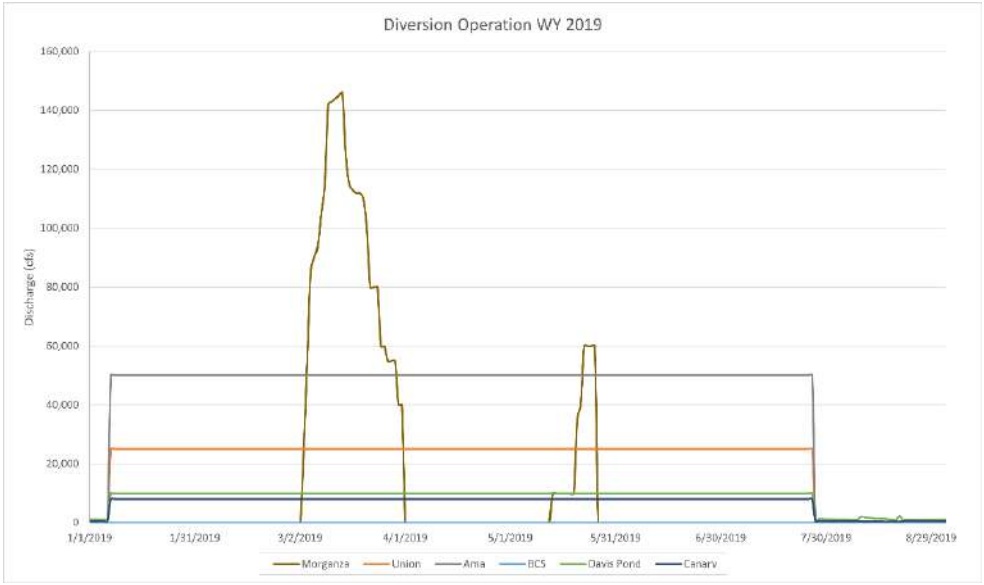
Base vs. Morganza



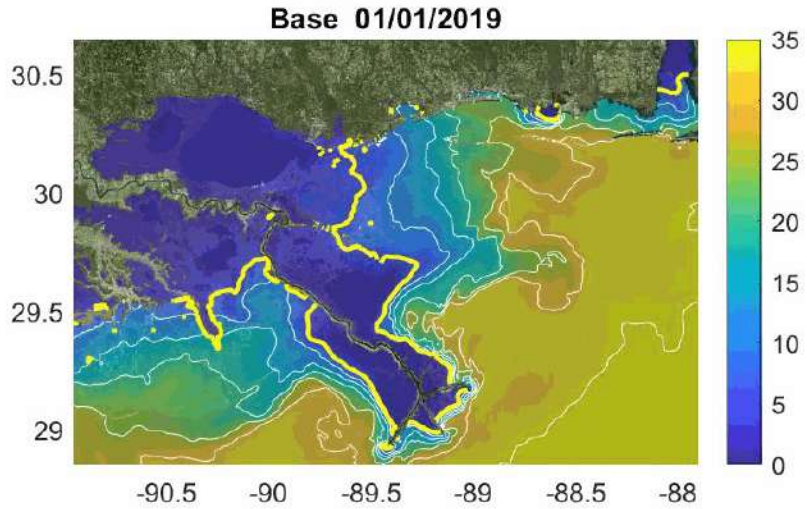

Diversion Operation WY 2019:
Union25Ama50
Discharge (cfs)
160,000
140,000
120,000
100,000
80,000
60,000
40,000
20,000
0
1/1/2019
2/1/2019
3/1/2019
4/1/2019
5/1/2019
6/1/2019
7/1/2019
8/1/2019
Assisted BCS (cfs)
Union Operation (cfs)
Ama Operation (cfs)

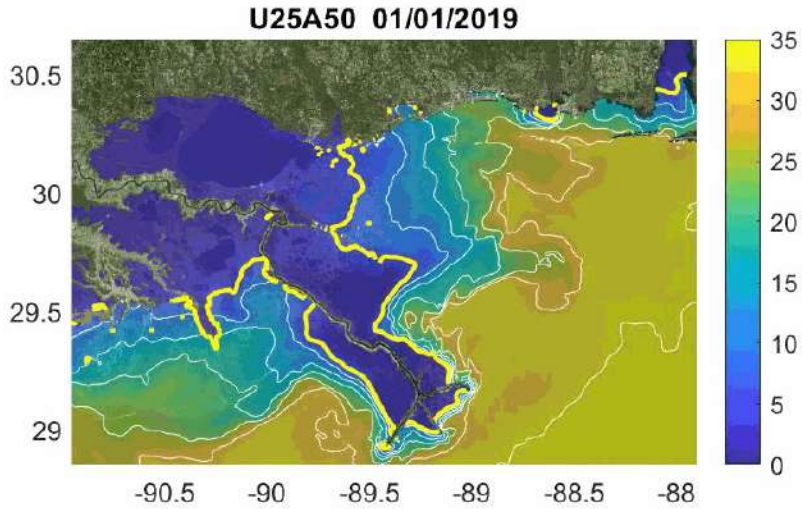

Diversion Operation WY 2019
Discharge (cfs)
160,000
140,000
120,000
100,000
80,000
60,000
40,000
20,000
0
1/1/2019
1/31/2019
3/2/2019
4/1/2019
5/1/2019
5/31/2019
6/30/2019
7/30/2019
8/29/2019
Morganza
Union
Ama
BCS
Davis Pond
Canarv


Diversion Operation WY 2019:
Union25Ama50
Discharge (cfs)
160,000
140,000
120,000
100,000
80,000
60,000
40,000
20,000
0
1/1/2019
2/1/2019
3/1/2019
4/1/2019
5/1/2019
6/1/2019
7/1/2019
8/1/2019
Assisted BCS (cfs)
Union Operation (cfs)
Ama Operation (cfs)

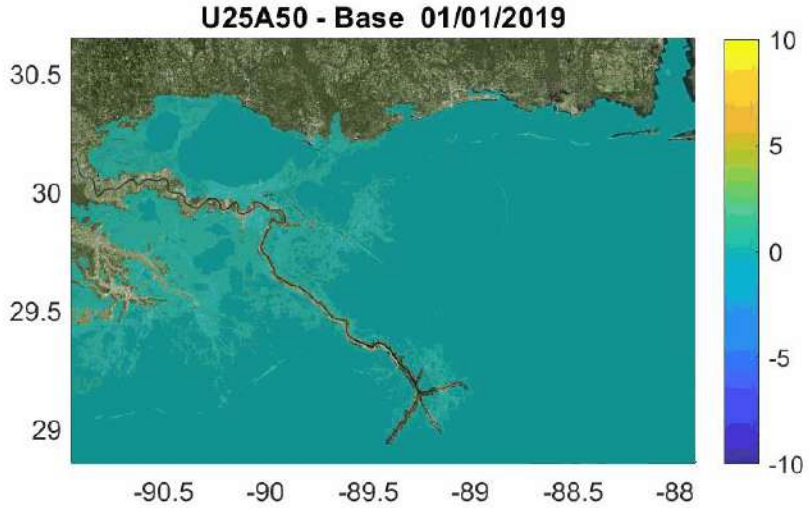

Diversion Operation WY 2019
Discharge (cfs)
160,000
140,000
120,000
100,000
80,000
60,000
40,000
20,000
0
1/1/2019
1/31/2019
3/2/2019
4/1/2019
5/1/2019
5/31/2019
6/30/2019
7/30/2019
8/29/2019
Morganza
Union
Ama
BCS
Davis Pond
Canarv

Salinity (ppt, thick yellow line: 5-ppt contour)

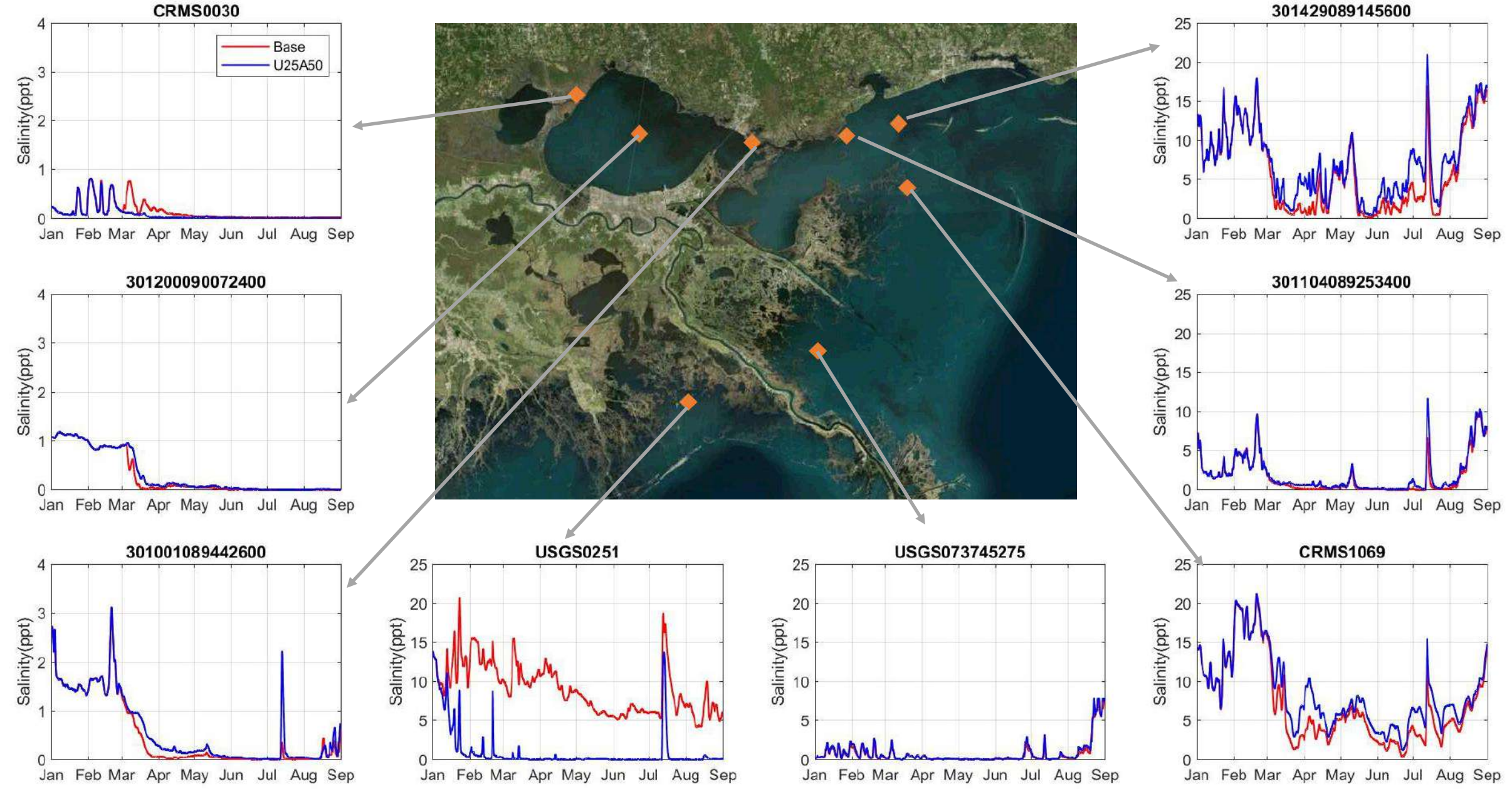




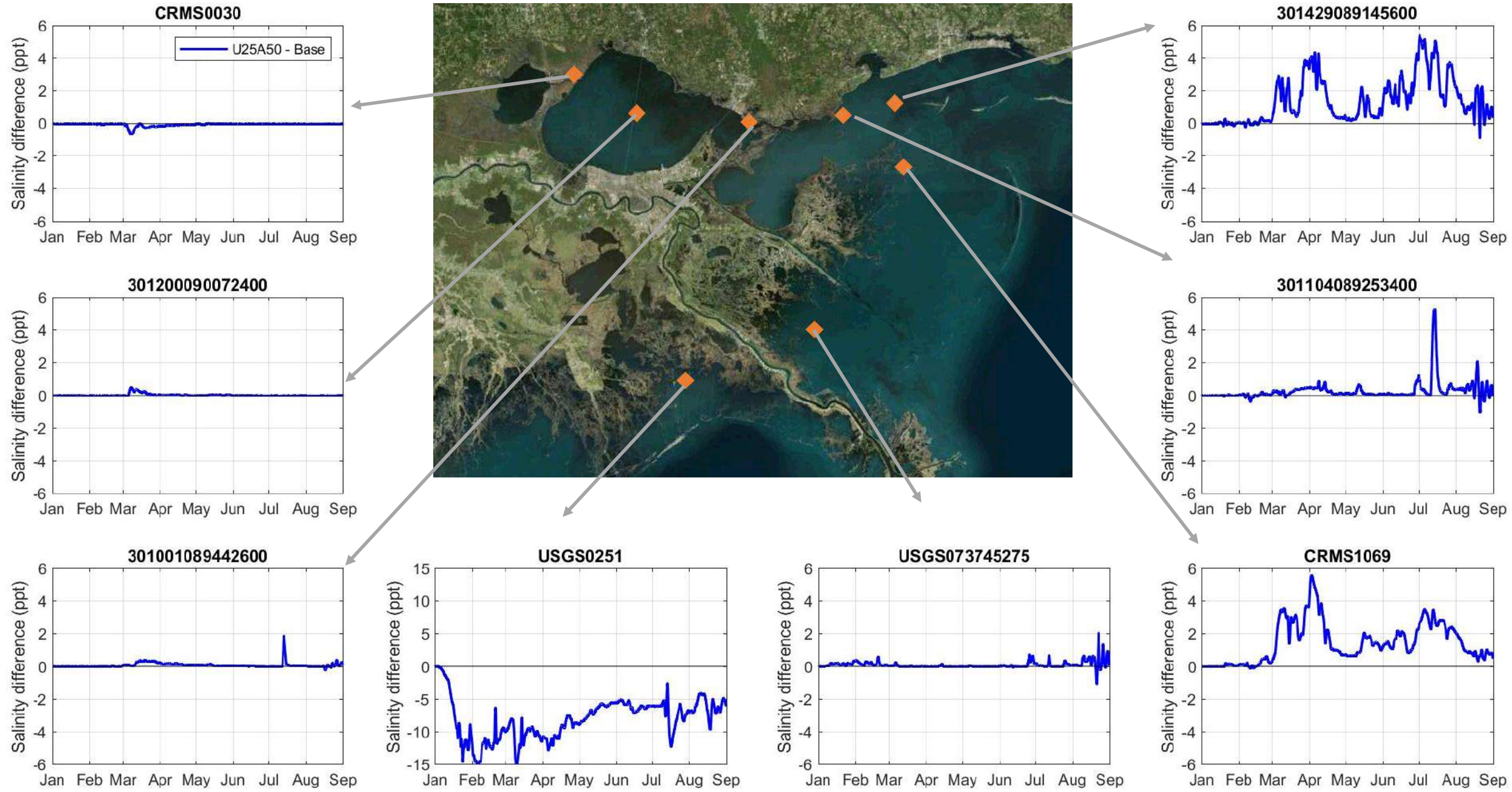
Salinity difference (ppt)



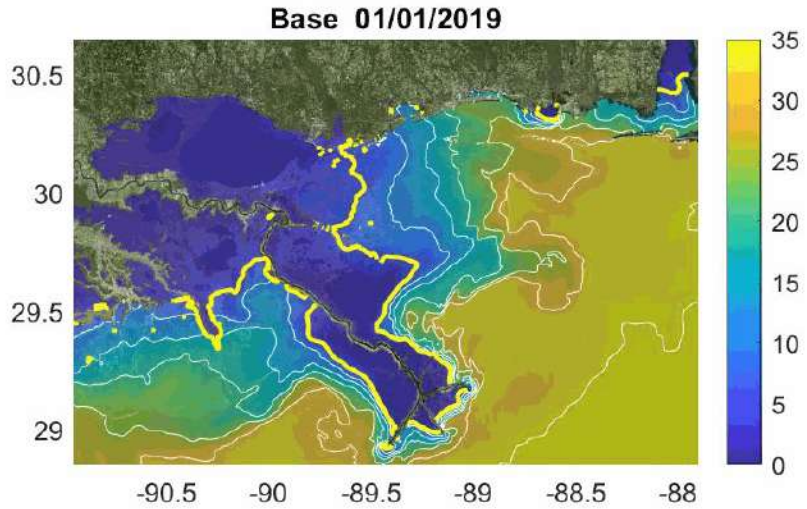
Salinity (ppt)

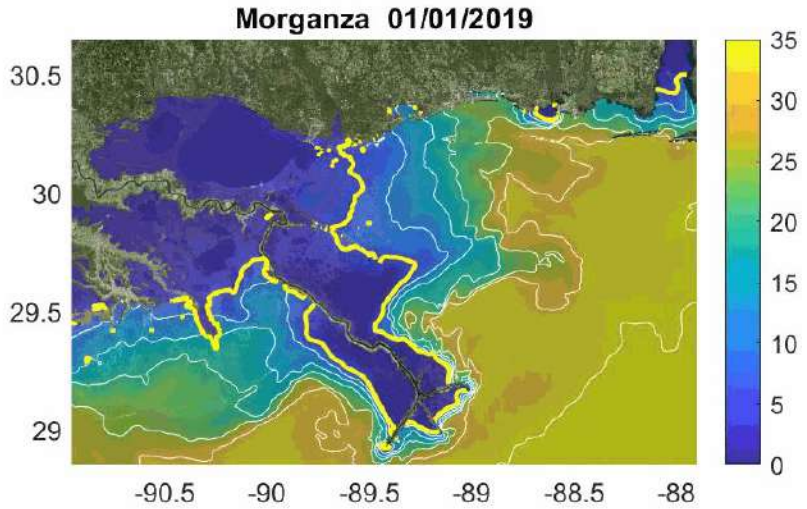


Salinity difference (ppt)

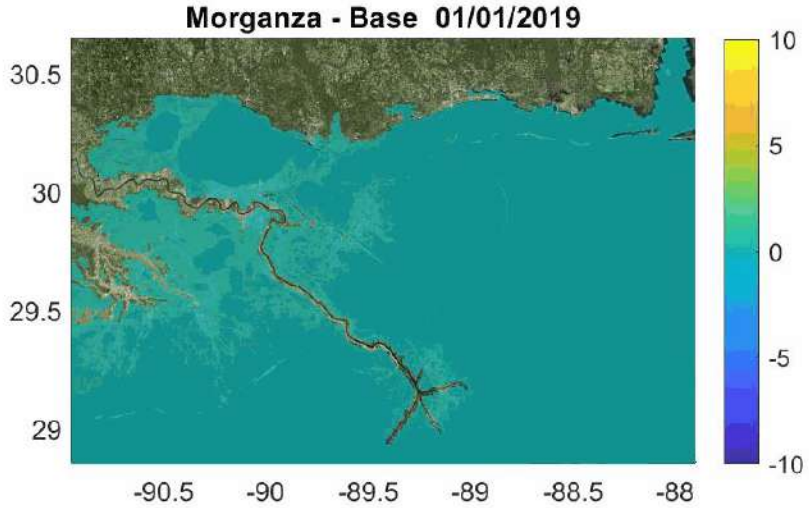


Salinity (ppt, thick yellow line: 5-ppt contour)

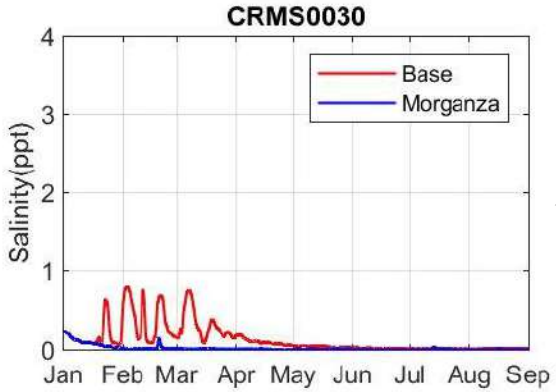


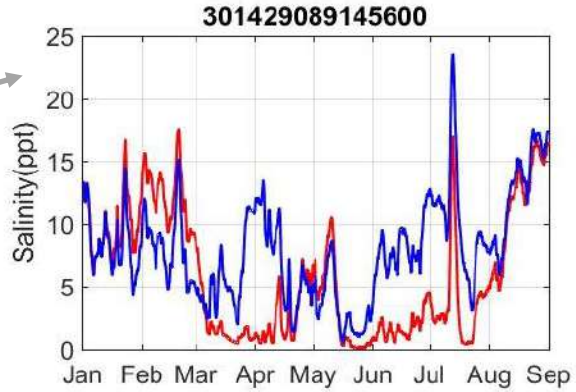


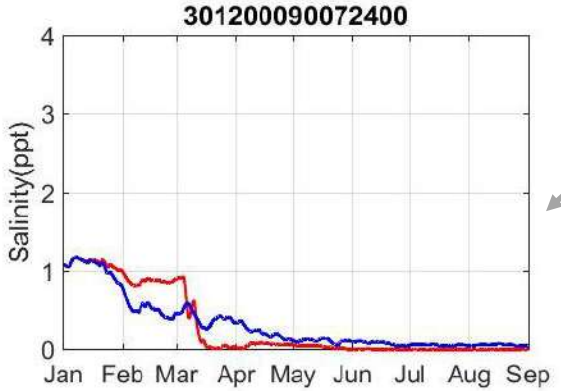
Salinity difference (ppt)

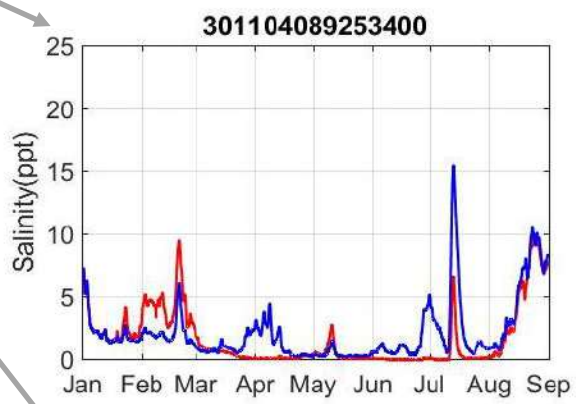


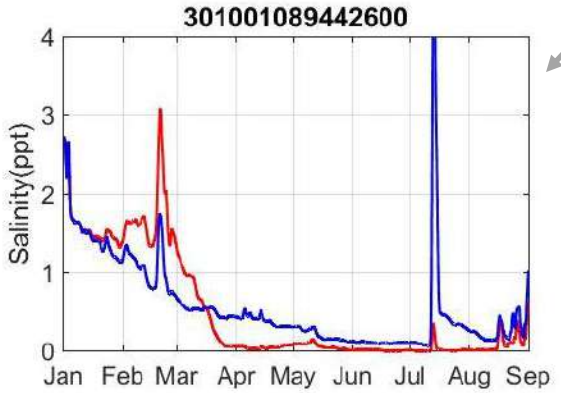
Salinity (ppt)

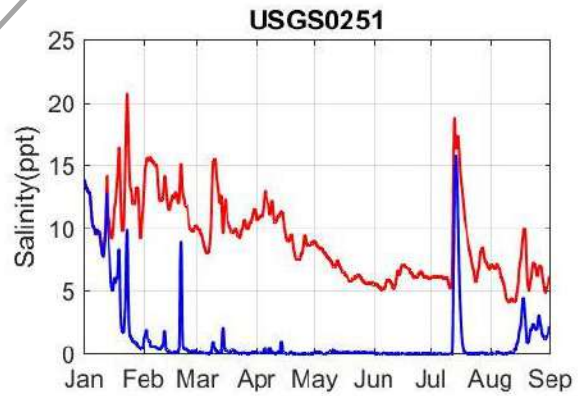


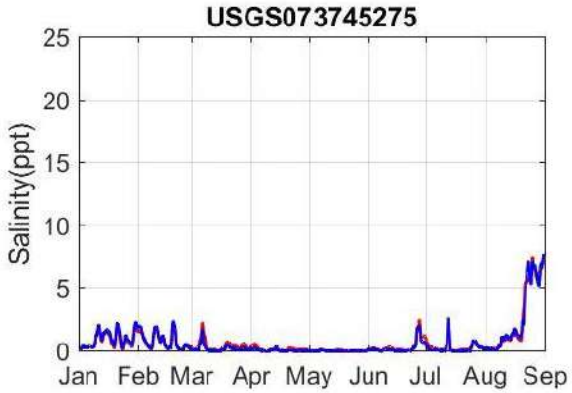


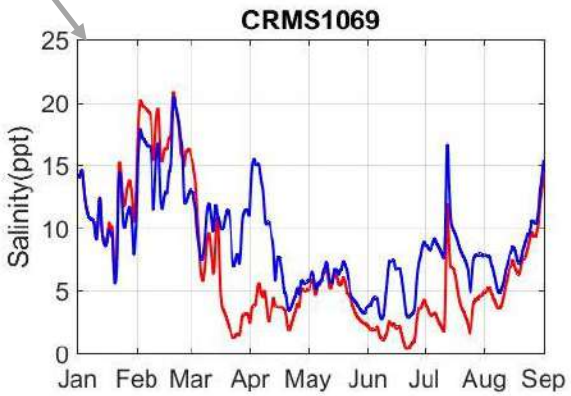




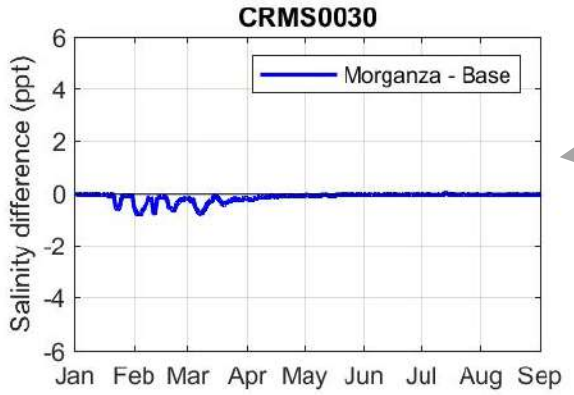


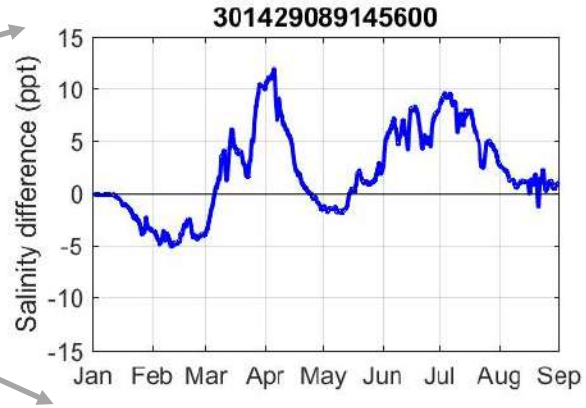


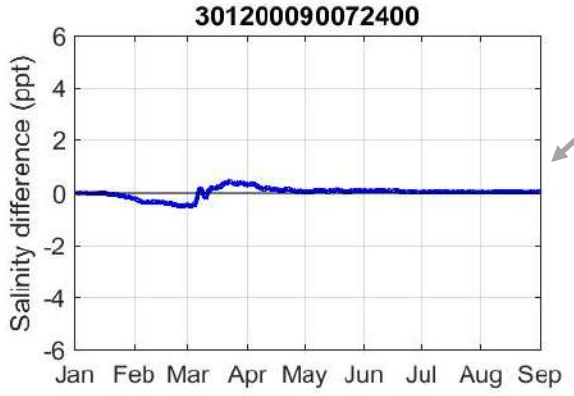


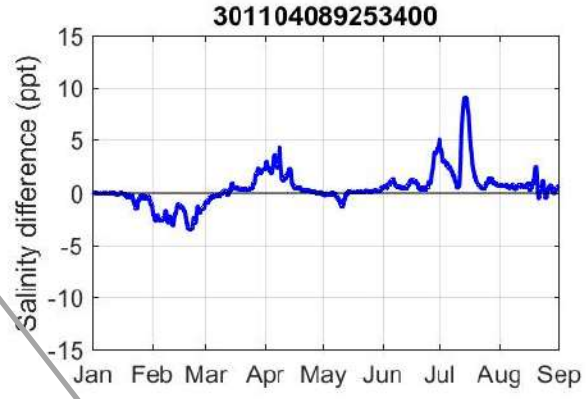


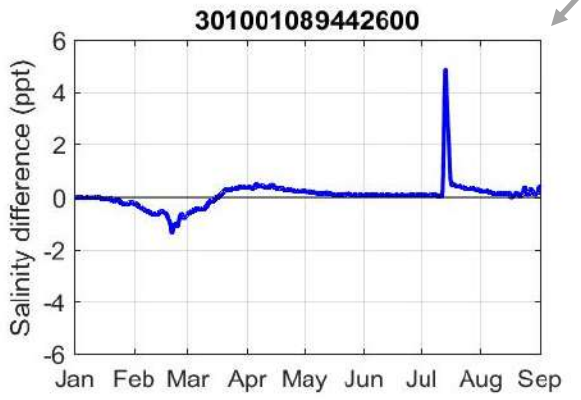
Salinity difference (ppt)



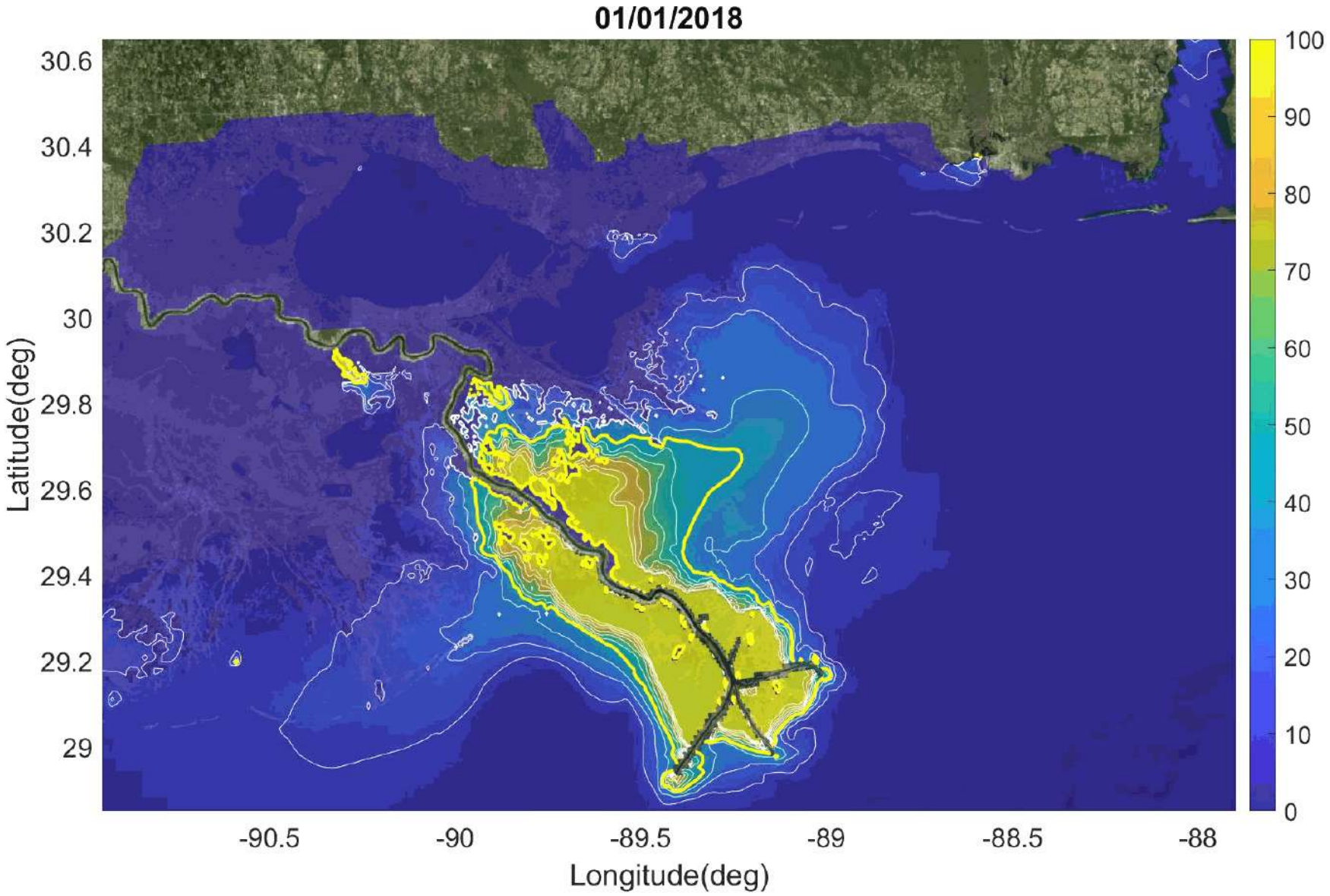




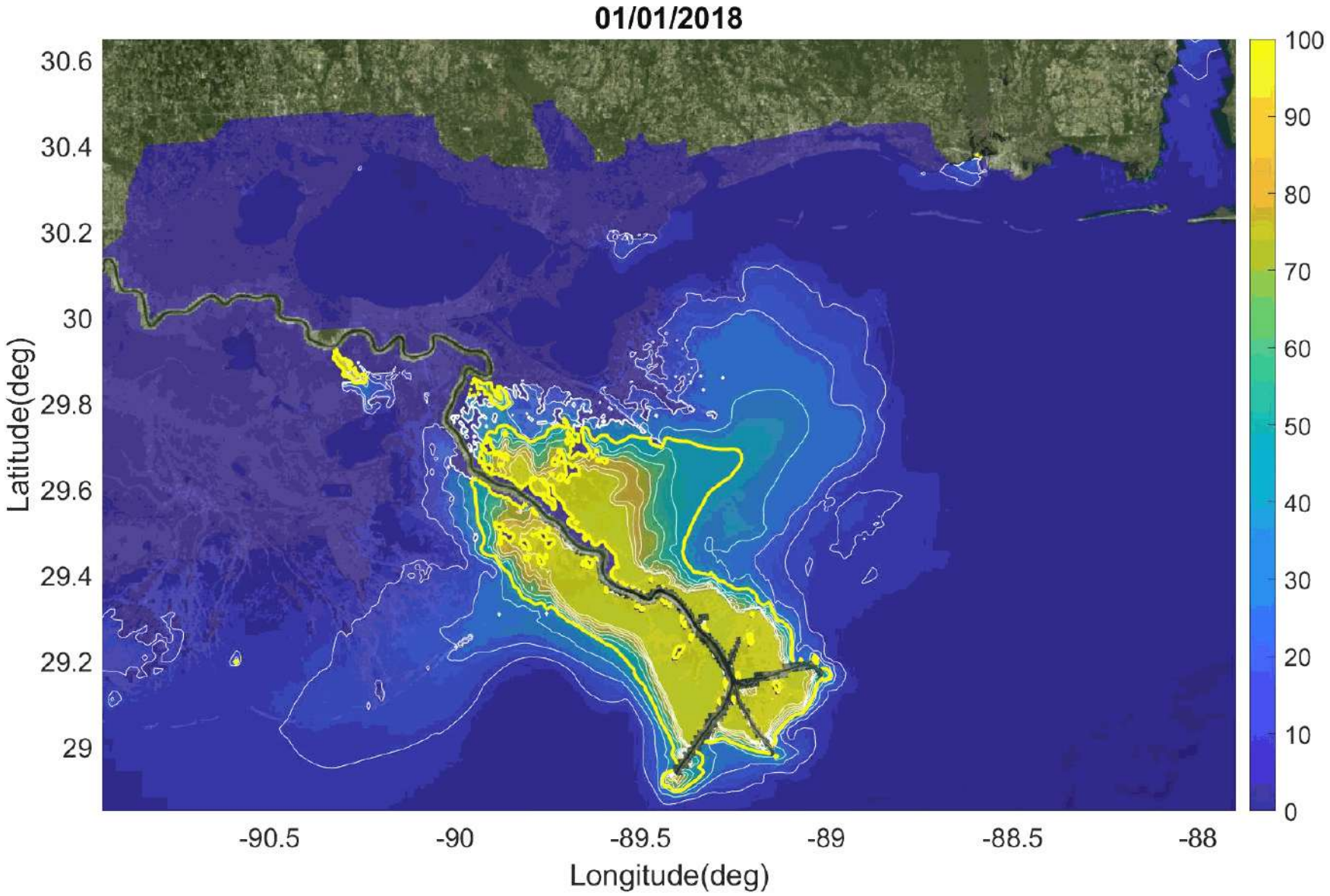




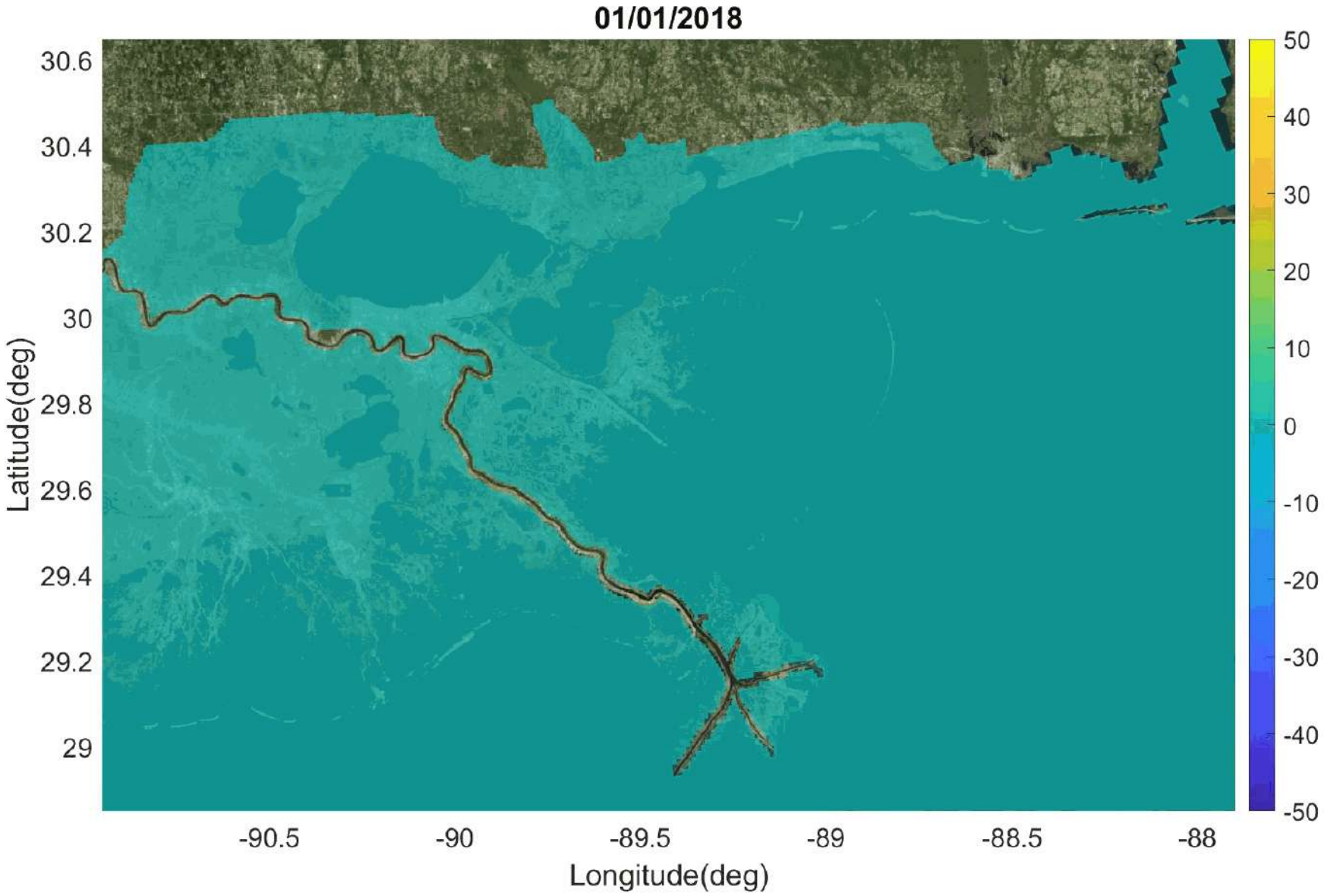
2018 SST (mg/l, thick yellow line: 40-mg/l contour)



2018 Union-diversion SST (mg/l) run with BCS and Union diversions



2018 SST (mg/l) run with diversions – 2018 SST (mg/l)



Closing Remarks

- Adjustments to the flood risk management strategy for the Lower Mississippi River are needed
- The scenarios we performed illustrate the potential benefits of using multiple outlets concurrently to meet the flood-risk requirements while benefiting the ecosystem
- Communications with stakeholders are helpful to consider the efficacy of implementing alternate management strategies for the Lower Mississippi River
- Upper river diversions could create added protection benefits to local communities from natural hazards (hurricanes, and rainstorm flooding)
- CPRA is currently evaluating the range of Union capacities
- Continue improving this model as more data and funds become available

Operation Plan for Ama and Union

Ama or **Ama North** diversion opening criteria are:

- 0 cfs when MR < 200,000 cfs
- Linearly interpolated to 50,000 cfs when MR reaches 1 Mil cfs
- Linearly extrapolated when MR exceeds 1 Mil cfs

Union diversion opening criteria area:

- output 25,000 cfs when MR exceeds 1 Mil cfs