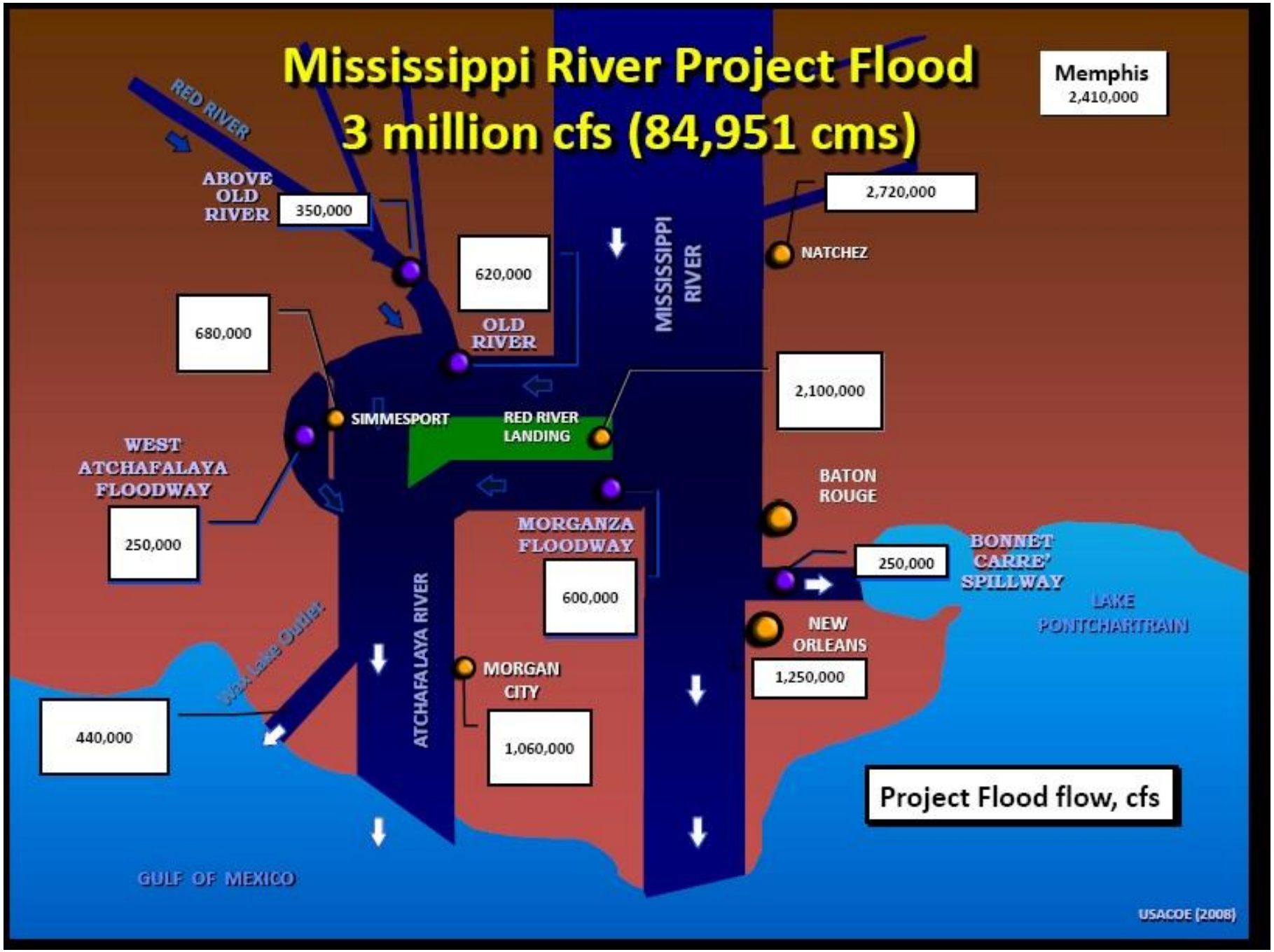
Utilizing Upper Diversions in River Water Management Case Study: 2019 Mississippi Flood Event

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 Union and Ama diversions to address some of the challenges
- 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
NEW ORLEANS
1,250,000
Wax Lake Outlet
ATCHAFALAYA RIVER
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

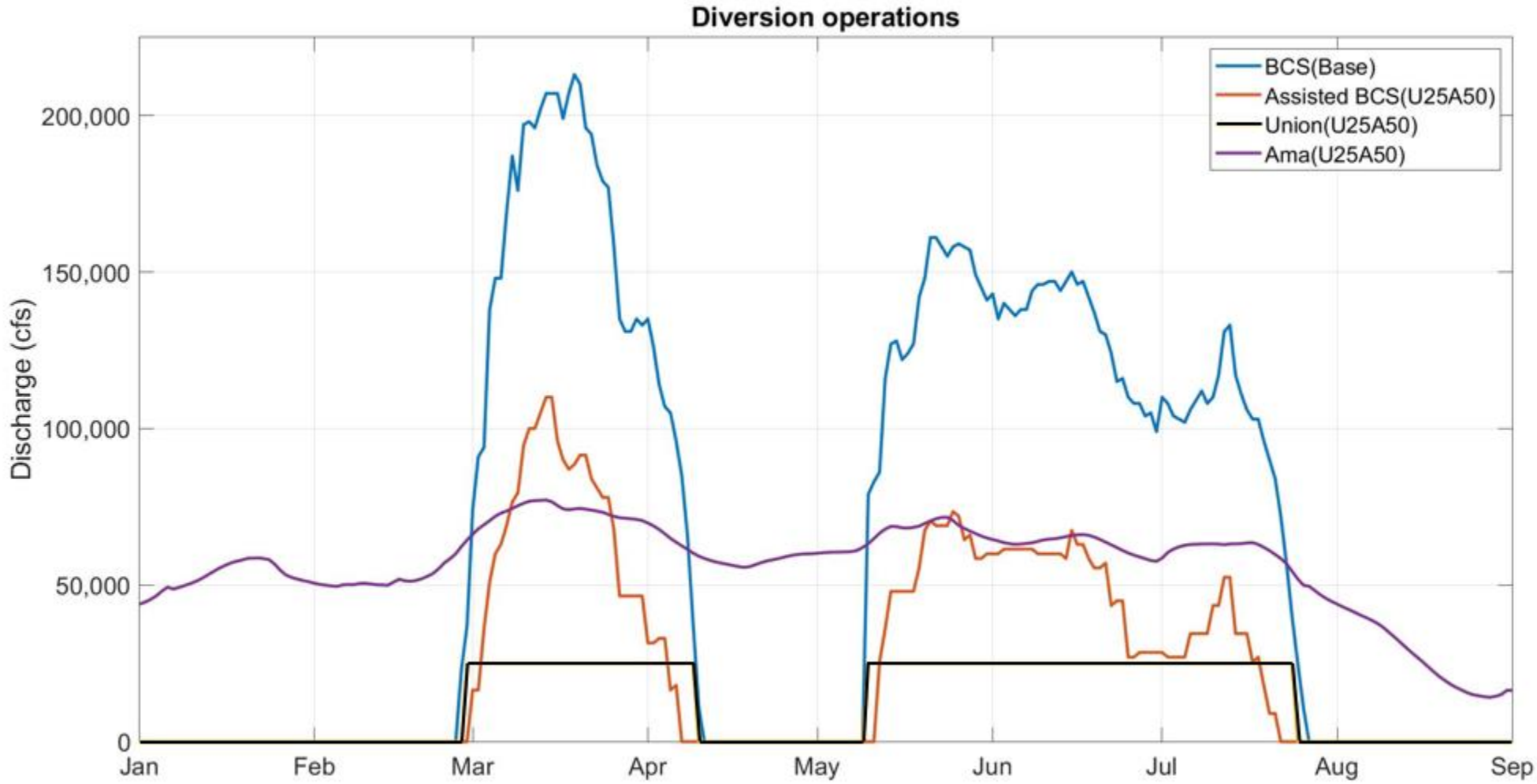
Opening Conditions for Ama and Union

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

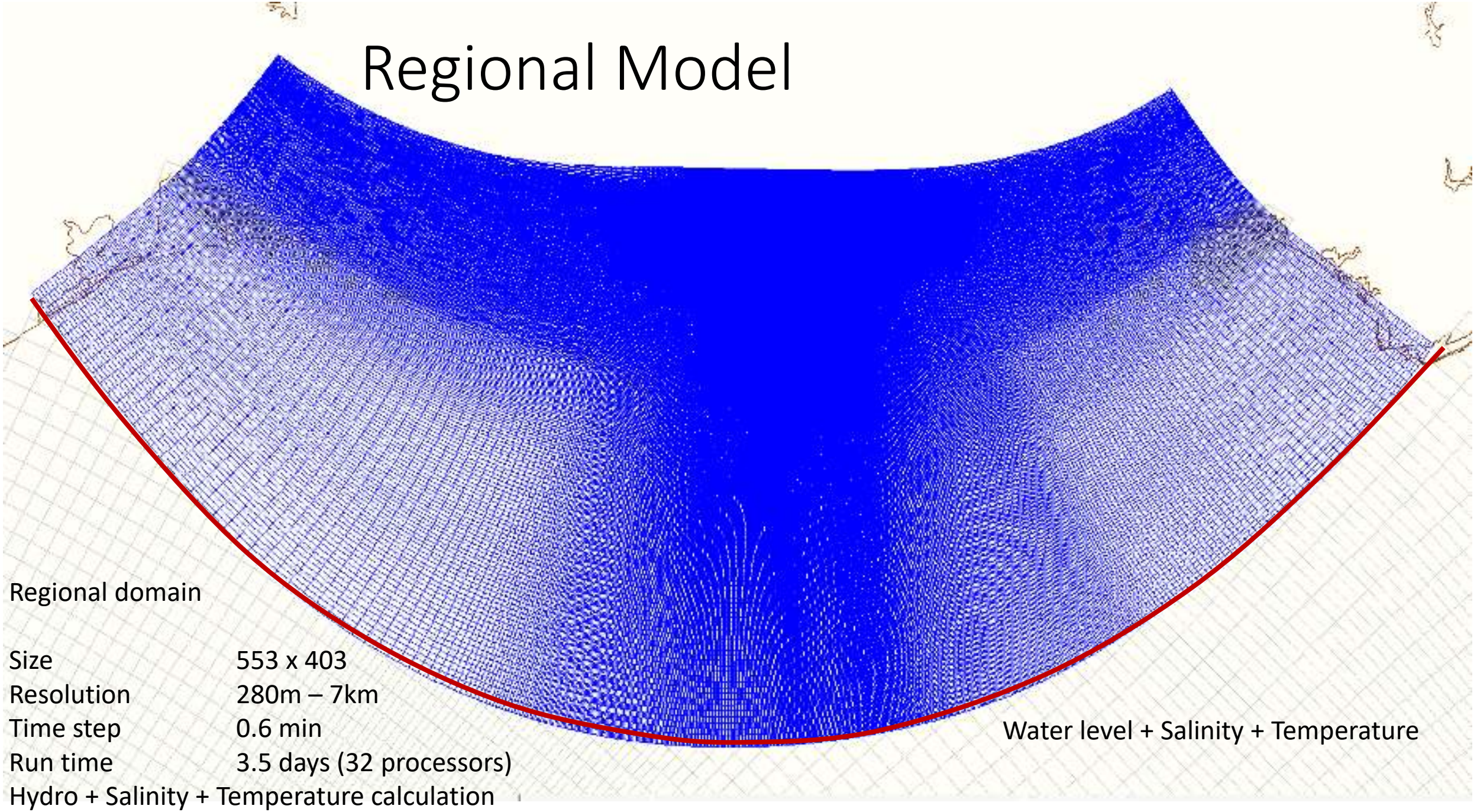


	Bonnet Carre' Spillway	Bonnet Carre' Spillway +Union+Ama
Total Days Open	121	107
Total BCS Diverted Volume ($10^{10} \times ft^3$)	13.4	5.0
Volume Reduction Percentage	-	63%

Runs: January 1, 2019 – September 1, 2019

1. Base (Historical)
2. U25A50 (Union at 25k cfs, Ama at 50k cfs, assisted BCS)

Regional Model



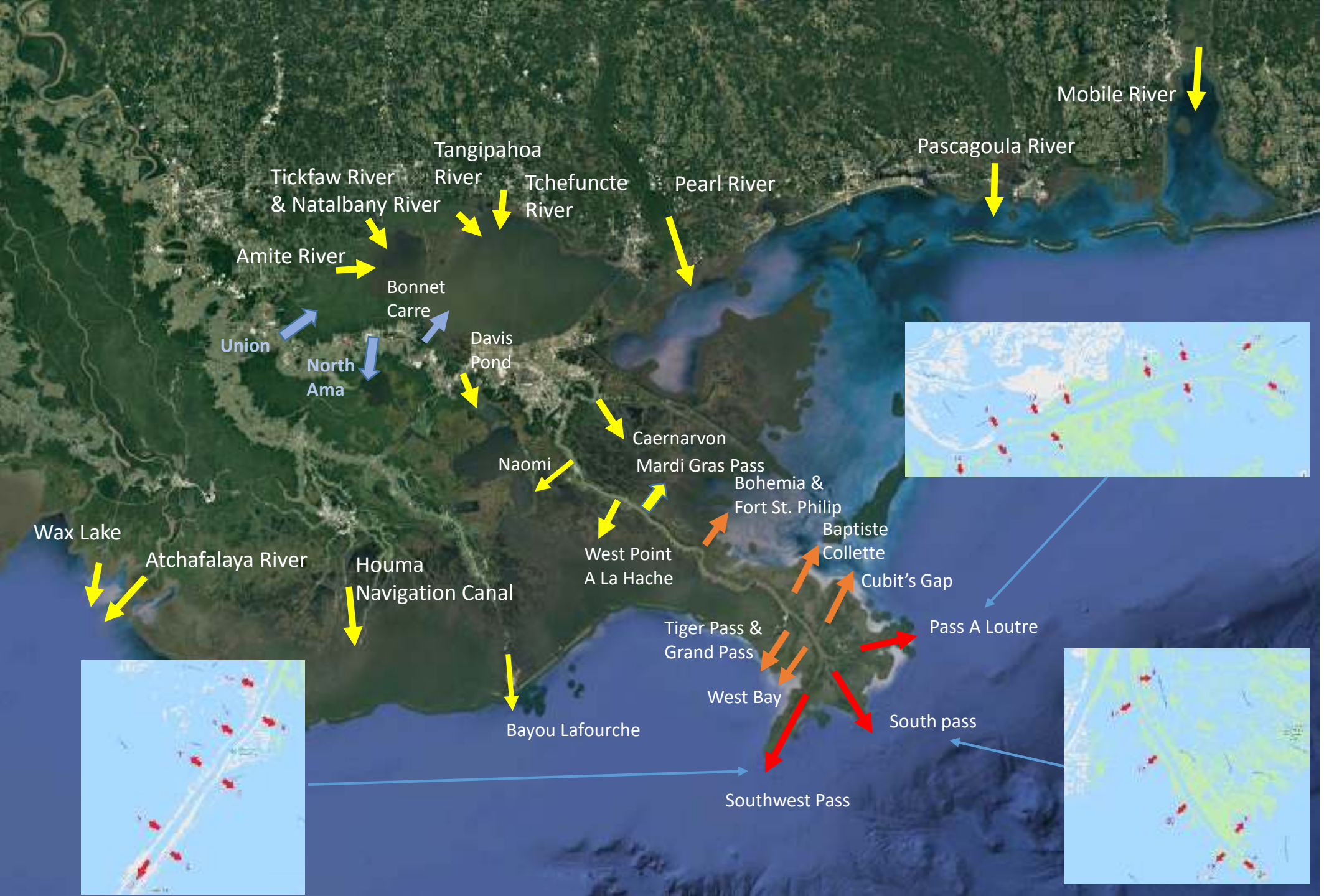
Regional domain

Size	553 x 403
Resolution	280m – 7km
Time step	0.6 min
Run time	3.5 days (32 processors)

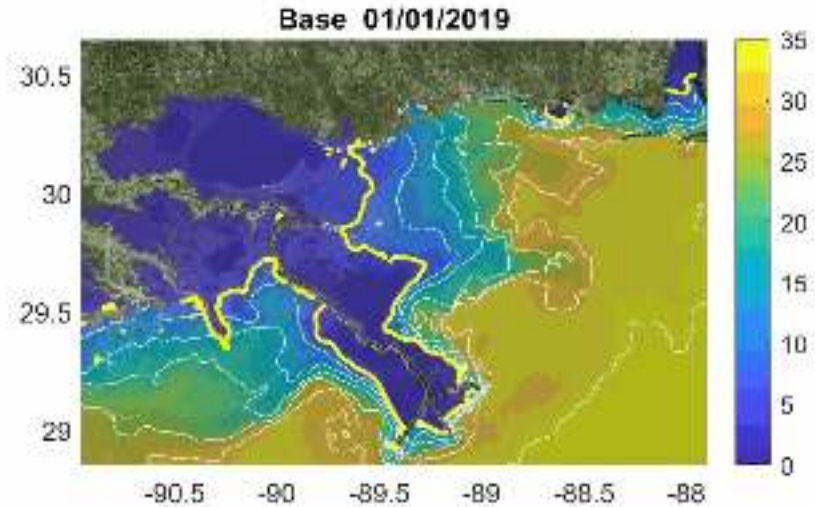
Hydro + Salinity + Temperature calculation

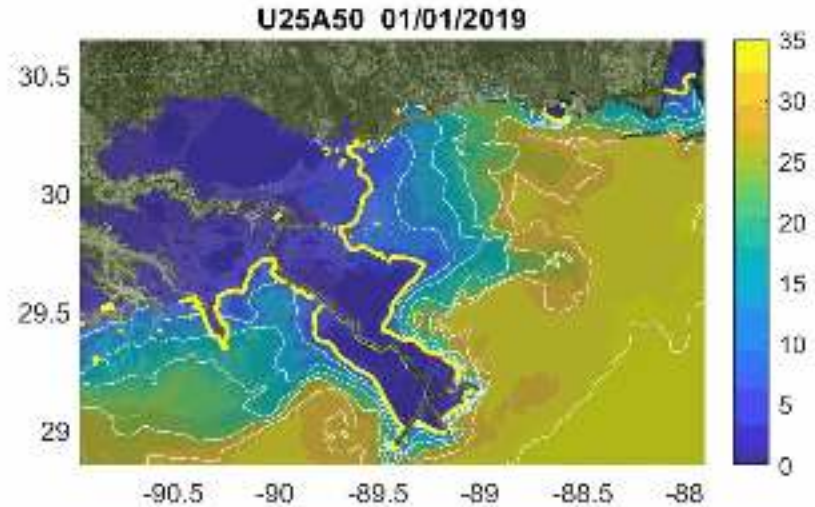
Water level + Salinity + Temperature

Discharge Sources

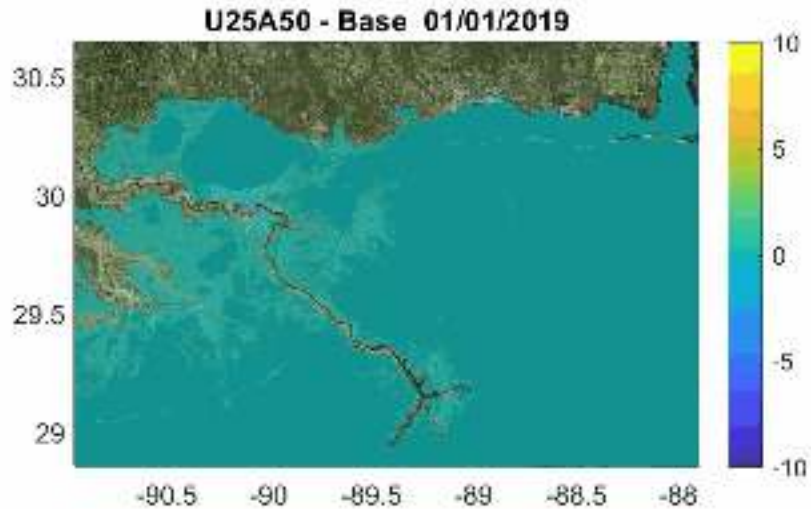


Salinity (ppt, thick yellow line: 5-ppt contour)

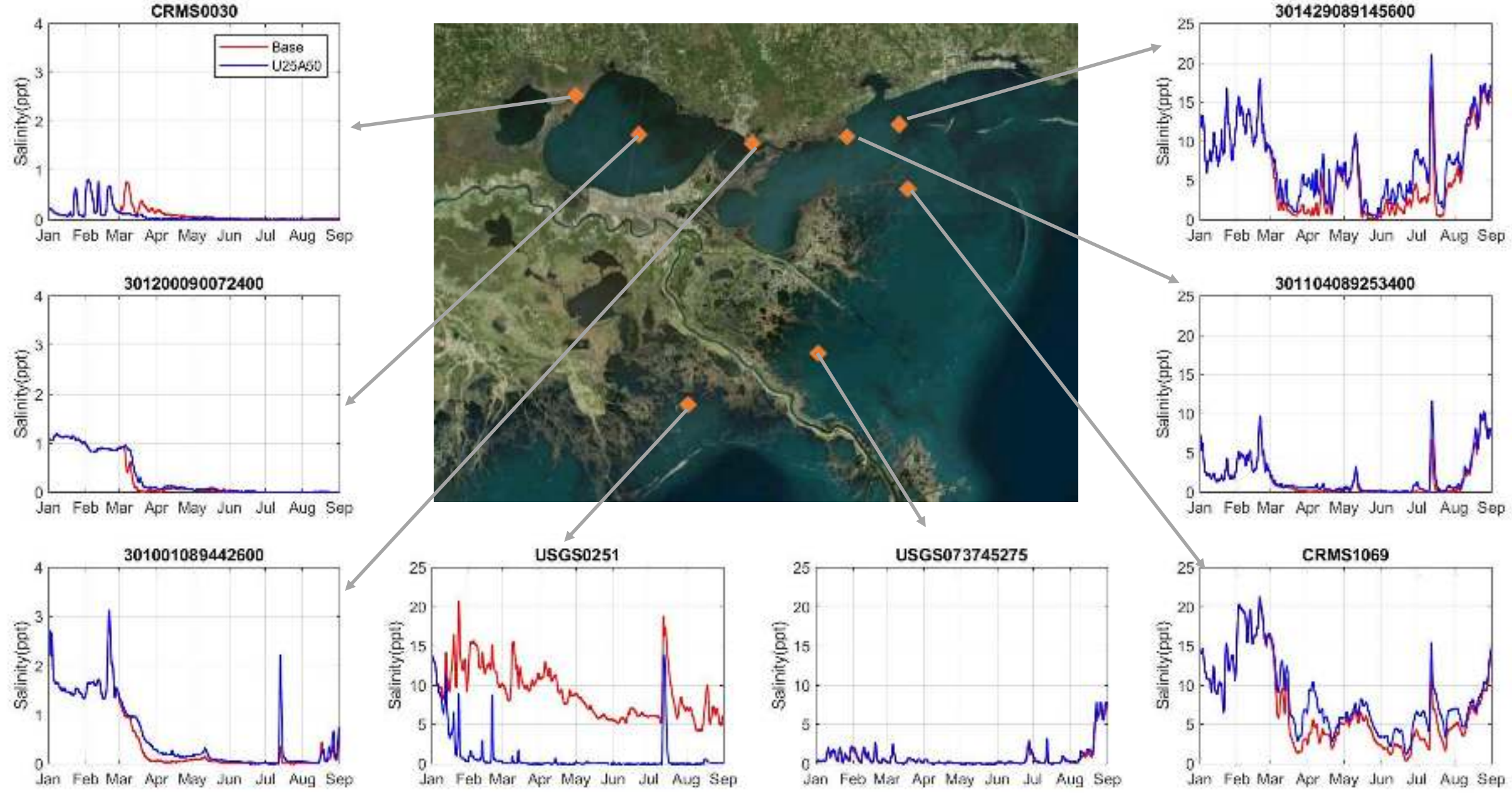




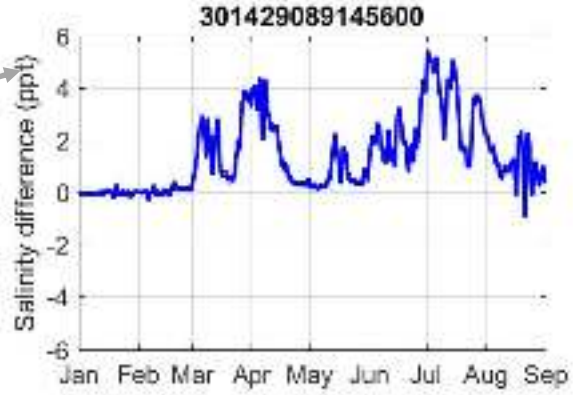
Salinity difference (ppt)



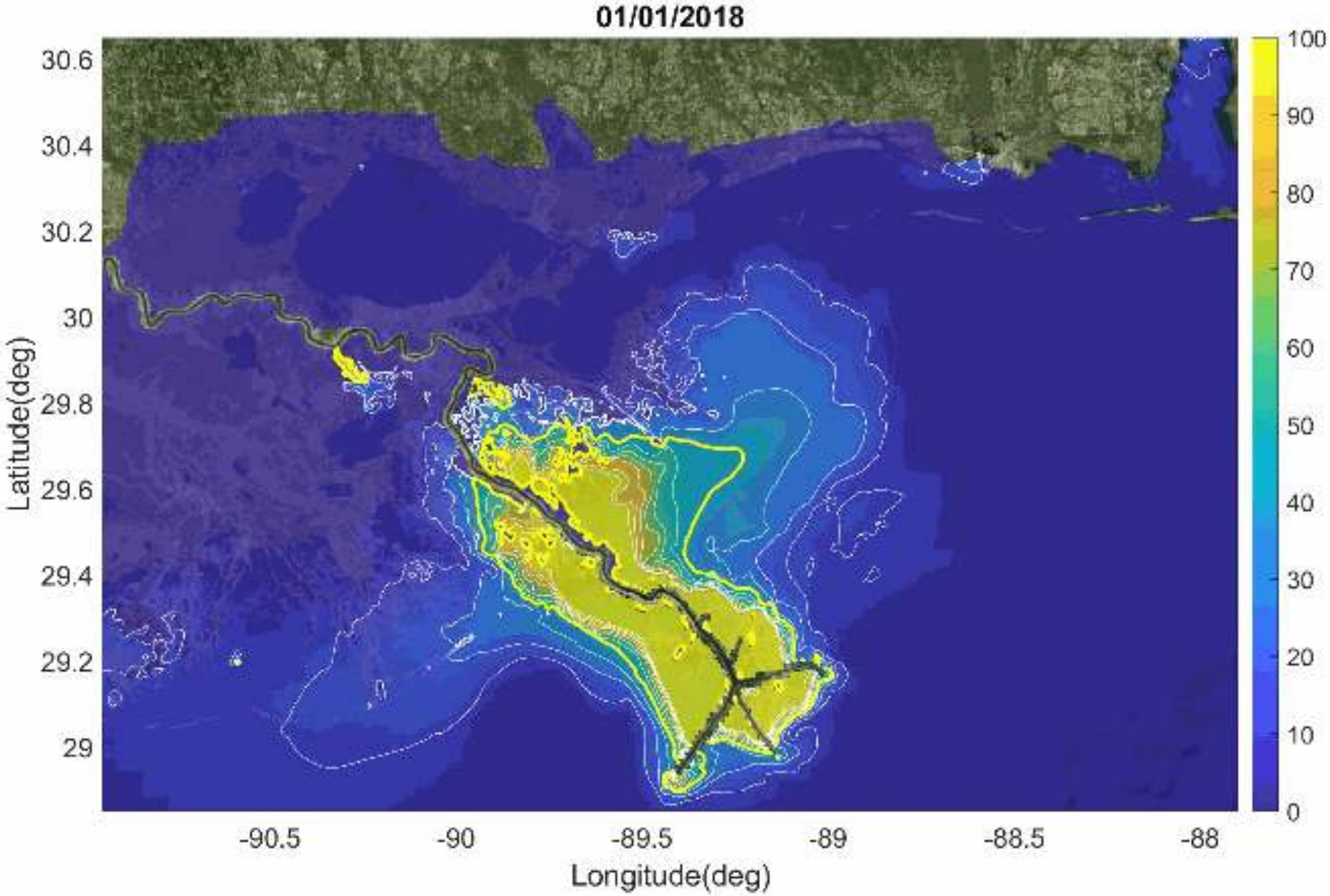
Salinity (ppt)



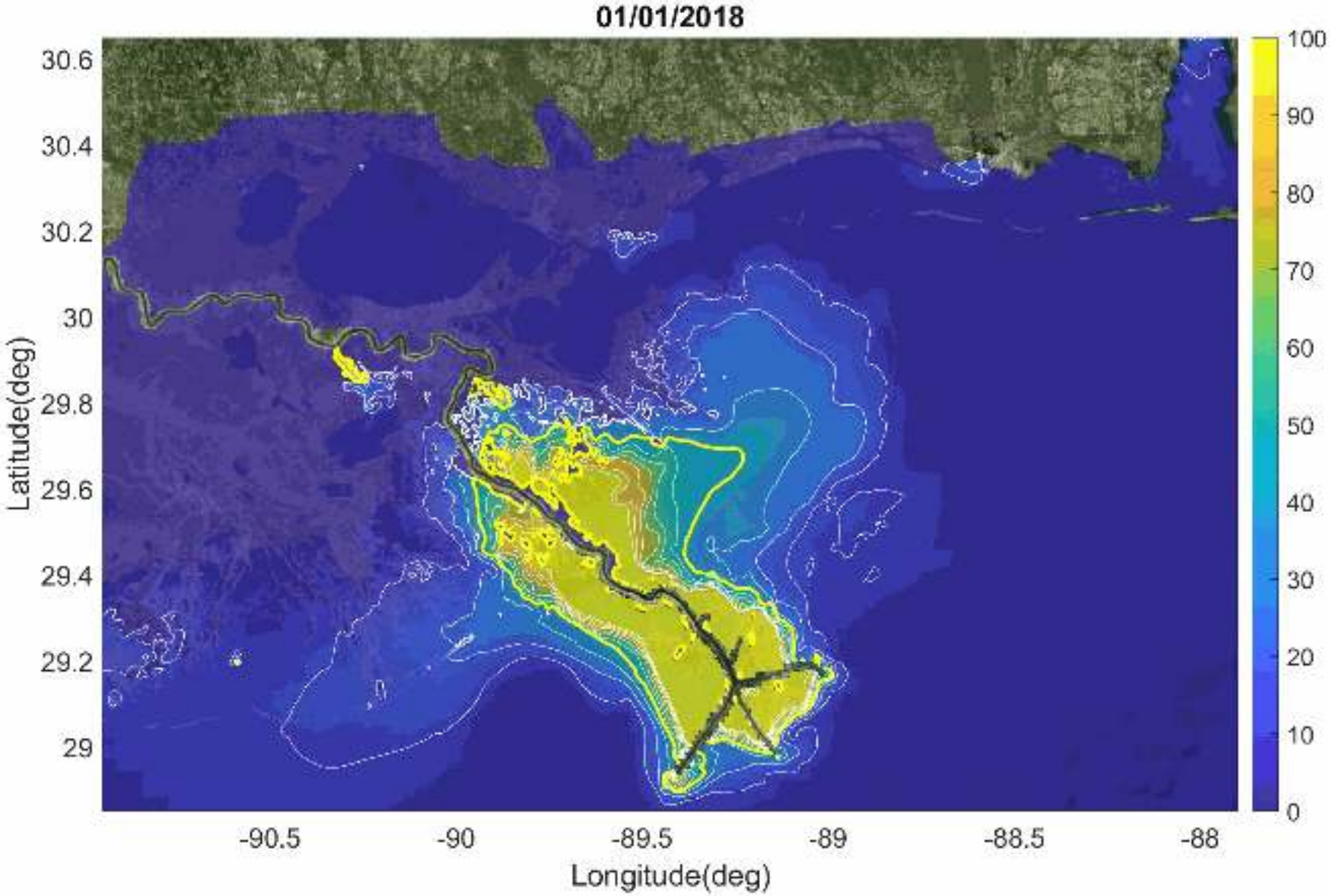
Salinity difference (ppt)



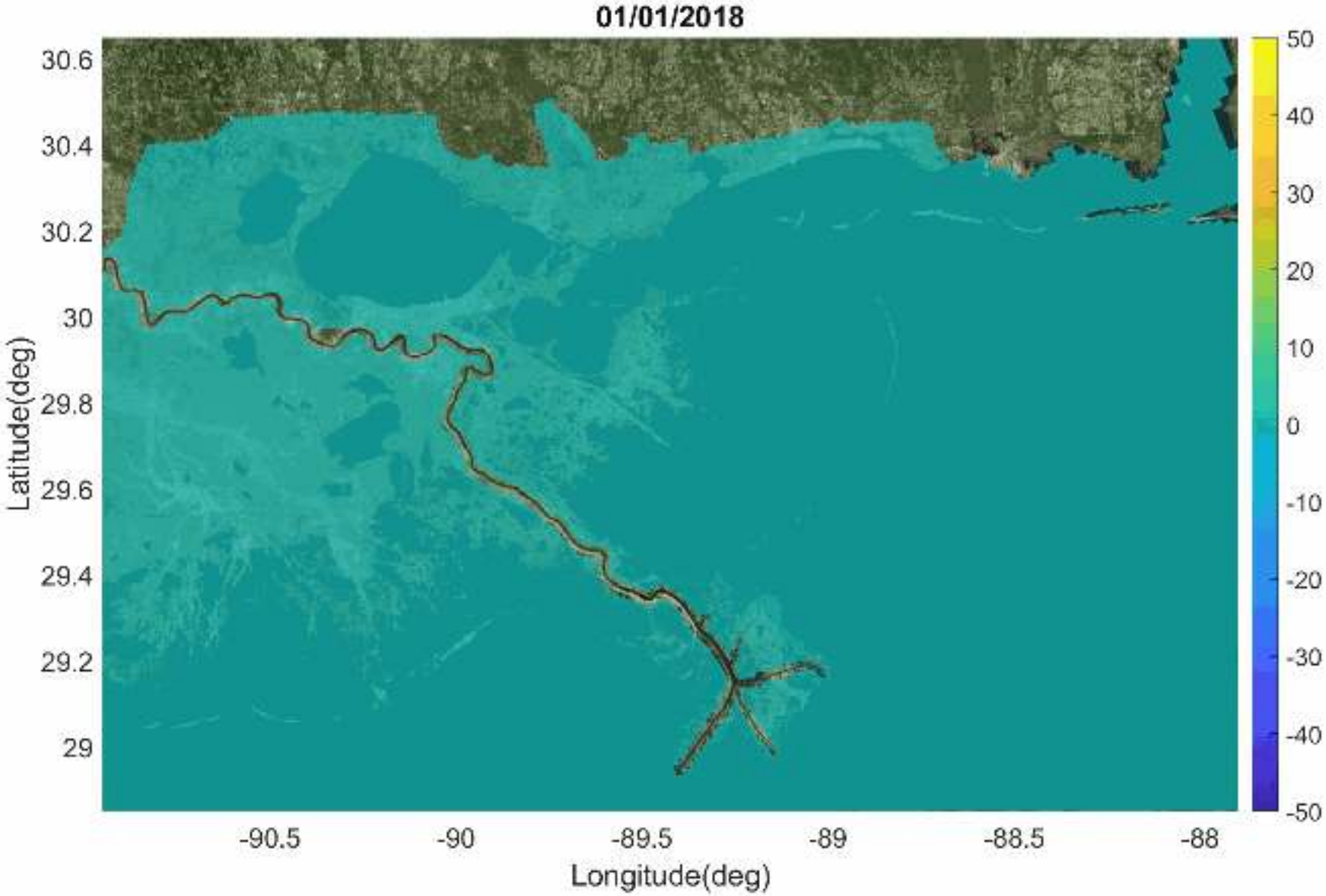
2018 SST (mg/l, thick yellow line: 40-mg/l contour)



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

- Continue improving this vital water, sediment, and water quality model as more data and funds become available.
- Perform more scenarios to evaluate various capacities of Ama and Union
- CPRA is currently evaluating Union capacities of 25K, 50K, 75K, and 100K CFS
- Communicate with stakeholders about the efficacy of implementing upper River Diversions to capture the potential benefits and impacts on the ecosystem and local communities
- Explore the benefits of the upper river diversions in creating added protection benefits to local communities from natural hazards (hurricanes, and rainstorm flooding).