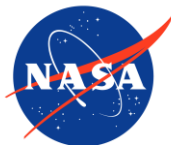


# Delta-X Digital Elevation Model

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June 5, 2023

Jet Propulsion Laboratory, California Institute of Technology



**Jet Propulsion Laboratory**  
California Institute of Technology

# Delta-X: Digital Elevation Model, MRD, LA, USA, 2021

**Preprint** This dataset is released as a preprint. The data are provisional. Read more [About Preprint Datasets](#).

## Overview

DOI	
Version	1
Project	<b>Delta-X</b>
Published	0000-00-00
Updated	2023-03-09
Usage	3 downloads

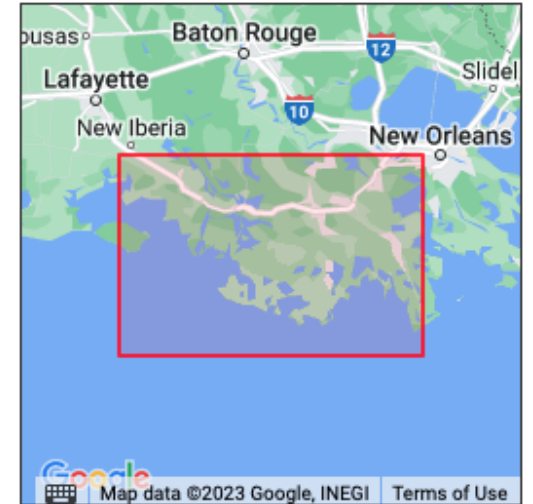
*Not yet published  
on ORNL*

[Download Data](#) 1.0 GB

[User Guide](#)

## Description

This dataset provides an updated Digital Elevation Model (DEM) for the Atchafalaya and Terrebonne basins in coastal Louisiana. The DEM is updated from the pre-Delta-X DEM (Denbina et al., 2020) and extended to the full Delta-X domain. Data include sonar data collected during the spring and fall 2021 campaigns as well as bathymetric data from the Coastal Protection and Restoration Authority System-Wide Assessment and Monitoring System (CPRA SWAMP). These bathymetry measurements were merged into one dataset, which is distributed in GeoTIFF format. The Delta-X mission is a 5-year NASA Earth Venture Suborbital-3 mission to study the Mississippi River Delta in the United States, which is growing and sinking in different areas. River deltas and their wetlands are drowning as a result of sea level rise and reduced sediment inputs. The Delta-X mission will determine which parts will survive and continue to grow, and which parts will be lost. Delta-X begins with airborne and in situ data acquisition and carries through data analysis, model integration, and validation to predict the extent and spatial patterns of future deltaic land loss or gain.



## Spatial Coverage

Bounding rectangle

**N: 29.96 S: 28.97 E: -90.17 W: -91.89**

## Temporal Coverage

**2012-01-01 to 2021-01-01**

# Products

- **DeltaX\_MultiSource\_WaterMask.tif**
- **DeltaX\_MultiSource\_DEM\_Atchafalaya-Terrebonne\_Basin\_2021.tif**
- **DeltaX\_MultiSource\_Data\_Source\_Flag.tif**
- Rasters of weighting factor of each data source

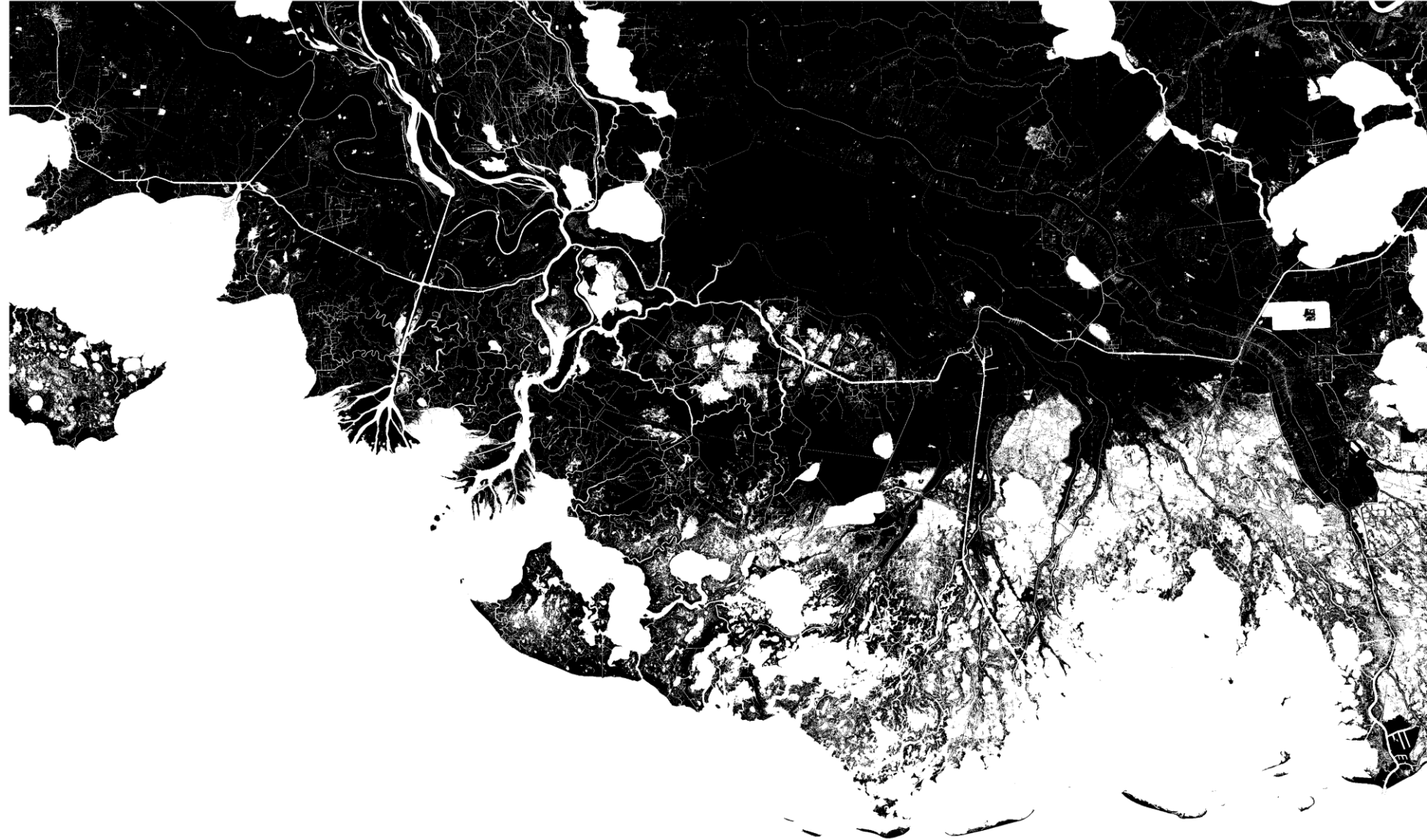
*\*\*\*Elevations are given in meters with respect to NAVD88\*\*\**

*\*\*Coordinate system for all files are EPSG 32615 (UTM)\*\**

*\*Spatial resolution = 10m\**

# Water Mask

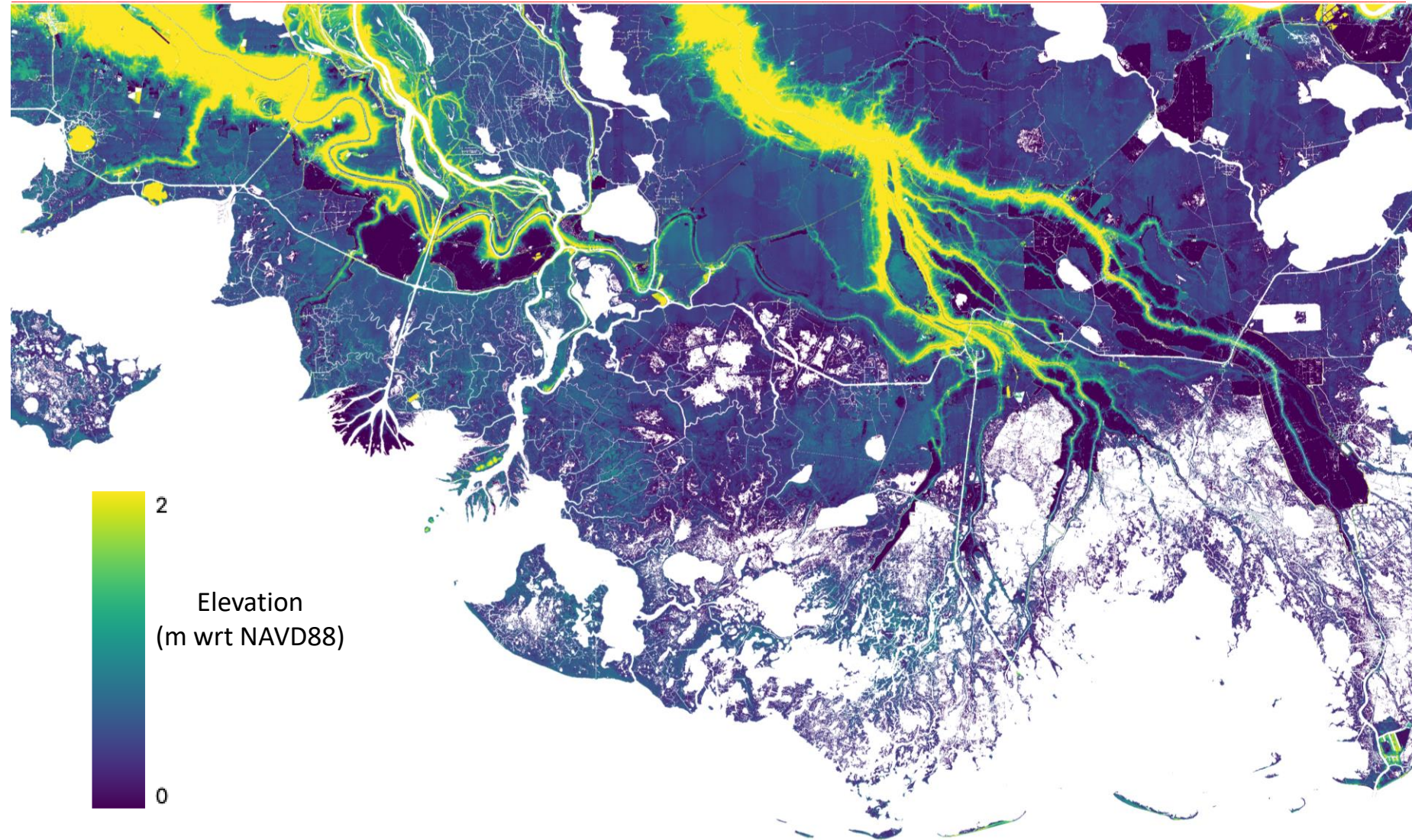
- Water/Land classification using aerial imagery from the **National Agriculture Imagery Program**
- 1m resolution, resampled to 10m
- Normalized Difference Water Index with Green and Near-Infrared bands
- Classifications in 2010, 2013, 2015, 2017, and 2019
- Permanent water bodies defined as pixels classified as water for at least 3 years
- Manual corrections in areas with bad results





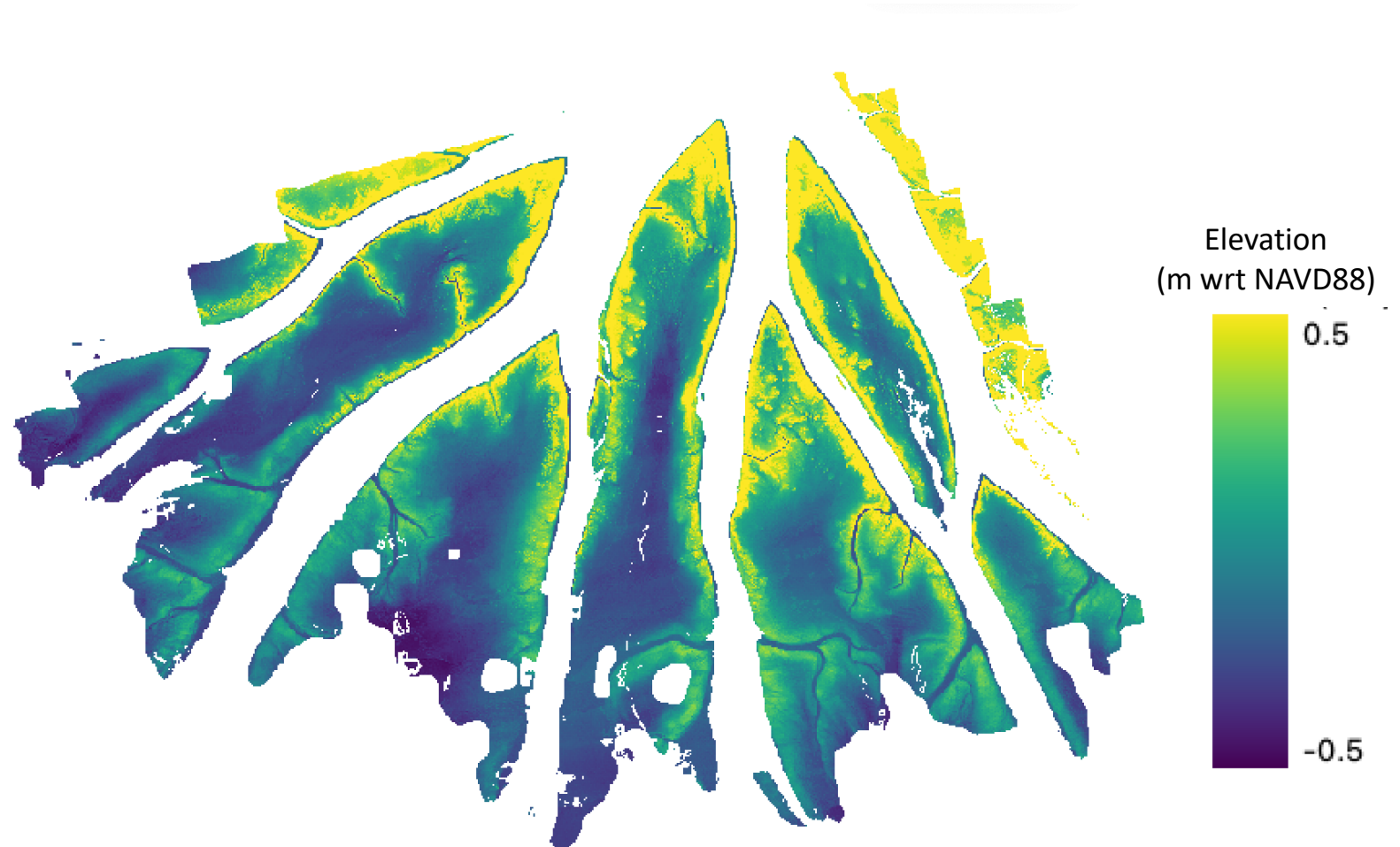
# Baseline Topography

- Lidar data available through the **USGS National Elevation Dataset**
- Colors correspond to the year of data acquisition:
  - Gold = 2012
  - Green = 2013
  - Purple = 2015
  - Pink = 2017



# Topography: Wax Lake Delta

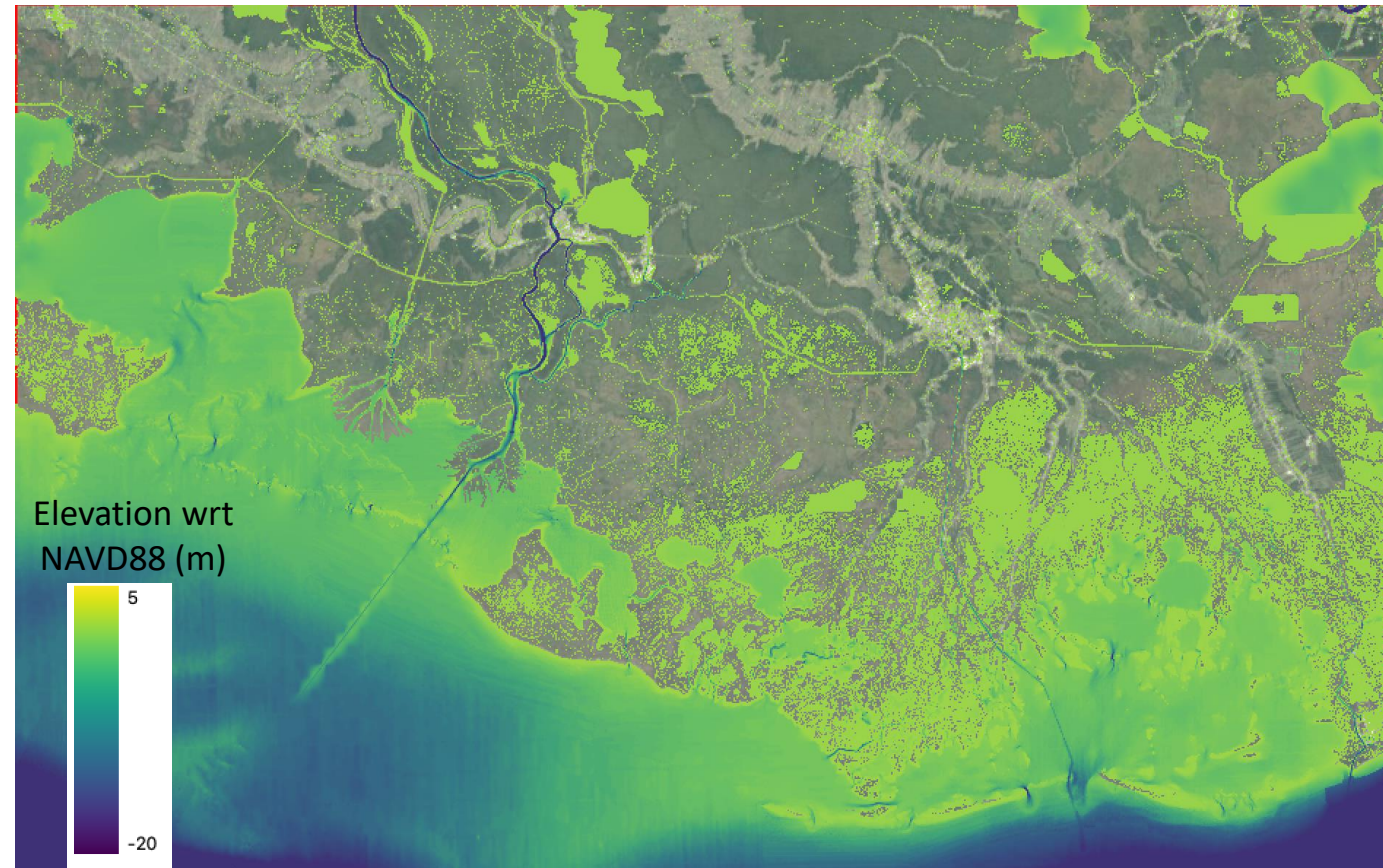
- NCALM Lidar data (winter 2020)





# Baseline Bathymetry

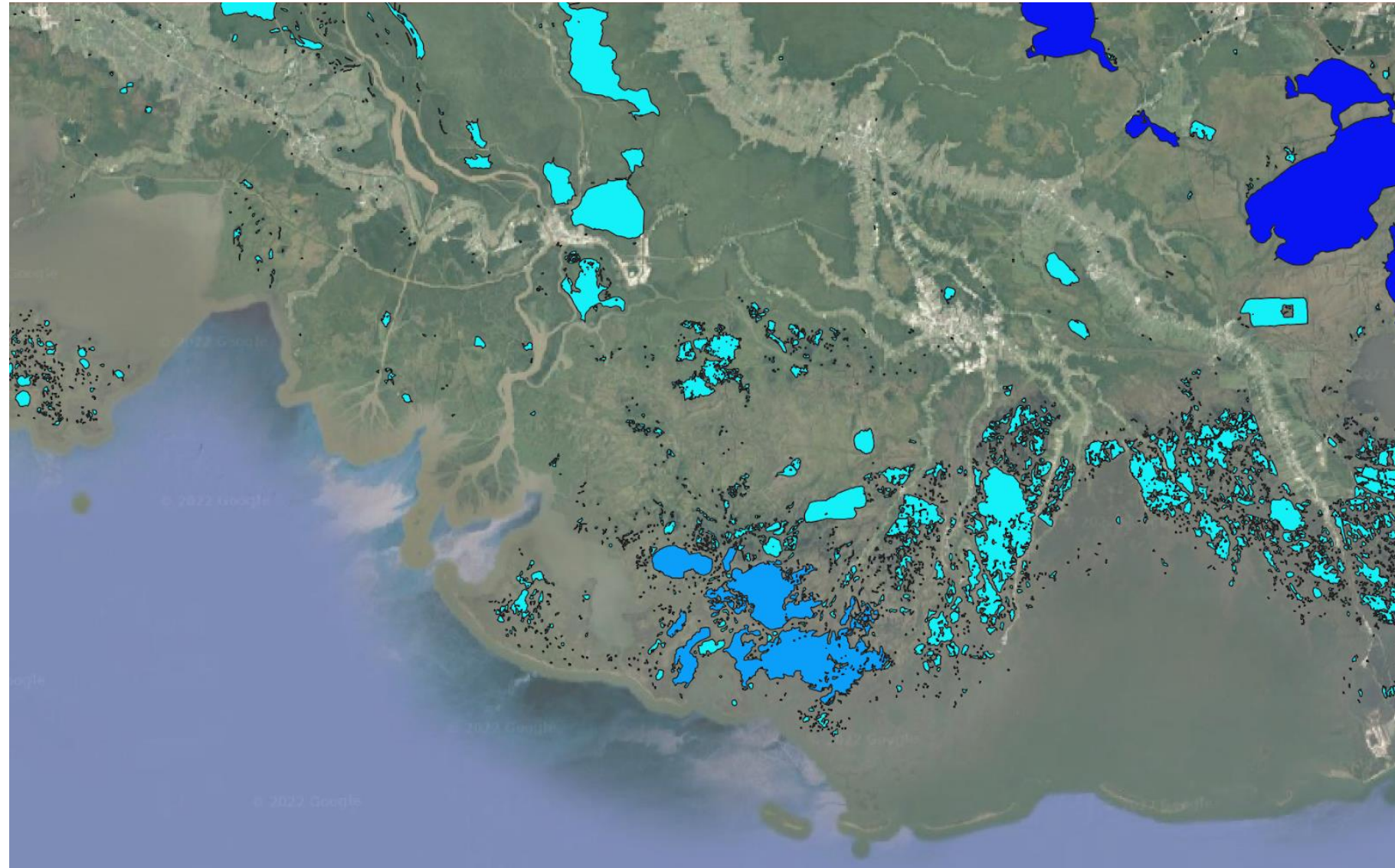
- **USGS/NOAA Coastal Elevation Dataset**
  - <https://www.usgs.gov/special-topics/coastal-national-elevation-database-applications-project>
- Data from **Xing et al. 2017**, who combined:
  - NOAA's bathymetry sounding database
  - the Digital Nautical Charts database
  - the 5-minute gridded elevations/bathymetry for the world (ETOPO5) database were combined





# Bathymetry: Lakes

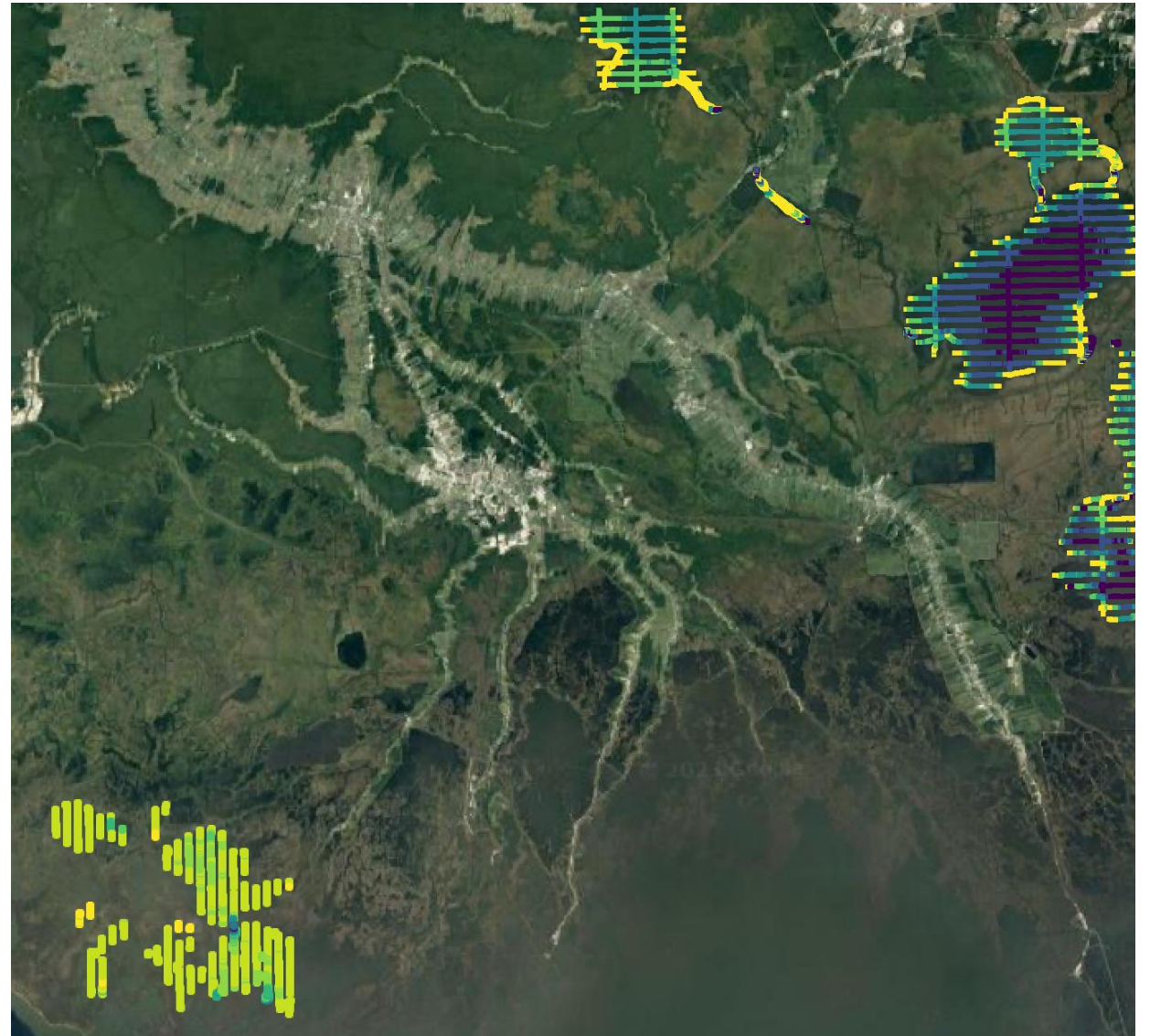
- Lakes were delineated using the **SWOT Prior Lake Database**
- Baseline bathymetry of lakes is set at -2m NAVD88





# Bathymetry: Lakes

- Large lakes were surveyed in the **CPRA System Wide Assessment and Monitoring Program (SWAMP)** campaign
- These lakes include Lake Salvador, Lake Cataouatche, Lac des Allemands, Bayou Perot, Lost Lake, Lake Mechant, Caillou Lake, Bay Junop, Bay Long, King Lake, Bay Voisin, Hackberry Lake, Fiddlers Lake, and Lake Pagie.
- Bathymetry data were interpolated using an inverse difference weighting algorithm.



# Bathymetry: Wax Lake Outlet/Delta

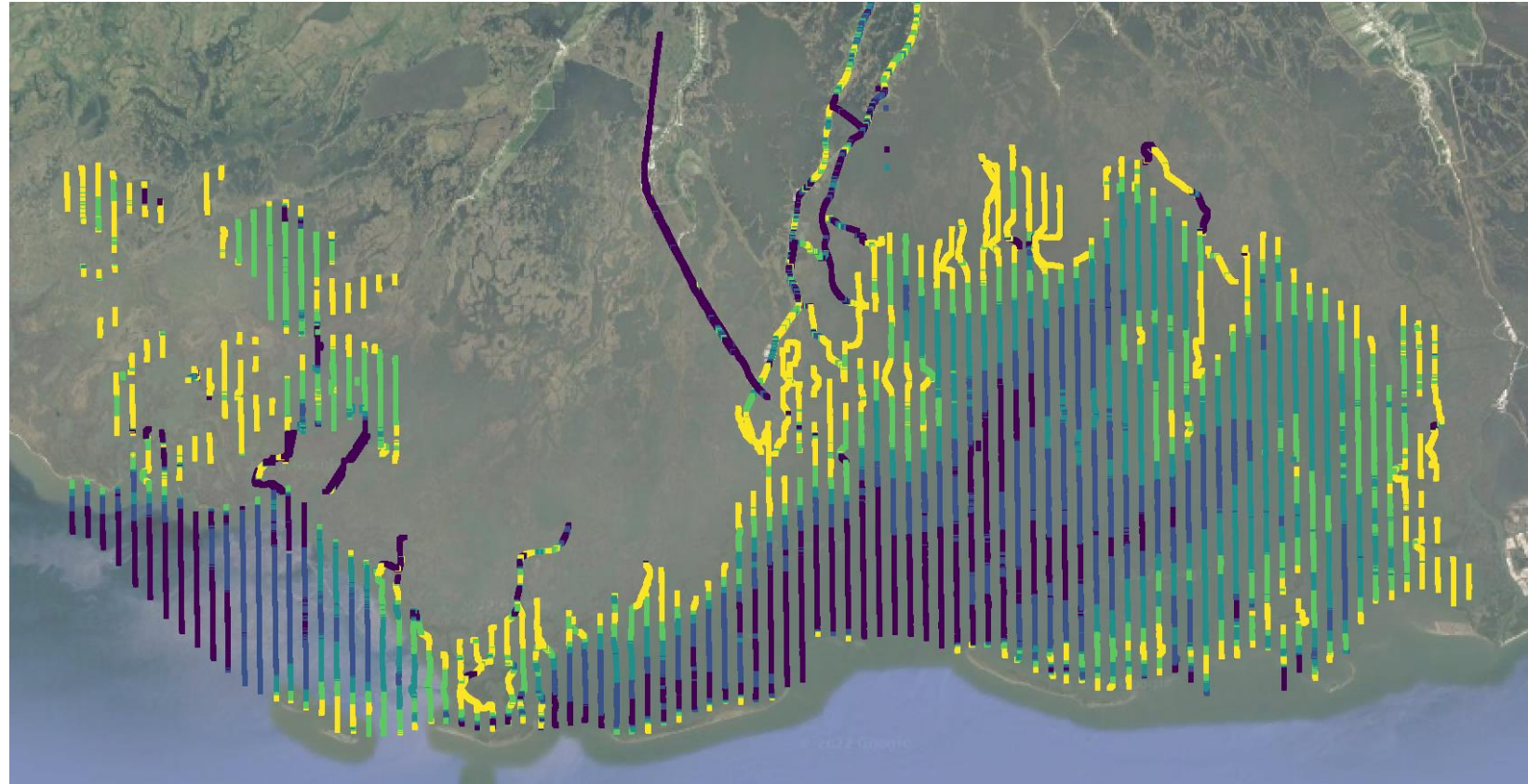
- Wax Lake Outlet and 4 main distributary channels were surveyed during **Pre-Delta-X** (2015) using a SonarMite Hydrolite Single Beam Echo Sounder (Blue)
- Within Wax Lake Delta, **Shaw et al. 2016** collected single and multibeam bathymetry data in main channels and the delta front in February 2015 (Black)





# Bathymetry: Terrebonne Bay

- Terrebonne bay bathymetry was surveyed in 2019 as part of the **CPRA SWAMP** program
- Bathymetry data were interpolated using an inverse difference weighting algorithm.





# Bathymetry: Delta-X 2021 Sonar

- Surveys of channels were done by multiple field teams during the Spring and Fall 2021 **Delta-X** campaigns using a Lowrance Fish Finder



# Bathymetry: Inland Channels

- Any channels (defined by the water mask) that have no bathymetry data, are carved to -2m NAVD88
- The new water mask consistently captures channels wider than 30m, except channels that fill entirely with vegetation.
- Channels narrower than 30m are not capture.





# Bathymetry: Other Water Bodies

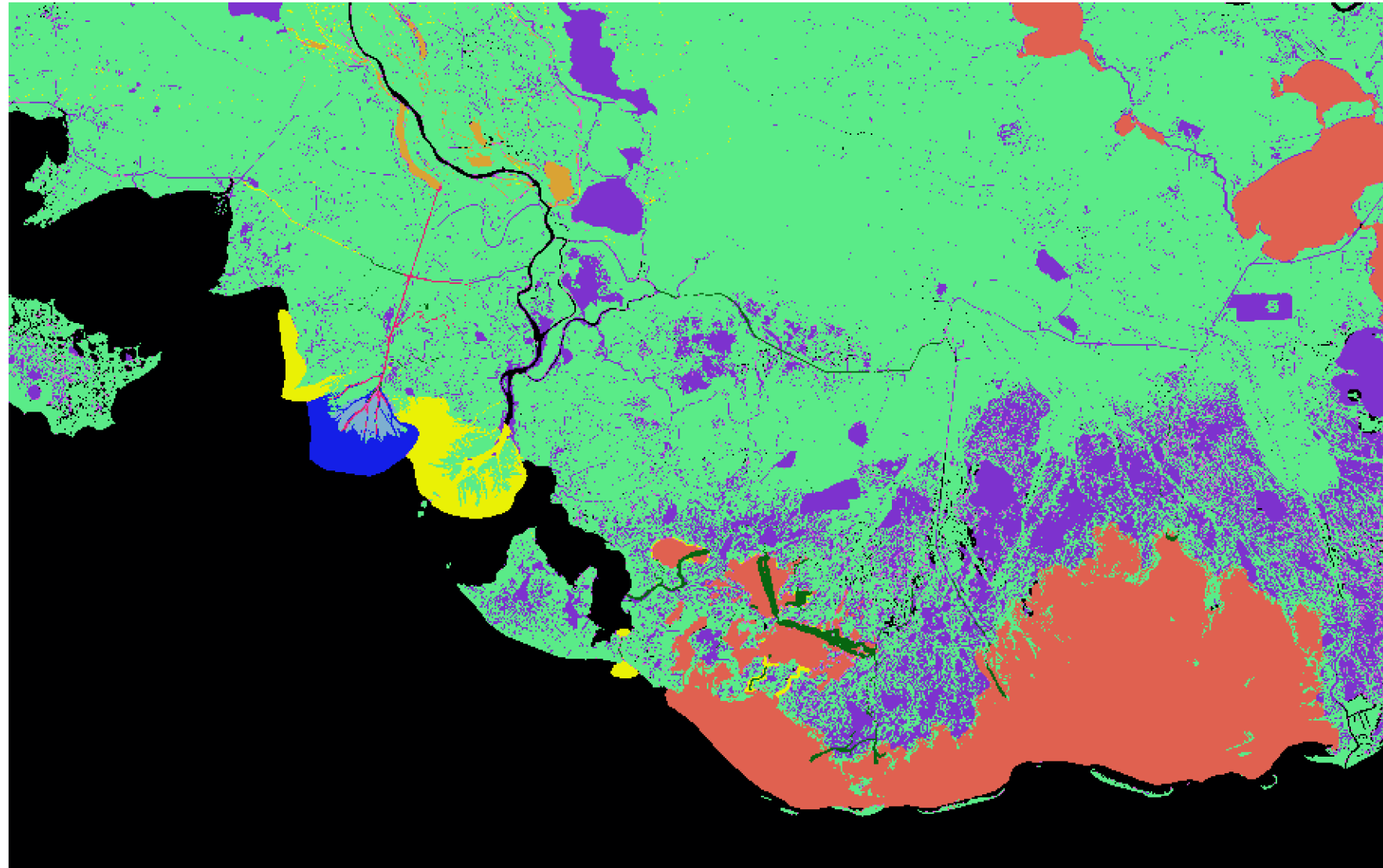
- Areas within the National Hydrography Dataset (NHD, USGS, 2011).
- Mean bed elevations were collected by USGS using a Lowrance HDS5 single-beam sonar and extended to similar water bodies.
- More information on techniques can be found in Kroes, D.E., 2022, <https://doi.org/10.5066/P94GULXE>



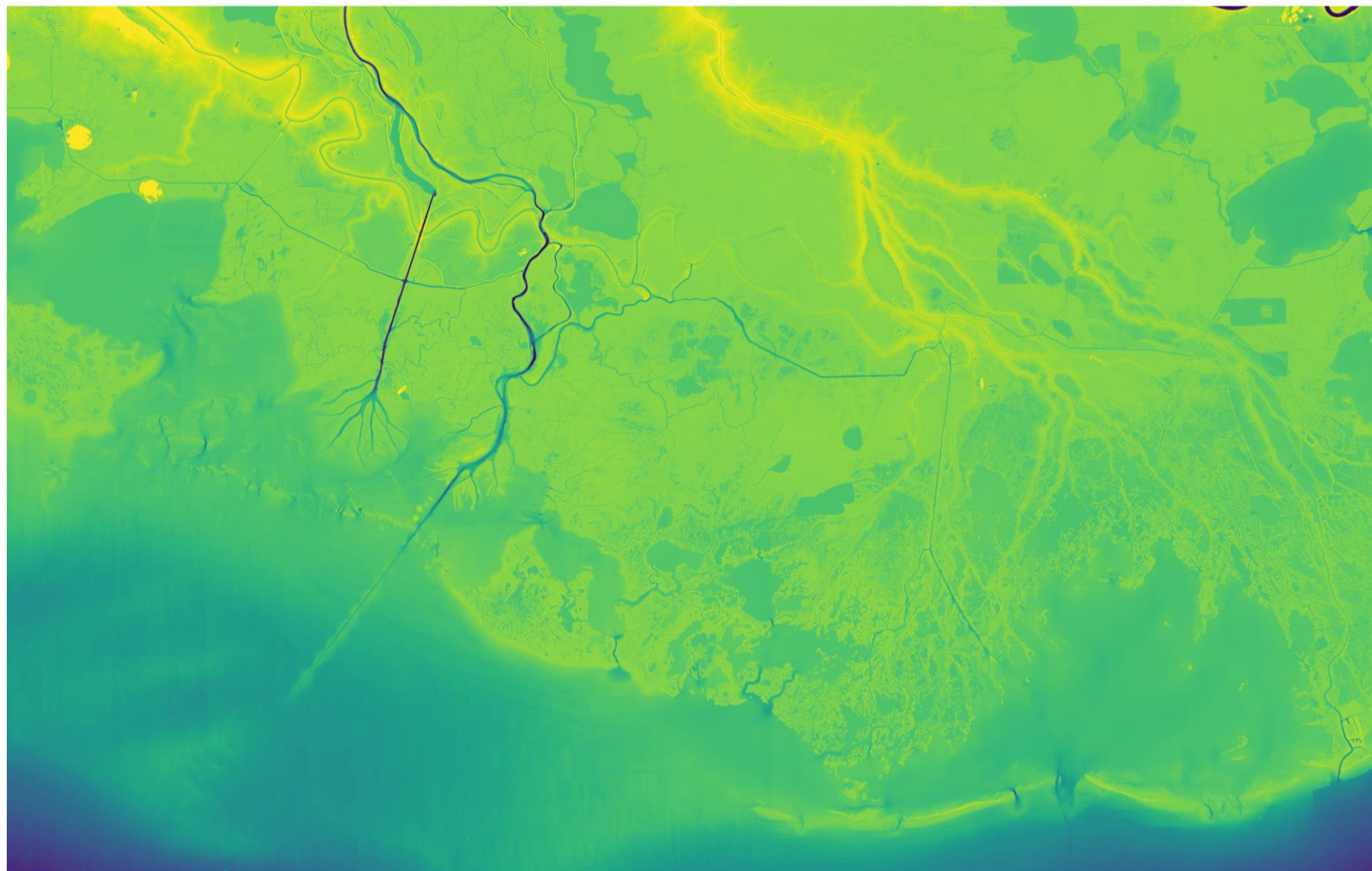


# Primary Data Source for Each Pixel

- 0: Topography from USGS
- 1: Topography from NCALM
- 2: Bathymetry from Pre-Delta-X Sonar
- 3: Bathymetry from Delta-X Sonar
- 4: Bathymetry from Shaw
- 5: Bathymetry from NOAA2011/CoNED
- 6: Bathymetry from CPRA
- 7: Bathymetry from other nautical charts
- 8: Synthetic Bathymetry (carved to -2 m in water bodies larger than 1 Ha where no other bathymetry data was available)
- 9: Mean bed elevations from Kroes, D.E., 2022
- 1: Mixed sources



# Final Merged Digital Elevation Model



Elevation wrt  
NAVD88 (m)



# ORNL DAAC

## 3 Products:

- [DeltaX\\_MultiSource\\_Data\\_Source\\_Flag.tif](#)
- [DeltaX\\_MultiSource\\_DEM\\_Atchafalaya-Terrebonne\\_Basin\\_2021.tif](#)
- [DeltaX\\_MultiSource\\_WaterMask.tif](#)

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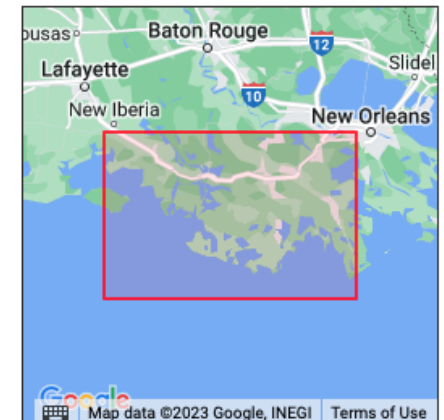
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# Data References

- U.S. Geological Survey, 2012/2013/2015/2017, Original Product Resolution (OPR) Source Digital Elevation Models (DEMs) - USGS National Map 3DEP Downloadable Data Collection: U.S. Geological Survey. *SWOT PLD*
- Danielson, J.J., Tyler, D.J., Cushing, W.M., Barras, J.A., Poppenga, S.K. Beverly, S.D, and Shogib, R., 2022, Topobathymetric Model of the Northern Gulf of Mexico, 1885 to 2021: U.S. Geological Survey data release, <https://doi.org/10.5066/P99JULDN>. Xing
- Shaw, J. B., Ayoub, F., Jones, C. E., Lamb, M. P., Holt, B., Wagner, R. W., Coffey, T. S., Chadwick, J. A., and Mohrig, D. (2016), Airborne radar imaging of subaqueous channel evolution in Wax Lake Delta, Louisiana, USA, *Geophys. Res. Lett.*, 43, 5035– 5042, doi:[10.1002/2016GL068770](https://doi.org/10.1002/2016GL068770).
- Todd M. Folse, Thomas E. McGinnis, Leigh A. Sharp, Jonathan L. West, Melissa K. Hymel, John P. Troutman, Dona Weifenbach, William M. Boshart, Laurie B. Rodrigue, Danielle C. Richardi, W. Bernard Wood, C. Mike Miller, Elizabeth M. Robinson, Angelina M. Freeman, Camille L. Stagg, Brady R. Couvillion, and Holly J. Beck. 2020. A Standard Operating Procedures Manual for the Coastwide Reference Monitoring System-Wetlands and the System-Wide Assessment and Monitoring Program: Methods for Site Establishment, Data Collection, and Quality Assurance/Quality Control. Louisiana Coastal Protection and Restoration Authority. Baton Rouge, LA. 252 pp
- Kroes, D.E., 2022, Mean bed elevations of waterbodies on the Atchafalaya River floodplain: U.S. Geological Survey data release, <https://doi.org/10.5066/P94GULXE>
- Xing, F., J.P.M. Syvitski, A.J. Kettner, E.A. Meselhe, J.H. Atkinson, and A.K. Khadka. 2017. Morphological responses of the Wax Lake Delta, Louisiana, to Hurricanes Rita. *Elem Sci Anth*, 5, p.80. DOI: <http://doi.org/10.1525/elementa.125>

# 2023 Delta-X Open Data Workshop

June 5, 2023 10:00am-12:20pm ET at Boston University

685-725 Commonwealth Avenue Room CAS-B18, Boston, MA

Virtual link: <https://jpl.webex.com/jpl/j.php?MTID=m9011ca24c2463546c9443b1a3a17448b>

Eastern Time	Title	Presenter(s)
10:00 – 10:15 am	Introduction	Marc Simard
10:15 – 10:50 am	Data Access	Matt Donovan, Yaxing Wei
10:50 – 11:00 am	Aboveground Biomass	Daniel Jensen
11:00 – 11:10 am	Water Level Change	Talib Oliver Cabrera
11:10 – 11:20 am	Water Level	Michael Denbina
11:20 – 11:30 am	Sediment Accretion	Robert Twilley, Andre Rovai
11:30 – 11:40 am	Vegetation Data	Edward Castaneda, Elena Solohin
11:40 – 11:50 am	DEM	Alexandra Christensen
11:50 – 12:00 pm	Modeling Hydrodynamics Using ANUGA	Paola Passalacqua, Antoine Soloy
12:00 – 12:20 pm	Discussions & Questions	