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Delta-X: Sonar Bathymetry Survey of Channels, MRD, Louisiana, 2021

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Summary

This dataset includes bathymetry data for water channels in a portion of the Mississippi River Delta (MRD) of coastal Louisiana. The data were collected using sonar during field efforts of the Delta-X Campaign taking place during 2021. In situ continuous surveys of channel bathymetry were conducted in the Atchafalaya and Terrebonne basins using either a Lowrance HDS-Live Fish Finder with Active Imaging 3-in-1 Transducer or a SonarMite Echo Sounder mounted on the side or back of the research boat. The sonar depth observations were delineated by the date, time, and location. These bathymetry measurements were used to generate a digital elevation model (DEM) through interpolation with ancillary DEMs. The data are provided in comma-separated values (CSV) format. A map of data collection routes is provided in compressed keyhole markup language (KMZ).

Sonar points were collected while the research vessel was operational and conditions were appropriate. Four teams collected sonar data: the Jet Propulsion Laboratory (JPL) using the Lowrance Fish Finder, University of North Carolina (UNC) using a SonarMite Echo Sounder, Boston University (BU) using a Lowrance Fish Finder, and California Institute of Technology (Caltech) using a Lowrance Fish Finder.

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.

The dataset includes 119 files in comma-separated values (CSV) format and one file in compressed keyhole markup language (KMZ).



Figure 1. Location 2021 sonar bathymetry surveys shown as colored lines in the Atchafalaya and Terrebonne basins of the Mississippi River Delta (MRD). The towns of Morgan City and Houma in coastal Louisiana are shown. Source: deltax_sonar_routes.kmz

Citation

Christensen, A.L., J.M. Mallard, J. Nghiem, J. Harringmeyer, M. Simard, T.M. Pavelsky, M.P. Lamb, and C.G. Fichot. 2022. Delta-X: Sonar Bathymetry Survey of Channels, MRD, Louisiana, 2021. ORNL DAAC, Oak Ridge, Tennessee, USA. <https://doi.org/10.3334/ORNLDAAC/2085>

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1. Dataset Overview

This dataset includes bathymetry data for water channels in a portion of the Mississippi River Delta (MRD) of coastal Louisiana. The data were collected using sonar during field efforts of the Delta-X Campaign taking place during 2021. In situ continuous surveys of channel bathymetry were conducted in the Atchafalaya and Terrebonne basins using either a Lowrance HDS-Live Fish Finder with Active Imaging 3-in-1 Transducer or a SonarMite Echo Sounder mounted on the side or back of the research boat. The sounder depth observations were delineated by the date, time, and location. These bathymetry measurements were used to generate a 'merged' digital elevation model (DEM) through interpolation with ancillary DEMs.

Project: [Delta-X](#)

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Related data set

Denbina, M.W., M. Simard, T.M. Pavelsky, A.I. Christensen, K. Liu, and C. Lyon. 2020. Pre-Delta-X: Channel Bathymetry of the Atchafalaya Basin, LA, USA, 2016. ORNL DAAC, Oak Ridge, Tennessee, USA. <https://doi.org/10.3334/ORNLDAAC/1807>

- Bathymetric survey of in the main channels of the Atchafalaya and Wax Lake Deltas conducted during the Pre-DeltaX 2016 field studies.

Acknowledgments

This work was supported by NASA's Earth Venture Suborbital-3 (EVS-3) program (grant NNH17ZDA001N-EVS3) and Jet Propulsion Laboratory's R&TD FY17-19 program.

2. Data Characteristics

Spatial Coverage: Atchafalaya River and Terrebonne Basins, Louisiana, USA

Spatial Resolution: Point samples.

Temporal Coverage: 2021-03-25 to 2021-09-25

Temporal Resolution: Continuous readings during surveys at 1 Hz

Site Boundaries: Latitude and longitude are given in decimal degrees.

Site	Westernmost Longitude	Easternmost Longitude	Northernmost Latitude	Southernmost Latitude
Atchafalaya River and Terrebonne Basins, Louisiana	-91.4729	-90.4012	29.7038	29.1029

Data File Information

This dataset consists of 120 files: 119 files of bathymetry data in comma-separated values (.csv) format and one file in compressed keyhole markup language (.kmz).

The naming convention for the bathymetry files is *deltax_sonar_AAAA_YYYYMMDD.csv*; (e.g., *deltax_sonar_UNC_20210922_154233.csv*), where

- AAAA = data collection team: "BU", "Caltech", "JPL1", "JPL2" or "UNC"
- YYYYMMDD = date of sampling in year (YYYY), month (MM), and day (DD)

Missing data or are indicated with the value -9999.

The file *deltax_sonar_routes.kmz* provides a map of sonar routes in compressed keyhole markup language (.kmz).

Table 1. Variables in the sonar bathymetry data files (*deltax_sonar_AAAA_YYYYMMDD.csv*).

Variable	Units	Description	Collected during Pre-Delta-X campaign?
basin		Name of basin: "Atchafalaya" or "Terrebonne"	Yes

sonar_id		Indicates the instrument by acronym of the team that collected the data. Lowrance HDS-Live Fish Finder with Active Imaging 3-in-1 Transducer ("JPL1", "JPL2", "BU", or "Caltech") SonarMite Echo Sounder ("UNC")	No. Collected during Delta-X campaigns
date	YYYY-MM-DD	Date of acquisition	Yes
time	hh:mm:ss	Time of acquisition in UTC	Yes
longitude	degrees east	Longitude of sonar GPS	Yes
latitude	degrees north	Latitude of sonar GPS	Yes
nearest_CRMS		Name of the nearest CRMS water level gauge with available water surface elevations relative to NAVD88 datum during the time of data collection	No. Collected during Delta-X campaigns
distance_to_CRMS	m	Distance from the sonar data point to the near CRMS water level gauge	No. Collected during Delta-X campaigns
water_depth	m	Corrected water depth	Yes
water_depth_raw	m	Uncorrected water depth (without adding the vertical offset)	Yes
bathymetry_NAVD88	m	Corrected bathymetry values using vertical offsets (Table 2).	No. Collected during Delta-X campaigns

3. Application and Derivation

The sonar data were used to expand the existing wetland digital elevation model (DEM) to channels. These bathymetry measurements were used to generate a 'merged' digital elevation model (DEM) through interpolation with ancillary DEMs (e.g. Gesch et al., 2018; Shaw et al. 2016).

4. Quality Assessment

Recorded depths of 0 m occur when the sounder comes out of the water in rough conditions, the water depth is too shallow, or when the boat is moving at too high a speed. Therefore, 0-m depth observations were removed from the vector product.

Uncertainties in the data come from several sources such as boat draft and instrumentation error.

5. Data Acquisition, Materials, and Methods

For the Delta-X campaign, surveys of channel bathymetry were conducted in the Atchafalaya and Terrebonne basins of the Mississippi River Delta of coast Louisiana, U.S. during March- April and August-September of 2021 (Figure 1). Continuous surveys of bathymetry were conducted using Lowrance HDS-Live Fish Finder with [Active Imaging 3-in-1 Transducer](#) and SonarMite Echo Sounder (Ohmex Ltd, 2018) sounders. The sounder was mounted on the stern or side of the research vessel beneath the water surface. The sounder was set to record during portions of the field campaign while surveying. During channel surveys, the sonar recorded the depth, which was converted to bathymetry using horizontal and vertical offsets (Table 2).

Five teams were involved in these surveys: Boston University (BU), California Institute of Technology (Caltech), University of North Carolina-Chapel Hill (UNC), and two teams from NASA's Jet Propulsion Laboratory (JPL1, JPL2).

Boats using the Lowrance HDS-Live Fish Finder mounted the sensor to the stern of the boat and the connected GPS was located at the boat console. A horizontal offset was calculated based on the direction the boat was moving and the distance from the boat console to the location of the sounder. Each team's boat had a slightly different configuration (Table 2) and the vertical offset was estimated as the distance of the sensor below the water surface. The expected change in this distance is 10-30 cm depending on boat speed and weight distribution. Depths presented in the data are both uncorrected and corrected (with the vertical offset added to the measured instrument depth, Table 1). Boats using the Lowrance Fish Finder did not have a survey-level global navigation satellite system (GNSS) unit. Therefore, to convert depth to bathymetry, a nearby water level gauge was used to estimate water surface elevation at the time of each sounder collection point. The nearest Louisiana Coastwide Reference Monitoring System (CRMS)(CPRA 2022; Steyer et al., 2003) water level gauge with available datum-corrected water surface elevations were used for this conversion. Bathymetry data files contain the name and distance to CRMS gauge.

Boats using the SonarMite Echo Sounder mounted the sensor to a 2-m pole on the side of the boat which was lowered into the water so the Echo Sounder was fully submerged. A GNSS antenna connected to a Septentrio PolaRx5 GNSS receiver was attached to the top of the pole to record horizontal position of the Echo Sounder at 1 Hz. Error is estimated to be <10 cm due to instrument precision and changes in the boat's position in the water. GNSS position data (latitude, longitude, ellipsoidal height relative to the NAVD88 datum) was post-processed using the Precise Point Positioning utility from Natural Resources Canada (NRCAN [CSRS-PPP](#) service) and converted to orthometric heights relative to GEOID12B geoid. Orthometric height of the antenna was converted to bathymetry by subtracting the height of the antenna and water depth.

Table 2. Sonar instrument, mounting location, and offsets

Instrument	Sensor location	Team	Vertical offset (m)	Horizontal offset (m)	
Lowrance HDS-Live Fish Finder with Active Imaging 3-in-1 Transducer	stern of boat	BU	0.29	3.50	
		Caltech	0.30	2.30	
		JPL1	0.51	2.30	
		JPL2	0.35	4.27	
SonarMite Echo Sounder	side of boat	UNC	0.29	0.00	

6. Data Access

These data are available through the Oak Ridge National Laboratory (ORNL) Distributed Active Archive Center (DAAC).

[Delta-X: Sonar Bathymetry Survey of Channels, MRD, Louisiana, 2021](#)

Contact for Data Center Access Information:

- E-mail: uso@daac.ornl.gov
- Telephone: +1 (865) 241-3952

7. References

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