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Delta-X: Feldspar Sediment Accretion Measurements, MRD, LA, USA, 2019-2023, Version 4

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Documentation Revision Date: 2025-02-10

Dataset Version: 4

Summary

This dataset provides elevation, hydrogeomorphic zone classification, soil carbon content, bulk density, organic matter content, and sediment accretion measurements collected at feldspar stations established near Louisiana's Coastwide Reference Monitoring Systems (CRMS) sites and on Mike Island in Wax Lake Delta (WLD). Feldspar stations were established to capture recent sediment deposition rates across hydrogeomorphic zones defined as discrete surface elevation ranges relative to NAVD88 (e.g., subtidal < -0.04 m, intertidal -0.04 m to 0.30 m, and supratidal > 0.30 m). Hydrogeomorphic zones classification was based on marsh surface elevation measurements acquired in November - December 2020 using a RTK GPS (Trimble R12, using Geoid 18). Between two and four feldspar stations were deployed approximately 25 and 50 meters from a main channel to represent existing hydrogeomorphic zones in brackish and saline emergent marsh vegetation, brackish and saline ponds within emergent marshes, tidal freshwater emergent marshes, and forested swamps. Cryocore technique was used to determine recent sediment deposition. Soil samples were collected to determine organic and inorganic fractions and organic carbon content. The data cover the Delta-X field studies conducted from Fall 2020 through Fall 2023. The first feldspar markers were deployed in October of 2019. The data are provided in comma-separated values (CSV) format.

There is one data file with this dataset in comma separated values format (.csv).



Figure 1. Top image: Cryocores showing sediment deposited on top of feldspar marker horizon; Bottom image: Feldspar station set up.

Citation

Twilley, R., A.F. Cassaway, A. Rovai, I.A. Vargas-Lopez, and J.A. Pineda-gomez. 2025. Delta-X: Feldspar Sediment Accretion Measurements, MRD, LA, USA, 2019-2023, Version 4. ORNL DAAC, Oak Ridge, Tennessee, USA. <https://doi.org/10.3334/ORNLDAAC/2381>

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1. Dataset Overview

This dataset provides elevation, hydrogeomorphic zone classification, soil carbon content, bulk density, organic matter content, and sediment accretion measurements collected at feldspar stations established near Louisiana's Coastwide Reference Monitoring Systems (CRMS) sites and on Mike Island in Wax Lake Delta (WLD). Feldspar stations were established to capture recent sediment deposition rates across hydrogeomorphic zones defined as discrete surface elevation ranges relative to NAVD88 (e.g., subtidal < -0.04 m, intertidal -0.04 m to 0.30 m, and supratidal > 0.30 m). Hydrogeomorphic zones classification was based on marsh surface elevation measurements acquired in November - December 2020 using a RTK GPS (Trimble R12, using Geoid 18). Between two and four feldspar stations were deployed approximately 25 and 50 meters from a main channel to represent existing hydrogeomorphic zones in brackish and saline emergent marsh vegetation, brackish and saline ponds within emergent marshes, tidal freshwater emergent marshes, and forested swamps. Cryocore technique was used to determine recent sediment deposition. Soil samples were collected to determine organic and inorganic fractions and organic carbon content. The data cover the Delta-X field studies conducted from Fall 2020 through Fall 2023. The first feldspar markers were deployed in October of 2019.

This is Version 4 of this dataset.

Project: [Delta-X](#)

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.

Related Datasets

Twilley, R., A. Fontenot-Cassaway, and A. Rovai. 2022. Delta-X: Feldspar Sediment Accretion Measurements, MRD, LA, USA, 2019-2023, Version 3. ORNL DAAC, Oak Ridge, Tennessee, USA. <https://doi.org/10.3334/ORNLDAAC/2290>

- Version 3 release of this dataset.

Twilley, R., A. Fontenot-Cassaway, and A. Rovai. 2022. Delta-X: Feldspar Sediment Accretion Measurements, MRD, LA, USA, 2019-2021, Version 2. ORNL DAAC, Oak Ridge, Tennessee, USA. <https://doi.org/10.3334/ORNLDAAC/2079>

- Version 2 release of this dataset.

Twilley, R., A. Fontenot-Cassaway, and A. Rovai. 2021. Delta-X: Feldspar Sediment Accretion Measurements for Coastal Wetlands, MRD, LA, USA. ORNL DAAC, Oak Ridge, Tennessee, USA. <https://doi.org/10.3334/ORNLDAAC/1998>

- Version 1 release of this dataset.

Acknowledgements

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2. Data Characteristics

Spatial Coverage: Louisiana's Coastwide Reference Monitoring Systems (CRMS) sites and on Mike Island in Wax Lake Delta (WLD), southern coast of Louisiana, USA

Spatial Resolution: Point

Temporal Coverage: 2019-10-04 to 2023-11-02; Sampling during Fall and Spring field seasons

Temporal Resolution: One-time field measurements

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

Site	Westernmost Longitude	Easternmost Longitude	Northernmost Latitude	Southernmost Latitude
Louisiana's CRMS sites and on Mike Island in WLD, southern coast of Louisiana	-91.44801	-90.8224	29.5643	29.1714

Data File Information

There is one file in comma separated values format with this dataset: [DeltaX_Soil_Properties_Fall2020_to_Fall2023.csv](#)

Missing numeric data are represented as -9999; missing text data are indicated by NA.

Table 1. Variables in the data file.

Variable	Units	Description
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basin	-	Basin: "Atchafalaya" or "Terrebonne"
campaign	-	Sampling season (e.g., "Fall_2020")
site_id	-	Site ID's: CRMS_0294, CRMS_0322, CRMS_0399, CRMS_0396, CRMS_0421, CRMS_2568, WLD_T1, WLD_T3.
hydrogeomorphic_zone	-	Hydrogeomorphic zone classification: "subtidal", "intertidal" or "supratidal"
elevation_navd88	m	Elevation in meters relative to NAVD88
latitude	degrees north	Latitude in decimal degrees
longitude	degrees east	Longitude in decimal degrees
station	-	Feldspar Stations ID's: herbaceous marshes (V25 and V50), forested swamp (T25), Supratidal (SUP), Intertidal (INT) and Subtidal (SUB)
plot	-	50 x 50 cm feldspar marker horizons plots: X, Y and Z
replicate	-	Replicate ID's for measurements taken from each cryocore: A,B or C
sample_id	-	Unique soil samples ID's
time_marker_deployed	YYYY-MM-DD hh:mm:ss	Date and time feldspar marker horizon plots were deployed
time_marker_sampled	YYYY-MM-DD hh:mm:ss	Date and time feldspar marker horizon plots were sampled
sediment_accretion	mm	Height of sediment accreted on top of feldspar marker horizon plots since deployment date
days_between_sampling_and_deployment	days	Number of days between feldspar marker horizon plots deployment and sampling event
soil_bulk_density	g cm ⁻³	Soil bulk density calculated from the sample's dry weight divided by its wet volume. Wet volume determined from the cross-sectional area of the core (cm ²) multiplied by the length the soil column interval (cm)
soil_organic_matter_content	percent	Organic matter content determined by loss on ignition (% of dry mass)
soil_organic_carbon	percent	Percent organic carbon determined on acid-fumigated soil samples using elemental analyzer (% of dry mass)
soil_organic_carbon_density	g cm ⁻³	Soil organic density obtained by multiplying sample's bulk density (g cm ⁻³) by its organic carbon fraction (g g ⁻¹).

3. Application and Derivation

Feldspar data will be used to calibrate and validate the ecogeomorphic (NUMAR, modified from NUMAN model by Chen and Twilley 1999) and hydrodynamic models. Data will be used to characterize in situ sediment deposition patterns across all Delta-X sites and to explain changes in sediment deposition across distinct hydrogeomorphic zones. This research will contribute to a better understanding of changes in sediment accretion, organic matter accumulation rates and soil carbon sequestration rates due to vegetation composition, salinity gradients and riverine sediment and nutrient loadings.

4. Quality Assessment

Data quality for each loss on ignition and carbon content on soil samples was determined on duplicate analytical replicates of each sample and the run precision was determined based on relative percent difference between replicates at an acceptance limit of <5%. For carbon content, accuracy and quality control were determined by the analysis of certified standard reference material during each run. Acceptable limits for accuracy were $\pm 5\%$. Data outside these limits was not used and samples were re-run to obtain new accurate values.

5. Data Acquisition, Materials, and Methods

Feldspar Stations were established near Louisiana's Coastwide Reference Monitoring Systems (CRMS) sites and on Mike Island in Wax Lake Delta (WLD) to capture recent sediment deposition rates across hydrogeomorphic zones defined as discrete surface elevation ranges relative to NAVD88 (e.g., subtidal < -0.04 m, intertidal -0.04 m to 0.30 m, and supratidal > 0.30 m; after Bevington and Twilley 2018). Hydrogeomorphic zones classification was based on marsh surface elevation measurements acquired in November - December 2020 using a RTK GPS (Trimble R12, using Geoid 18).

For CRMS_0294 and CRMS_0322, two feldspar stations were deployed in vegetated areas approximately 25 and 50 meters from a main channel (V25 & V50). For CRMS_0399, three feldspar stations were deployed: two feldspar stations were deployed in vegetated areas approximately 25 and 50 meters from a main channel (V25 & V50), and one pond station deployed at the edge of a pond approximately 25 meters from a main channel (P25). For CRMS_0396 and CRMS_0421, four stations were deployed at each site: two feldspar stations were deployed in vegetated areas approximately 25 and 50 meters from a main channel (V25 & V50), and two pond stations deployed at the edge of ponds approximately 25 and 50 meters from a main channel (P25 & P50). For CRMS_2568, two feldspar stations were deployed: one station in herbaceous vegetation (V25) and one station in forested vegetation (T25), both approximately 25 meters from a main channel. In Wax Lake Delta (WLD), six feldspar

stations were deployed: three stations along a transect near the island's apex at supratidal and subtidal (SUP & SUB) hydrogeomorphic zones, and three stations along a transect near delta front at supratidal and subtidal (SUP & SUB) hydrogeomorphic zones.

At each feldspar station, three 50 x 50 cm feldspar marker horizon plots (X, Y, and Z) were deployed on the soil surface. Each cryocore sample measured for accretion was given a replicate ID (A,B or C). Each cryocore showing a clear, white feldspar marker horizon was measured from the current soil surface to the top of the feldspar marker horizon. Each accretion measurement reported is the average of three individual measurements made with calipers.

Soil cores corresponding to sediment accretion measurements (e.g., height of sediment above feldspar marker) obtained in the cryocores were collected next to feldspar markers horizon plots to account for organic and inorganic fractions of newly deposited material. This strategy allowed for reducing disturbance of feldspar markers horizon plots, extending the makers' longevity. Soil samples were dried at 60°C until constant weight. Bulk density was calculated as the sample's dry weight divided its wet volume (g cm^{-3}). Wet volume is determined from the cross-sectional area (cm^2) of the soil core multiplied by the depth of each soil section (cm, based on the height of sediment above feldspar marker). Samples were homogenized and ground using a Wiley Mill. Organic matter content was determined by loss on ignition after combusting samples of a known mass at 550°C for 2 hours (Davies, 1974). Soil samples were fumigated in a desiccator for 8 hours with 12M HCl to remove inorganic carbonates (Harris et. al. 2001). Percent organic carbon on fumigated samples was measured with a ECS 4010 elemental analyzer (Costech Analytical Technologies Inc., Valencia, California). Soil organic density was calculated by multiplying the sample's bulk density (g cm^{-3}) by the sample's organic carbon fraction (g g^{-1}).

6. Data Access

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

[Delta-X: Feldspar Sediment Accretion Measurements, MRD, LA, USA, 2019-2023, Version 4](#)

Contact for Data Center Access Information:

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

7. References

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8. Dataset Revisions

Version	Release Date	Revision Notes
4.0	2025-01-24	Additional data were added for Fall 2023. Hydrogeomorphic zones classification was based on marsh surface elevation measurements acquired in November - December 2020 using a RTK GPS.
3.0	2024-01-18	Data for Spring 2022, Fall 2022, and Spring 2023 field seasons were added. The "normalized_accretion" variable was deleted.
2.0	2022-09-23	Fall 2021 data were added to the dataset; Fall 2020 and Spring 2021 data were updated.
1.0	2022-05-02	Initial release with Fall 2020 and Spring 2021 data.



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