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Delta-X: Feldspar Sediment Accretion Measurements, MRD, LA, USA, 2019-2021, Version 2

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Documentation Revision Date: 2022-09-23

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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 elevations extracted from the U.S. Geological Survey (USGS) Atchafalaya 2 project LiDAR Survey 2012 digital elevation model (<https://www.sciencebase.gov/catalog/item/543e6b86e4b0fd76af69cf4c>). Between two and three feldspar stations were deployed approximately 25 and 50 meters from the main channel to represent existing hydrogeomorphic zones in brackish and saline emergent marsh vegetation, 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. This dataset is from the Delta-X field studies conducted during Fall 2020, Spring 2021, and Fall 2021. The data is provided in comma-separated values (CSV) format.

This dataset includes one file in comma-separated values (*.csv) format.



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

Citation

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>

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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; after Bevington & Twilley 2018). Hydrogeomorphic zones classification was based on marsh surface elevations extracted from the U.S. Geological Survey (USGS) Atchafalaya 2 project LiDAR Survey 2012 digital elevation model (<https://www.sciencebase.gov/catalog/item/543e6b86e4b0fd76af69cf4c>). Between two and three feldspar stations were deployed approximately 25 and 50 m from the main channel to represent existing hydrogeomorphic zones in 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.

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. 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: Fall 2020 sampling: 2020-10-04 to 2020-11-10; Fall 2021 sampling: 2021-08-19 to 2021-10-06; Spring 2021 sampling: 2021-03-21-2021-03-31 and 2021-08-19

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	-91.4449	-90.8224	29.5643	29.1714

There is one data file in comma-separated values (.csv) format with this dataset: **DeltaX_Soil_Properties_Fall2020_Spring2021_Fall2021.csv**

Numeric data not included in the file are represented as -9999; missing text data are indicated by NA.

Table 1. Variables in the data file.

Variable	Units	Description
basin		Basin: "Atchafalaya" or "Terrebonne"
campaign		Sampling season: Fall_2020, Spring_2021, or Fall_2021
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
notes_time_marker_sampled		Notes regarding sampling. Corresponding <i>time_marker_sampled</i> values are -9999
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
normalized_accretion	mm yr ⁻¹	Yearly normalized sediment accretion (mm yr ⁻¹) obtained by multiplying sediment accretion (mm) by 365 days per year and then dividing the result by the 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	percentage	Organic matter content determined by loss on ignition (% of dry mass)
soil_organic_carbon	percentage	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

Sediment accretion data will be used to calibrate and validate the ecogeomorphic (NUMAR, modified from NUMAN model by Chen and Twilley 1998) 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 of soil samples was obtained using duplicate analytical replicates of each sample. 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 nearby 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. These zones were 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 & Twilley 2018). Hydrogeomorphic zones classification was based on marsh surface elevation measurements acquired in November and December 2020 using a RTK GPS (Trimble R12, using Geoid 18).

For CRMS_0294, CRMS_0322, CRMS_0399, CRMS_0396, and CRMS_0421, two feldspar stations were deployed in vegetated areas approximately 25 and 50 m from a main channel (V25 & V50). For CRMS_2568, two feldspar stations were deployed: one station in herbaceous vegetation (V25) and one station in forested vegetation (T25), both approximately 25 m from a main channel. In Wax Lake Delta (WLD), six feldspar stations were deployed: three stations along a transect near the island's apex (T1) at supratidal, Intertidal and subtidal (SUP, INT, and SUB) hydrogeomorphic zones, and three stations along a transect near delta front (T3) at intertidal and subtidal (SUP, INT, and SUB) hydrogeomorphic zones.

At each feldspar station, three 50 x 50 cm feldspar marker horizons 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.



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