Delta-X: Feldspar Sediment Accretion Measurements, MRD, LA, USA, 2019-2023, Version 3

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Documentation Revision Date: 2024-01-18

Dataset Version: 3

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 and field GPS measurements in November - December 2020. 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, Fall 2021, Spring 2022, Fall 2022, and Spring 2023. The data are provided in comma-separated values (CSV) format.

This is Version 3 of this dataset, which extends the data through Spring 2023.

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, 2019-2023, Version 3. ORNL DAAC, Oak Ridge, Tennessee, USA. https://doi.org/10.3334/ORNLDAAC/2290

Table of Contents

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) and field GPS measurements in November - December 2020. 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. This is Version 3 of this dataset, which extends the data through Spring 2023.

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.

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.

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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 2023-04-28: Sampling during Fall and Spring field seasons (six 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	-91.4451	-90.8224	29.5643	29.1714

There is one data file in comma-separated values (.csv) format with this dataset: **DeltaX_SedimentAccretion.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
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 (V35 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 *time_marker_sampled* 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
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 ± 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). These target elevations were pre-determined based on the 2012 LiDAR-based digital terrain model (DTM) published by the USGS National Elevation Dataset adjusted to the 1988 North American Vertical Datum (NAVD88) reference system. Marsh surface elevation measurements were also acquired in November and December 2020 using a RTK GPS (Trible R12, using Geoid 18).

For all sites except CRMS2568 and Wax Lake Delta (WLD_T1, WLD_T3), two feldspar stations were deployed in vegetated areas approximately 25 and 50 meters from a main channel (stations: 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 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.

The data include dates and locations that feldspar markers were deployed and later sampled.

At each feldspar station, three 50 x 50-cm feldspar marker horizons plots (X, Y, and Z) were deployed on the soil surface. Soil cores using cryocore methods were collected next to feldspar markers horizon plots. 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.

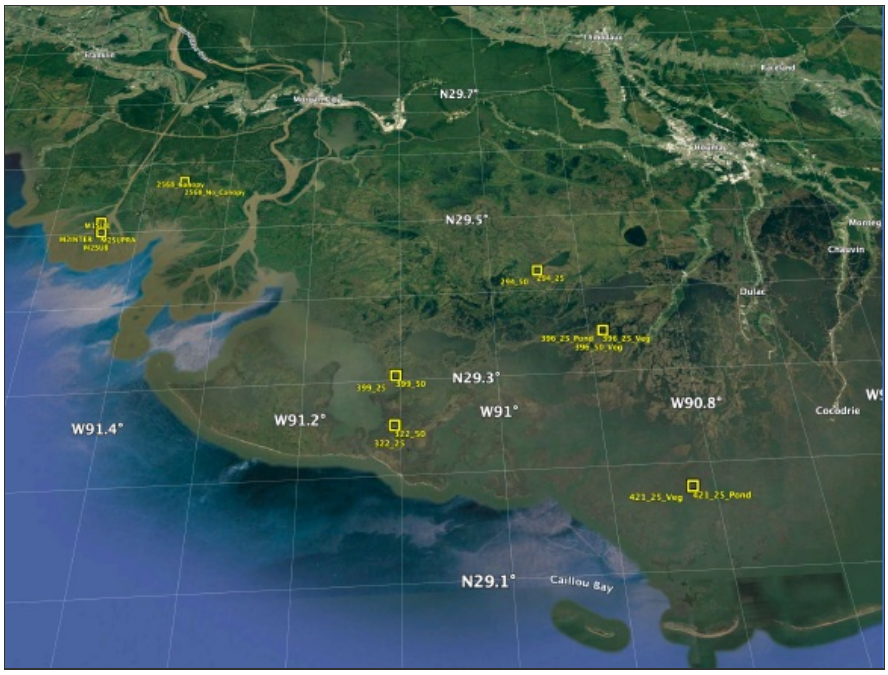

Figure 2. Map showing the distribution of feldspar sampling stations across Atchafalaya and Terrebonne coastal basins.

To assess organic and inorganic fractions of newly deposited material, soil cores corresponding to sediment accretion measurements (e.g., height of sediment above feldspar marker) were collected next to feldspar markers plots using a Russian peat borer. This strategy reduced disturbance to 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).

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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	Description
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.