



Extreme Weather Effects and Annual Trends in Sediment Biogenic Silica off the Louisiana Coast



PP13E-0914 – Monday, 15 December 2025 – 14:15-17:45 CST

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Introduction

- Early diagenetic processes (i.e. reverse weathering) play important roles in the sequestration of biogenic silica ($bSiO_2$) in marine sediments
- Coastal zones and continental shelves are areas with high burial for organic matter and $bSiO_2$
- However, knowledge on the variability of these processes over different timescales, and response in extreme events, is limited.

Methods

- We present data from seven cruises over two sites spanning from 2021-2025
- Sampling encompasses pre- and post- condition for two tropical cyclones
 - Hurricane Ida (2021) - Category 4
 - Hurricane Francine (2024) - Category 2
- A sequential digestion method was used to quantify sediment silica into operationally defined pools
 - **bSi**: Mild alkaline digestion with no acid pre-leach (quantifies diagenetically unaltered $bSiO_2$ pool)
 - **SiAlk**: Mild alkaline digestion with acid pre-leach (quantifies both diagenetically altered and unaltered $bSiO_2$ pool)
- A one-way ANOVA and post-hoc comparison was done to define significant zonation within sediment profiles

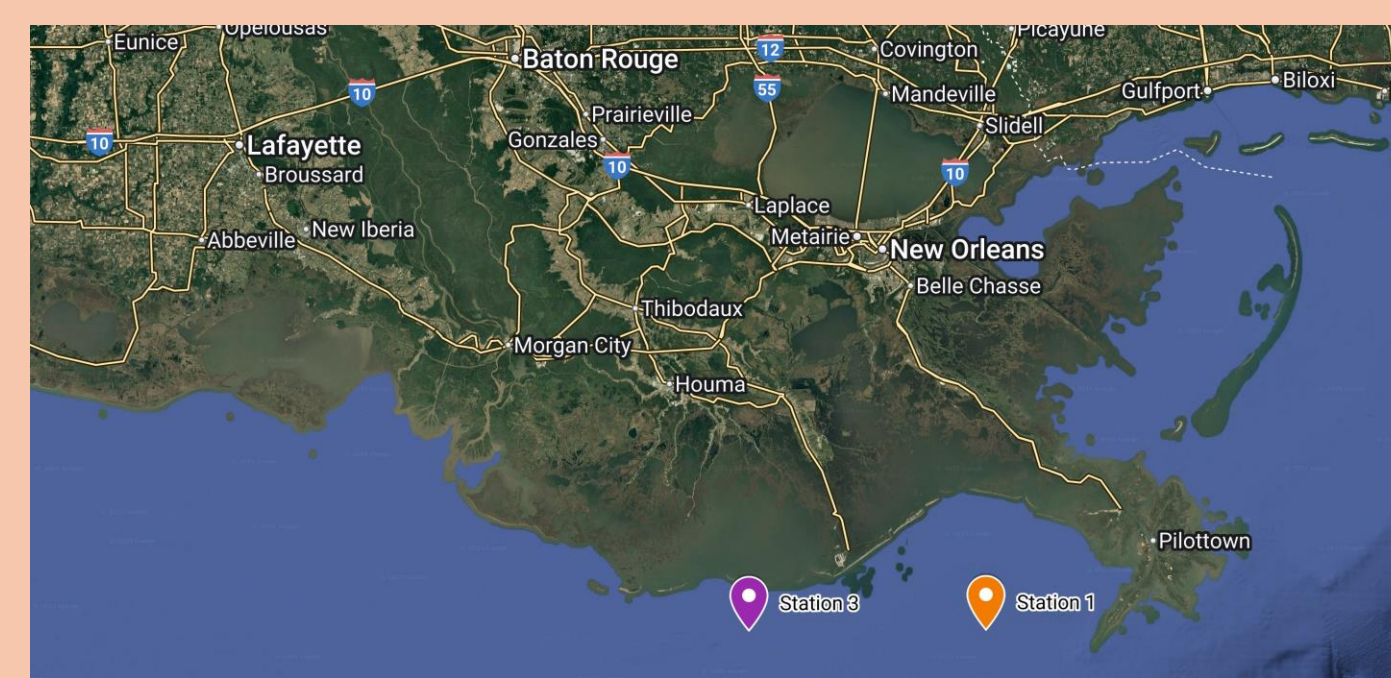
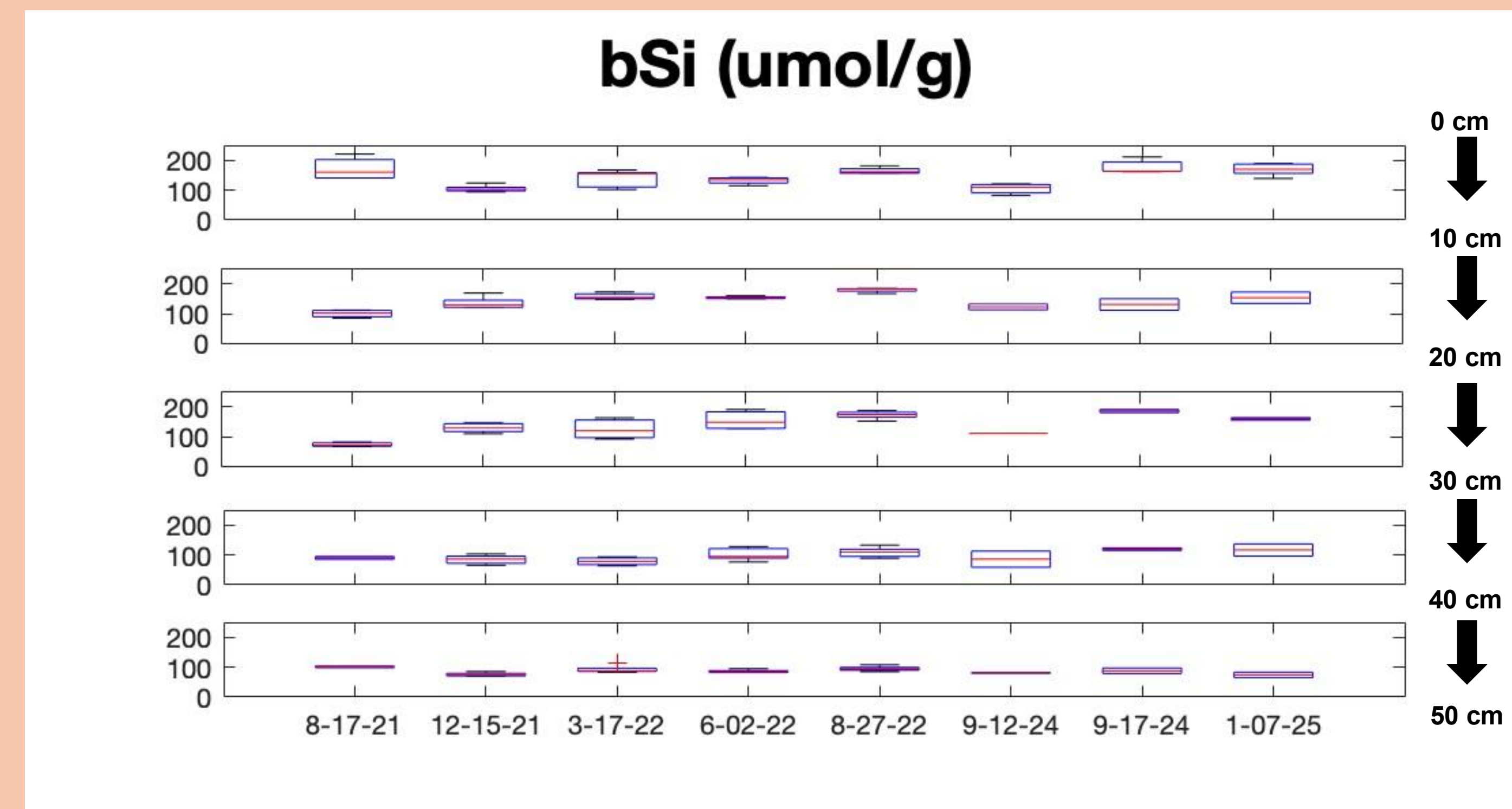


Figure 1: Map displaying the locations of Station One (orange) and Station Three (purple) off the coast of Louisiana, United States.

Station 1



Station 3

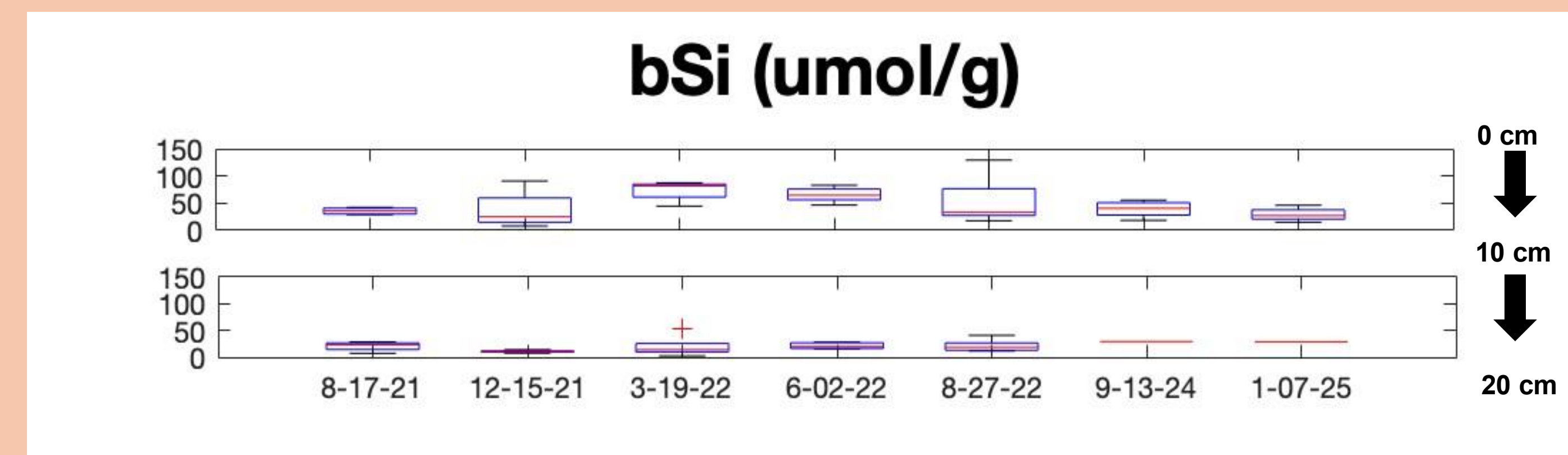


Figure 2: Displays average bSi quantities in $\mu mol/g$ in 10 cm depth intervals for each sampling date. The closest sampling date post extreme weather event is 12-2021 (Ida) and 9-2024 (Francine).

Results

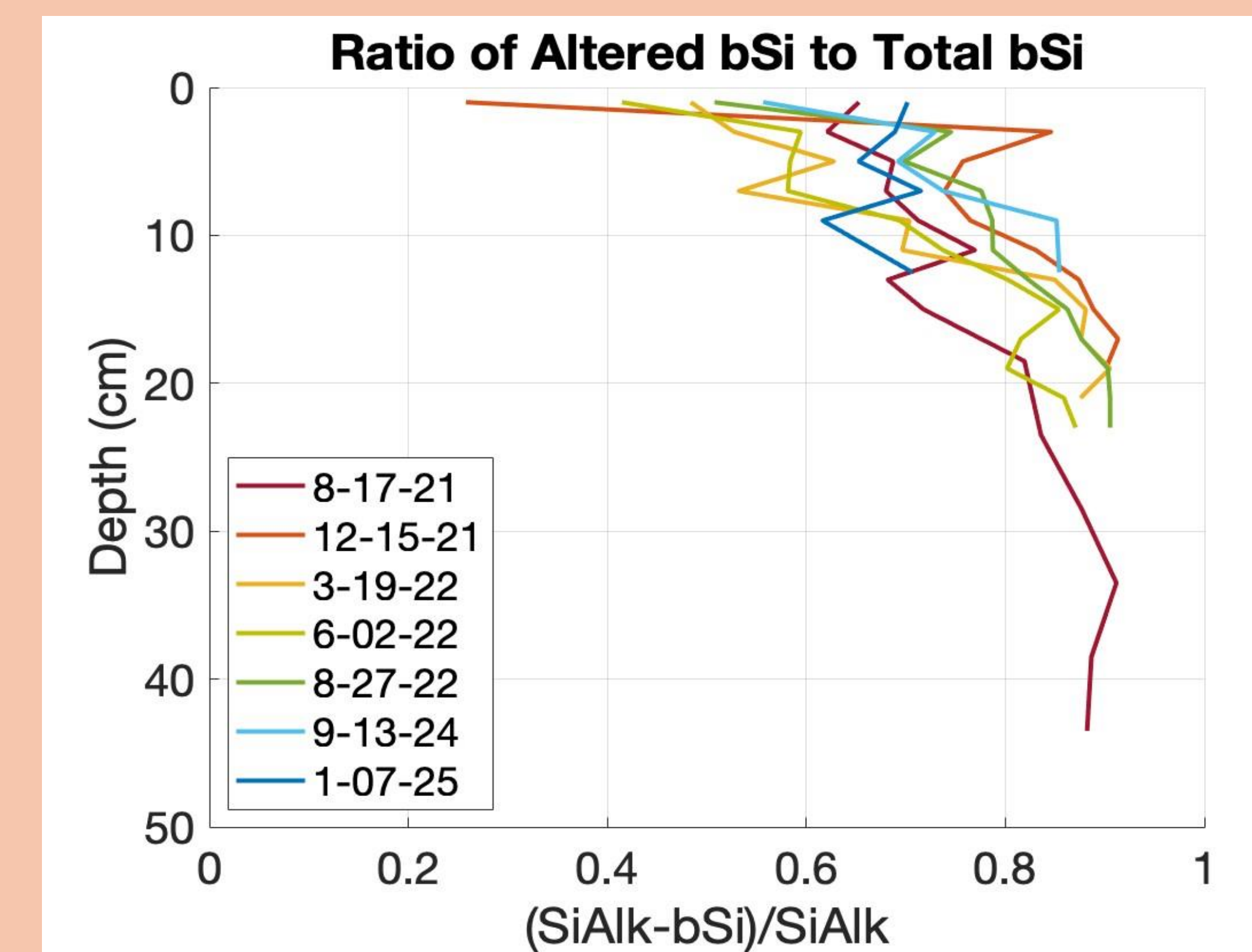
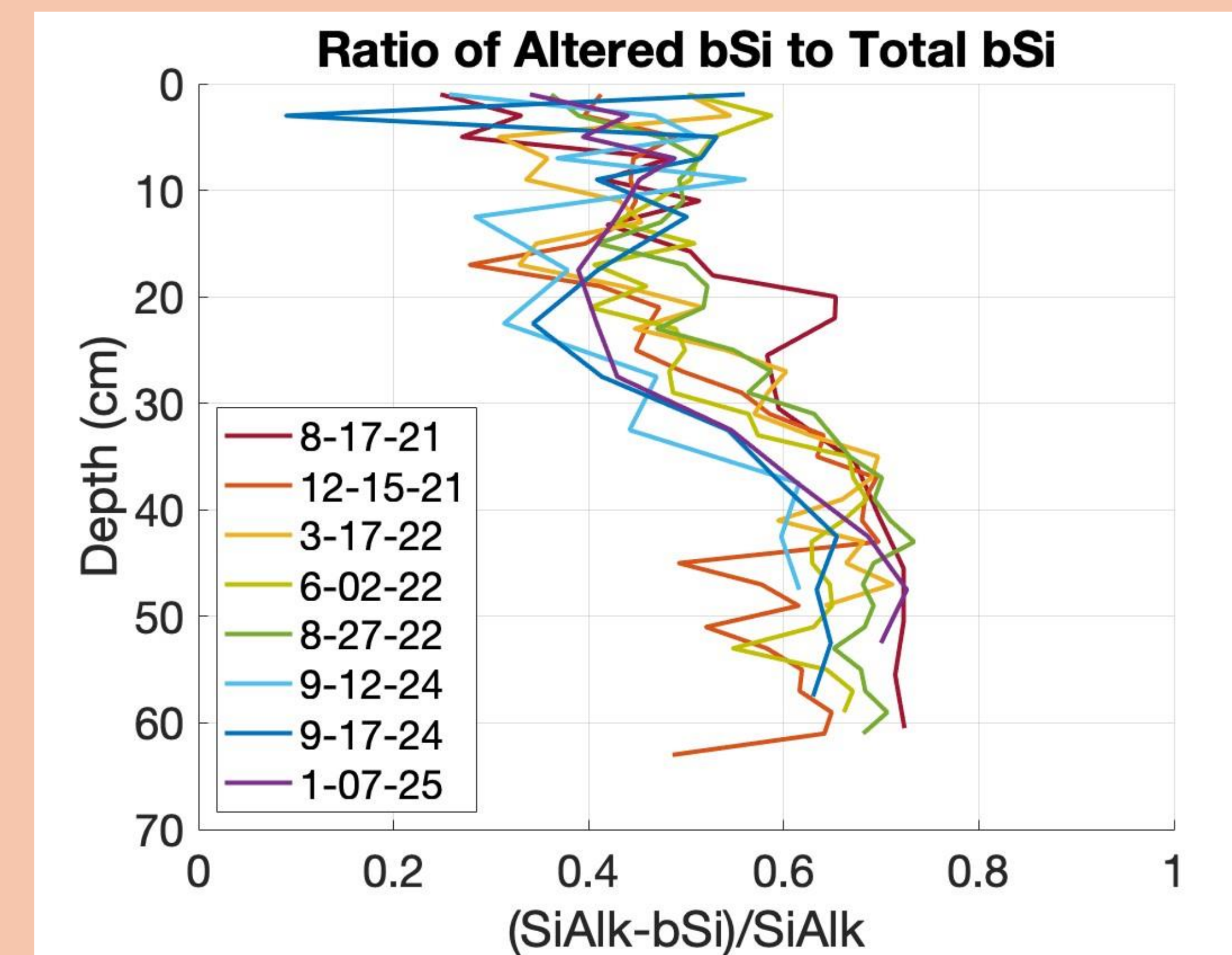


Figure 3: Displays the ratio of authigenically altered $bSiO_2$ to total $bSiO_2$ down core for all sampling dates (each colored line is a sampling date). Ratios obtained by subtracting bSi (unaltered $bSiO_2$) from $SiAlk$ (total $bSiO_2$) and dividing by $SiAlk^1$.

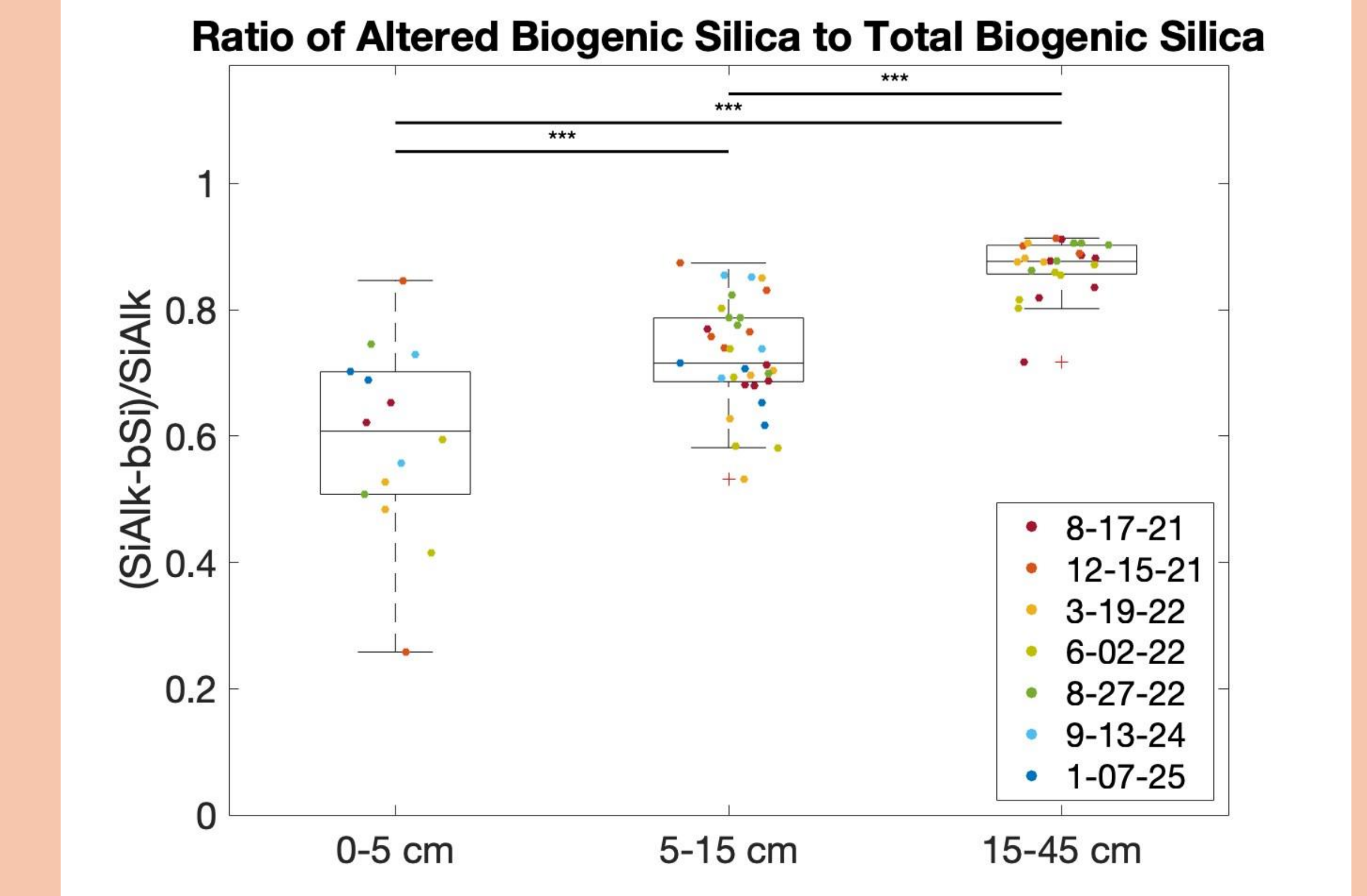
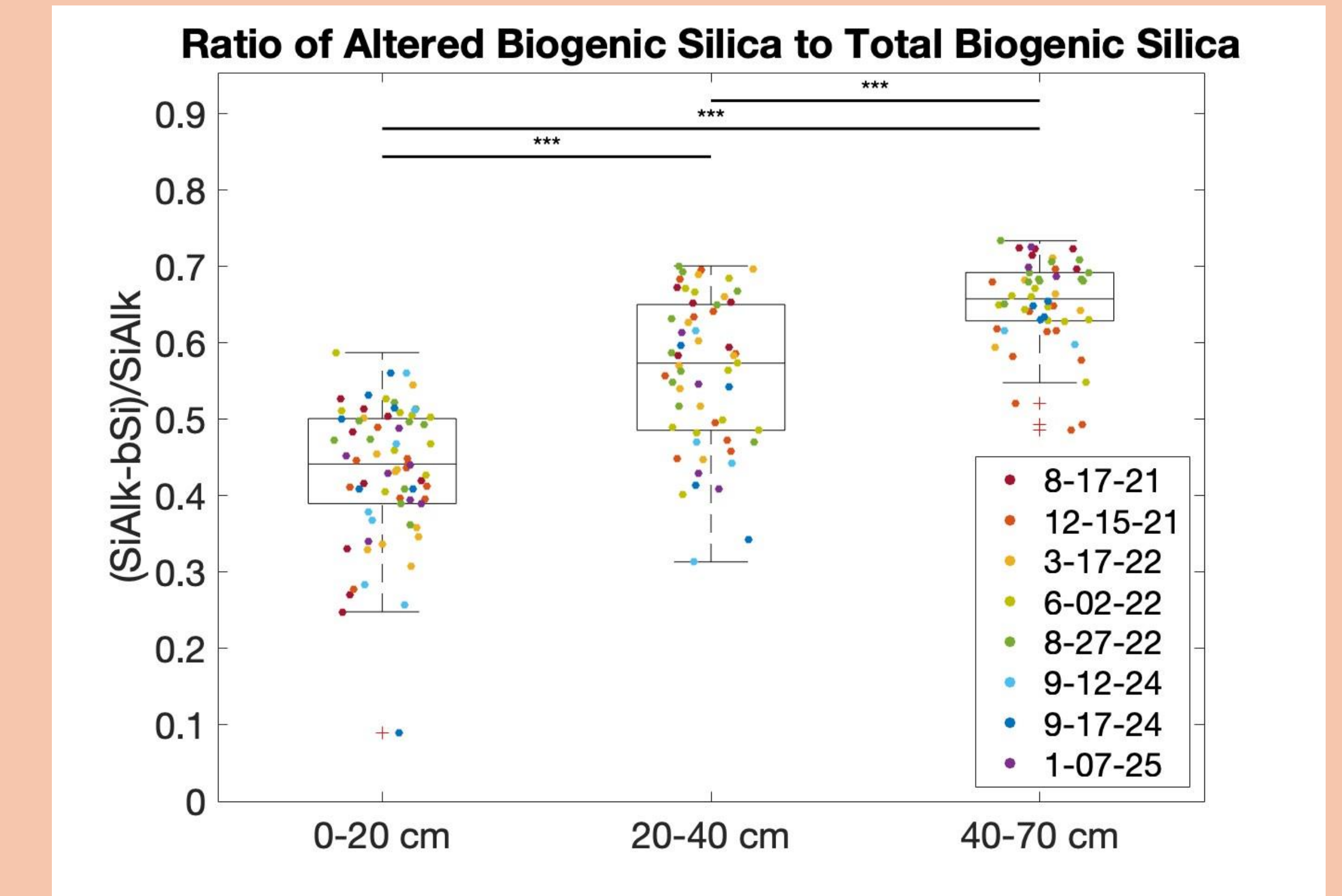


Figure 4: Averages across all sampling dates for each zone within the sediment profile. From left to right: zone of variability, diagenetic transition zone, and stabilization zone. Lines show correlation between zones and stars indicate statistical significance ($p < 0.001$).

Conclusion

- Post extreme weather events $bSiO_2$ quantities are highly variable, but stabilize on the order of months
- Despite post event variability, the proportion of authigenically altered $bSiO_2$ showed repetitive trends for both sites
- These trends display significantly different zones within the sediment profile
- Trends show a pattern of sequestration where at depth a majority of particulate $bSiO_2$ is authigenically altered

Acknowledgements & References

This work was funded by the National Science Foundation (OCE-2319429, JWK, BKR [QUALIFIED]; OCE-2205277, SR and OCE-2205278, JWK [XTreme Si]; and OCE-1924585, JWK [SiLi]). We would like to thank the crew of the R/V Pelican. We would also like to thank all the collaborators and those that helped with generating the data utilized.



¹ Krause et al. 2017 DOI: 10.1016/j.csr.2017.09.014