Short-term sedimentation in Conowingo Reservoir and the upper Chesapeake Bay, May-December 2015

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Role of the Palinkas lab in the Conowingo study

Reservoir:

- Sediment characterization (grain size, organic and coal content, etc.) of short (shared with Cornwell group) and long (shared with AECOM)

- Sedimentation rates and ages with naturally occurring radioisotopes – bimonthly (^{7}Be) and 100-y (^{210}Pb) perspectives

Upper Bay;

- Sediment characterization and short-term sedimentation rates (summer 2015 cruise on Carson with Cornwell group)
- Post-storm sampling (synchronized with Sanford group; *still waiting for storm…*)

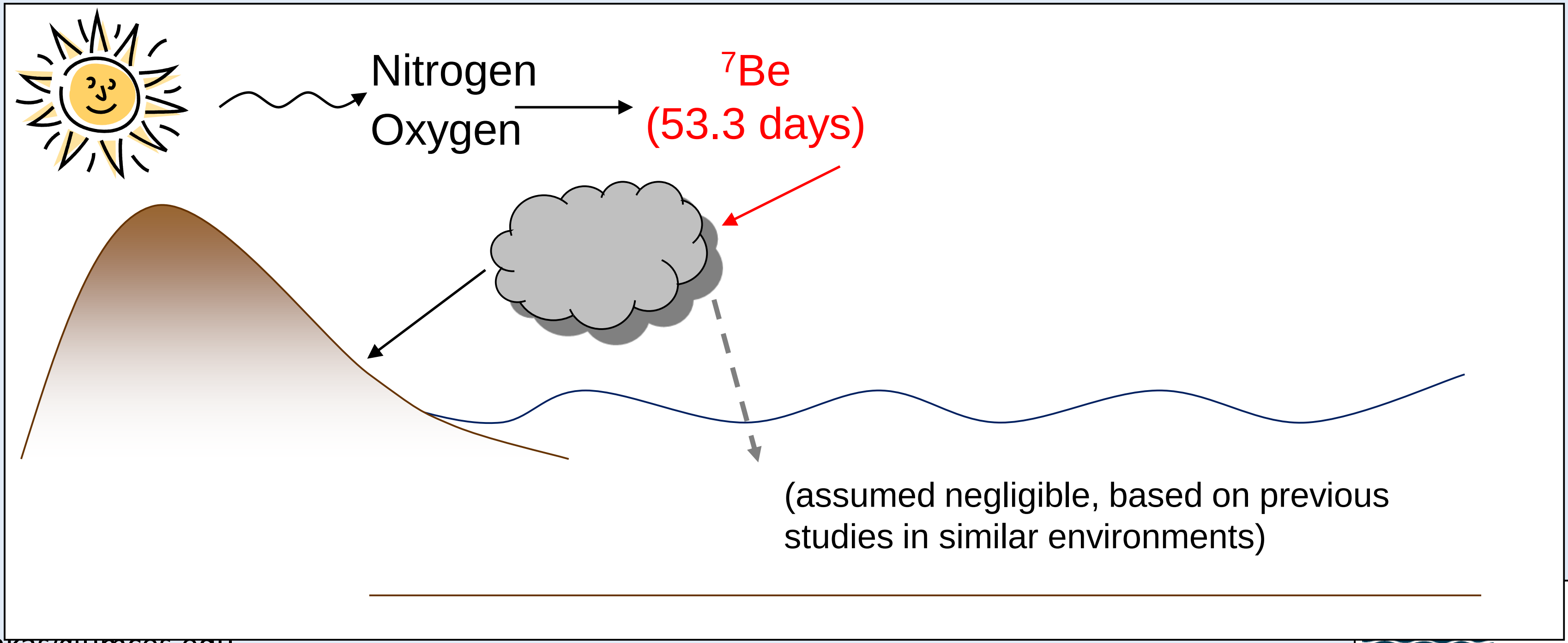
Today:

- Grain size and short-term sedimentation in reservoir – May, July, September, December 2015
- Grain size and short-term sedimentation in upper Bay (August 2015)

*Similar data on Flats (MD Sea Grant project)

Quick primer on ^{7}Be

- Produced in atmosphere; delivered to the surface mostly by rainfall, where it attaches to particles on land
- Half-life 53.3 days; assumed limit of detectability 4-5 half-lives (~250 days) and mean lifetime 77 days
- Inventory = how much "new" watershed sediment is present at a specific place at time; decay-correct between consecutive samplings



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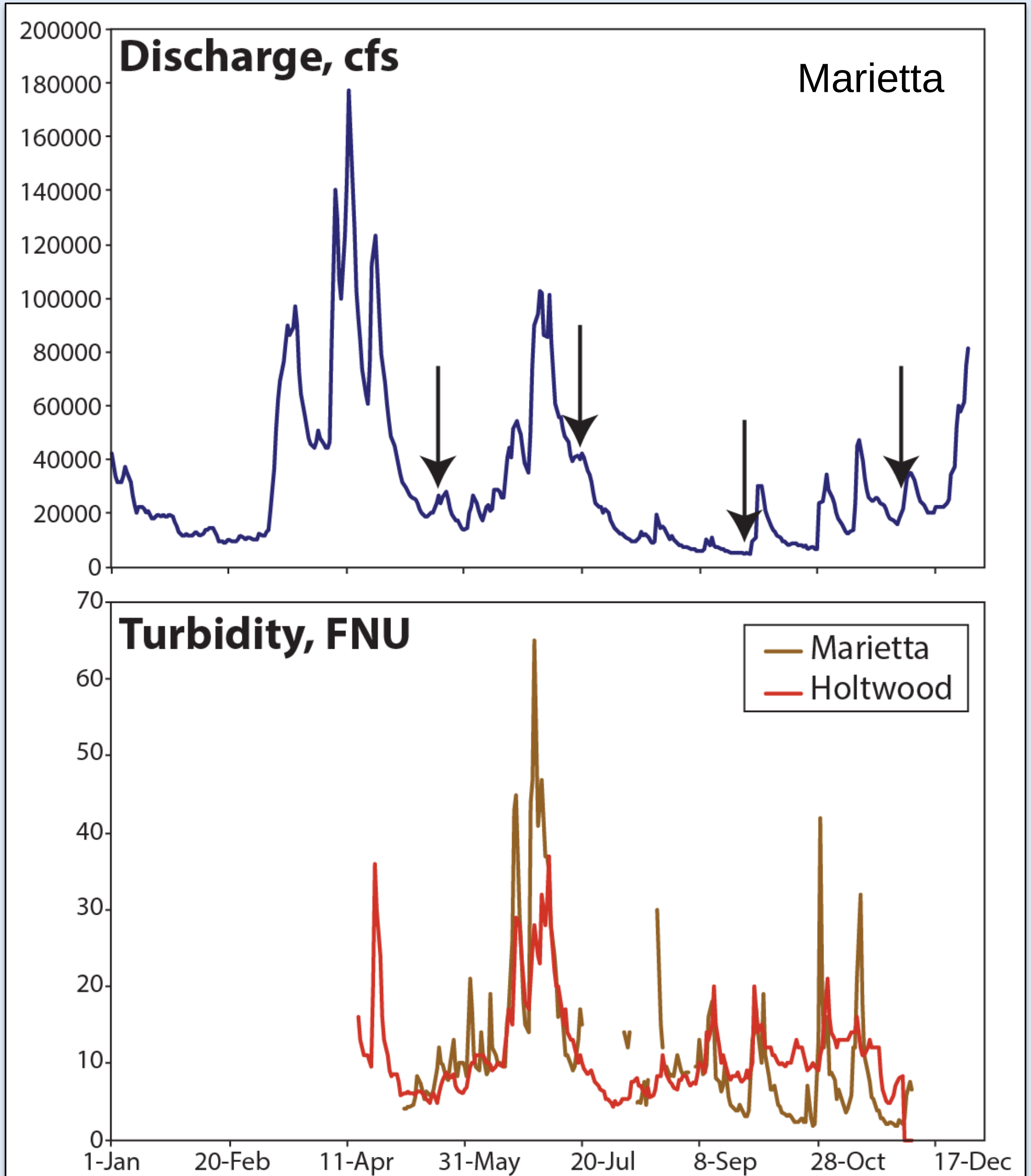

River discharge and turbidity

Data from USGS online portal for 2015

- Arrows indicate sampling dates
- Turbidity data unavailable for most of time before May sampling
- Holtwood turbidity data end on the day of December sampling; Marietta record ends 4 days later

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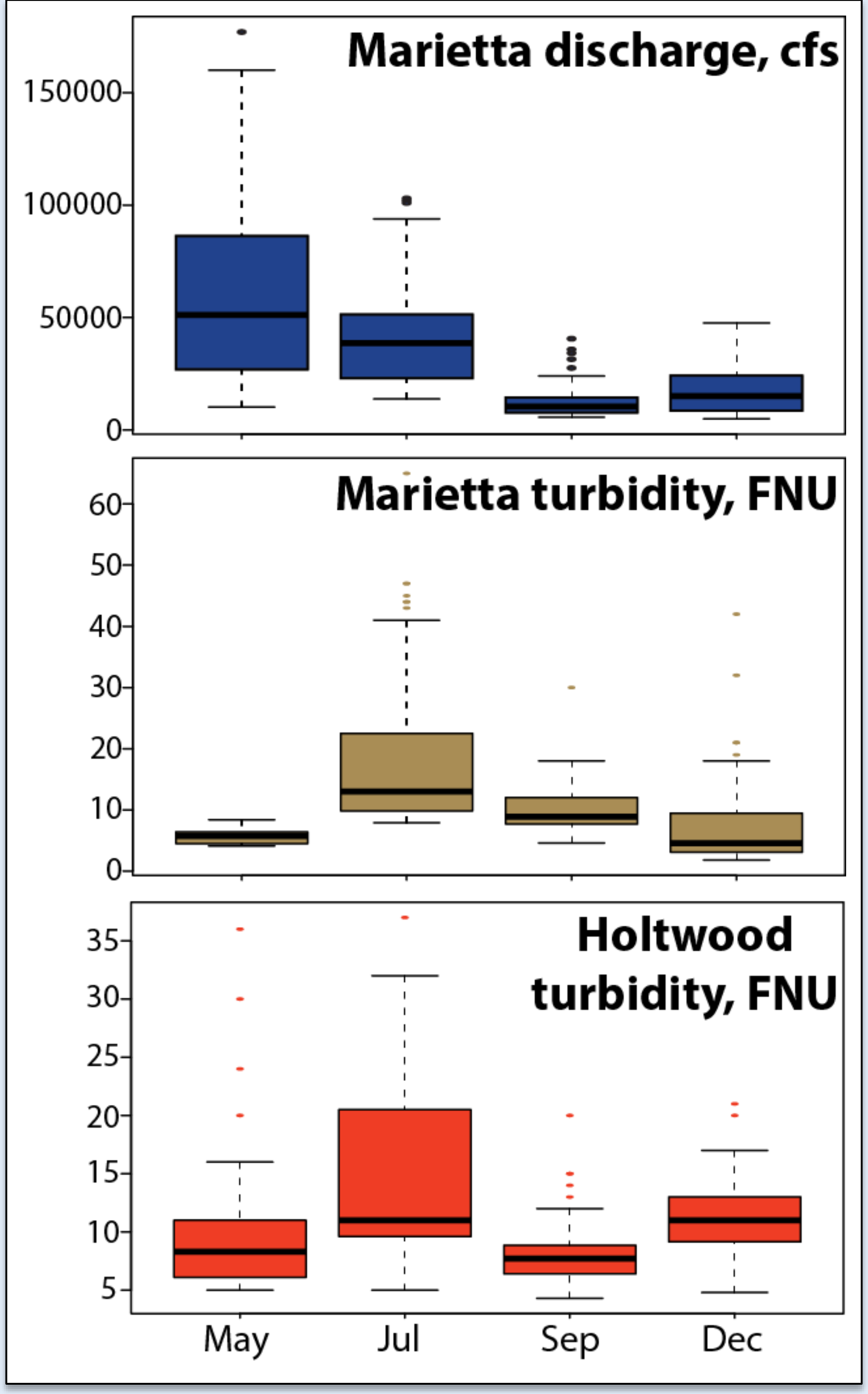

Bimonthly variability in river discharge and turbidity

Box plots of values between sampling; May box includes values for 77 days (mean lifetime of ^{7}Be) before sampling

Note that May turbidity values offer incomplete picture of spring freshet

Discharge at Marietta highest in May, lowest in September; turbidity generally follows the pattern of discharge (disregarding May)

Sediment input thus assumed to be highest in May, lowest in September

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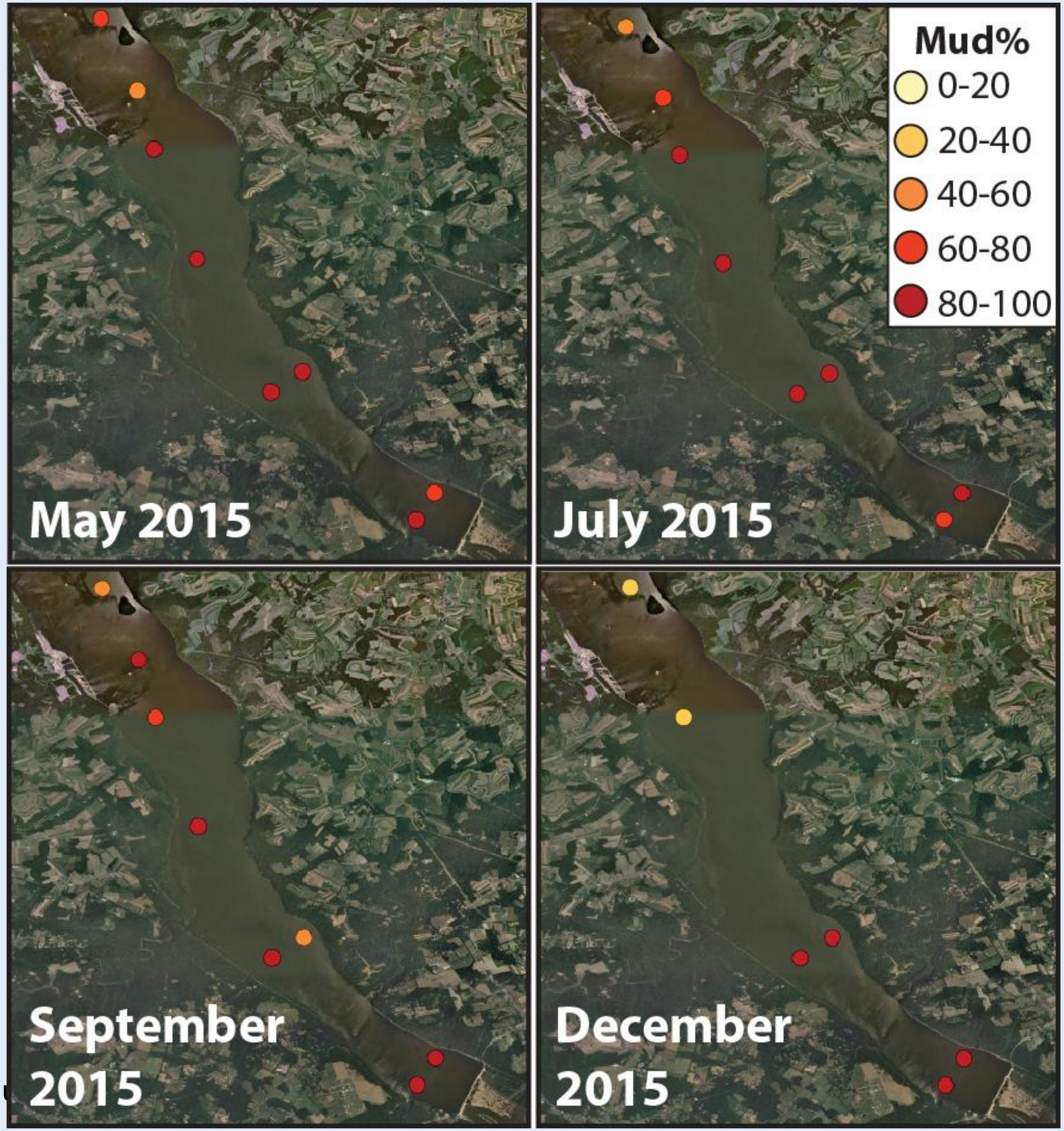
Surficial sediment grain size in the reservoir



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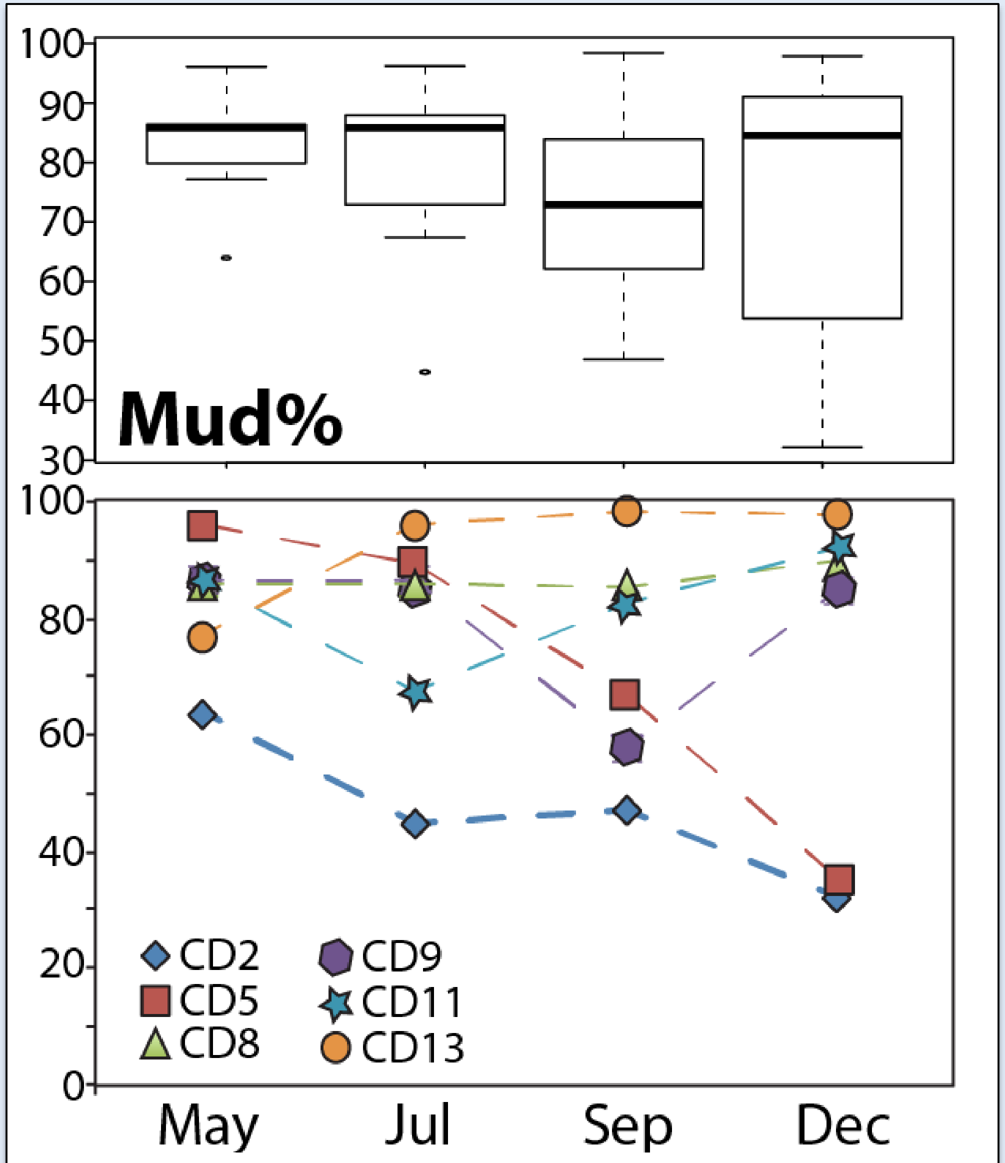
Temporal variability in surficial mud content



- Median similar in May, July, and December, but September much coarser
- Variability increases over time, toward coarser end of scale
- Surficial sediment coarsens over time at upstream sites (CD2, CD5); fines/is relatively steady at CD13, CD8
- Variable grain size at CD9 and CD11

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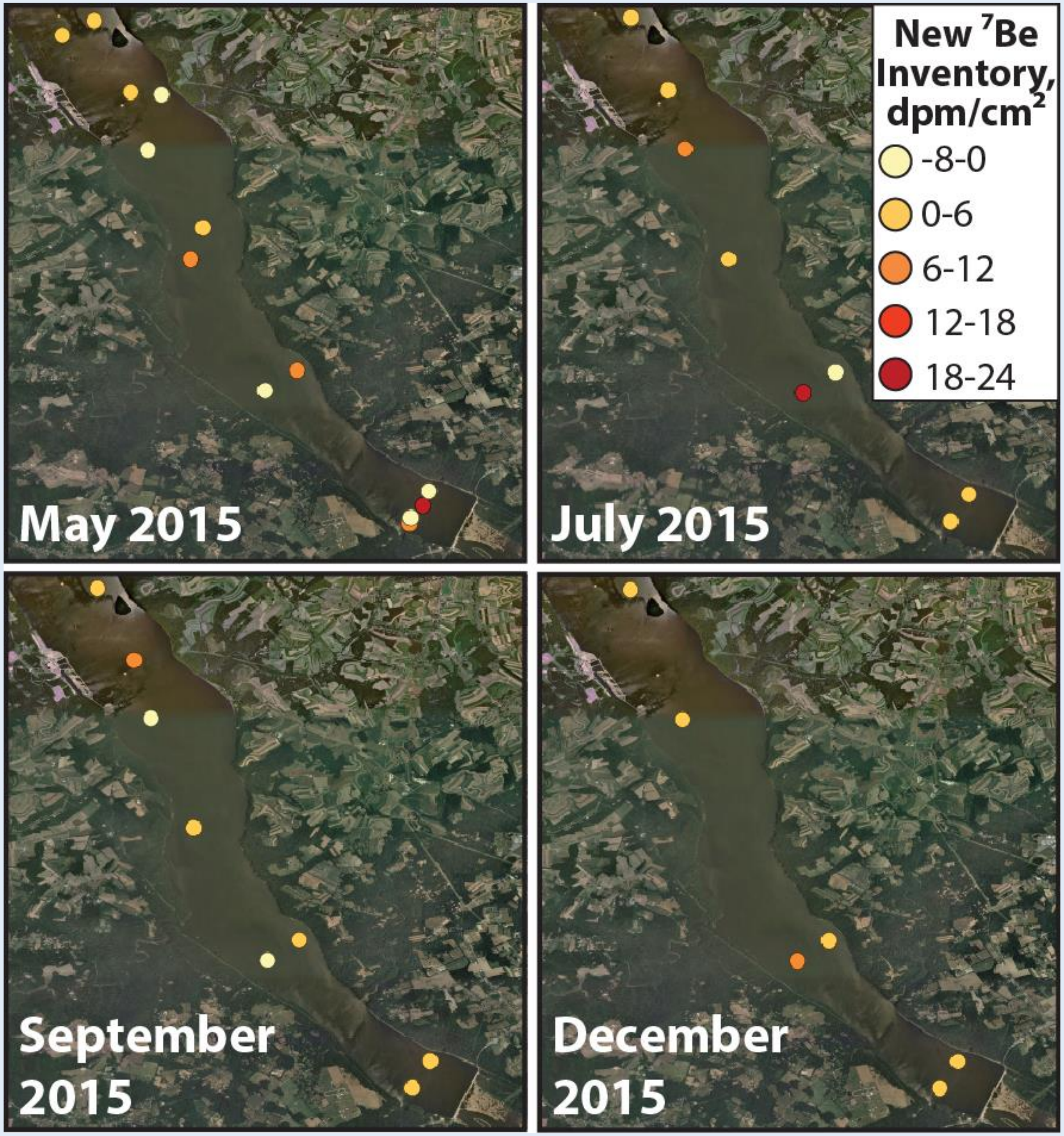
^{7}Be inventories in the reservoir



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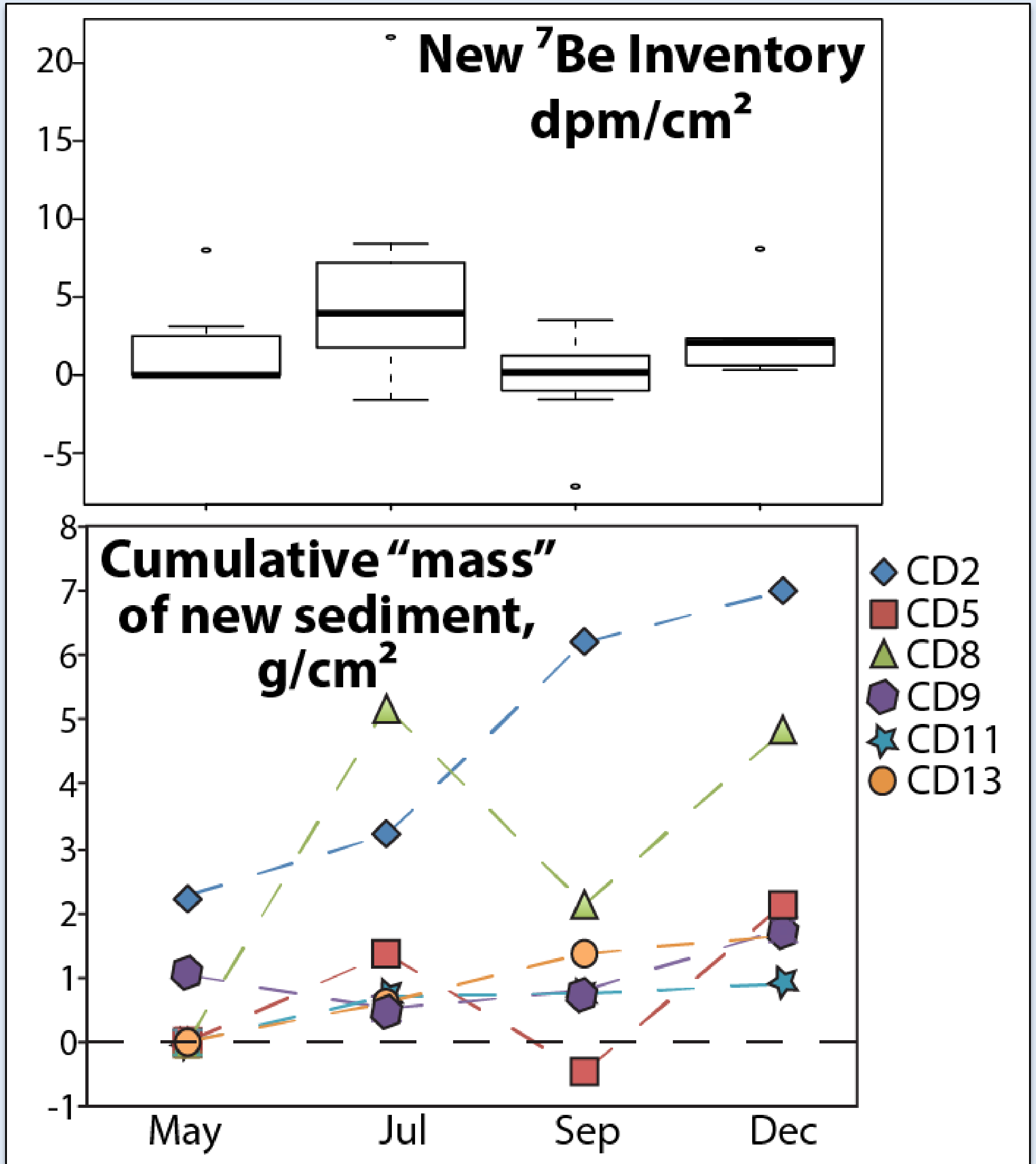
Temporal variability in “new” sedimentation



Median inventory is highest in July

Where is sediment from the April/May event? Upstream? Not tagged with ^{7}Be?

Trends at individual sites are highly variable!

- CD2: consistent deposition of new sediment; shallower water
- CD5 and CD8: new sediment arrives in July, leaves in September (CD8 in channel)
- CD11, CD13: modest deposition; deeper water

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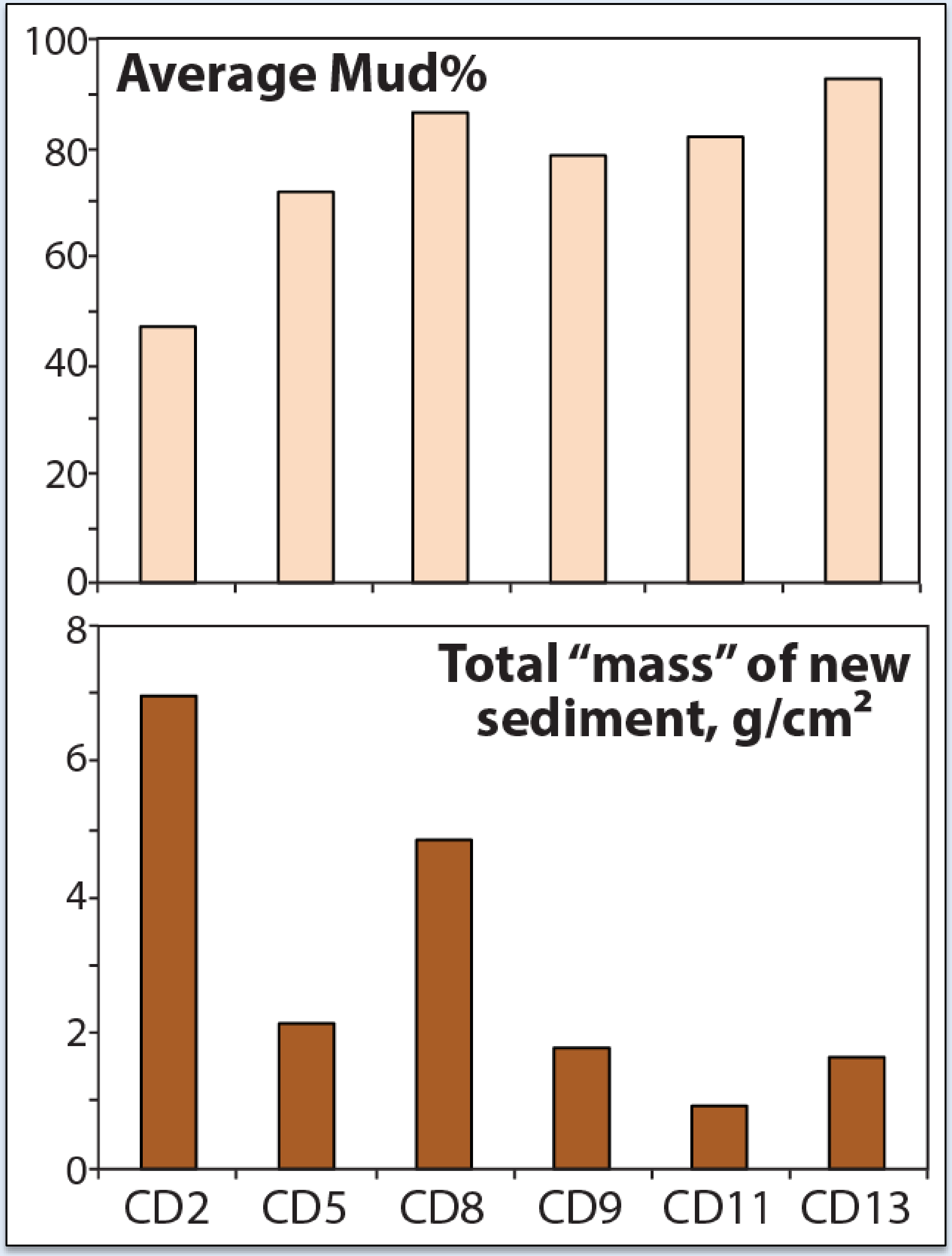
Down-stream trends in the reservoir



Grain-size: downstream fining, as expected

^{7}Be: downstream reduction in new inventories

Reduction of inventories downstream could reflect reduced sedimentation and/or older sediment

Understanding trends at individual sites complicated – need to pull all data together

- Hotspot at CD8 may be related to temporary channel deposition/erosion

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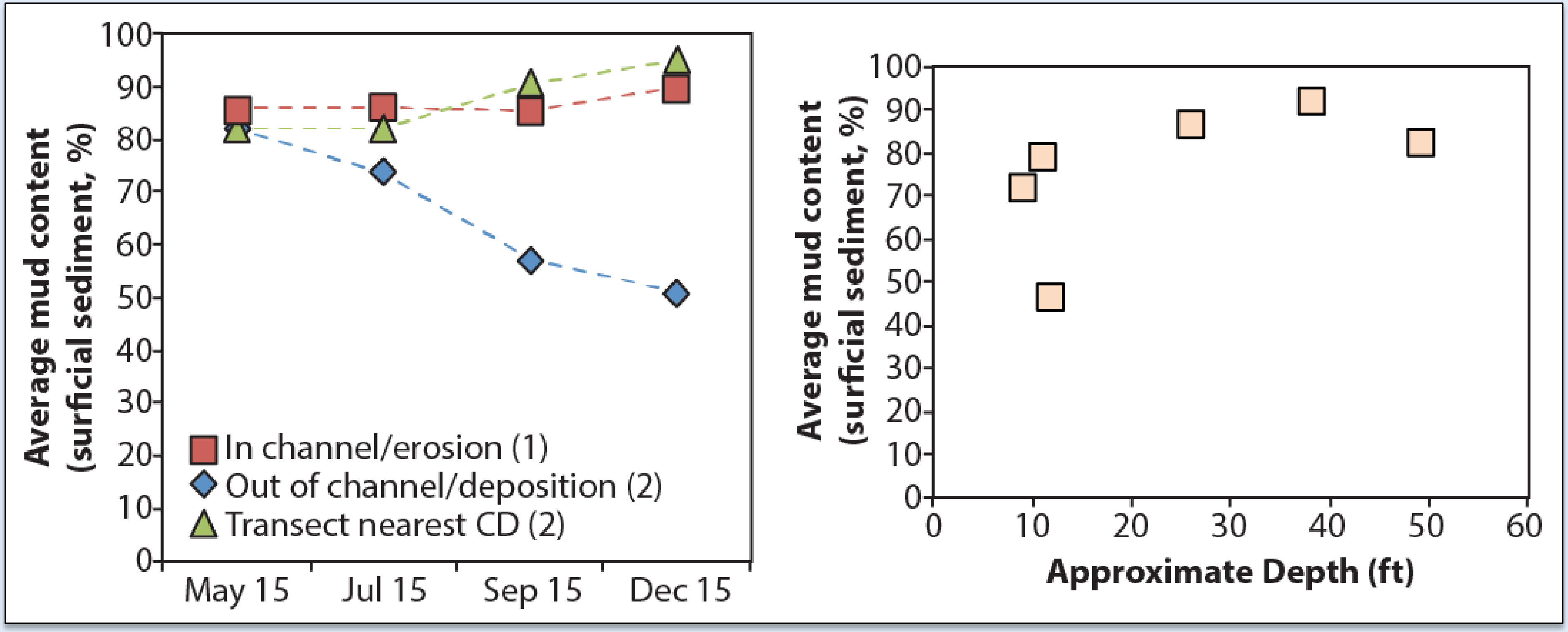
Grain-size variability with geomorphology*



*Note: very low n

- Sites characterized by long-term geomorphic setting (based on GIS map)
- Depositional/out-of-channel sites coarsen over time, rest steady and/or fine
- No apparent (or statistical) relationship of mud content to approximate depth

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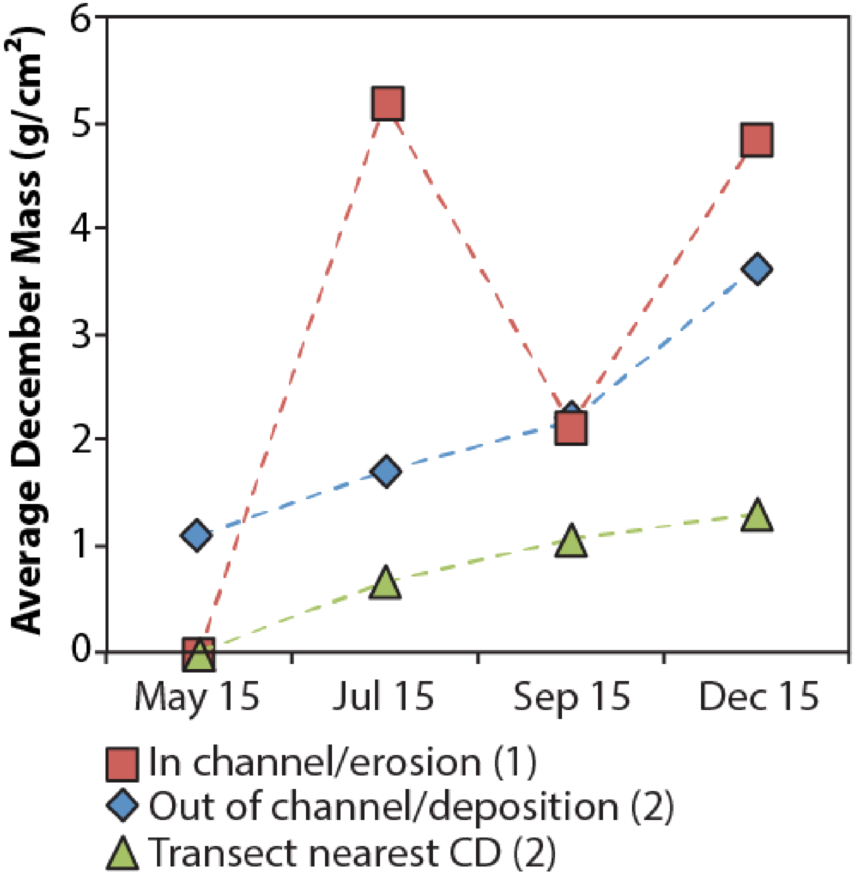
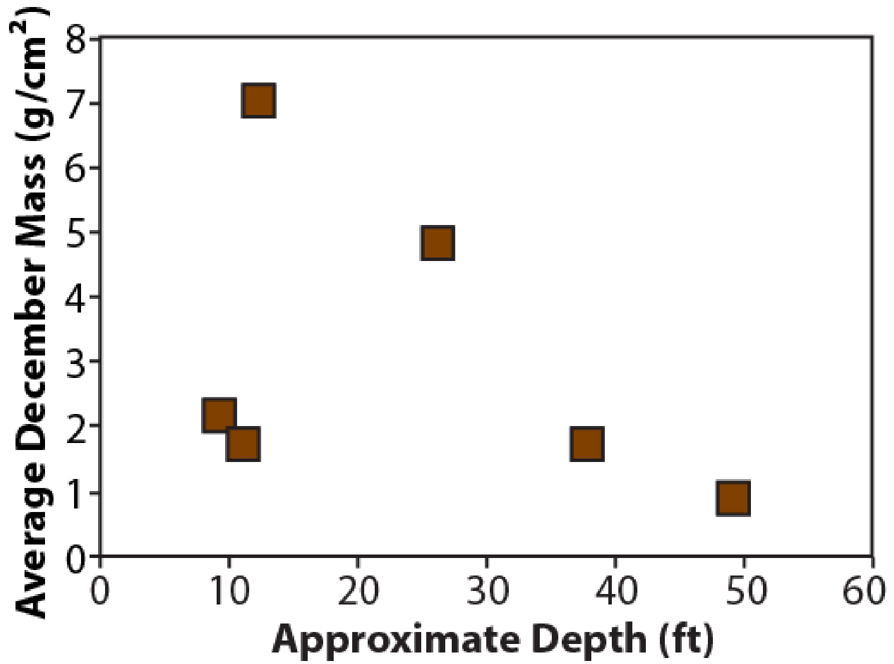
Sediment "mass" variability with geomorphology*





*Note: very low n

- Most sites have continuous deposition of "new" sediment, except in the channel
- Upstream sites outliers (CD2, CD5) on mass versus depth plot?

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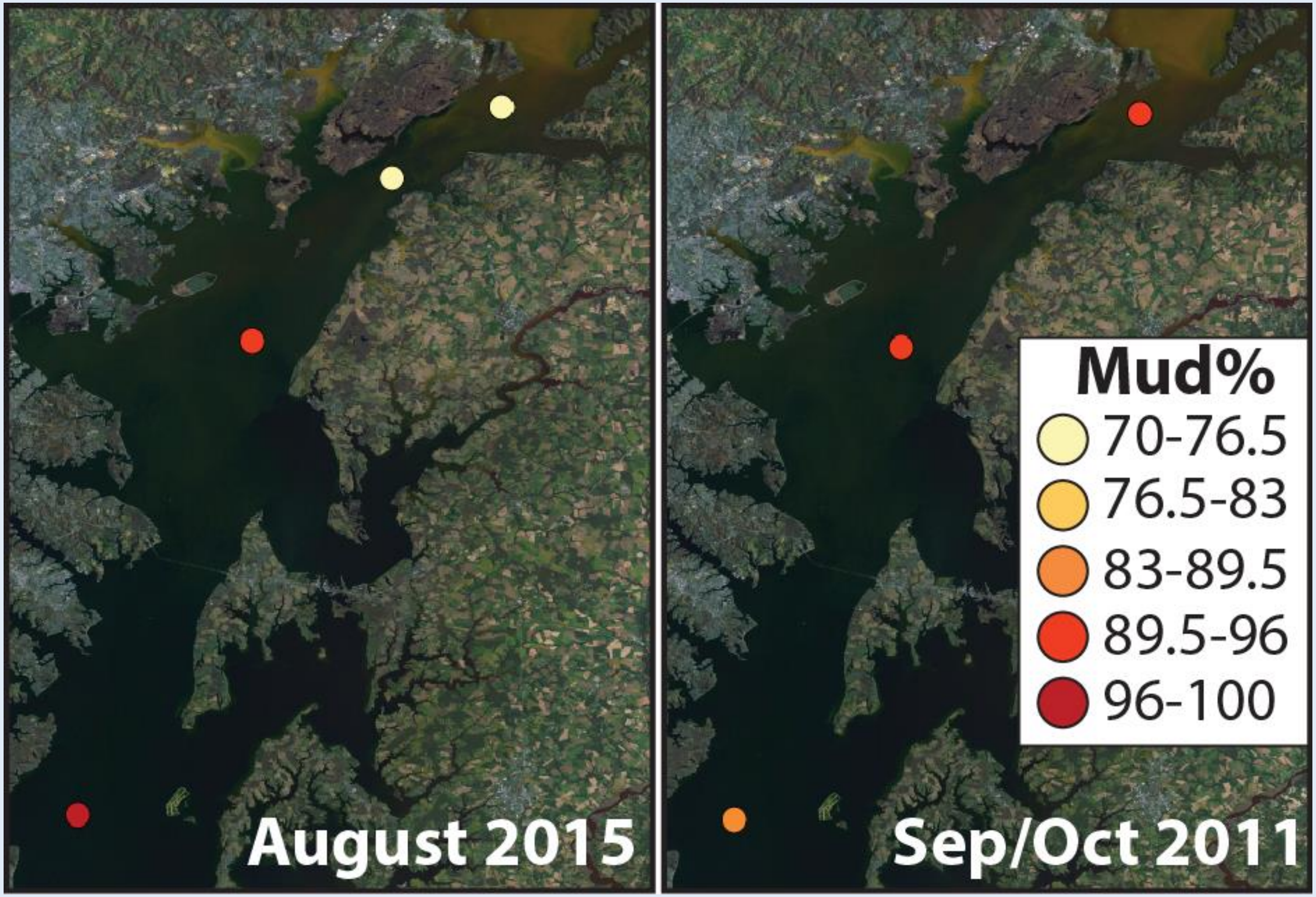
Surficial sediment grain size in the upper Bay



Sediment is coarser upstream in August 2015 than after TS Lee, but downstream sediment is finer

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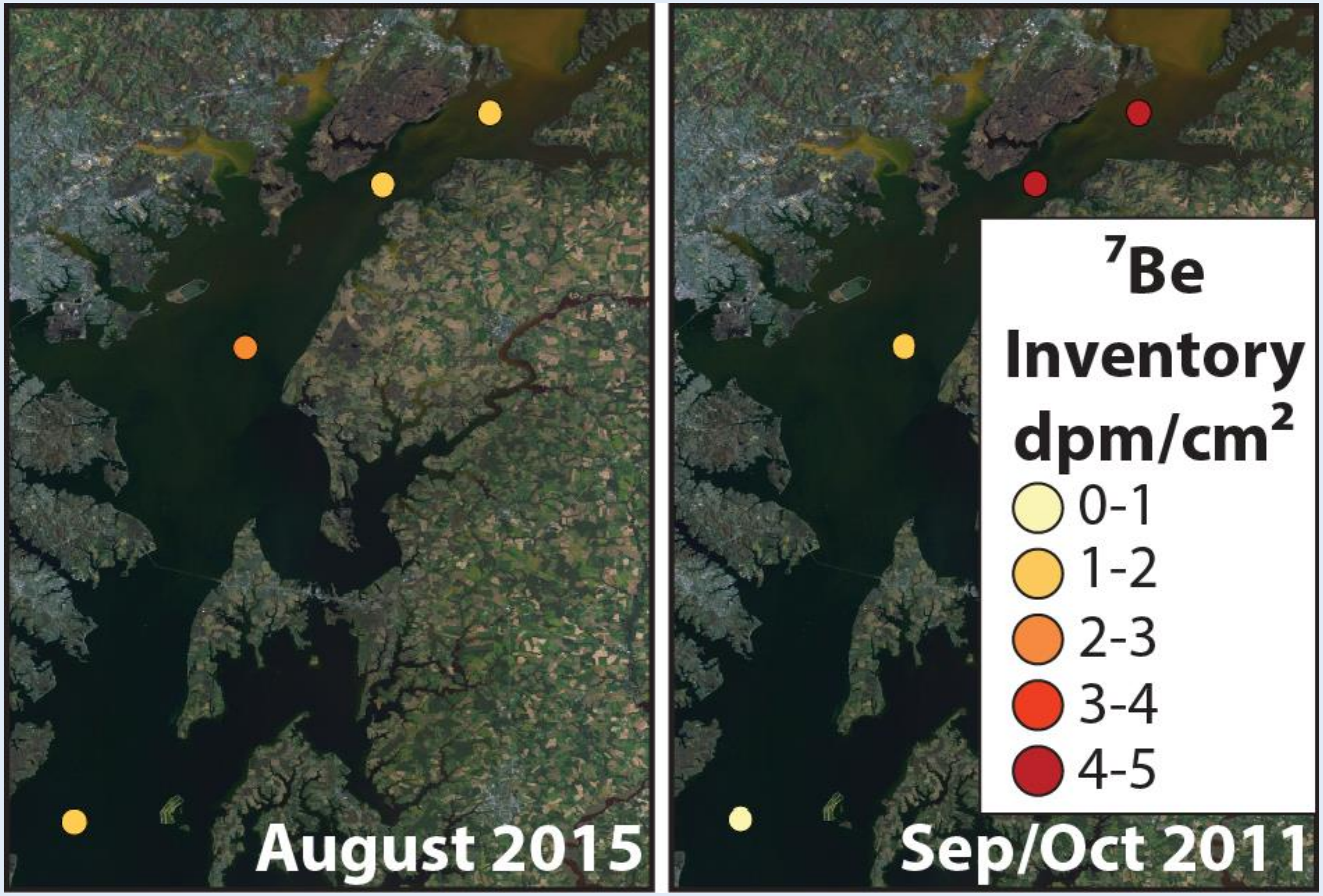
^{7}Be inventories in the upper Bay



Inventories are much lower upstream than after TS Lee and are more evenly distributed, with higher values at downstream sites

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Summary

Broad pattern in the reservoir: upstream sites coarsen over time, and mud content of surficial sediment increases downstream; inventory of recent sediment decreases downstream. *Possible explanation:*

- Sediment initially deposits upstream and is subsequently transported downstream, so that sediment is older at the downstream sites

- Much variability in space and time!

"Missing" recent sediment in May – temporarily deposited upstream of coring sites?

Broad pattern in the upper Bay: ^{7}Be inventories are higher upstream of the Bay Bridge after TS Lee; inventories in a "normal" (i.e., absent major storms) year are more evenly distributed and perhaps higher downstream. *Possible explanations:*

- *Supply:* TS Lee sediment dominated by Susquehanna River input; "normal" Susquehanna supply more similar to that from other tributaries

- *Transport:* TS Lee sediment settled rapidly at mouth; "normal" sediment transported past this zone

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