Goldschmidt 2024 Abstract
https://doi.org/10.46247/gold2024.24702

Characterizing the response of riverine particulate organic carbon to storm events in the Upper Sangamon River Basin, Illinois, using elemental and stable isotope analyses

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Rivers play an important role in the global carbon cycle as transporters and reactors of particulate organic carbon (POC). Storm events have a disproportionately large impact on POC mobilization and transport, yet the spatiotemporal dynamics of riverine POC during storms is not well understood. This is especially true of agricultural watersheds – intensively managed landscapes where anthropogenic inputs and land use change have greatly altered the dynamics of the systems. This project attempts to characterize storm-mobilized POC in suspended river sediment using high spatiotemporal resolution sampling of multiple storm events in the Upper Sangamon River Basin (USRB) of central Illinois, USA, a highly modified, low-relief watershed dominated by row-crop agriculture. The USRB is the primary field site of the Critical Interface Network (CINET; NSF grant EAR-1331906), a thematic cluster of NSF's Critical Zone Collaborative Network (CZNet). Suspended sediment POC and particulate total nitrogen (PN) concentrations and $^{13}C/^{12}C$ and $^{15}N/^{14}N$ ratios were measured from the river and from tile drains – networks of agricultural subsurface drainage systems that are a dominant contributor of agricultural water discharge. POC behaviors were then examined for correlations with precipitation, storm trajectories, and river discharge. Results indicate time-resolved POC inputs emerge over the course of a storm in the Sangamon. Precipitation is a likely driver of POC dynamics during the early storm period when POC concentrations exhibit large and clearly defined early flush peaks. A 13C-enriched storm-driven signature indicates high levels of row crop material in the samples, and a strong linear correlation between the %POC and $\delta^{13}C$ values was observed throughout the watershed and tile drain, diagnostic of a two endmember mixing scenario with one endmember being corn-soybean row crops. This well-defined mixing scenario may be indicative of the relatively poor connectivity between the land surface and the river channel. We postulate that the landscape is trapping eroding soils in remnant shallow depressions that are legacies of the last glaciation, and behind man-made levees. Trapping process may be removing higher density clastic particles thus allowing low density, high %OC particles from row crop fields to dominate the POC contributions during rain events.