EGU2020-5833
https://doi.org/10.5194/egusphere-egu2020-5833
EGU General Assembly 2020

Soil Organic Carbon Distribution and Isotope Composition Response to Erosion in Cropland under Soybean/Maize Production

Greg McCarty and Xia Li
USDA ARS, Hydrology & Remote Sensing Lab, Beltsville, United States of America (greg.mccarty@usda.gov)

Soil erosion and deposition patterns can affect the fate of soil organic carbon (SOC) in agroecosystems. Topographic constraints affect soil redistribution processes and create spatial structure in SOC density. We combined isoscape (isotopic landscape) analyses for $\delta^{13}C$ and cesium-137 (^{137}Cs) inventory via digital terrain analysis quantifying SOC dynamics and soil redistribution patterns to gain insight on their responses to topographic constraints in an Iowa cropland field under soybean/maize (C3/C4) production. Additionally, historic bare soil orthophotos were used to determine soil carbon distribution before the 1960s (prior to global ^{137}CS fallout). Topography-based models were developed to estimate ^{137}Cs inventory, SOC density, and $\delta^{13}C$ distributions using stepwise principal component regression. Findings showed that spatial patterns of SOC were similar to soil erosion/deposition patterns with high SOC density in depositional areas and low SOC density in eroded areas. Soil redistribution, SOC density, and $\delta^{13}C$ signature of SOC were all highly correlated with topographic metrics indicating that topographic constraints determined the spatial variability in erosion and SOC dynamics. The $\delta^{13}C$ isoscape indicated that C3-derived SOC density was strongly controlled by topographic metrics whereas C4-derived SOC density showed much weaker expression of spatial pattern and poor correlation to topographic metrics. The resulting topography-based models captured more than 60% of the variability in total SOC density and C3-derived SOC density but could not reliably predict C4-derived SOC density. This study demonstrated the utility of exploring relationships between $\delta^{13}C$ and ^{137}Cs isoscapes to gain insight on fate of SOC within eroding agricultural landscapes.