Soil erosion impacts on nutrient deposition in a typical karst watershed

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Soil erosion has a significant influence on nutrient redistribution and deposition. However, the effect of soil erosion on nutrient deposition remains unclear in karst areas such as southwest China, which represents an ecologically fragile zone experiencing severe soil erosion. The objective of this study was to investigate the characteristics of soil organic carbon (SOC), total nitrogen (TN), and total phosphorus (TP) deposition in a karst watershed of southwest China over the past 60 years and evaluate the relationship between soil erosion and nutrient deposition. The peak-cluster depressions in southwest China are typical for the geomorphological type, which is an ideal place to determine the sediment chronology, and the estimation of sediment and nutrient deposition rates. Three soil profiles were excavated in a typical karst depression. The characteristics of $^{137}$Cs, $^{210}$Pb\textsubscript{ex}, particle size distribution, and nutrients at different soil depths were investigated to evaluate the effect of soil erosion on nutrient deposition. Results showed that there was a significant negative correlation between nutrient concentrations and clay content ($P<0.001$). Generally, compared with $^{137}$Cs, $^{210}$Pb\textsubscript{ex} had a higher correlation with SOC and TN. In an undisturbed sediment profile, Pb/Cs can reflect nutrient dynamics better than a single nuclide. The nutrient deposition rates increased before 1953, reached its maximum in 1954-1956, and then dropped rapidly from 1957 to 2015. The sediment deposition rates were negatively correlated with nutrient concentrations ($P<0.01$), but had a positive influence on nutrient deposition rates ($P<0.01$). This implies that the temporal variation in nutrient deposition rates over the past 60 years was dominated by soil erosion rather than nutrient concentrations. This study provides a new insight to explore the historical nutrient deposition rates in a peak-cluster karst depression, and may help effectively control soil erosion and sustainable development of agro-ecosystems.