Understanding C-N coupling constrained by the isotopic technique in the Karst Critical Zone of Southwest China

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The water chemistry and stable isotopes ($\delta^{18}O$-H_2O, δD-H_2O, $\delta^{13}C$-DIC, $\delta^{15}N$-NO_3^-, $\delta^{18}O$-NO_3^-) were analyzed to improve understanding solute sources and transformation processes in the Karst Critical Zone, Guizhou Province, Southwest China. Guizhou Province locates on the center of the Southeast Asian karst region, which is the largest karst area in the world. Geomorphologic types change from clusters of peaks with depressions to peak forests with broader valleys, and finally to peak forests with plains from the upper streams to the lower streams of the catchment in the studied area. Average annual precipitation generally ranges from 1,200 mm to 1,400 mm and about 80% falls during the wet season. The DIC concentrations and the $\delta^{13}C$-DIC values show pronounced seasonal variations, with the lowest values being observed during the high flow season (from May to October). The water chemistry and isotopic proof indicate that CO_2 derived from organic matter oxidation plays an important role in seasonal carbon dynamic in this typical karstic environment. The nitrate dual isotopic results suggested that nitrate mainly derives from oxidation of reduced nitrogen. Chemical weathering processes of carbonate might be enhanced by using nitrogen fertilizer because liberated protons and enhanced HCO_3^- flux were produced through by nitrification. Considering the calculated quantity of nitrate that may have been derived from nitrification measured at the outlets, the enhanced HCO_3^- flux caused by the nitrification could account for about 1/5 of the total HCO_3^- exported from this catchment. This result indicates that carbon flux in rivers was significantly impacted by the nitrogen cycle, especially in this karstic agricultural area, which should be considered for quantification of the carbon cycle in the Karst Critical Zone.