Mechanisms controlling carbon and nitrate transportation in the Three Gorges Reservoir area

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The Three Gorges Dam is the largest hydropower dam in the world, and the ecological environment and biogeochemical processes should be concerned for scientists and government. This study investigated the carbon and nitrogen transportation processes and related biogeochemical processes in the reservoir based on water chemistry and stable isotopes. The spatially and temporally measurements of partial pressure of CO_2 (pCO_2) along the Three Gorges Dam system showed that the pCO_2 ranged from 619 to 2383 μatm, and were supersaturated relative to atmospheric CO_2. At the station near the upstream part of the reservoir, the pCO_2 at high-flow was much lower than that at low-flow. Organic matter mineralization produced more CO_2 in the surface water of the reservoir area at the high-flow seasons. Mineralization of organic carbon should be responsible for the $\delta^{13}C$-depleted of riverine DIC. The nitrate (nitrogen) behaviors were controlled by water regulation and related biological activities based on nitrate isotopes. Organic carbon mineralization is sensitive to temperature variability, and temperature is expected to be an important driver of the dissolved CO_2 over-saturation. Meanwhile, degradation of organic matter may produce the "new" nitrate in vertical profile by mineralization-nitrification in the TGR zone at the same time. The construction of Three Gorges Reservoir (TGR) increased the water transit time and accelerated the organic matter mineralization in the TGR. The results suggest that carbon and nutrient cycling changes markedly in large rivers that have been impounded.