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Geochemical characteristics of the Changjiang (Yangtze) River water during a large flood event and implications for enhanced chemical weathering and CO_2 consumption

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Chemical weathering is an important process in the Earth's geochemical cycle. Most of the studies have concentrated on global river water chemistry in order to investigate continental chemical weathering and CO_2 consumption rates. However, few studies have focused on the impact of large flood events on river water chemistry and chemical weathering. The Changjiang River Basin experienced large floods in 2020. The runoff of Changjiang River is larger than multi-year (1950-2019) average by 33% and 35% in July and August, respectively. In this study, we collected water samples (<0.22 μm) of Changjiang River at Datong Station (the first hydrology station not affected by tidal influence from estuary) from July 2020 to June 2021. We analyzed major ions, DOC and Sr isotopes of Changjiang River water, to investigate the impact of large flood events on chemical weathering and CO_2 consumption.

The results show that the concentrations of Ca^{2+}, Mg^{2+}, and HCO_3^- were high during the flood event, which is attributed to calcite and dolomite dissolution (Saturation Index <0) caused by dramatic dilution effect of large discharge. The elevated DOC concentration during the flood event is caused by extensive soil erosion. In addition, an inverse model is used to quantify the relative contributions of different solute sources to the dissolved load. We found that the flood event could induce a greater relative contribution of active carbonate weathering and thus increase the rate of CO_2 consumption.

The Sr concentration and varied from 1.91 to 2.77 μmol/L with an average of 2.31 μmol/L and the $^{87}Sr/^{86}Sr$ ratios varied from 0.710297 to 0.710897 with an average of 0.710566 during the sampling period. Although the Sr concentrations in July and August are comparable with that in previous years, the $^{87}Sr/^{86}Sr$ ratios are significant lower (0.710345±0.000054) than that in previous years (0.710648±0.000109 from Luo et al. (2014) and 0.71150 from Chetelat et al. (2008)), indicating a major contribution from carbonate weathering during the large flood event.

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