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Sensitivity of hydrochemistry and dissolved carbon dynamics to storms based on high-resolution data at the karst critical zone, SW China

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Hydrochemical behaviour and dissolved carbon dynamics have high sensitivity to hydrologic variations during high-flow periods in monsoonal-influenced regions, especially in the critical zone of agricultural karstic catchment where existing anthropogenic interference and carbonate weathering with rapid kinetics. Here we selected Chenqi catchment, a 1.5 km^2 sub-catchment of Houzhai basin in Puding, SW China, as study area to analyze the response of hydrochemistry and dissolved carbon dynamics to discharge changes, through hourly sampling campaigns in the outlet of spring water during the high-flow period. Most dissolved ions exhibit distinct responses to discharge variations, their concentrations are negatively correlated with spring water discharge, which can be well fitted using power-law function, indicating their chemostatic behaviours as discharge increases, but biogeochemical processes influencing different ions are miscellaneous. Ca^{2+}, Mg^{2+} and HCO_3^- are mainly controlled by dissolved soil CO_2 and carbonate weathering, while NO_3^- and Cl^- both have anthropogenic inputs and may exist some link about their source areas or transport processes activated during high-flow periods. Other ions are generally affected by the dilution of rainwater. Hydrological conditions and biogeochemical processes regulate dissolved carbon dynamics, resulting in the variation of $\delta^{13}C_{DIC}$. There are two sources for DIC in spring water of Chenqi catchment, namely biological source (DIC_{bio}) and geological source (DIC_{carb}). The contribution ratio of DIC_{bio} is around thrice that of DIC_{carb}, and they both show chemostatic response to varying discharge although the degrees for DIC_{bio} is stronger. The response of dissolved carbon dynamics to discharge variations display different degrees at different stages of the wet season. It was find that most dissolved solutes (except DOC) normally present clockwise hysteresis loops plotting from the top-left to bottom-right due to the dilution on the rising limb of the storm, but the loop area and hysteresis index are different within or between diverse storms. The pattern is related to rain intensity/amount and antecedent conditions, which can affect flow pathways and likely source areas, leading to different transport time and loads. These hysteresis behaviours are generally controlled by antecedent conditions of storms, range/peak of discharge and solute concentrations, and storm duration. Overall, this study highlighted the sensitive characteristics of hydrochemistry and dissolved carbon dynamics to hydrological variations in small agricultural karstic catchment based on high resolution information.