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1 **Organic Carbon Sources and Controlling Processes on Aquifer Arsenic Cycling in the Jiangnan**
2 **Plain, Central China**

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9 **Abstract**

10 Groundwater arsenic contamination is a common environmental problem that threatens the health
11 of over 100 million people globally. Apparent seasonal fluctuations in groundwater arsenic
12 concentrations have been reported in various locations worldwide, including the Jiangnan Plain, central
13 China. This phenomenon has been attributed to shifts in redox conditions induced by seasonal
14 incursions of surface water. However, it is not clear what processes during the incursion lead to
15 changes in the redox conditions and what is the source of the organic carbon driving these processes.
16 Therefore, we conducted a long-term investigation of stable carbon isotopic compositions in surface
17 water and groundwater, as well as long-term monitoring of hydraulic gradients and geochemical
18 compositions at the Jiangnan Plain. Results indicated that a series of biogeochemical processes
19 occurred during surface water incursion, including aerobic microbial respiration, nitrate and sulfate
20 reduction. Groundwater arsenic was removed by adsorption on iron oxyhydroxides produced during
21 oxidation of ferrous iron, resulting in dramatic decreases in arsenic concentrations during surface water
22 recharge seasons. These processes were likely driven by organic carbon vertically transported from
23 surface water and released from the surficial aquitard above 15 m. Groundwater pumping may
24 accelerate the vertical infiltration of oxidizing recharge water and drive exogenous organic carbon to
25 depth. Findings of this study advance the understandings of the mechanisms that cause temporal
26 variations in groundwater As and the importance of exogenous organic carbon that may influence the
27 temporal behavior of arsenic in groundwater.

28

29 **Key words:** Seasonal fluctuations; Groundwater arsenic; Organic carbon; Stable carbon isotope.

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