

Groundwater anomaly related to CCS-CO₂ injection and the 2018 Hokkaido Eastern Iburi earthquake in Japan

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Carbon capture and storage (CCS) is considered a key technology for reducing CO₂ emissions into the atmosphere. Nonetheless, there are concerns that if injected CO₂ migrates in the crust, it may trigger slip of pre-existing faults. In order to test if this is the case, covariations of carbon, hydrogen, and oxygen isotopes of groundwater measured from Uenae well, southern Hokkaido, Japan are reported. This well is located 13 km away from the injection point of the Tomakomai CCS project and 21 km from the epicenter of September 6th, 2018 Hokkaido Eastern Iburi earthquake (M 6.7). Carbon isotope composition was constant from June 2015 to February 2018, and decreased significantly from April 2018 to November 2019, while total dissolved inorganic carbon (TDIC) content showed a corresponding increase. A decrease in radiocarbon and δ¹³C values suggests aquifer contamination by anthropogenic carbon, which could possibly be attributable to CCS-injected CO₂. If such is the case, the CO₂ enriched fluid may have initially migrated through permeable channels, blocking the fluid flow from the source region, increasing pore pressure in the focal region and triggering the natural earthquake where the brittle crust is already critically stressed.