

Study of the chemical fluxes associated with SGD in several hotspots along the French Mediterranean coastline

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ABSTRACT

Although submarine groundwater discharge (SGD) has been investigated in many places of the world, very few studies were conducted along the French Mediterranean coastline, despite the presence of several well-known karstic springs. Almost no information is available on the fluxes of water and chemical elements associated with these systems and on their potential impact on the geochemical cycling and ecosystems of the coastal zones. In this study, we report airborne thermal infrared (TIR) images that allowed us to locate terrestrial groundwater inputs in several areas along the French Mediterranean coastline of Côte Bleue, ~20 km west of the city of Marseille. The four radium isotopes (²²³Ra, ²²⁴Ra, ²²⁶Ra, ²²⁸Ra) were analyzed in several hotspots to characterize the geochemistry of the karstic springs. Nearshore karstic springs were elevated in salinity, reflecting seawater intrusion into the coastal aquifer, and were highly enriched in Ra isotopes. Offshore surface water transects of radium isotopes were used to derive horizontal eddy diffusivity (mixing), and were subsequently combined with surface water nutrient gradients (N, DSi) in order to determine the net nutrient flux from SGD. We also report fluxes of various chemical compounds (nutrients, DIC, DOC, DON, DOP, trace elements as well as several pollutants) associated with these SGD. Repeated sampling over a one-year period (April 2016, October 2016, December 2016, March 2017, May 2017) provides insight into the temporal variability of seawater intrusion to the coastal aquifer and SGD to Côte Bleue.

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