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Quantitative Assessment of Radon-222 Degassing Phenomenon from the Investigation of Groundwater/Surface water Interaction (GSI) processes in Shallow Turbulent Rivers in Campania region, Southern Italy.

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In the investigation of Groundwater/Surface water Interaction (GSI) processes in different water bodies typologies, the use of Environmental Tracers, like Naturally Occurring Radionuclides, have been proven to be an extremely reliable and powerful tool. In particular, among them the (short-lived) radionuclide Radon-222 (referred to as Radon), occurring in the gaseous phase in normal conditions of temperature and pressure, has the advantages to be almost chemically inert, easily detectable on site and its physical signal is not disturbed by any kind of anthropically produced "noise". Therefore, differently from other tracers of artificial nature, it can be safely and successfully employed especially in natural environments, like Natural Parks and Wildlife Protected Areas, because it does not contaminate the surrounding environments being a Naturally Occurring Radioactive Material. Radon, produced in every mineral matrix through the spontaneous decay of Radium, turns out to be rather soluble in water, even though depending on the temperature of the water body, and, therefore, it occurs ubiquitously in all kinds of natural waters. In particular, Radon activity concentrations values, measured in groundwater, are typically some (from three to four) orders of magnitude higher than those ones detected, instead, in surface waters. For such reasons Radon turns out to be a remarkable tool for the Groundwater/Surface water Interaction (GSI) processes and a good indicator for the localization and the semi-quantitative assessment of groundwater discharges into different kinds of water bodies like lakes, rivers and sea.

This work summarizes some outcomes from a series of experimental measurements campaigns performed in relevant river basins of Campania region, southern Italy, where interdisciplinary investigations about Groundwater-River Interactions have been carried on using Radon as a Natural Tracer. The experimental measurement campaigns have been performed using the Radon-in-Air analyzer, RAD7, together with the Radon-in-water accessories, Radon Water Probe and RADH2O (DURRIDGE Co. Inc.), for continuous and batch sampling measurements, respectively.

In the examined study cases among which a typical karst environment has also been investigated, this methodology reveals to be a successful procedure for the localization of the contributions of groundwater to the riverbed, in the case of shallow turbulent rivers, the characterization of the recharge and discharge periods in a karst aquifer, the classification of different typologies of karst springs there occurring and provide a first contribution to surficial-groundwater seasonal hydrograph separation.

From the experimental data collected in the implementation of this approach to different types of shallow turbulent rivers we are enabled to make a preliminary quantitative assessment the Radon degassing phenomenon, so far investigated only for lakes and oceans. The corresponding results are described following the Rosgen classification of the different kinds of fluvial water bodies and, therefore, displayed according to their different turbulence characteristics.