SEASONAL MAGNITUDE OF SUBMARINE GROUNDWATER DISCHARGE IN RÍA DE VIGO

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Abstract: Submarine Groundwater Discharge (SGD), i.e. any flow across the sediment-water interface (Burnett et al. 2003), is recognized as a major source of continental water to the global ocean, thus exerting a major control over coastal water composition (Kwon et al. 2014). Radioisotopes are used to evaluate, for the first time, the seasonal occurrence and magnitude of SGD in Ría de Vigo, a large embayment affected by seasonal, wind-driven upwelling. The activities of ^{222}Rn and ^{226}Ra are determined in surface and deep waters of Ría de Vigo during five seasonal basin-scale surveys. Additionally, the activities of ^{222}Rn and ^{226}Ra are also seasonally determined in the aquifer systems surrounding the ría, beach porewaters, sediment incubations, atmosphere and the adjacent coastal sea. The system reveals as naturally enriched in ^{222}Rn due to the widespread presence of granitic basement rocks in the region. High ^{222}Rn activities (up to 10^5 Bq m^{-3}) are detected in boreholes surrounding the ría, with a general strong seasonal variation in the ^{222}Rn content. Concomitantly, high ^{222}Rn activity (>400 Bq m^{-3}) is measured in certain areas of the ría showing also strong seasonality. Box model, mass balance techniques are used to account for the different circulation patterns found in the embayment and thus, to perform a volumetric estimation of total and freshwater SGD in Ría de Vigo. The contribution of fresh groundwater revealed a relevant component of solute transport to the ría, equivalent to ~10% of the volume discharged through surface freshwaters to the system. On the other hand, the large magnitude of seawater recirculating through permeable sediments, determined by the circulation pattern inside the embayment and enhanced during storm events, shows the potential for being a large source of regenerated solutes to the ría.

Keywords: SGD, thermal imagery, ^{222}Rn, ^{226}Ra, Ría de Vigo

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References:

Burnett, W.C., Bokuniewicz, H., Huettel, M., et al. (2003). Groundwater and pore water inputs to the coastal zone. Biogeochemistry, 66, 3–33.

Kwon, E.Y., Kim, G., Primeau, F., et al. (2014). Global Estimate of Submarine Groundwater Discharge Based on an Observationally Constrained Radium Isotope Model. Geophys Res Lett, 2014GL061574.