Intra-annual variation of submarine groundwater discharge in the Jiulong River Estuary revealed by ^{226}Ra and ^{228}Ra

We have used ^{226}Ra and ^{228}Ra to quantify intra-annual variations in the flux of submarine groundwater discharge (SGD) into Jiulong River Estuary via bimonthly surveys in 2014. The fluxes (in 10^7 m^3d^{-1}) were estimated to be 0.13-0.30 in February, 0.07-0.16 in April, 0.66-2.00 in June, 0.48-1.03 in August, 0.12-0.26 in October, and 0.25-0.55 in December, accounting for 3%-33% of the concomitant river discharge. The seasonal pattern was summer > winter > fall > spring, almost the same as previous studies in 2010 and 2011. This wide range of SGD flux indicated that it may be driven by various factors, such as river discharge and tidal intrusion. We found that there was no obvious time lag between the river and SGD discharges. Based on the time series data, tides had a negative effect on the activity of these isotopes and similarly on SGD. The addition of dissolved radium isotopes corrected for desorption in the estuary may caused by SGD and porewater exchange (PEX).