Tracing Fresh Water Plume Migration in the Estuary after a Typhoon Event Using Sr Isotopic Ratios

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Abstract

In tropical estuaries, plumes of freshened waters derived from runoffs or episodic floods (e.g., those caused by typhoons) greatly influence the physical (sediment dynamics), chemical (elements and nutrients), and biological conditions of these systems. They may also have profound effects on biogeochemical cycles in coastal environments. Tracing fresh-water plumes, therefore, is a critical issue to obtain a better understanding of nutrient and chemical supplies in the coastal region.

The distribution of estuarine water is complicated due to intense regional mixing and hydro-morphological restrictions. Here we apply high precision $^{87}Sr/^{86}Sr$ measurements ($2\sigma = \pm 3$ ppm) in estuarine waters, together with dissolved Ba and Mn, to trace freshened plumes after the Toraji Typhoon. Small, but distinguishable Sr isotopic variations were detected in the surface layer of the Kao-ping Estuary where $\Delta^{87}Sr$ varied up to 50 ppm. On the basis of these geochemical constraints, two distinct sources with high $\Delta^{87}Sr$ were identified which subsequently mixed with the South China Sea Surface Water. The most radiogenic Sr source can be attributed to enhanced water-sediment interactions generated by the typhoon. An additional source of high $^{87}Sr/^{86}Sr$ ratio is attributed to redox transformation of suspended particles due to variations in river discharges.