Geophysical Research Abstracts, Vol. 8, 05428, 2006
SRef-ID: 1607-7962/gra/EGU06-A-05428

2 dimensional particle tracking model – Prediction of movement of dissolved particles in Tolo Harbour, Hong Kong

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A 2 dimensional particle tracking model is used to simulate the dispersion of dissolved radioactive nuclides in Tolo Harbour, Hong Kong. The path followed by each individual particle is solved by three processes which are advection, diffusion and radioactive decay. Diffusion and radioactive decay are computed by random walk method and stochastic method respectively. The density of particles is calculated to obtain the radioactive concentration at the end of the simulation.

On the other hand, we have developed the delayed coincidence system for ^{224}Ra measurement. Seawater samples taken from Tolo Harbour were used to investigate the spatial distribution of ^{224}Ra. Large volume (50-100L) sample was required to preconcentrate the geochemical tracer, which can be quantitatively extracted by a column of manganese-coated acrylic fiber (Mn-fiber). The Mn-fiber was then placed in the system to measure ^{224}Ra. The short-lived daughters, ^{220}Rn, are swept from the Mn-fiber to a scintillation detector where alpha decays of ^{220}Rn and ^{216}Po occur. A delayed coincidence circuit analyzed signals from the scintillation detector to obtain radioactivity of ^{224}Ra.

The field data were used to verify the modeling result. It is assumed that the three rivers and two potential submarine spring act as point sources for ^{224}Ra while the coast of Plover Cove acts as a non-point source because significant amount of submarine groundwater seepage is speculated there. Our model is found to fit well with the field data. From our model, further implications on other dissolved particles such as NO_3 and PO_4 can be made if their sources are identified.