

Residence times of water and chemical flows in a karst spring

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Residence times have been estimated using tritium, CFCs and stable isotopes in a large karst spring (Te Waikoropupu Springs, Golden Bay, New Zealand, Stewart and Thomas, 2008). This spring system, with its discharge of $14 \text{ m}^3/\text{s}$, is representative of the flow paths over a large catchment. Combined with flow and chemical measurements, these lead to a steady-state (or average) model of the flows in the watershed. The model shows that the spring is fed by two different flow systems, each drawn in different amounts from three sources (high and low altitude rainfall, and river seepage). $\delta^{18}\text{O}$ and chloride measurements identify the proportions of each of these flow systems. Monte Carlo estimation methods were then applied to determine the residence times of the spring and its two component flow systems and their uncertainties. Fig. 1 shows simulations to the tritium concentrations measured in the spring using exponential piston flow mixing models for each flow system. The mean residence time of the spring was 9.6 ± 5.0 years, and that for the component flow systems were 1.3 ± 0.7 years and 12.3 ± 6.7 years respectively.

Keywords: Mean residence time (MRT), Spring, Tritium, CFCs, Chloride

