

Comparing tritium concentrations and water transit times in the Chikuma and Fujikawa River basins, Japan

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To understand surface-groundwater interactions, we investigated temporal variability of rain and river water tritium concentrations from June to Oct 2018 and estimated tritium-tracer mean transit times (MTTs) in the Chikuma and Fujikawa River basins, Japan. Tritium is an environmental tracer with a half-life of 12.32 years and is utilized to characterize water circulation from precipitation to surface water via groundwater in the catchment scale. In 2018, we collected monthly precipitation from June to October at four locations between 400 and 1,350 m above sea level and river water samples at normal and below normal discharge in Ueda of the Chikuma River basin and in two Kofu locations of the Fuefuki and Kamanashi Rivers in the Fujikawa River basin. Tritium concentrations of rain and river water samples were analyzed with medium accuracy in Japan and selected river water samples were analyzed with ultra-low level analysis at GNS Science Tritium Laboratory in New Zealand. For the Chikuma basin, an average tritium concentration of Ueda river water is 1.99 TU and is slightly lower than Fujikawa average tritium concentrations of 2.17 TU and 2.28 TU in the Fuefuki and Kamanashi Rivers, respectively. These tritium concentrations were utilized to estimate mean transit times (MTTs) at sampled locations using exponential-piston flow (EPM) models with scaling factor of 1.44 estimated based on measured tritium in local rainfall for monthly tritium concentrations in Chiba (Gusyev et al., 2016; 2019). To evaluate uncertainty of model parameters, we varied EPM ratio from 19 to 0.01 and MTTs from 1 to 200 years. For the Chikuma basin, the MTTs of river flow are between 18 and 34 years, similar to those of Fujikawa river water MTTs between 12 and 32 years. In the next step, we plan to investigate the possibility of much younger MTTs due to the tritium scaling factor and the mixture of young and old river waters.

References:

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