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## Spatial and temporal change of average residence time of spring and stream waters and its hydrological interpretation

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Multi-tracer approach using solution, CFCs and stable isotopes was applied to investigate the temporal and spatial variation of residence time of spring and stream waters in a forested headwater catchment underlain by granite, Hakushu, Yamanashi Prefecture, central Japan.

The average residence times of spring, tributary and main stream waters were estimated to be ranging from 7 to 16 years, 7 to 19 years and 7 to 13 years, respectively during high flow season, whereas those in the low flow season were estimated to be ranging from 14 to 20 years, 10 to 17 years and 7 to 19 years, respectively. Thus, the residence time of the water during the high flow season was higher than that during the low flow season, and that of the main stream water with a larger catchment area was lower than that of spring water with a smaller capture area.

The hydro-chemical data suggests that the high groundwater table and hydraulic gradient in the mountain causes a dominant role of shallow groundwater with a short residence time in the spring/stream water during the high flow season, whereas the deep groundwater contributes dominantly in the spring/stream water during the low flow season. Additionally, the water with a short residence time recharged by the precipitation fallen at the higher elevation seems to cause the shorter residence time of the main stream water.

Keywords: Headwater, Residence time, Spring, Stream