A tracer approach and numerical simulation approach were applied to investigate the groundwater flow system in a mountainous catchment, Mt. Tsukuba, Ibaraki Prefecture, central Japan. The Mt. Tsukuba has two peaks and the elevations are 877 m and 871 m, which is underlain by gabbro in the area higher than the elevation of 500 m and granite in the lower elevation. The flow paths and the residence time of the spring water were induced by using the solute concentrations, stable isotopes of hydrogen and oxygen and chlorofluorocarbons as tracers. The residence time of the springs located at the elevations higher than 300 m ranged from 5 to 10 years, whereas that of the spring located at the elevations lower than 300 m ranged from 20 to 40 years. A numerical simulation showed that the groundwater table exists at the elevation of approximately 500 m, suggesting that the springs located at the elevation more than 500 m are maintained by the perched groundwater. The locations where the simulated groundwater table crosses the ground surface agree well with the observed springs. The model calculated the average residence time and the average volumetric water content to be approximately 23 years and 4.5% in the whole mountain, and the estimated values seem to be reasonable considering the observed results.