The comparison of the percolation mechanism of the soil water under two different humid climates using the stable isotopic profile

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It is important to make clear the percolation mechanism of the soil water in unsaturated zone from the surface to groundwater table for the effective use of groundwater resources. In the past, there are many studies of the percolation mechanism of the soil water with the help of the environmental radioisotope, especially in the relatively dry climate areas with little amount of rainfall. In this study, two hydrologically different areas, Hokkaido (the precipitation of 942 mm/y) and Kumamoto (the precipitation of 1960 mm/y) have been selected where had relatively thick volcanic ash layer which accumulates the soil water over several years of recharged precipitation continuously. In the sites, the no drill water boring in unsaturated zone was used to extract the soil core. The soil water was extracted by centrifuging method in every 5cm depths and analyzed the environment radio and stable isotopes. The percolation mechanism of the soil water in both areas has been cleared by comparing these isotope profiles.

In consequence of analyzing soil water tritium concentration and stable hydrogen and oxygen isotopic ratio, the following became clear. Calculated result of the Displacement Flow Model with the use of the tritium concentration in the soil water shows that the average downward movement velocity is about 1.4m/y in Hokkaido, 2.3 m/y in Kumamoto and annual recharge rate is 525mm/y, 1137mm/y respectively. Also, it was confirmed that about 10 % of the precipitation became runoff in Kumamoto. On the other hand according to the results of the stable hydrogen and oxygen isotopic ratio in the soil water, the d-excess data shows that in Hokkaido soil water is recharged by the precipitation of the all the year around while in Kumamoto mainly by the summer precipitation (from April to October). In the case of the soil water evaporation on the ground surface, the delta-diagram shows that non-equilibrium isotopic fractionation process dominates in Hokkaido while the equilibrium isotopic fractionation in Kumamoto. Especially in Kumamoto, the variation of the stable isotope ratio in the soil water profile was confirmed mostly related with amount of rainfall in the summer and this stable isotopic seasonal pattern was well coordinated with period estimated from the tritium concentration.