Behavior of inorganic ions in air deposition and surface runoff water in an alpine headwater catchment of Mt. Norikura

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Meltwater from perennial snow patch lies on alpine catchment play an important role on the lower ecosystems as sources of fresh water during the warm season as well as rainfall, but chemical properties of air deposition and overland flow from a headwater catchment is not revealed in Japan. To characterize chemical behavior follow the rainfall and snowmelt runoff events, we studied chemical properties of stream water and air deposition during warm seasons 2016-2018, using a hydrometric and hydrochemical approaches and stable isotope of water. The study was carried out in the upper Maekawa River catchment on the east slope of Mt. Norikura, central Japan. Using an approximate curve calculated from the scatter diagrams with discharge and inorganic ion concentrations in stream water, we attempted to quantify the amount of inorganic ion dissolved in stream water during the period of August 28 to October 10, 2017.
Overland flow generation time following rainfall events was within several hours and lower surface runoff rate (up to 7%). The hydrological response properties indicate that periglacial slope overlapped by debris mainly have high water permeability and through the ground along the lava structure quickly. From the result that surface runoff rate of inorganic ions is higher than that of water amount, estimation of the amount of inorganic ions included in air deposition and surface runoff water suggest that eluviation from andesite rock contributes surface runoff amount of K^{+}, Mg^{2+} and Ca^{2+}. In contrast, surface runoff rate of Cl^{-}, NO_3^{-}, SO_4^{2-} were 3.9%, 2.7% and 6.5%, respectively, and it implies the dependency on air deposition for these ions dissolved in overland flow. High-frequency sampling during a rainfall event revealed that first runoff components frequently present a lower value (-19.1‰ at lowest) in $\delta^{18}O$ compared with that of stream water (-16.1‰ at lowest) during non-rainfall period. The fact that $\delta^{18}O$ of new snow obtained 2000m a.s.l. on the east slope of Mt. Norikura in January 2017 was approximately -19‰ suggests that meltwater infiltrated into the ground at early snowmelt season contribute overland flow temporarily follow rainfall input in September and October.

Keywords: headwater catchment, air deposition, perennial snow patch, stream water chemistry

