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COLOR MONITORING ON ALPINE SNOWPACK FOR EVALUATION OF VOLCANIC GAS DIFFUSION

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Organisms and abiotic substances of aerosols occasionally leave a color mark on the surface of snow and ice in arctic and alpine environments. Snow and ice having additive color tend to accelerate the melting speed due to the decrease of albedo. Therefore, monitoring the color on glacier and snowpack is important in order to estimate their mass balance and to predict the dynamics of snow and ice. Volcanic gases including sulfur species generally have no specific color in the atmosphere. However, in arctic and alpine ecosystems covered by snowpack, its surface captures gas and provides a place where the following chemical reaction (1) will be advanced at a low temperature condition.

$$2H_2S + SO_2 \rightarrow 2H_2O + 3S \qquad (1)$$

In this case, snow surface would turn its color into yellowish, because of the accumulation of sulfur's crystallization. Therefore, we would be able to evaluate diffusion of volcanic gas by monitoring snow surface color in such an environment. Since the sulfur species of volcanic gas serve as toxins for plants and animals, the evaluation for volcanic gas diffusion is necessary to keep tourists safe and conserve healthy ecosystem in arctic and alpine regions.

In this study, we monitored the color of snowpack surface in a snowy alpine valley of *Tateyama* mountains, central Japan, where volcanic gas flux was recently found to be increasing after the Great East Japan Earthquake. First, we confirmed the relationship between snow surface color and chemical components of the snow along the distance from an active volcano. Konica-Minolta colorimeter was used for monitoring the color of snow surface. We also took aerial photos using an unmanned aerial vehicle (UAV) to observe wide areas of snow surface color in the study site.

The snowpack located near the active volcano consisted of both colors of yellow and green. The intensity of these colors was decreasing with an increase of distance from the volcano. Our chemical analysis detected sulfur particles in samples of snowpack, and the detectable intensity of sulfur particles was significantly correlated both with colors of the snow surface. We also show spatial pattern of yellow snowpack surface using aerial photos by a UAV, and further discussed the diffusion pattern of volcanic gas in the study area.