

# Spatio-temporal variations of algal snow in Mt. Gassan, Yamagata prefecture, Japan

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Red, yellow or green colored snow due to algal blooming often appeared on the melting snow surface in the forest zone of Mt. Gassan in Yamagata Prefecture, Japan. Their distribution has been reported to be caused by physical and chemical conditions of snow surface. For example, green snow appears on eutrophic snow surfaces whereas red snow appears in poor nutrition snow surface in Antarctica. However, their temporal and spatial distributions and controlling factors are still unknown. Therefore, in this study, to clarify spatio-temporal changes of algal snow and their controlling factors, we investigated the algal biomass, pigment compositions, and nutrient conditions of colored snow of Mt.Gassan.

Snow samples were collected at 7 sites between 800 m and 1500 m above sea level along a ridge of the southern part of Mt.Ubagatake in May and June, 2018. We collected a surface snow sample from randomly selected surface at each site. The sample was preserved in a plastic bag and was melted in a laboratory. The chlorophyll a concentrations in the samples were measured with a fluorophotometer. Absorption spectra of the extracted pigments were measured with a spectrophotometer. The soluble chemical ions concentrations were measured with an ion chromatography. The samples were also observed with a microscoped.

Most of colored snow appeared in May was green snow. In June, red snow was often observed above the timber line, while orange snow was observed below the timber line. As a result of analyzing the absorption spectrum of the dye extracted from the sample, two kinds of waveforms were observed in both May and June. No major absorption was seen at any site in May. In January and June, the waveforms were found above and below the forest limit, both of which showed greater absorption than in May. Algal biomass generally increased from May to June at any sites. In addition, nitrate and phosphate ions, which are essential nutrients for algal growth, did not show any altitudinal trend, but decreased from May to June. The change of snow color from green in May to red or orange in June may be due to decrease of nutrient at the surface snow. The difference of snow color between above and below the timber line may be due to difference of solar radiation conditions.

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