

## Permafrost environments in Japan: a revision based on freeze-thaw processes on the summit of Mt. Fuji

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Permafrost environments on the Japanese high mountains were reviewed from viewpoints recently known through the intense observations of ground thermal regimes on Mt. Fuji. Unique, rapid increase in shallow ground temperature was observed on Mt. Fuji, which was triggered by rainwater infiltration and was induced by permeable volcanic sandy gravels. In general, thermal conduction controls temperature fluctuation of ground during seasonal freezing and thawing. On Mt. Fuji, however, additional convective heat makes the temperature gradient extremely large in the shallow ground. The mean annual ground temperature (MAGT) on the permafrost table (c. 1 m deep) was about 1 °C higher than that of the ground surface. The temperature gradient of a site lacking permafrost was much larger, and the MAGTs at the depth of 2 m were 3 to 5 °C higher than those of the surface. Under similar environments, permafrost distribution has been overestimated from the near-surface ground temperatures. In the Japanese Alps, permafrost presence was suggested mostly in blocky fields having high permeability. The MAGTs at the 2 m depth of there should be estimated to be at least 3 °C higher. This means that permafrost is nearly absent in the Japanese Alps. The only directly observed permafrost on Tateyama, northern Japanese Alps, lay below a snow cover lasting until August, which prevented rainwater infiltration in the ground. It would be better that this permafrost was not considered the evidence of the lower boundary of altitudinal permafrost but one of isolated patches reflecting extremely irregular snow distribution. In contrast to Mt. Fuji and the Japanese Alps in the central Japan, permafrost in the Taisetsu Mountains, northern Japan, can be spread under higher air temperature, because the area hardly undergoes typhoons and a stationary front in autumn. Thus, the latitudinal gradient of lower permafrost boundary is probably larger than that of air temperature along the Japanese Archipelago.

Keywords: Permafrost distribution, Ground temperature, Mt. Fuji, Taisetsu Mountains, Japanese Alps