

Chemical Characteristics of Snowpack due to Differences in Snowfall Type in Japan Alps

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Abstract

We conducted a snow survey in February 2006 and January 2007 in Japan Alps. Approximately 0.60 m and 1.05 m snowfalls were deposited at the study site in February 2006 and January 2007, respectively. It was observed that the occurrence of snowfall was due to the low pressure formation in the vicinity of Japan and it also being the winter monsoon period. As a result of the analyzed snowpack, including new snow at a high resolution every 0.03 m, a plurality of high-electric conductivity layers were observed at different depths. From the measurement of the major ion concentrations, it was observed that the high-electric conductivity layers had different chemical characteristics. High concentrations of NO_3^- and SO_4^{2-} deposits were observed in the snowpack layer that was formed due to the low-pressure system that passed in the vicinity of Japan. On the other hand, the layer that formed during the winter monsoon pattern, large amounts of sea salts were deposited in the snowpack in January 2007. However, layers with a high sea-salt concentration were not observed in February 2006. We analyzed the movement of the air mass that flowed into the study area. Air mass passed through the city at the time of the passage of the low-pressure system. In addition, the air mass that crossed the Sea of Japan entered the study area during the winter monsoon pattern. However, the movement of the air mass was different during the winter monsoon pattern in February 2006 and January 2007.

1. Introduction

The chemical components accumulated with snowfall during the winter season are stored in the snowpack. The accumulated chemical components are separated by the process when the snow particle metamorphoses into the surface of the snow particle and begins to flow out with the snowmelt water (Suzuki, 1996; Suzuki, 2000). The snowmelt water flow in the early snowmelt period begins to dissolve the chemical components at the surface of the snow particle. Therefore, many chemical components are included in the snowmelt water that begins to flow out in this period. The acidification occurs temporarily in the river as the snowmelt water flows out (Kuramoto and Suzuki, 2006).

A study on the weather conditions and winter precipitation was performed. Suzuki (1983, 1984) collected the winter precipitation and snowpack of one winter season in Sapporo, Hokkaido prefecture. The origin of the chemical components was examined in the sample. SO_4^{2-} was influenced by the use of fossil fuels in Sapporo, whereas Na^+ and Cl^- were sea salt.

Suzuki and Endo (1994a, 1994b) collected winter precipitation samples everyday in Tohkamachi, Niigata prefecture. The chemical characteristics of the samples and the weather conditions were investigated. Large amounts of sea salt were deposited during the winter monsoon pattern and large amounts of acid-containing materials were deposited when a low-pressure system passed the south coast of Japan.

There is no outbreak source near the mountainous regions. The pollutants from the neighborhood are not deposited in these regions. In addition, the weather condition changes with time. Therefore, sampling at short intervals of time is necessary to examine a detailed change. However, if the area does not pass through the snowmelt process, it is thought that the chemicals originating from the precipitation is stored and accumulated intermittently. The chemical components preserved in the snowpack of the mountainous region can be obtained through various atmospheric information. However, it is difficult to clarify the exact time scale of the deposited snow in each layer where there is little availability of meteorological observation data in the mountainous region. Therefore, the presumption of the deposition period