

Making Snow Meter Using Neutron Cosmic Rays Observation Data Collected By Cosmic Watch

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One of the methods to observe volcanic activity is to measure the change in gravity, but in winter, snow falls on the gravity measuring instruments and affects the measurement due to the gravity of the snow. In order to correct for this, it is necessary to measure the amount of snowfall and modify the data. The use of cosmic rays has been attracting attention as a method to measure the amount of snow cover. In this method, a cosmic ray detector is placed under the snow, and the amount of snow cover is calculated from the decay of the cosmic ray energy. In this study, we aimed to reduce the cost of this method by using Cosmic Watch, an inexpensive and compact cosmic ray detector. The cosmic ray detector consists of two main components: a scintillator and a photomultiplier. The scintillator emits a small amount of light when a cosmic ray penetrates it, and this light is measured and recorded as an electrical signal using a photomultiplier. The voltage value of the electrical signal obtained is proportional to the energy of the cosmic ray. In this study, two cosmic ray detectors are stacked on top of each other and only the data detected simultaneously by the two detectors are recorded. By using the coincidence measurement, the noise data other than cosmic rays can be reduced drastically.

When neutron cosmic rays pass through snow, the energy of the cosmic rays decays in proportion to the amount of snow cover, so the amount of snow cover can be calculated by measuring the energy of the cosmic rays. However, Cosmic Watch can observe many other cosmic rays in addition to neutrons, so it is necessary to collect only the neutron data needed for the snow meter. To do this, we need to perform Pulse Shape Discrimination (PSD), which is a cosmic ray analysis method to determine the type of cosmic ray by integrating the voltage decay of the waveform data of the electrical signal obtained from the photomultiplier. This method is based on the fact that the attenuation of the electric signal is different for each type of cosmic ray depending on the characteristics of the scintillator. I installed a scintillator called EJ276, which can easily perform PSD of neutrons, in Cosmic Watch to collect data of neutron cosmic rays. In order to obtain a waveform outline, the voltages were acquired continuously over a number of times. Now that we are able to obtain neutron data through PSD, we would like to conduct experiments using actual snow and water tanks to see if we can correctly calculate the amount of snow and water from neutron cosmic rays.

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