

Research of past solar activity by using cosmogenic nuclides

MIYAKE, Fusa^{1*}

¹Institute for Advanced Research (Solar-Terrestrial Environment Laboratory), Nagoya University

Cosmogenic nuclides, such as ^{14}C and ^{10}Be , are produced by cosmic rays which enter to the Earth. These nuclides are accumulated in tree-rings and ice sheets, respectively. We can investigate the past cosmic ray intensity by measuring the content of these nuclides in archive samples. Also the content of the cosmogenic nuclides can figure out the past solar activity because the cosmic ray intensity to the Earth is modulated by the solar geomagnetic activity.

The IntCal dataset, which is a sequence of ^{14}C content data with 10-yr resolution for over this 10,000 years, shows the past solar activity. Yearly ^{14}C content data have also been examined, mainly for grand solar minima. From these annual ^{14}C content measurements, it has been suggested that the length of the Schwabe cycle increased during some grand solar minima. However, the Sporer Minimum does not show this negative correlation between the solar activity and the Schwabe cycle length. Then we need additional ^{14}C data for longer periods.

On the other hand, if a severe SPE (Solar Proton Event) had occurred in the past, it would be possible that the content of the cosmogenic nuclides increase suddenly with an increase of the incoming cosmic ray intensity with a short time. We found two such events in AD774-775 and in AD993-994 by an annual measurement of ^{14}C content. Also there are signatures of these cosmic ray events in the ^{10}Be concentration data. It is possible that a cause of these events is a severe SPE. If such events occur now, it inflicts heavy damage on modern society. Then, it is important to investigate an occurrence rate and a pattern of occurrence of severe SPEs, and we expect that annual ^{14}C measurement will figure out such things.

We are planning the annual ^{14}C content measurement for this 10,000 years using Japanese wood samples (this 5,000 years) and North American wood samples (this 10,000 years). In this presentation, I will be talking about the plan of the ^{14}C content measurement for the research about the past solar periodic activity and the severe SPE occurrence. Add to this, I will be introducing an outlook of a ^{10}Be content measurement which will show us a history of solar activity for a prolonged period.

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