

A12r Rapid increase in cosmic-ray intensity in the past from tree rings

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Radiocarbon (^{14}C) is produced by cosmic rays in the upper atmosphere. Then it forms carbon dioxide to circulate global environment including the biosphere and oceanic layers. Therefore, increases in ^{14}C concentrations in tree rings could be attributed to cosmic-ray events. The record of the past 3,000 years in the IntCal09 data set, which is a time series at 5-year intervals describing the ^{14}C content of trees over a period of approximately 10,000 years, shows three periods during which ^{14}C increased at a rate greater than 3% over 10 years. Two of these periods have been measured at high time resolution, but neither showed increases on a timescale of about 1 year.

We measured ^{14}C contents in annual rings of Japanese cedar trees from AD 750 to AD 820 (the remaining period), with 1- and 2-year resolution. As a result, we found a rapid increase of about 1.2% in the ^{14}C content from AD 774 to 775, which is about 20 times larger than the change rate attributed to ordinary solar modulation. When averaged over 10 years, the data are consistent with the decadal IntCal ^{14}C data from North American and European trees. We introduce the method of measurements and the characteristics of the event. We also discuss a solar flare and a local supernova explosion or a gamma-ray burst as a cause of the event.