Long-term Variation of Solar Activity Level during the Past 6000 Years

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In this paper, we discuss the long-term variation of solar activity level during the last 6000 years, based on the frequency analyses of annually measured carbon-14 content in tree rings. The long-term variations of solar activity are often reconstructed based on decadal data of cosmogenic nuclides, however, it is difficult to eliminate the effect of the changes in climate change, geomagnetic field intensity, and the anthropogenic effect. So far, multiple scenarios for the long-term variation of solar activity level have been suggested based on the records of cosmogenic nuclides; such as the carbon-14 content in tree rings and the beryllium-10 content in ice cores from polar regions.

Our previous studies have shown that the actual length of solar decadal cycle varies in time, depending on the level of solar activity, and thus it can be an independent reference for the absolute level of solar activity. For example, the variation of carbon-14 content in tree rings suggests that the length of 11-year/22-year cycles had been 14-year/28-year cycles during the Maunder Minimum (Miyahara et al., 2004). On the other hand, short cycles of about 9 years have been found at Medieval Maximum Period (Miyahara et al., 2008). Short cycles have been also found at the Solar Activity Maximum at around 6000 BP. Our records obtained so far indicate that the lengths have varied within 8-15 years depending on the level of long-term solar activity. Based on the results of the frequency analysis, we discuss the most probable scenario for the long-term variation of solar activity level.

Keywords: Keyword1; solar activity, solar cycle, cosmogenic nuclide, carbon-14, tree rings;

References

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