

Prospects of Interdisciplinary Research for Solar Influence on Climate

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Solar magnetic (sunspot) activity is one of the factors that vary the climate of the Earth. The variation of solar magnetic activity consists of the so-called 11-year cycle (solar cycle) and the long-term variation, which is recorded in cosmogenic isotopes (¹⁴C and ¹⁰Be) contained in tree-rings and the ice core in Antarctica and Greenland. The long-term variations of the Sun are believed to be caused by the dynamo mechanism, which periodically reverses the magnetic polarity of polar regions and sunspots in each solar cycle. On the other hand, it has also been observed that there is a certain correlation between the long-term variation of the solar activity and global climate change. In particular, the medieval warm period that lasted from approximately the 10th century to the 14th century, and the Little Ice Age, which lasted until the mid-19th century from the 14th century, respectively correspond to the active age and the quiet era (Grand Minima) of solar activity. It suggests that the global climate is likely to have received some influence from the Sun. Several different mechanisms of solar influence on climate have been proposed; for instance, the variability of solar irradiance, the impact on clouds of galactic cosmic rays, and the chemical influence of high-energy particle precipitated into upper atmosphere. However, the detail mechanism is not elucidated yet. The current solar cycle (cycle 24) is likely to be the quietest cycle in the past 100 years. Some possibility is pointed out that the solar activity is further reduced, and a new ground minimum will start during the 21 century. Therefore, the understanding of solar influence on climate is an extremely important issue in order to improve the predictive reliability of global climate change in future. In order to solve this important issue, the point of view of seamless science, which holistically investigates the Space-Sun-Earth system, is needed. To establish that, the interdisciplinary study of astrophysics, solar physics, geo-space science, meteorology, climatology, and paleoclimatology plays an important role. In this presentation, we discuss about the important issues for the solar influence on climate, and introduce the new project planned in Nagoya University to solve them by the collaboration of Solar-Terrestrial Environment Laboratory, Hydrospheric Atmospheric Research Center, and Center for Chronological Research.

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