

The effect of Solar radiation on the Climate of Yakushima

MURAKI, Yasushi^{1*} ; SHIBATA, Shoichi² ; SHIBATA, Takashi³

¹Solar-Terrestrial Environment Laboratory, Nagoya University, ²Department of Engineering, Chubu University, ³Graduate School of Environment Studies, Nagoya University

Yakushima (Yaku-island) is located to the south of Kyushu in Japan and is known as one of the world natural heritages of UNESCO. There are mountains on the island with heights of about 2,000m where cedar trees have lived for more than 2000 years. We analyzed meteorological data for the island from 1938 to 2013 and found several interesting results:

- (1) Eleven and 20-30-year-periodicities are present in the data on daylight hours. Similar periodicities are, however, not seen in the data on temperature or water vapor pressure.
- (2) The 11-year-periodicity appears strongly in June, the rainy season of the island, while the 20-30-year-periodicity is seen throughout the year except in April.
- (3) An 11-year-periodicity can be also seen in the data for June and July at the other remote island Hachijojima situated 300km to the south of Tokyo. Both islands are located on the Kuroshio warm current.
- (4) The daylight hour data for January increased systematically around 1976. This may be related to the change of the North Hemisphere Temperature (NHT) in 1976.

In order to explain the observations, we examined the following hypothesis. Ocean waves produce large numbers of tiny salty droplets which contain plankton on the sea surface. These droplets (aerosols) are winded up and reach at the top of the mountain. They may act as cloud condensation nuclei (CCN).

It is known that the intensity of the UV light from the Sun is modulated by solar activity. It is also possible that the growth rate of CCN is affected by the solar UV radiation in the early stage of the aerosol formation process. We speculate that this may be why solar activity is recognized in the daylight hour data. We have not accounted for the 20-30-year-periodicity in the data, but we speculate that this could be related to the Pacific Decadal Oscillation (PDO). Details will be presented at the conference.

Keywords: solar activity, solar Ultra-Violet light, cloud, daylight hours, aerosols, Pacific Decadal Oscillation

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