Characteristics of the Sunspots that Produce Large Solar Flares and the Possibility to Investigate these Events Utilizing Historical Observational Records

*Shin Toriumi[1]

1. National Astronomical Observatory of Japan

Solar flares are the sudden releasing of magnetic energy and, among them, the energetic ones that occur around the sunspot regions may directly and indirectly affect the Earth through the enhancement of electromagnetic waves, releasing of high energy particles, and coronal mass ejection. While it is accepted that the strongest flare activity ever observed is the "Carrington event" in September 1859, in order to understand the mechanisms and trends of such extreme space-weather events, it is crucial to increase the sample number of the events with enough observational data and conduct statistical investigations. Although often these events do not have observations of sufficient data quality for modern scientific analysis, there are several ways to elucidate how and why the strong events occurred. In this presentation, we first show the morphological and magnetic characteristics of flare-productive sunspots that are revealed by observational data analysis of sunspots in Solar Cycle 24 (especially for six years from 2010) and by magnetohydrodynamic simulations to model these sunspots. Then, we introduce several research attempts to reconstruct magnetic activities by using historical documents such as sunspot drawings. Finally, we discuss the the possibility to investigate extreme space-weather events by applying our modern knowledge of flare-productive sunspots to extreme events in history.

Keywords: Solar flares, Sunspots, Historical documents

