

太陽プロトンイベントが全球雷活動に与える影響

Effects of Solar Proton Event on Global Lightning Activity

*佐藤 光輝¹、片岡 龍峰²

*Mitsuteru Sato¹, Ryuho Kataoka²

1. 北海道大学 大学院理学研究院、2. 国立極地研究所

1. Department of Cosmoscience, Hokkaido University, 2. National Institute of Polar Research

Lightning discharges tend to occur at active thunderclouds generated by the strong upward wind, which transports the moist air mass from the ground surface to the upper troposphere. In the global scale, lightning discharges mainly occur in tropical and subtropical land areas because the land surface can be easily heated by the solar radiation, which finally establishes the strong upward wind. Thus, it is the conventional theory that the lightning activities are purely determined by the tropospheric dynamics. However, recent studies show the observational evidences that the lightning activity and lightning-excited radio wave activity are modulated by the energetic solar event, such as solar-X-ray burst and solar proton event. For example, it was shown that the resonance frequency and amplitude of Schumann resonance waves radiated by lightning discharges are rapidly increased during the energetic solar proton precipitation. It was also shown that the lightning occurrence number and thunder days over Europe were increased after the arrival of the high speed solar wind stream to the Earth and increase of the solar energetic proton flux. Despite these observational facts, it is still not clear whether these modulation was simply created by the rapid change of the Earth-ionosphere waveguide structure or by lightning activity. Even though these modulation was created by the change of lightning activity itself, it is not clear that such change occurs locally or globally. In order to clarify the relation between the energetic solar events and global lightning activity and to identify the effects of solar proton events on the global lightning occurrence number, we have analyzed lightning data derived from the global lightning detection network (WWLLN) and ELF magnetic field waveform data obtained at Syowa station, Antarctica in 2013-2015. We have conducted the superposed epoch analysis for the WWLLN lightning data and have calculated the time variation of the Schumann resonance amplitude and resonance frequency using Syowa ELF data. At the presentation, we will show the detailed results derived from these analysis and will report the effects of the energetic solar events on the global lightning activity.

キーワード：雷活動、太陽プロトンイベント

Keywords: Lightning activity, Solar proton event