Characteristics of solar wind control on Jovian UV auroral activity obtained from Hisaki EXCEED and ground-based observations

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While the Jovian magnetosphere is known to be dominated by the internal source of plasma and energy, it also has an influence from the solar wind. The ultraviolet (UV) aurora and solar wind dynamic pressure are proposed to be anti-correlated in a theoretical model, on the other hand, previous observations such as those by the Hubble Space Telescope showed a positive correlation between them.
We made a statistical analysis of the total power variation of Jovian UV aurora obtained by the spectrometer EXCEED (Extreme Ultraviolet Spectroscope for Exospheric Dynamics) on board the Hisaki satellite. The data set we use was obtained from Dec. 2013 to Feb. 2014 and from Dec. 2014 to Feb. 2015. We compared the total UV auroral power in 900-1480 A with solar wind dynamic pressure at Jupiter estimated from the observation at 1 AU with a one-dimensional MHD model. Superposed epoch analysis supports the positive correlation as the previous observation: Auroral total power increases when solar wind dynamic pressure enhanced around Jupiter. Furthermore, the auroral total power shows a positive correlation to the duration of a quiescent interval of the solar wind before the enhancements of the dynamic pressure with the correlation coefficient of 0.86. It is larger than the correlation to the amplitude of dynamic pressure enhancement with the correlation coefficient of 0.44. A similar trend was observed in the auroral field-aligned currents which are inferred from the color ratio between the two bands of the Hisaki spectrum data. These statistical characteristics define the next step to unveil the physical mechanism of the solar wind control on the Jovian magnetospheric dynamics.
One possible scenario to explain the results is that the magnetospheric plasma content controls the aurora response to the solar wind variation. A long quiescent interval would mean that plasma supplied from Io is more accumulated in the magnetosphere. The solar wind compression of the magnetosphere shifts the plasma inward and cause adiabatic heating to become hot and dense plasma, which leads to an enhancement of the auroral field-aligned current density. The auroral field aligned current also depends on the angular velocity distribution of the magnetospheric plasma, however, it is still unclear how the distribution varies during the solar wind compression. We also made a coordinated observation with Hisaki and CSHELL on Infrared Telescope Facility when Juno measured upstream solar wind condition. The intensity of infrared H_3^+ emission can be used as an index of the atmospheric heating, and the ion wind velocity distribution is related to field aligned current. The initial result indicates that total intensity of H_3^+ emission increases when the UV auroral total power and the dynamic pressure increase, which suggests the atmospheric heating occurs in the thermosphere. However, we cannot find any relation between ion wind velocity and the UV aurora. In this presentation, we will discuss a possible scenario for the solar wind control of the Jovian aurora.

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