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Does an enhancement in Io's volcanic activity weaken Jupiter's magnetospheric activity?

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Io is the most volcanically active body in the solar system. Io's atmosphere consists of volcanic gas, and this volcanic gas continuously escapes from Io into Jupiter's inner magnetosphere. Jupiter's inner magnetosphere is therefore occupied by plasma which consists of heavy ions (e.g., S+, S++, S+++, O+, O++ and O+++). This magnetospheric environment is very different from that of the earth because its magnetospheric plasma has its origin almost only in solar wind. It is well-known that magnetospheric phenomena of the earth like magnetic storms are actually triggered or controlled by the solar wind or solar activity. Influence of the solar wind on Jupiter's magnetosphere is also known. However, Io's contribution on Jupiter's magnetospheric changes has not investigated well while we know Jupiter's inner magnetosphere is filled with Iogenic plasma. In this study, we tried to reveal this outstanding issue.

Jupiter's sodium nebula, extending over several hundreds of Jovian radii, is a result of atmospheric escape of sodium atoms originated from Io through Jupiter's inner magnetospheric structure named Io plasma torus. Previous studies revealed that brightness of the sodium nebula is dependent on volcanic activity on Io. We made ground-based observations of Jupiter's sodium nebula and found a distinct enhancement in 2007. In addition, activities of Jupiter's radio emissions, DAM and HOM, are also available using data from a spacecraft WIND around the time of the enhancement of the sodium nebula in 2007. These radio emission activities are believed to be related to Jupiter's aurora activities. Most of the radio signals are not contaminated by solar radio or earth's auroral radio emissions around this period fortunately. Activities of both DAM and HOM seemed to become lower after the sodium nebula enhancement in aspects of both emission power and occurrence. This relations may indicate the Io's volcanic enhancement weakened Jupiter's magnetospheric activities temporally. The Io-DAM has its source region around L=5.9, and that of HOM is L=8-11. This means Io's volcanic enhancements control Jupiter's inner magnetospheric activities in a region between L=6 and 11. However, this is an insight obtained from only a single event. More events should be studied in the suture to obtain more detailed insights.

Keywords: Jupiter, Io, magnetosphere, volcanism