Response of Jupiter's Aurora to Mass Loading Monitored by Hisaki During Volcanic Eruptions at Io

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The production and transport of plasma mass are essential processes in the dynamics of planetary magnetospheres. At Jupiter, it is hypothesized that Io’ s volcanic plasma carried out of the plasma torus is transported radially outward in the rotating magnetosphere and is recurrently ejected as plasmoid via tail reconnection. The plasmoid ejection is likely associated with particle energization, radial plasma flow, and transient auroral emissions. However, it has not been demonstrated that plasmoid ejection is sensitive to mass loading because of the lack of simultaneous observations of both processes. We report the response of plasmoid ejection to mass loading during large volcanic eruptions at Io in 2015. Response of the transient aurora to the mass loading rate was investigated based on a combination of Hisaki satellite monitoring and a newly-developed analytic model. We found the transient aurora frequently recurred at a 2–6-day period in response to a mass loading increase from 0.3 to 0.5 ton/s. In general the recurrence of the transient aurora was not significantly correlated with the solar wind although there was an exceptional event with a maximum emission power of ~10 TW after the solar wind shock arrival. The recurrence of plasmoid ejection requires the precondition that amount comparable to the total mass of magnetosphere, ~1.5 Mton, is accumulated in the magnetosphere. A plasmoid mass of more than 0.1 Mton is necessary in case that the plasmoid ejection is the only process for mass release.

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