

Modulation of the jovian ring current due to impulsive volcanism on Io

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Abstract

Orbit-to-orbit changes in the ring/magnetodisc current system at Jupiter were inferred from Galileo magnetometer data by Russell et al. (2001) and indicated modulations of around 5 nT which lasted for less than one Galileo orbit. These observations showed both positive magnetic field perturbations, associated with compression of the magnetosphere by the solar wind, and negative perturbations associated with an increase in the mechanical stresses involved in force balance with the $j \times B$ force (Leisner et al., 2007). In this study we examine the role that impulsive volcanism on Io might play in driving the latter type of ring current modulations. We use recent UV observations of the Io plasma torus (Yoneda et al., 2010) to model diffusion of iogenic material throughout the jovian system. The resulting time-dependent profiles of flux tube are used in an Euler potential model of the jovian magnetodisc (Achilleos et al., 2010) to quantitatively investigate changes in the ring current associated with impulsive volcanic eruptions on Io. We also comment on the possibility of impulsive events on Enceladus driving the saturnian ring current perturbations reported by Leisner et al. (2007).

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