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Long-term variability of Jupiter's current sheet and its implications for the aurora

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Abstract

Observations of Jupiter's UV auroral emissions show that the ionospheric positions of the main emission and the Ganymede footprint can vary by as much as 3 degrees over several years. One possible explanation for this shift is a change of the strength of Jupiter's current sheet density [*Grodent et al.*, 2008], which would alter the amount of field line stretching and displace the ionospheric mapping of field lines at a fixed radial distance in the magnetosphere. Recent modeling work by *Nichols* [2011] has shown how varying the mass loading rate from Io and the hot pressure plasma content can result in the required shift of the main emission and Ganymede footprint. In this study we examine *in situ* measurements collected by the Galileo magnetometer between 1996 and 2003 (during 31 orbits of the planet) to determine whether the observed long-term variability of Jupiter's magnetodisk is consistent with the observed auroral changes. Beginning with the measured magnetic field, we remove the internal planetary field and local time effects, and use a current sheet model to determine the current sheet density that gives the best fit to the data for each individual orbit. We find that the observed current sheet strength varies by about a factor of 1.4 during the Galileo era, and that this observed variability is sufficient to shift the ionospheric footprint of Ganymede and the main oval emission (taken to be 30 R_J) by a few degrees of latitude. Finally, we investigate possible relationships between long-term variations in Jupiter's current sheet strength and quantities such as Io dust production, brightness of volcanoes on Io, magnetospheric plasma density, UV auroral observations, and solar wind conditions.

References

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