A simulation study on solar wind influence on long-term variation of Jovian Synchrotron Radiation

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Jovian Synchrotron Radiation (JSR) is a non-thermal radiation emitted by relativistic electrons trapped by Jovian magnetic field, whose frequency range is usually between a few hundred MHz and a few GHz. Based on the assumption that the source of electron is at some outer boundary (e.g. 6 Jovian Radii) and radial diffusion of electrons occur due to the violation of third adiabatic invariant, a number of diffusion models in the past could explain the steady profile of electron population and the resulted total flux density of JSR. Yet, the reason behind its time variation remains unclear, especially, no model could reproduce the long-term variation whose JSR amplitude is 20 ~ 30%, which has a strong correlation with solar wind dynamic pressure shifted 2 ~ 3 years forward in time.
In our study, we have made a radial diffusion model taking Hisaki's observation result into account that dawn-to-dusk electric field is present and is modulated with solar wind dynamic pressure. New diffusion coefficient is applied here in terms of solar wind dynamic pressure, and relative JSR amplitude is calculated according to the pressure variation between 1971 and 2005. By comparing with an observation at 2.3 GHz, we present our result that JSR amplitude of 20 ~ 30 % and a strong correlation between JSR and time-shifted solar wind dynamic pressure can be sucessfully recovered between 1971 and 1989, and discuss why and how long-term variation happens. For the period later than 1989 where the correlation is mostly lost, one might have to look for another possibility (e.g. active volcanic Io's activity).

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