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Statistics of plasma sheet convection

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We study statistically plasma sheet convection using ion and magnetic field data obtained by Cluster 1 and 3 (years 2001–2007), Geotail (1995–2006), and THEMIS 1–5 (2007–2009). The condition ion $\beta > 0.5$ is used to find the plasma sheet regime. Plasma sheet convection is observed to be dominated by slow speed ($<$100 km/s) flows that circulate around Earth on both sides towards the dayside. Higher speeds flows are concentrate around the aberrated midnight meridian. With increasing speed, the sunward component of the flow velocity becomes more pronounced, such that flows with $V>$500 km/s are directed almost purely sunward, not circulating around Earth like the slower flows. Interplanetary magnetic field (IMF) y- and z-components are observed to penetrate the plasma sheet, causing a rather uniform change of a few nT in the same magnetic field component. Moreover, during $IMF_z<0$ conditions, a channel of increased B_z is created in the nightside around the aberrated (due to Earth's orbital motion) midnight axis. It is suggested that the channel is caused by dipolarization and magnetic flux pileup related to fast flows. Compared to $IMF_z<0$ conditions, the nightside region of highest mean flow speed is shifted towards dusk during $IMF_y<0$ conditions, and towards dawn during $IMF_y>0$ conditions. For the $V>$100 km/s flows, no correlation is found between the plasma sheet flow speed and the solar wind electric field magnitude, but between the flow speed and IMF clock angle there is a clear correlation, with increasing speed as IMF turns southward.