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Consequences for magnetospheric dynamics of the Cassini PPO field and field aligned current observations

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The Cassini spacecraft magnetometer yielded an immense amount of information about the polarization and global structure of magnetic planetary period oscillations. Typically separate northern and southern modes with separate periods are present. In both cases, the phase rotates in the sense of planetary rotation. Features such as the signal current system, the phase and polarisation structure and evolution of northern and southern amplitudes are now well-established. We use such information to derive the stress, forces and torques provided by the signals. The observed signal phase structure indicates magnetospheric currents have a strong resistive component so that there is substantial energy deposition in the magnetosphere in addition to the ionosphere. The global magnetic field polarisation pattern shows that the signals twist magnetic field. A twisted field stores angular momentum. The field shear reduces wherever magnetospheric currents flow transverse to the field. Magnetohydrodynamic arguments can be used to show that the transverse currents provide angular momentum to the plasma in the sense of planetary rotation. Numerical estimates show that the signals can provide an important contribution to sustaining sub-corotational motion in the plasma diffusing outward from moon or ring sources deep within the magnetosphere.