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Planetary period oscillations in Saturn's magnetosphere: Evolution of magnetic oscillation properties from southern summer to post-equinox

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We investigate the evolution of the properties of planetary period magnetic field oscillations observed by the Cassini spacecraft in Saturn's magnetosphere over the interval from late 2004 to early 2011, spanning equinox in mid-2009. Oscillations within the inner quasi-dipolar region (L < 12) consist of two components of close but distinct periods, corresponding essentially to the periods of the northern and southern Saturn kilometric radiation (SKR) modulations. These give rise to modulations of the combined amplitude and phase at the beat period of the two oscillations, from which the individual oscillation amplitudes and phases (and hence periods) can be determined. Phases are also determined from northern and southern polar oscillation data when available. Results indicate that the southern-period amplitude declines modestly over this interval, while the northern-period amplitude approximately doubles to become comparable with the southern-period oscillations during the equinox interval, producing clear effects in pass-to-pass oscillation properties. It is also shown that the periods of the two oscillations strongly converge over the equinox interval, such that the beat period increases significantly from $\sim$20 to more than 100 days, but that they do not coalesce or cross during the interval investigated, contrary to recent reports of the behavior of the SKR periods. Examination of polar oscillation data for similar beat phase effects yields a null result within a $\sim$10% upper limit on the relative amplitude of northern-period oscillations in the south and vice versa. This result strongly suggests a polar origin for the oscillation periods.