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Solar wind-radiation belt coupling via wave-particle interactions

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We investigate the solar wind-radiation belt coupling process, focusing on the large flux enhancement of outer belt electrons associated with high speed coronal hole streams. The flux enhancement tends to occur during the high-speed streams with predominantly southward interplanetary magnetic field (IMF). The IMF dependence can be understood as a result of the internal acceleration of relativistic electrons by wave-particle interactions as follows: The internal acceleration by wave-particle interactions is especially effective when a continuous source of hot electrons is maintained to produce chorus waves for several days. The continuous injection is enhanced during a prolonged period of intense convection and/or substorms associated with southward IMF in high-speed streams. Here we show evidence that the activities of hot electrons, whistler mode chorus waves, and convection/substorms during southward IMF events are clearly different from that during northward IMF events. Based on these results, we propose a model of solar-wind radiation belt coupling in which wave-particle interactions driven by continuous hot electron injections play an important role for the flux enhancement of outer belt electrons.

Keywords: radiation belts, solar wind, relativistic electron acceleration