

磁暴环电流衰减率对磁层能量状态的影响

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Effects of the ring current decay rate on the energy state of the magnetosphere

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摘要

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摘要

赤道环电流是引起磁暴扰动的主要电流体系, 环电流衰减速率极大地影响着磁层能量收支估计和磁暴预报. 本文提出评价环电流的两条新指标: (1) E指标 (磁暴事件总能量收支平衡指标), 即磁暴全过程的积分能量收支平衡; (2) L指标 (长期总能量收支平衡指标), 即几年、十几年或更长时段内积分能量收支平衡. 我们用1998~2003年44个磁暴事件以及第23太阳周 (1998~2003年) 的连续资料, 分别检验了几类衰减率模型对上述两条指标符合的情况. 结果表明, PA1978和XD2010两类模型对E指标符合得最好, 即无论磁暴强弱, 它们均显示出事件总能量收支平衡的基本特征; 同时, 这两类模型与L指标符合得也最好, 即它们的能量基本平衡, 而且磁暴期间的能量消耗表现出明显增强的重要特征.

关键词: 环电流 衰减率 磁层能量收支 太阳风-磁层耦合 ϵ 函数

Abstract:

Geomagnetic storms are mainly resulted from the ring current, the decay rate of which is one of the key parameters for estimating energy budget of the magnetosphere and for storm prediction. Two new criteria are proposed in this paper for evaluating the decay rate: (1) the E-criterion: the total energy balance for a storm event, or balance between the integrated energy input and output during whole course of the event; (2) the L-criterion: the total energy balance for a long interval, or balance between the integrated energy input and output for a long interval. Several models of decay rate are examined by using 44 selected storms during 1998~2003 and an 11-year-long continuous record for the 23rd solar cycle (1998~2008). The results show that the PA1978 and XD2010 models show fairly well energy balance for all the storm events, satisfying the E-criterion. In addition, the two models fairly well satisfy the L-criterion, exhibiting enhanced energy dissipation during storm events and long-term energy balance.

Keywords: Ring current Decay rate Magnetosphere energy budget Solar wind-magnetosphere coupling ϵ function

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