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亚暴期间极光电集流带的变化

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Variations of the auroral electrojet belt during substorms

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摘要 极光活动加剧和极光电集流增强是磁层-电离层能量耦合的两种重要表现形式，它们同为磁层带电粒子向电离层沉降的结果，但是变化规律却非常不同.本文用地基磁场资料，反演极区等效电流体系，研究地磁平静期和扰动期极光电集流带的运动特点.研究表明，Harang间断把极光电集流带分为两段：下午—黄昏段的东向电集流带较弱，而晨侧和子夜—凌晨段的西向电集流带较强.在亚暴膨胀相，随着AE指数增大，整个极光卵向赤道扩展，而极光电集流带却表现出分段差异的特点：下午—黄昏东向电集流带向低纬移动，晨侧西向电集流带也向赤道移动，而子夜—凌晨西向电集流带则向极移动.电动力学分析表明，在不同地方时段，控制电流的主要因素不同，因而，电流及其磁扰有不同的特点：下午—黄昏东向电集流和晨侧西向电集流组成了DP2电流体系，主要受控于磁层对流电场，反映了“驱动过程”的行为；而子夜—凌晨西向电集流是DP1电流体系的基本部分，主要受控于电导率，反映了“卸载过程”的特点.

关键词 极光电集流， 极光， 粒子沉降， 电离层电导率， 电离层电场

Abstract： Both aurora display and auroral electrojet, as the most important manifestations of the energy coupling between the magnetosphere and the ionosphere, are resulted from particle precipitation, and greatly enhanced during substorms. However, they have rather different behaviors and AE-dependences. In this paper, the dynamic characteristics of the auroral electrojet belt are studied by using equivalent current systems deduced from ground-based magnetic records. The results show that the electrojet belt is divided by Harang discontinuity into two parts: the minor eastward electrojet in afternoon sector and the major westward electrojet in midnight-morning sector. The former shifts equatorward when AE increases, just as the auroral oval does; the latter is divided into two sections: the midnight section shifts poleward when AE increases, while the morning section shifts equatorward. A study on physical mechanism responsible for these differences reveals that the principal factor controlling the midnight-morning westward electrojet is ionospheric conductivities, while the principal factor controlling the afternoon eastward electrojet is electric field, instead of conductivities.

Keywords Auroral electrojet, Aurora, Particle precipitation, Ionospheric conductivity, Ionospheric electric field

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