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磁正午附近极光强度与沉降粒子能量关系的参数模型

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A parameter model of auroral emissions and particle precipitation near magnetic noon

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摘要

极光是日地能量耦合过程中粒子沉降到极区电离层的最直观表现,对于理解地球空间环境及预测空间天气具有重要作用.本文利用2003—2009年的北极黄河站的多波段地面极光观测,结合DMSP卫星粒子沉降探测,对磁正午附近的极光强度与沉降粒子沉降能量之间的关系进行了定量研究.统计结果表明,在10—13磁地方时(MLT)630.0 nm的极光发光占主导,以低能粒子沉降为主;而在13—14MLT,630.0 nm/427.8 nm极光强度比值降低,沉降粒子能量较高.另外,利用极光强度与沉降电子的能通量以及极光强度比值与平均能量之间的函数关系,初步建立了北极黄河站磁正午附近极光强度与沉降粒子能量关系的反演参数模型,为将来空间天气的监测服务.

关键词 极区电离层, 极光强度, 粒子沉降, 黄河站

Abstract:

The aurora is one of the most significant visible manifestations of the dynamic processes associated with the precipitation of particles into the polar ionosphere generated by the solar-terrestrial interactions, which has played an important role in understanding our Earth's environment and predicting the space weather. Using high temporal resolution optical data obtained from the three-wavelength all-sky imagers at Yellow River Station (YRS) in the Arctic, together with the particle precipitation data measured by the DMSP satellites, we investigated the quantitative relationship between the auroral intensities and the energy features of the precipitated particles near magnetic noon. The statistical results indicated that the soft auroral electron precipitation was dominated near magnetic noon during 10—13MLT with 630.0 nm auroral emissions. The *I*(630.0 nm)/*I*(427.8 nm) ratio decreased as the intensity of 427.8 nm increased in the 13—14MLT sector, suggesting the energy of the precipitated particles was getting higher. In addition, the intensity of 427.8 nm was dependent on the total energy flux of the precipitating electrons and the *I*(630.0 nm)/*I*(427.8 nm) ratio was related to the average energy. We have built a parameter model of auroral emissions and particle precipitation near magnetic noon at YRS, which will serve to monitor the space weather in the future.

Keywords Polar ionosphere, Auroral intensity, Particle precipitation, Yellow River Station (YRS)

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