Geophysical Research Abstracts
Vol. 16, EGU2014-2043-1, 2014
EGU General Assembly 2014

The storm-substorm relationship: spectral characteristics of ions dispersionless injection

Zhaohai He

State Key Laboratory of Space Weather (Center for Space Science and Applied Research, Chinese Academy of Sciences), Beijing, China (he_zh@nssc.ac.cn)

Spectral characteristics of isolated and storm time ion injections have been analyzed by best fitting the differential ion fluxes with the three-parameter kappa distribution function by using Levenberg-Marquardt and Universal Global Optimization methods during four different phases (pre-growth phase, during the growth phase, at the substorm expansion phase and the recovery phase). The temperature, T, and the number density, N, could be deduced from the three fitted parameters. This paper has reported similarities and differences in spectral characteristics between the two classes of injection events. The similarities are including: (1) The temperature and the kappa index increase significantly during the substorm expansion phase; (2) The characteristic energy and the kappa index show an approximately linear relationship especially during the expansion phase and recovery phase. However, it has been explained theoretically in both adiabatic and nonadiabatic acceleration way. Their differences are as follows: (1) The number density increases during the isolated injection onset, while it decreases during the storm time injection onset; (2) during the expansion phase of isolated ion injections the number density increases with the temperature and their relationship satisfies with the adiabatic transport criteria, so ions transport adiabatically. During the expansion phase of storm time injection, the number density decreases while the temperature increases. Their relationship satisfies with the isobaric process criteria, therefore the ions behave isobarically and nonadiabatically. (3) The slope parameter at expansion phase is always less than the value observed during the growth and recovery phase for storm time injection. However, an opposite trend has been observed for isolated injection. It should be pointed out that the intercept parameter varies oppositely to the slope parameter for both classes of events. The reversed trends of two parameters and two classes of events are consistent with the theoretical results.