Quasi-electrostatic instabilities in ring current region

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ABSTRACT

The compositional changes of H^+ and O^+ ions are substantial during magnetic storms and become most prominent during intense storms in the ring current region. The anisotropic H^+ and O^+ ions provide an adequate source of free energy for the excitation of ring current instabilities. A dispersion relation for quasi-electrostatic low-frequency modes is derived by considering four-component plasma consisting of isotropic electrons and background cold protons and both energetic protons and oxygen ions having Dory-Guest-Harris (DGH) type loss cone distributions. Further the dispersion relation is solved numerically for the storm-time ring current parameters. It is found that anisotropy of enegetic oxygen ions can excite low-frequency (less than proton cyclotron frequency) modes whereas the anisotropic protons can drive high frequency (greater than proton cyclotron frequency) modes. These modes could scatter the ring current ions into the atmospheric loss-cone leading to their precipitation in to the ionosphere.