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Cluster Observations of High Altitude Oxygen Outflow Burst and Associated Wave Activities

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The Cluster quartet regularly observe high altitude ion outflow (Re> 4) by the CIS/CODIF ion spectrometer. Occasionally significant energization (acceleration/heating) of outflowing oxygen ions is detected within the regular background tailward streaming cold oxygen ion beams from the poleward cusp to lobe/mantle and polar cap regions. The energization is often accompanied by broad band wave activities detected by field measurements (EFW, STAFF and FGM).
In this report we try to examine possible scenarios explaining the observed high altitude Oxygen ion bursts and associated waves to understand the spatio-temporal characteristics of heavy ion transport in the view point of the wave-particle interaction problem.
In the case study on April 12 2001, an Oxygen ion burst event is characterized by a sudden increase of maximum energy from 500 eV to larger than 10 keV accompanied by significant increase of field aligned bulk velocity (50 km/s to 170 km/s) and temperature (from 10 eV to 1 keV) with a relaxation time of about 5 minutes. Broadband ELF waves associated with this Oxygen burst event predominantly have a large electric field component. On the contrary, the successive Proton outflow event is accompanied by electric and magnetic field components with large downward Poynting flux.
Results from multipoint measurements indicate that the observed waves are spatially and temporally correlated with the poleward moving boundary structure of high parallel outflowing O+ ion flux within the time resolution of each measurement.
We take different methods to study the energy exchange between outflowing oxygen ions and waves such as the linear instability analysis and test particle simulation.

The statistical study will be performed to find out the quantitative relationship between energized particles and associated waves and the occurrence conditions for the burst events taking into account the external force such as the solar wind parameters.