The Plasmasphere During Major Geomagnetic Storms: Analysis Of Trapped Particles In The Outer Radiation Belt

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OBJECTIVE
Find a possible relationship between the evolution of the trapped population and the process of magnetic reconnection during storms by combining measurements of the plasmapause and the aurora to better understand and quantify the variability of the Earth's outer radiation belt during strong storms.

INTRODUCTION
The interaction between the Earth’s magnetic field lines and the solar wind results in a cycle of magnetic field lines opening and closing known as the Dungey substorm cycle, mostly governed by the process of magnetic reconnection. The geomagnetic field lines can therefore have either a closed or an open topology.

Closed field lines can trap electrically charged particles that bounce between mirror points located in the North and South hemispheres while drifting in longitude around the Earth, forming the plasmasphere, the radiation belts and the ring current.

The outer boundary of the plasmasphere is the plasmapause. Its location is mostly driven by the interplay of the corotation electric field of ionospheric origin, and the convection electric field that results from the interaction between the IMF and the geomagnetic field.

At times of prolonged intense coupling between these fields, the response of the magnetosphere becomes global and a geomagnetic storm develops. The ring current created by the motion of the trapped energetic particles intensifies and then decays as the storm abates. The ring current and the trapped particles are expected to vary during storms.

METHODOLOGY

**Instruments**
- **IMAGE-EUV**
  Observes the distribution of the trapped helium ions (He+) in the plasmapause at 30.4 nm.
- **IMAGE-FUV**
  Takes images of the proton/electron aurora using SI12, SI13 and WIC. We use the SI12 data to identify the polar cap boundary (not contaminated by dayglow).
- **SuperDARN**
  Measures the line-of-sight velocity of the ionospheric plasma and produces large scale maps of the convection pattern including the location of the Héppner-Maynard Boundary (HMB) which represents the latitudinal extent of the ionospheric convection pattern.

**Geomagnetic Storm Cases**
- **Case of August 2000**
- **Case of April 2001**

These intervals are characterized by large values of open flux and reconnection rates.

RESULTS

The correlation between the Dst index and the parameters shown in the table cover the whole time range of the storms. If we compute the correlation taking into account the intervals between the main and recovery phase, the correlation increases.

Conclusions

- **Strong correlation found between the Dst index and the average plasmapause location (Lp,pp) and another correlation found between the HMB latitude and the open flux. Also we found a good correlation values during storm times between the Dst index and the open flux, the solar wind velocity and other parameters.**

- **We expect to find a relation (direct or indirect) relating the plasmasphere density and location, Dst index, open flux and reconnection.**

- **Precipitating electrons are dominant in the ionosphere during storm time.**