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Trapped Population Response During Geomagnetic Auroral Super Storms

Jessy Matar, Benoit Hubert, Zhonghua Yao

16th European Space Weather Week
Liège, Belgium

Motivation

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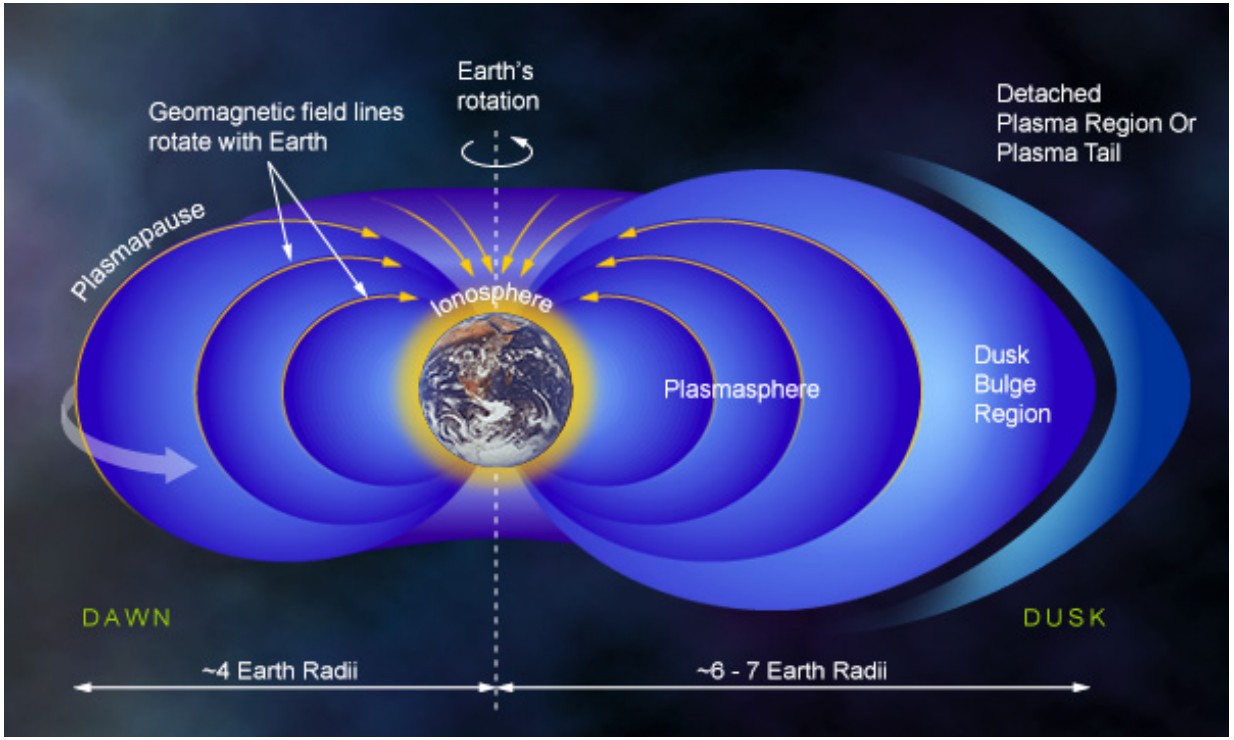

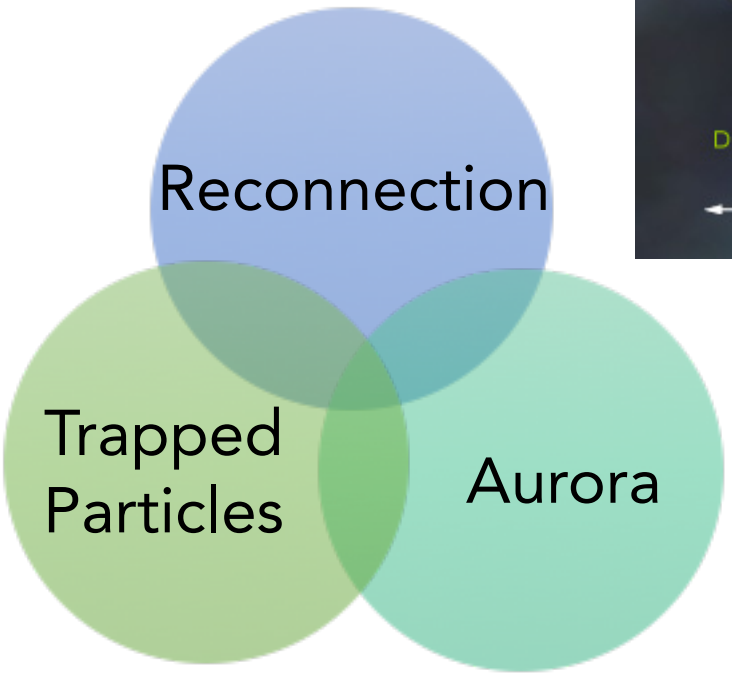

Methodology

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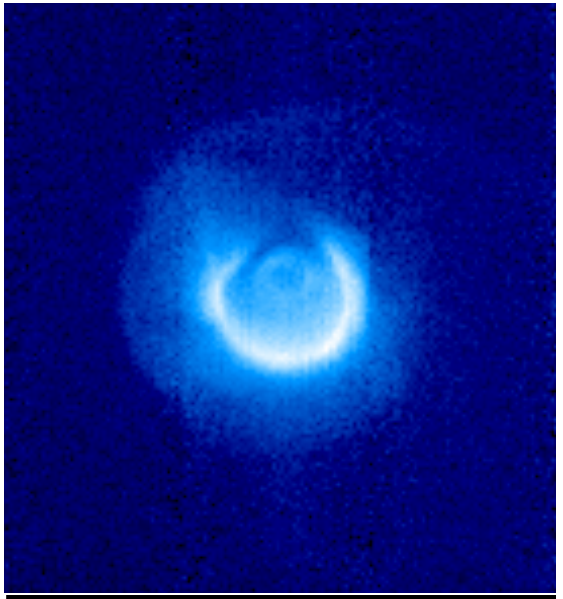
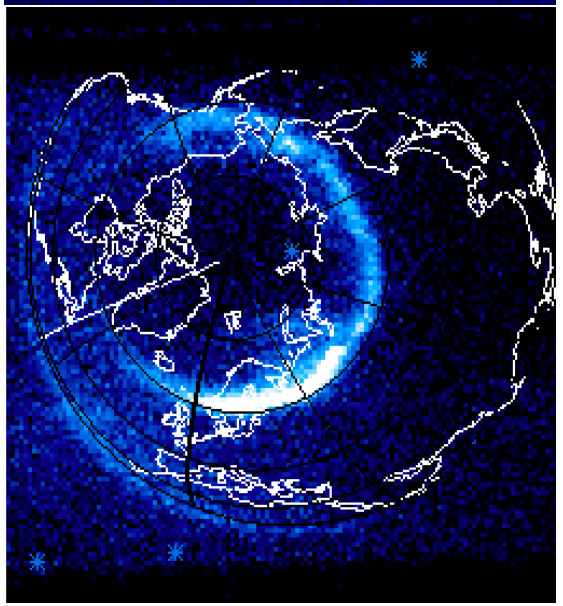
1. Quantify the properties of the trapped population of Earth's radiation belts using EUV observations of the plasmasphere

2. Analyze FUV images of the polar aurora complemented with SuperDARN data

3. Investigate geomagnetic storms during which the radiation belts have more pronounced responses to global disturbances of the magnetospheric system





Analysis

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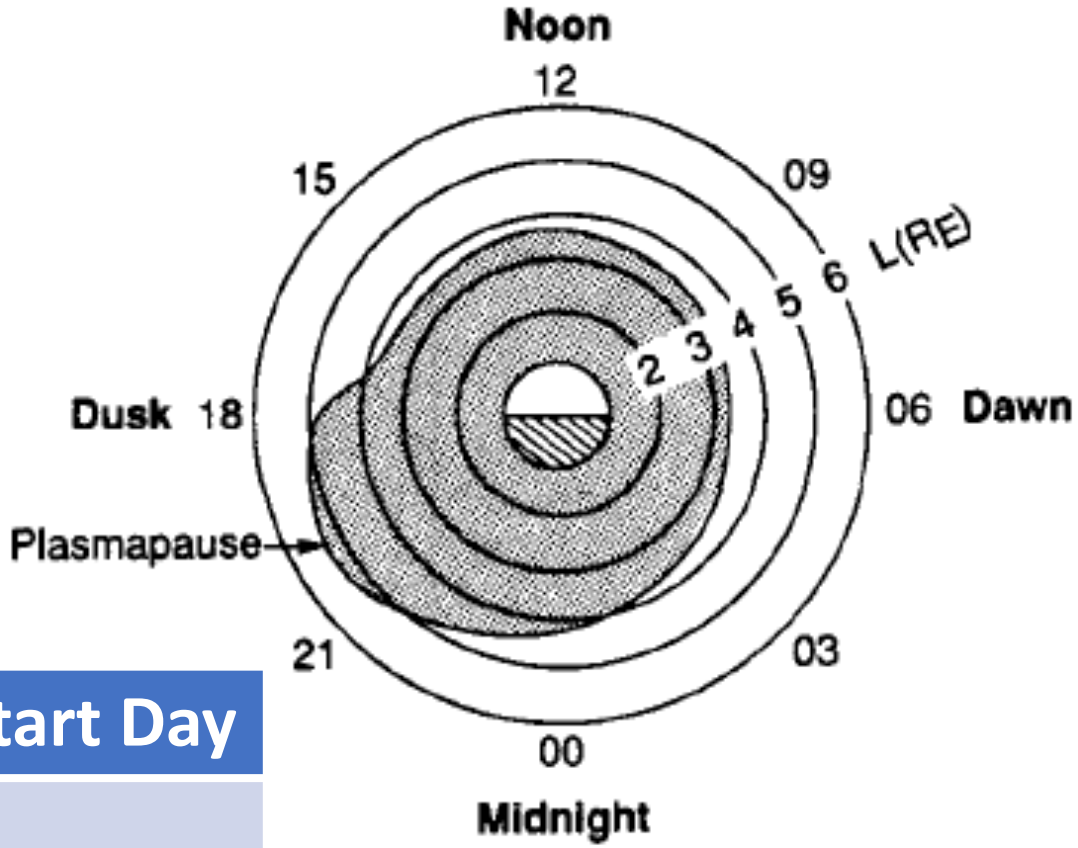
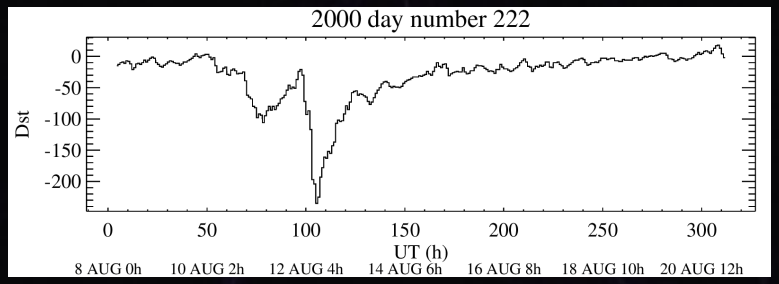
Case Study

STORMS
1. Initial Phase
2. Storm Main Phase
3. Recovery Phase

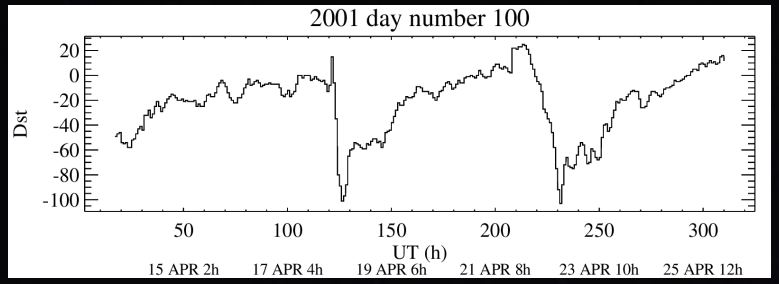


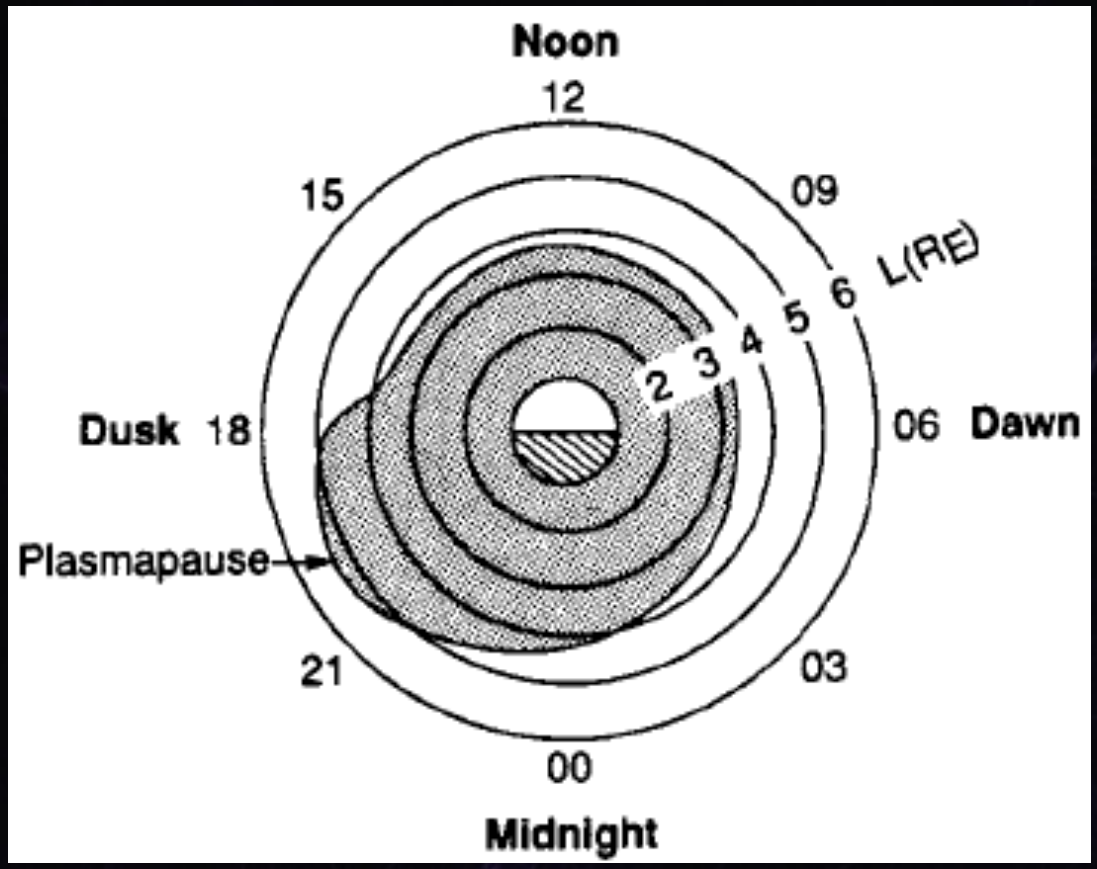
Year	Month	Start Day
2000	August	9
2001	April	10

August 2000



April 2001





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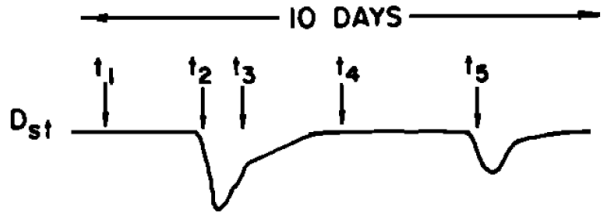
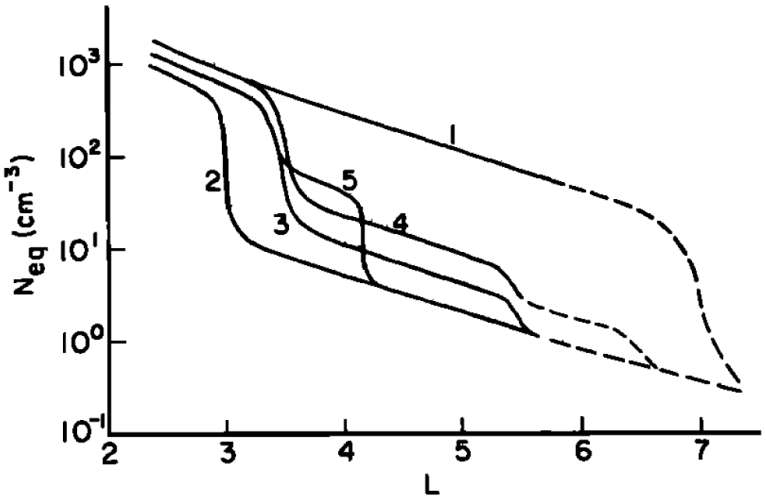
He+ Density Budget During Storm Time





(D. L. CARPENTER AND C. G. PARK 1973)

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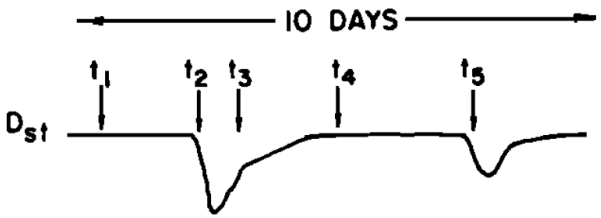
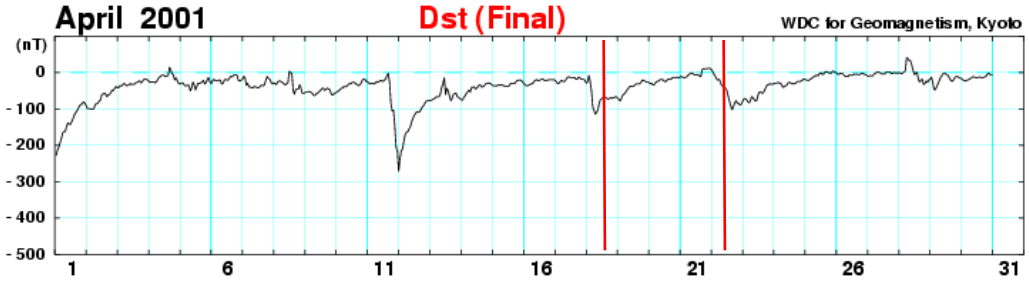
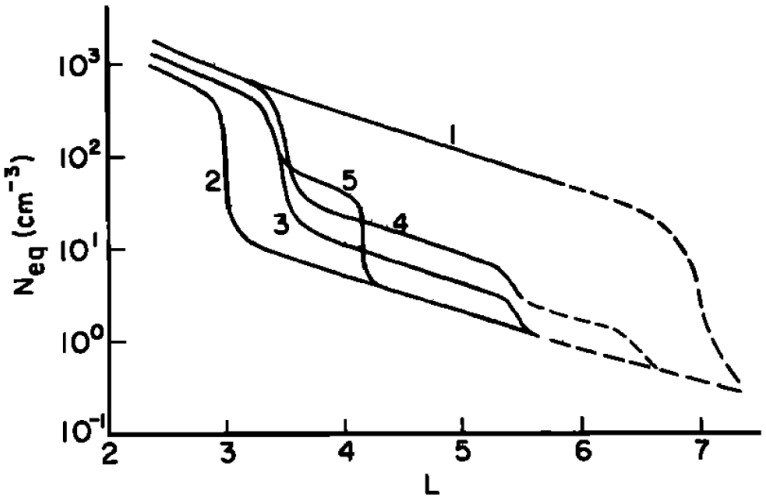
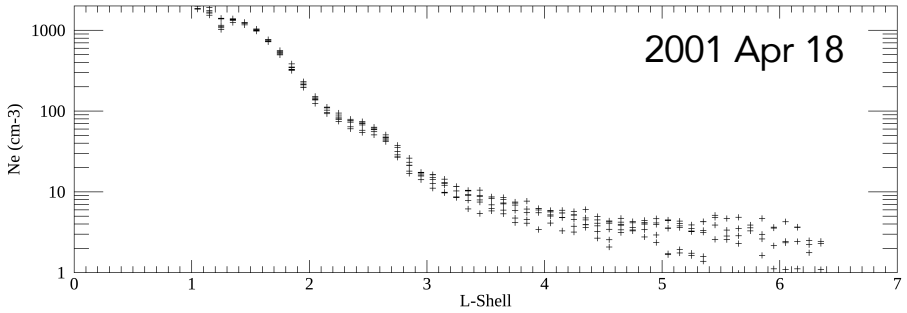
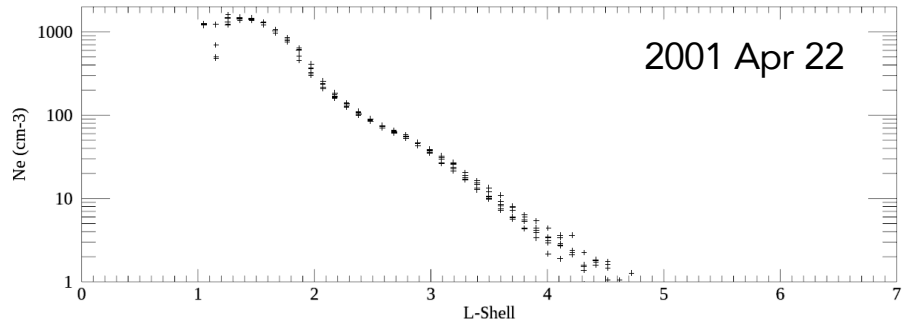






(D. L. CARPENTER AND C. G. PARK 1973)





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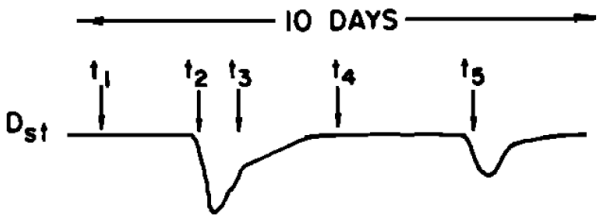
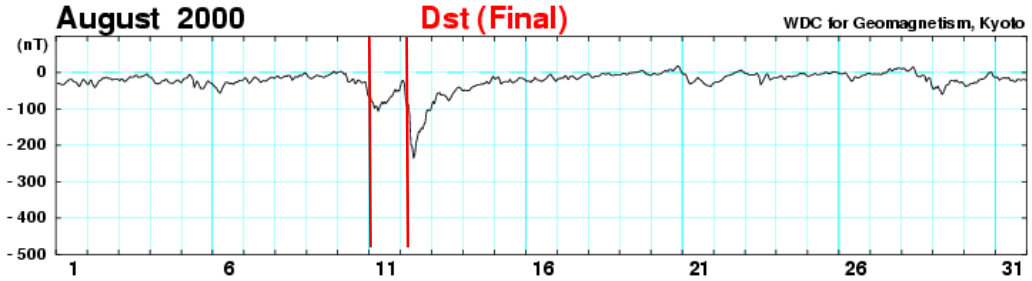
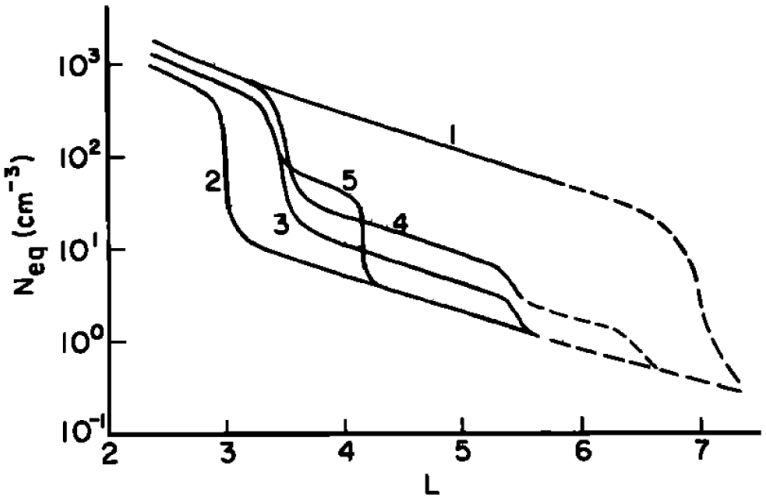
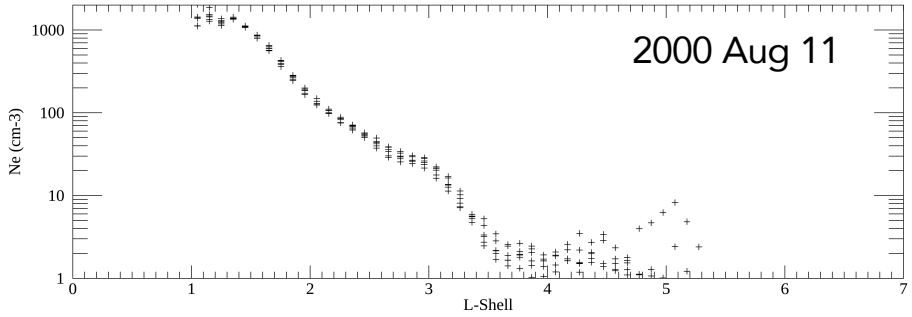
He+ Density Budget During Storm Time

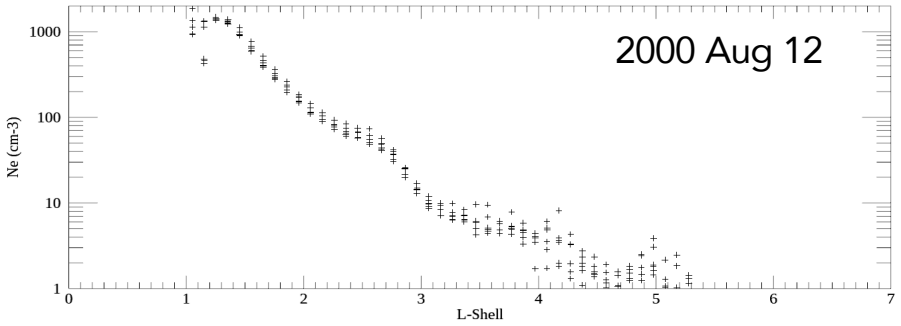






(D. L. CARPENTER AND C. G. PARK 1973)





Analysis

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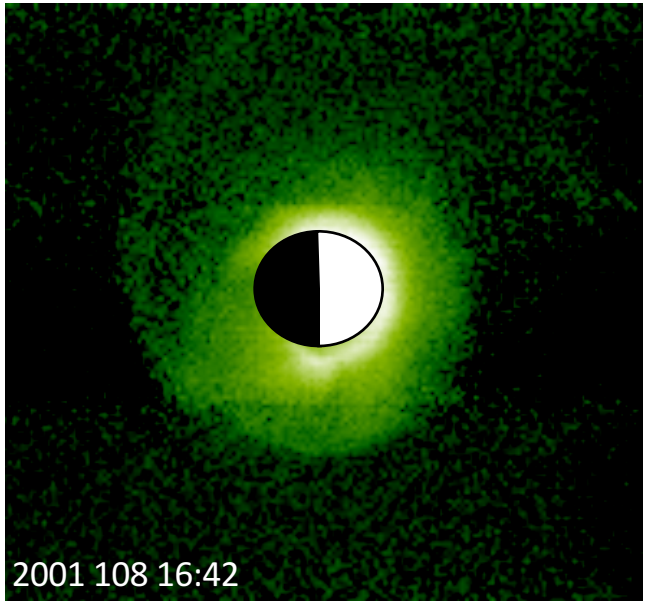
Plasmapause (L_{pp}) Extraction



- Directly from the EUV images
- Extract plasmapause (Goldstein et al. 2003)

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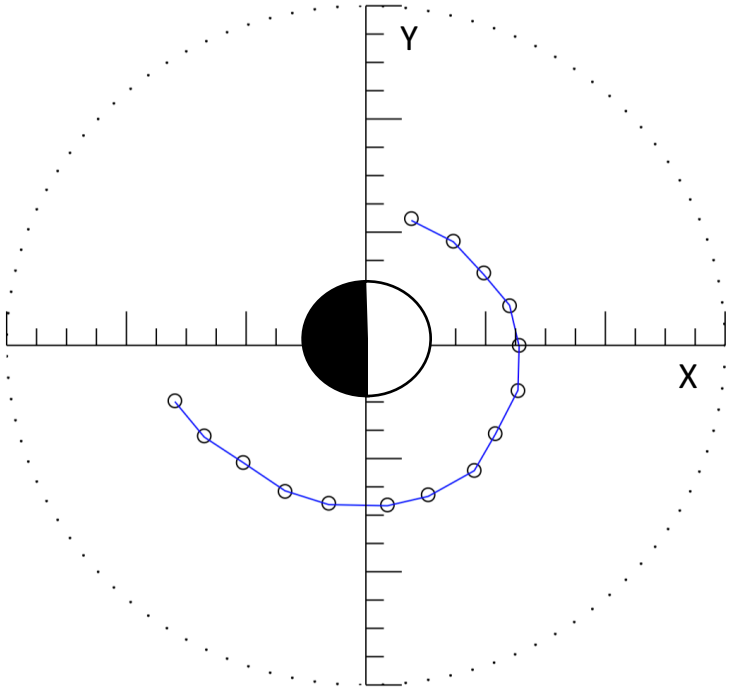
Plasmapause (L_{pp}) Extraction



Extracted

- Interpolate by Fourier series expansion
- Extract L_{PP} and E_{PP} (Goldstein et al. 2004)

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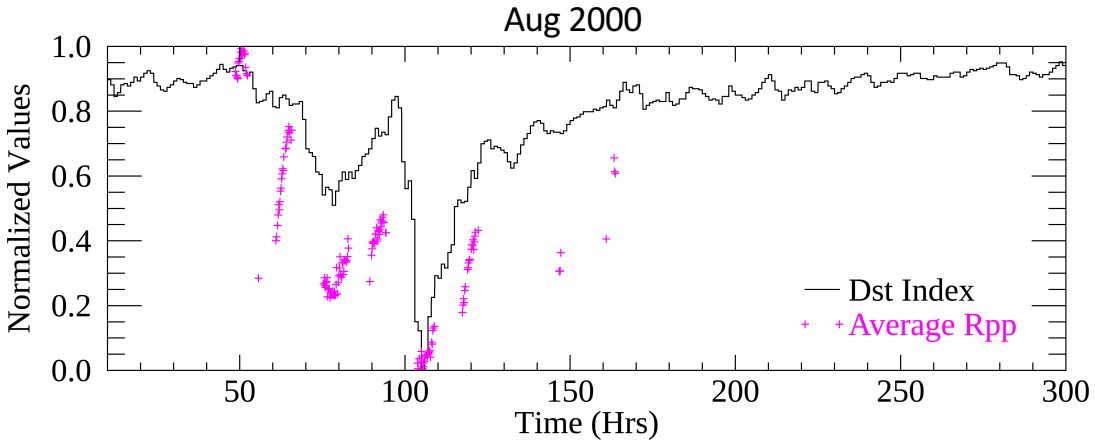
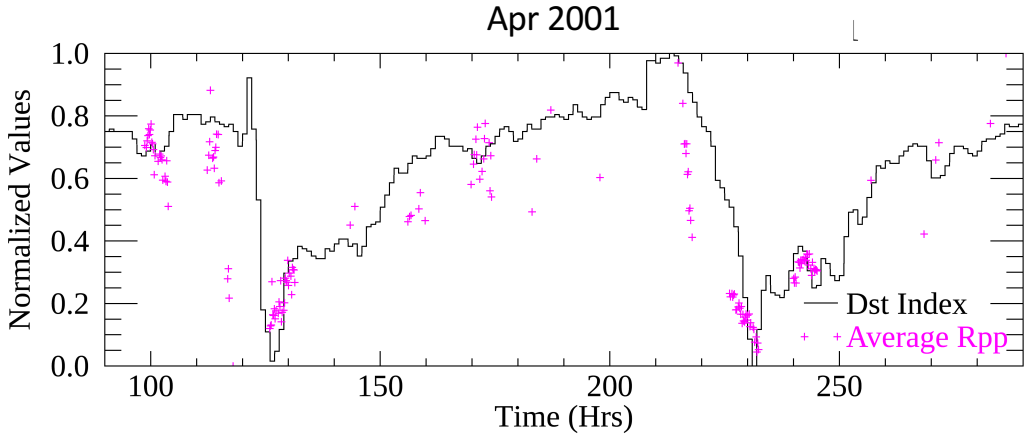
Plasmapause (L_{pp}) Extraction

Dst vs L_{PP}





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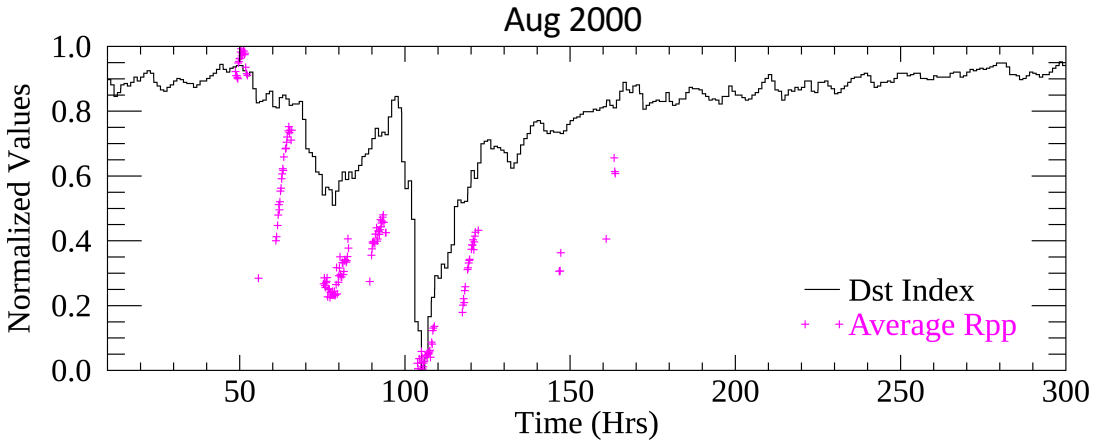
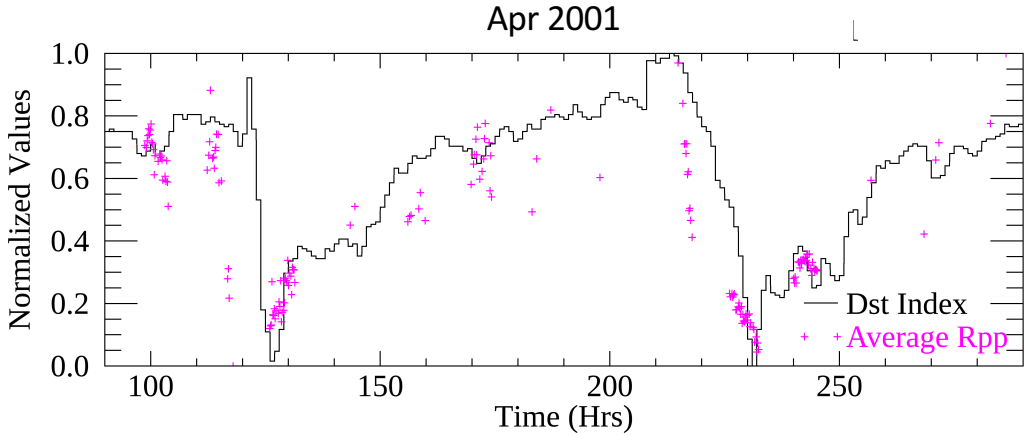
Plasmapause (L_{pp}) Extraction

Dst vs L_{PP}



Pearson Correlation Coefficient = 0.87

Pearson Correlation Coefficient = 0.83



Analysis *Ionosphere-Plasmasphere Comparison*

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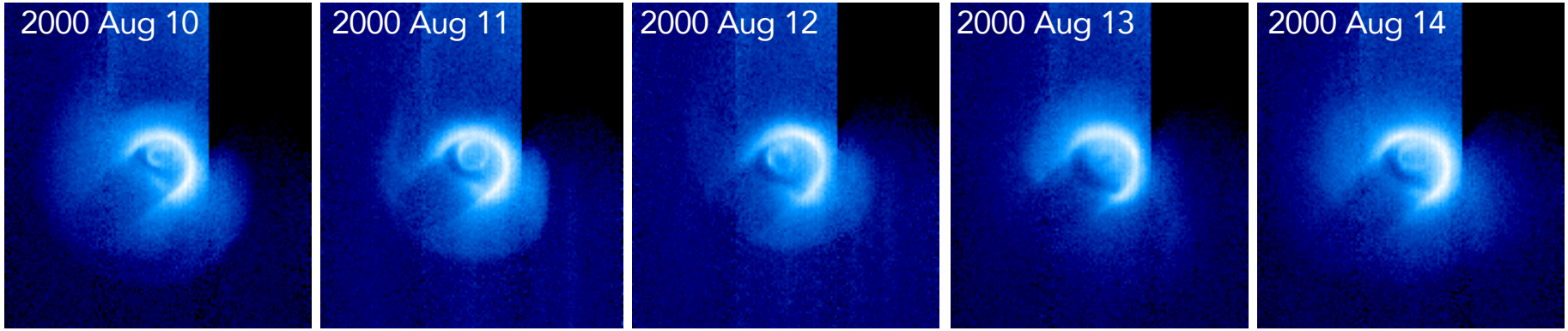
~7 R_E



Analysis *Ionosphere-Plasmasphere Comparison*

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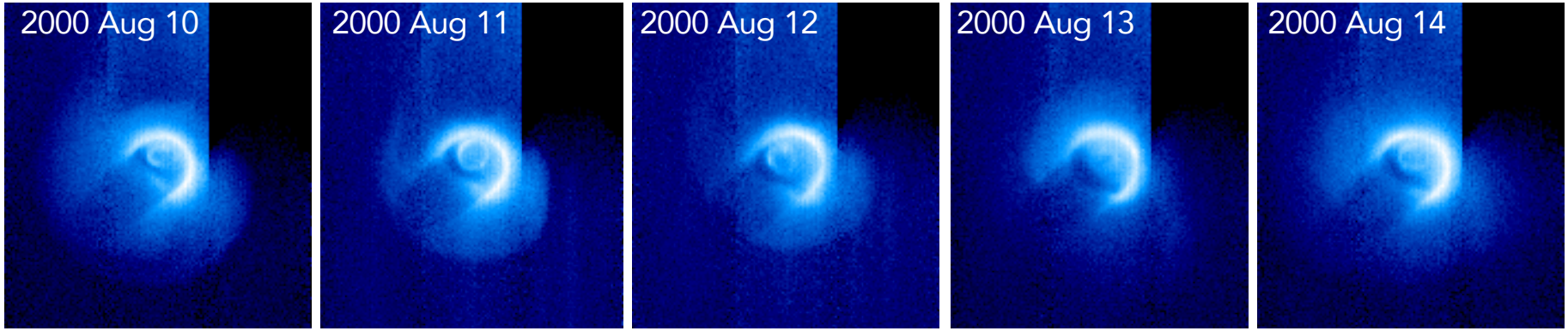

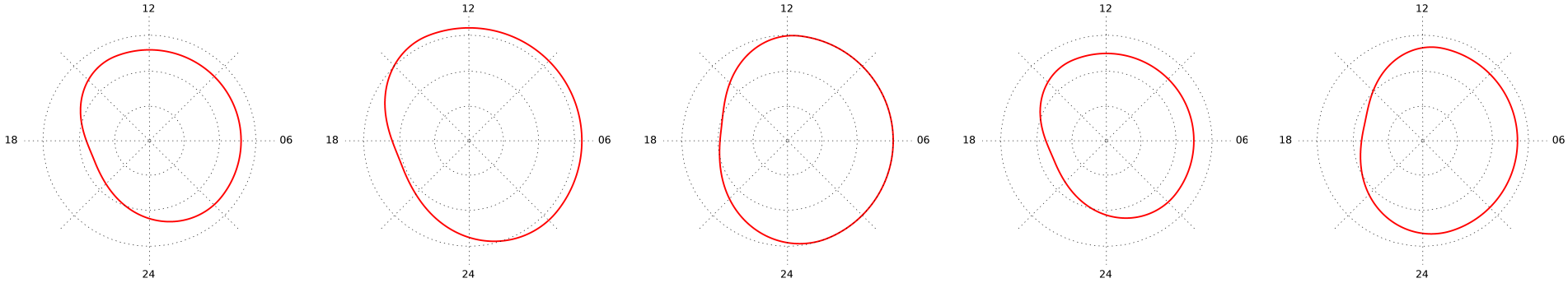

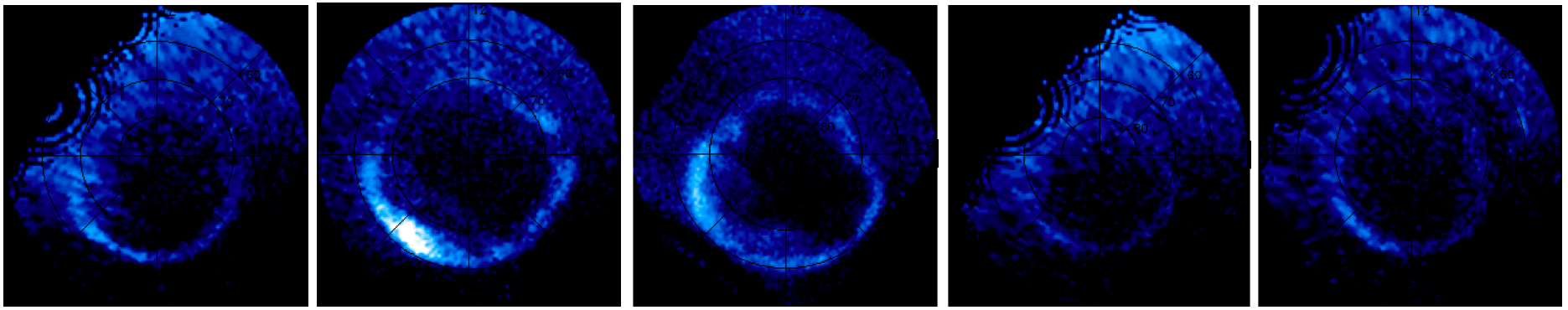

Analysis

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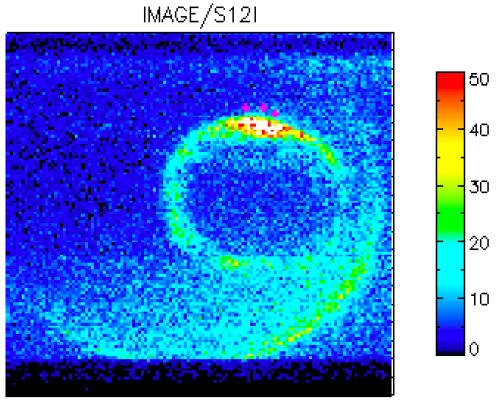
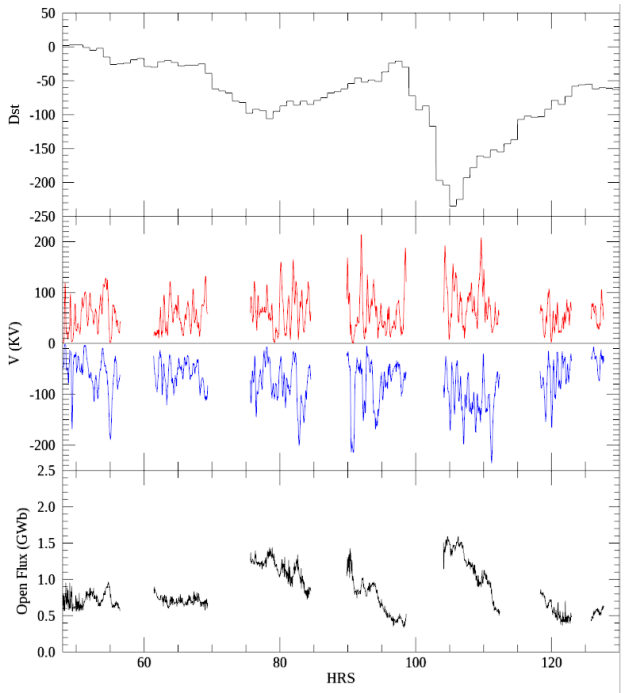
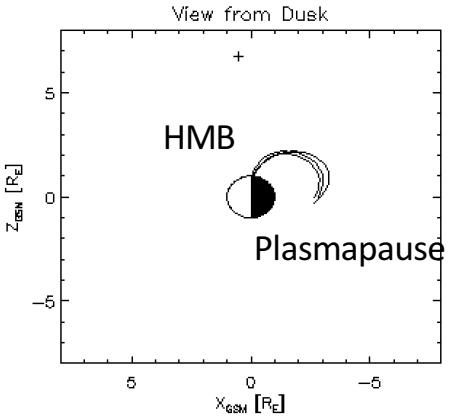
- Aurora reconnection rates from FUV-SI (Method from Hubert et al. 2006)
- Density and E_{PP} from EUV
- E_{Con} and Potential from SuperDARN







E_{SW} - E_{Con} (Lei et al. 1991)

E_{SW} - E_{PP} (Murakami et al. 2007)

Compare E_{PP} and E_{Con}

Future Work

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- Strong correlation between Lpp and Dst
- Future investigation:

    1. Mapping using Tsyganenko magnetic field models between **Ionosphere – Plasmasphere**
    2. Total precipitated electrons and protons
    3. Study substorm cases

Thank you

Jessy Matar
jmatar@uliege.be