

Polar observations in the plasmopause/trough region

H. Laakso and A. Masson

1. Introduction

- Polar orbits
- V_{sc} vs. density

2. Individual PP/trough passes

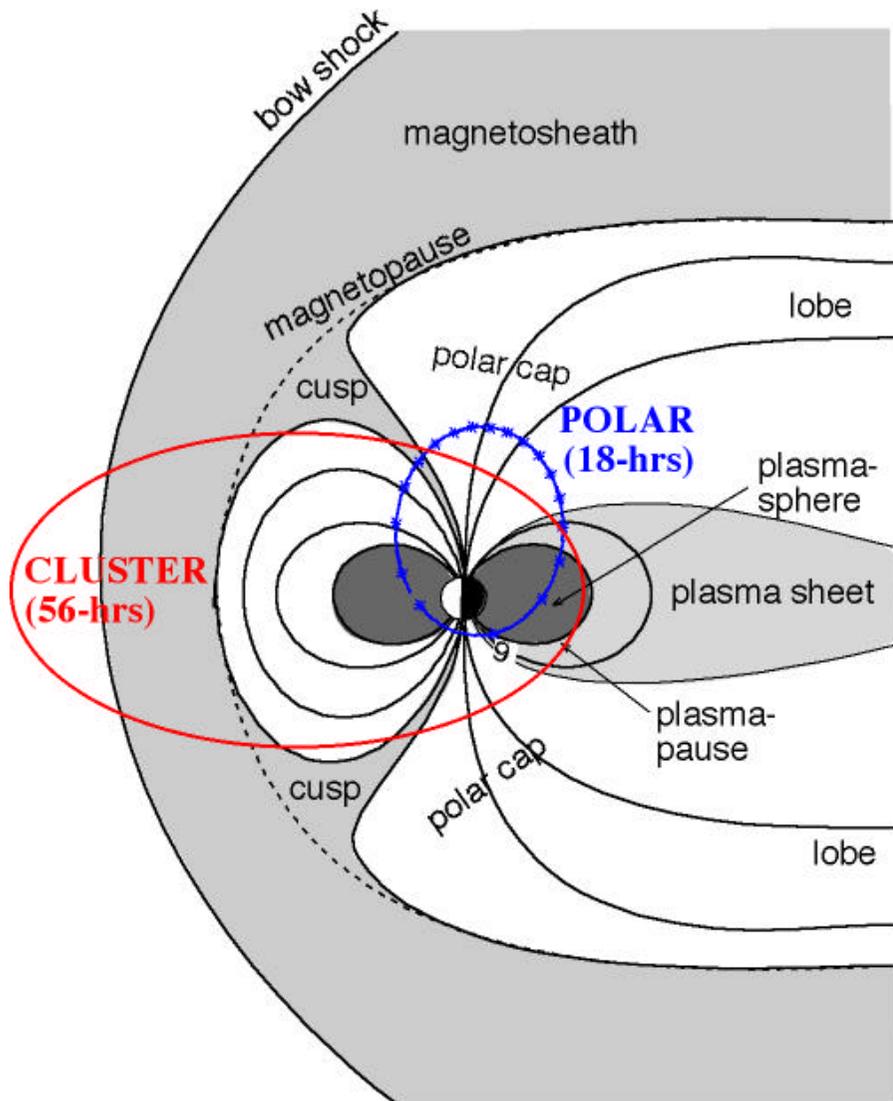
- extreme cases
- fitting to a model

3. Statistical results [vs. K_p , MLT]

- PP location, thickness
- density profiles [plasmasphere, trough]

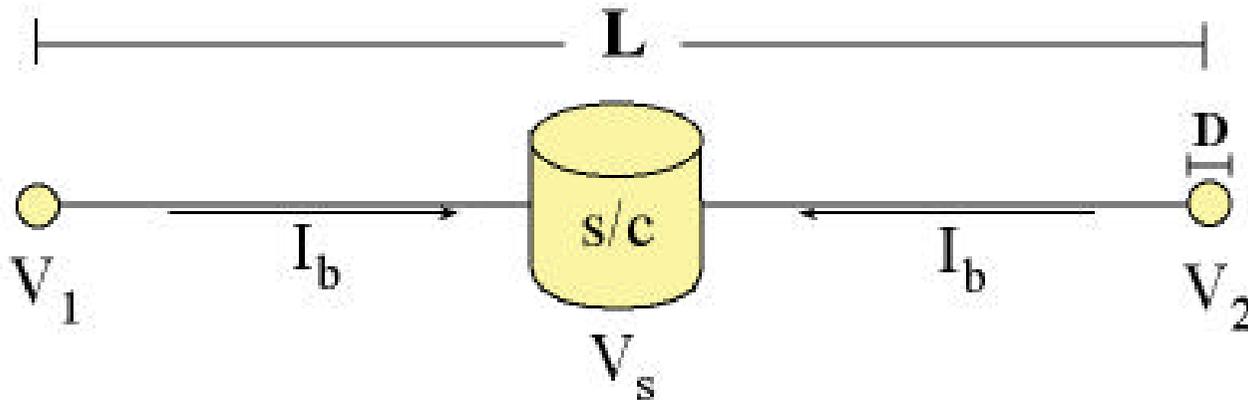
4. Summary

Cluster and Polar Orbits



- The Polar satellite has passed through the inner magnetosphere, the plasmasphere and the plasma trough, more than 10,000 times.
- Using the electron densities provided by the EFI experiment in 1996-1999, we study the density variation at $L = 3-12$.
- Using a simple model, we can derive
 - » **power law coefficients** for the plasmasphere and trough densities (slopes of density declines)
 - » **plasmopause location and thickness**
- We study these characteristics with **MLT and K_p** .

Electric Field Instrument



Parameter	Polar	Cluster
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L (m)	100-130	88
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D (cm)	8	8
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Sampling (Hz)		
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- normal	20-40	25
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- burst	1600-8000	450
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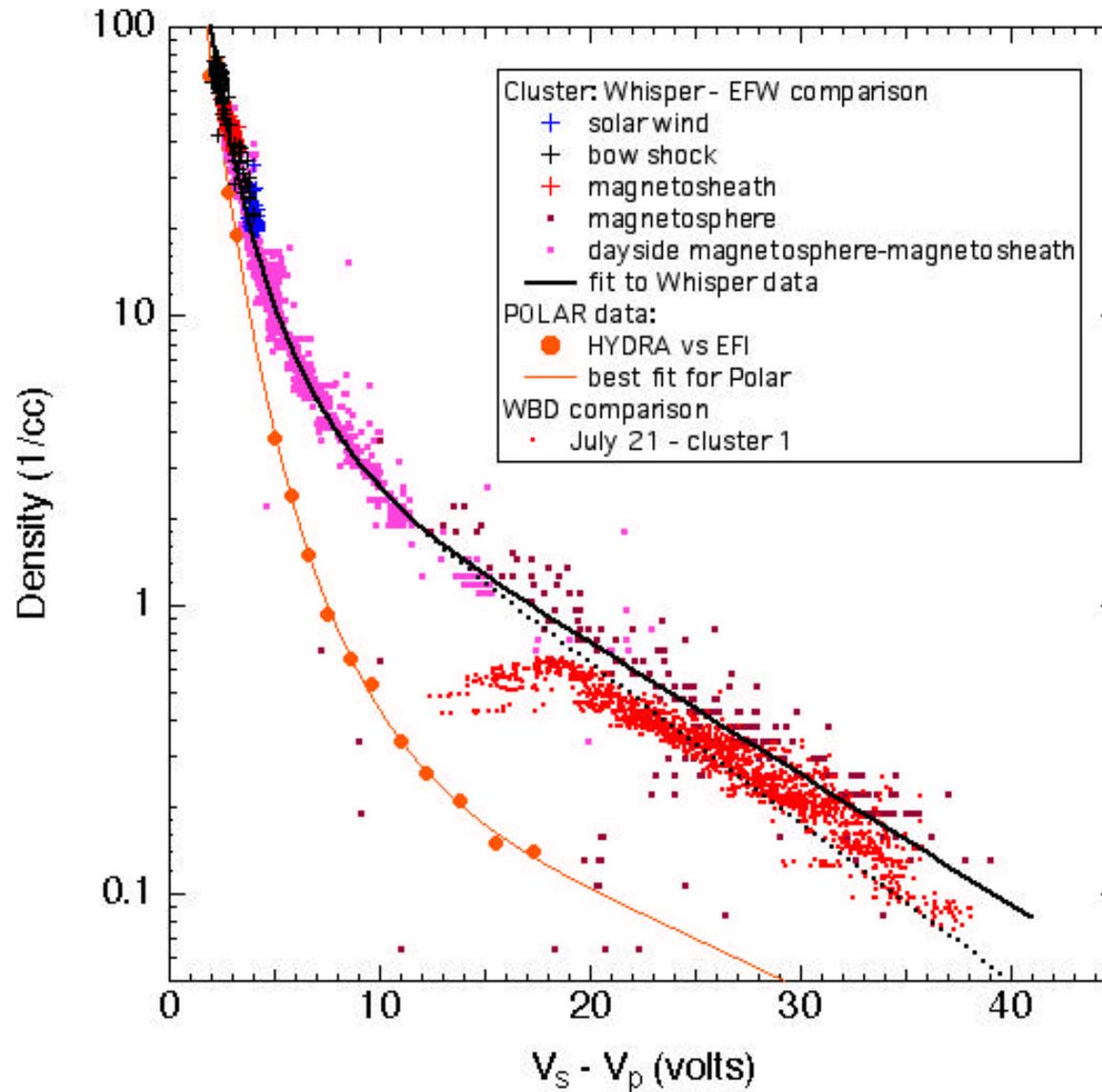
electric field:

$$E = (V_1 - V_2)/L$$

spacecraft potential:

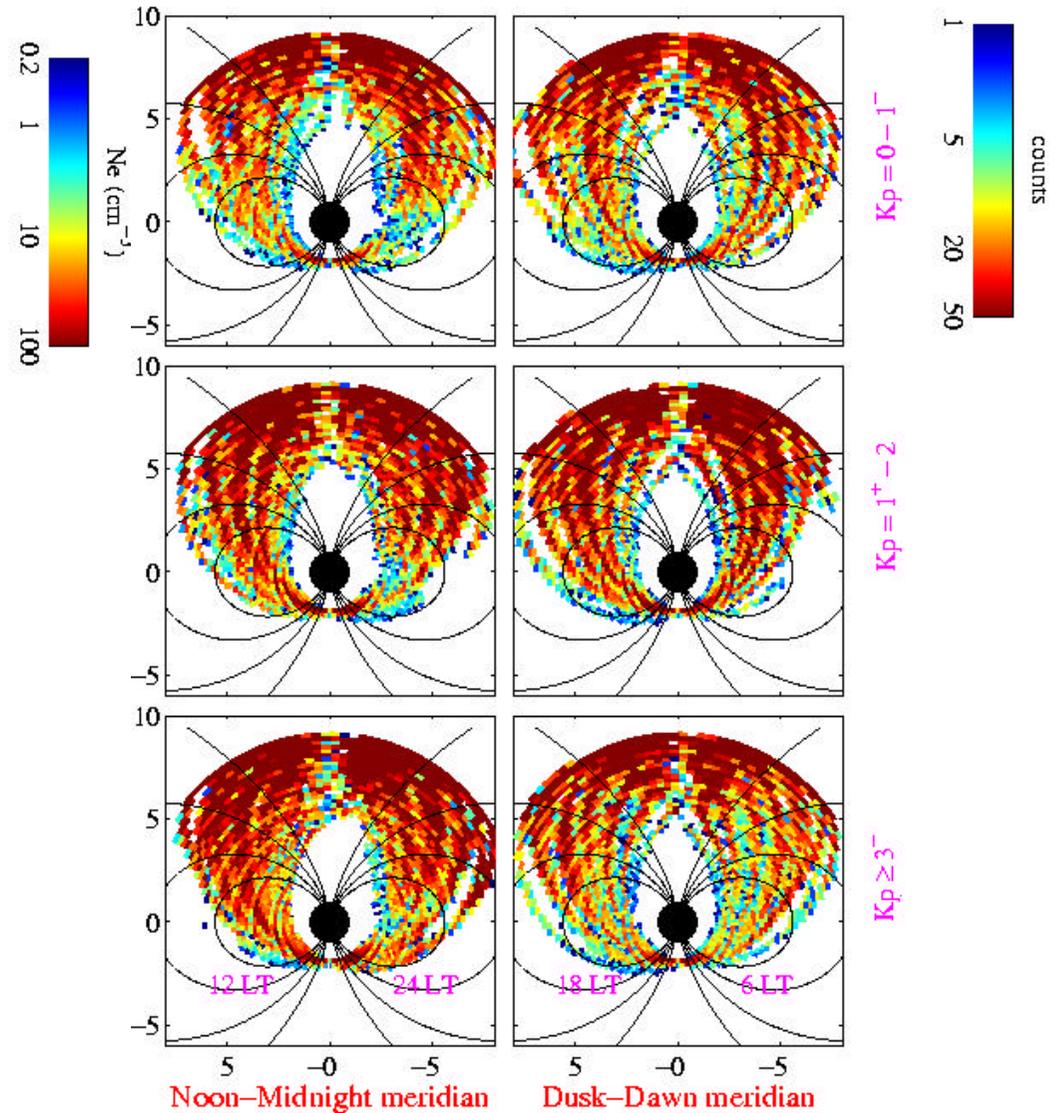
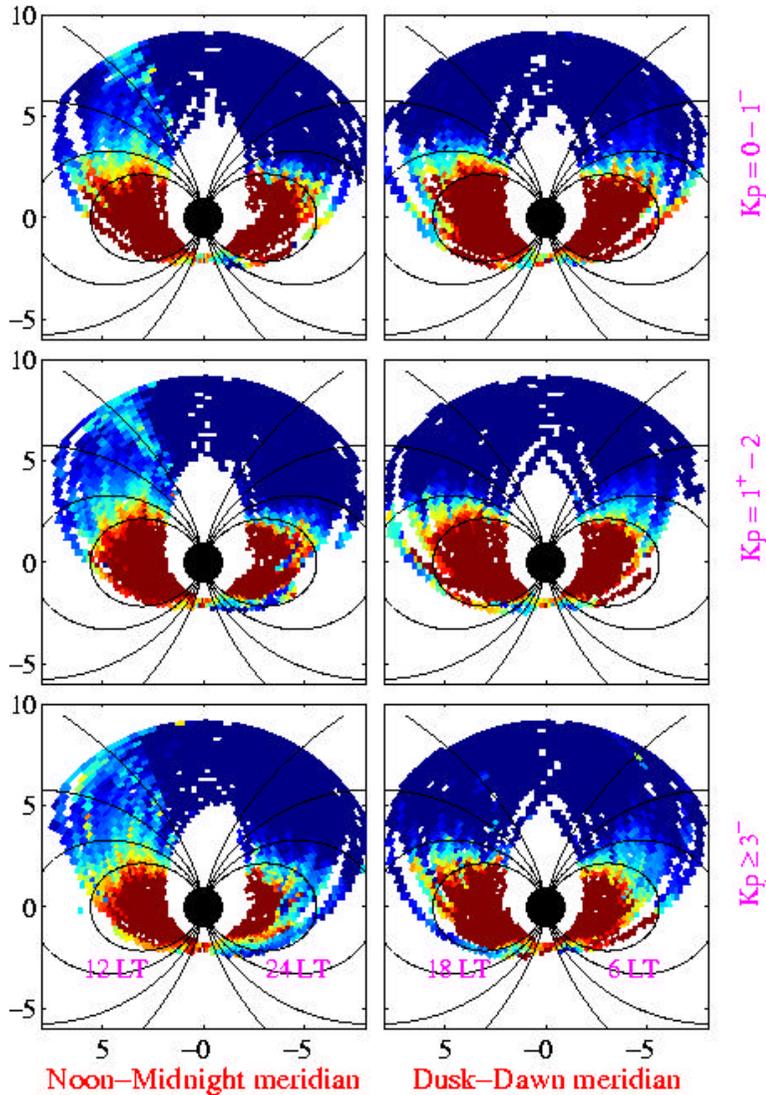
$$? V = V_1 - V_s$$

V_{sc} vs Electron Density

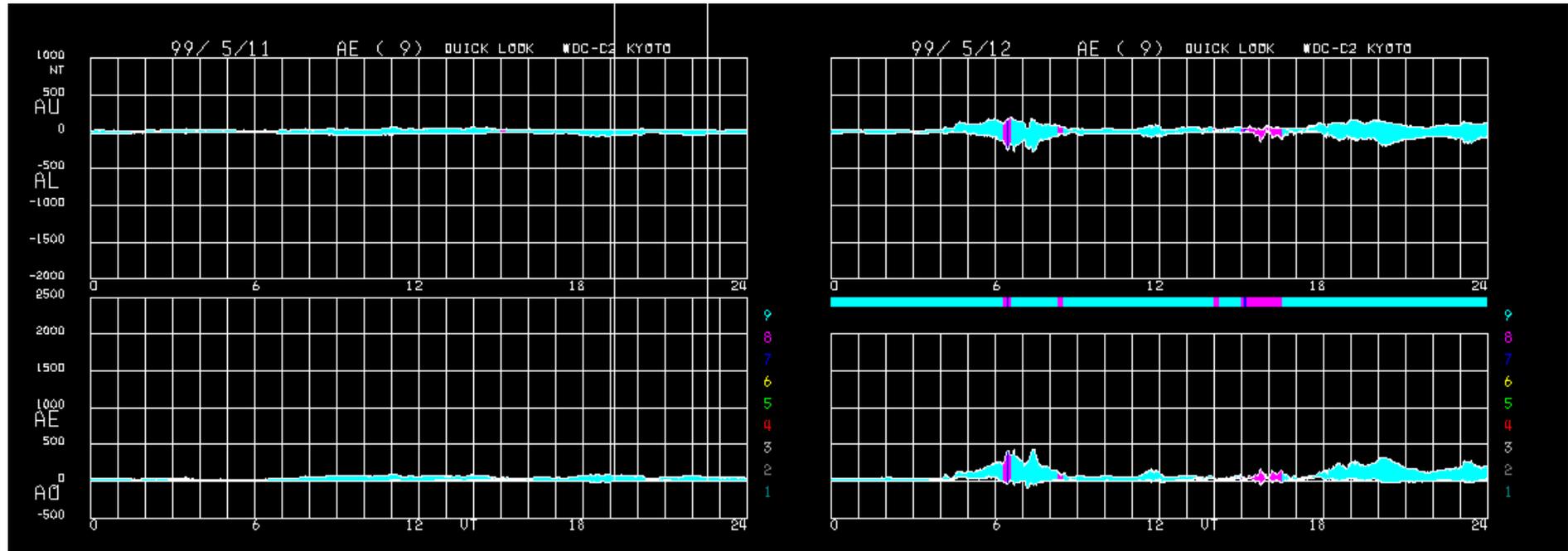


Average Electron Density

Polar EFI: April 1, 1996 – Dec 31, 1999

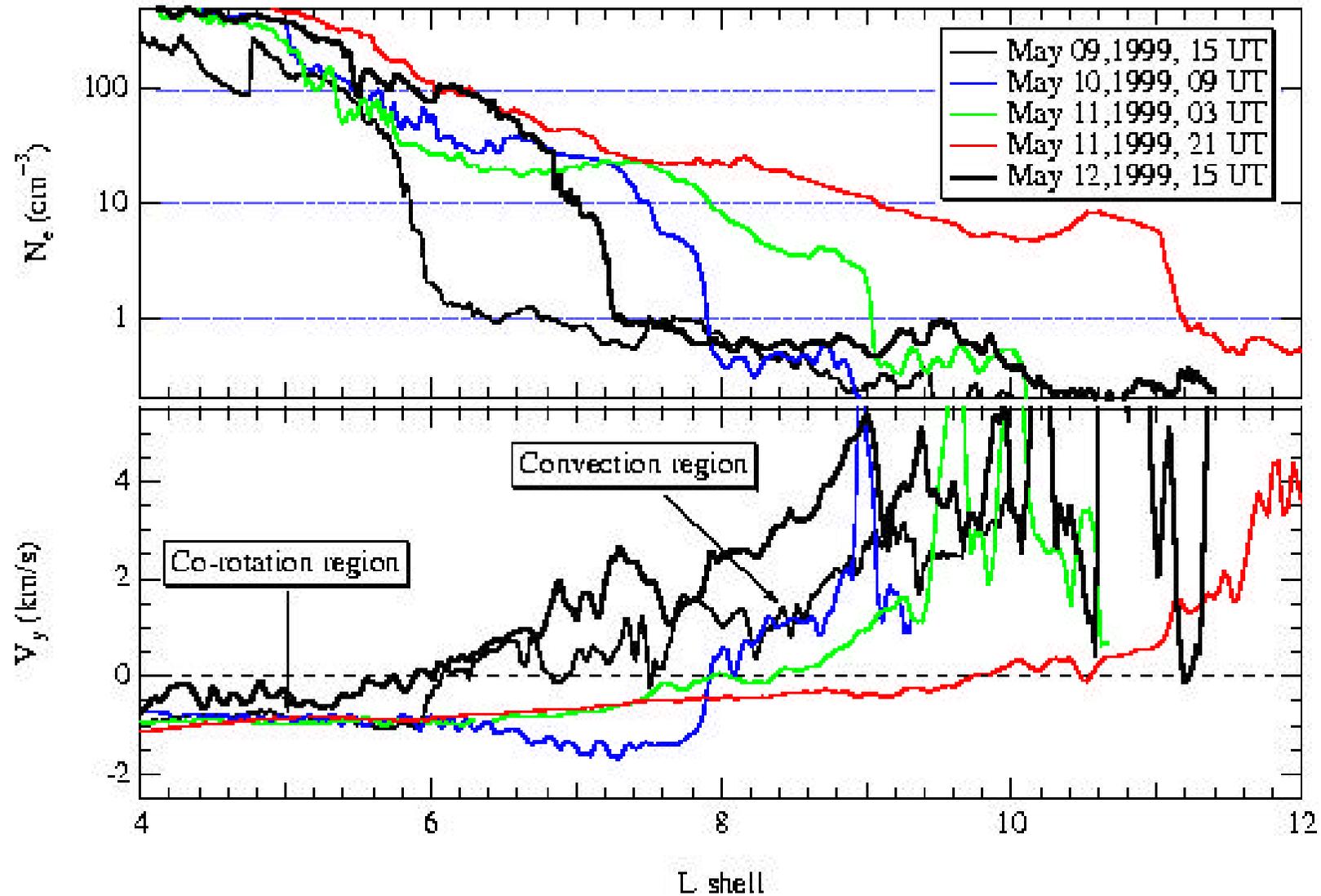


AE on May 11-12, 1999



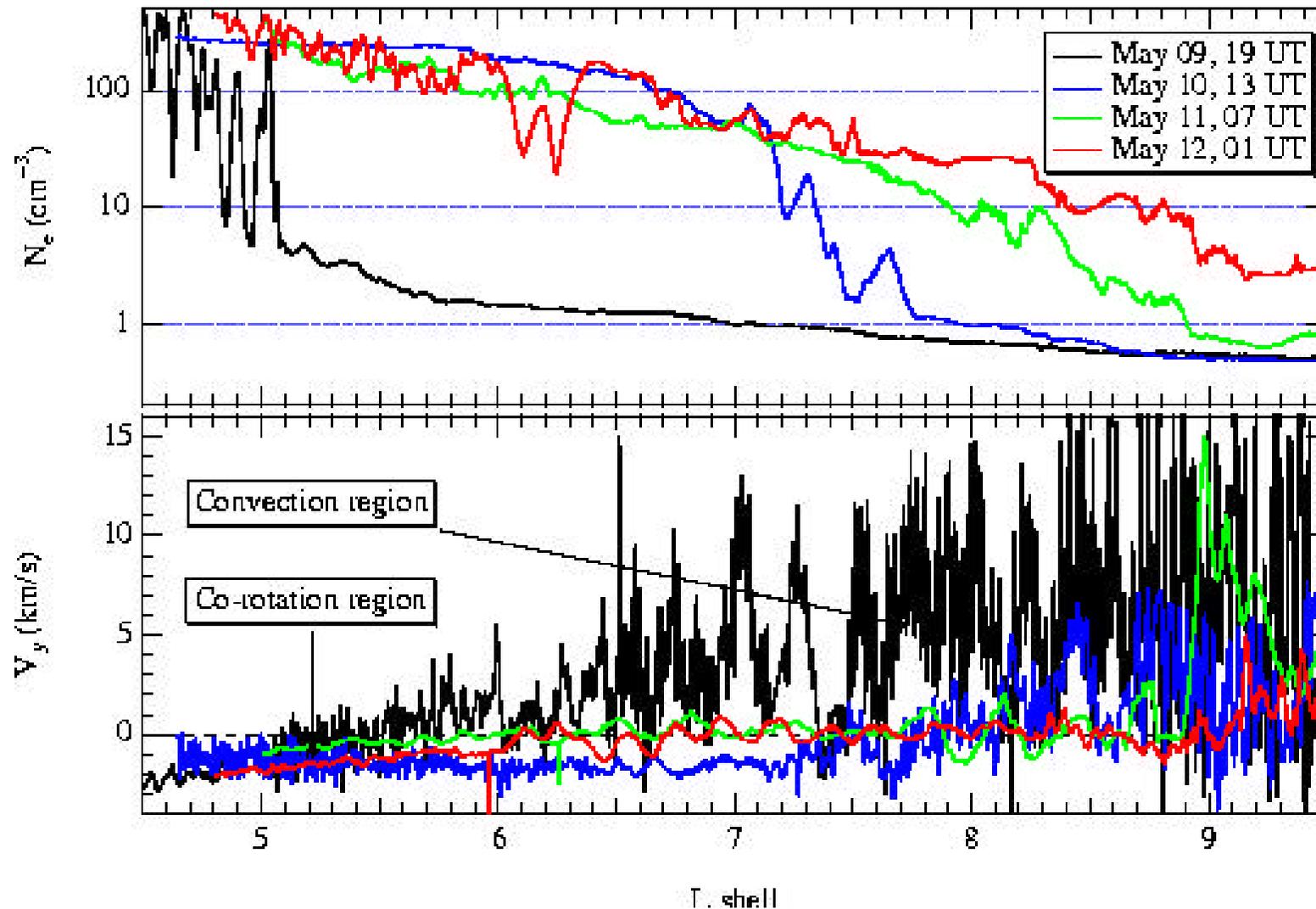
Plasmapause Evolution

Polar EFI experiment, 20–22 MLT sector



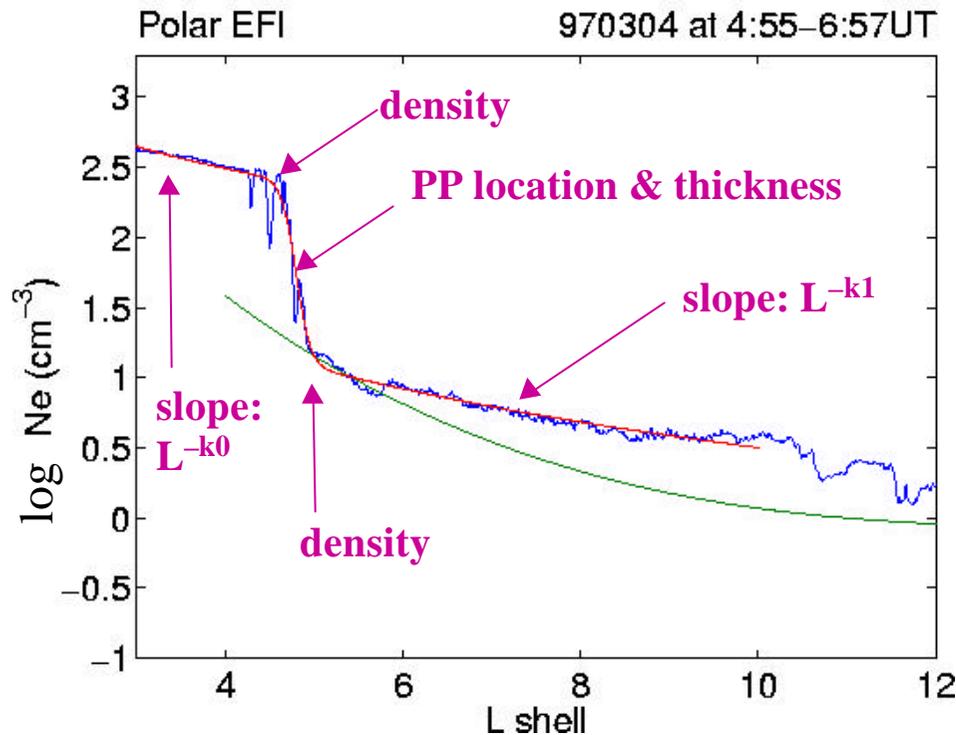
Plasmapause Evolution

Polar EFI experiment, 8–10 MLT sector



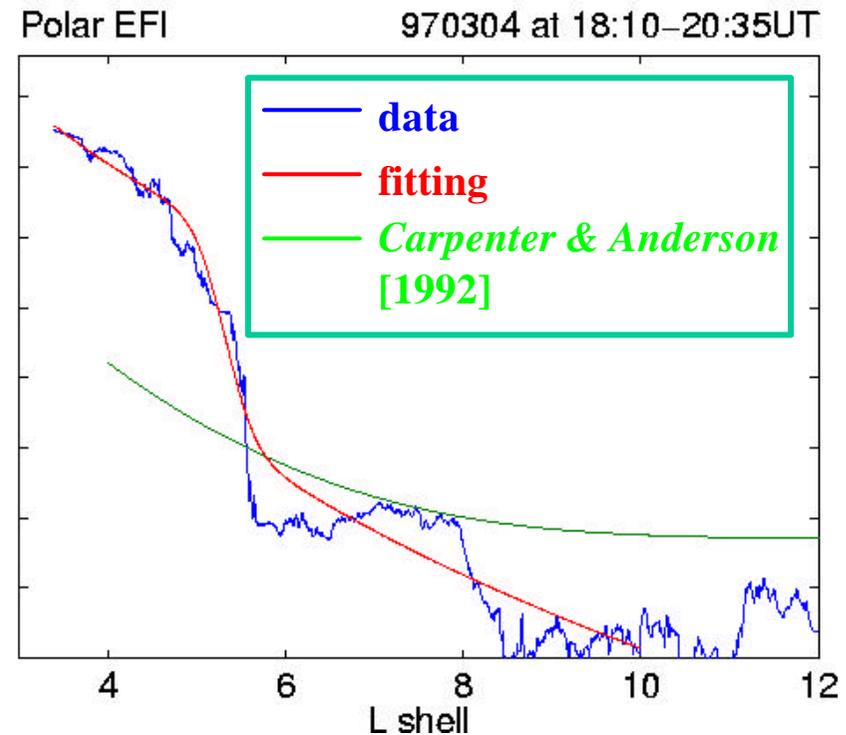
Simple plasmasphere/trough & good fitting

at 14.6 MLT & -7...40 mag.lat



Evolving plasmasphere/trough & bad fitting

at 2.3 MLT & 38...-17 mag.lat

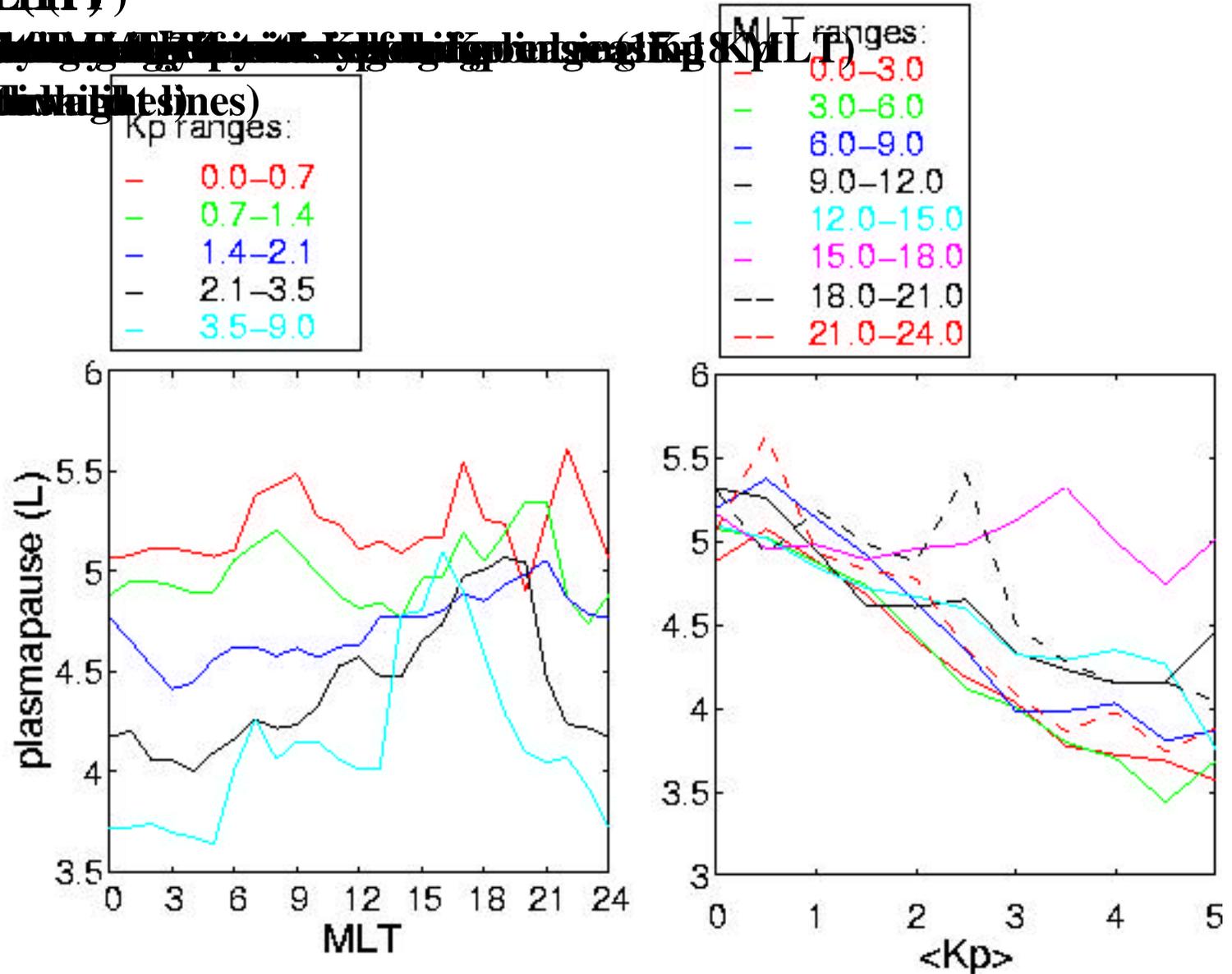


Plasmopause Location

Right hand panel (PPP)

- ~~Implication of $\langle Kp \rangle$ on the location of the plasmopause (100 km)~~

(co-parameterized lines)



plasmopause thickness

- widest at 12-21 MLT
- decreases with K_p
- very thin at 21-03 MLT for high K_p
- weak K_p dependence in duskside bulge

plasmopause location

- moves earthward with increasing K_p
- sunrise bulge at 6-9 MLT (also large thickness)
- duskside bulge at 12-18 MLT
- noon-midnight asymmetry increases with K_p
- dawn-dusk asymmetry increases with K_p

trough density profiles

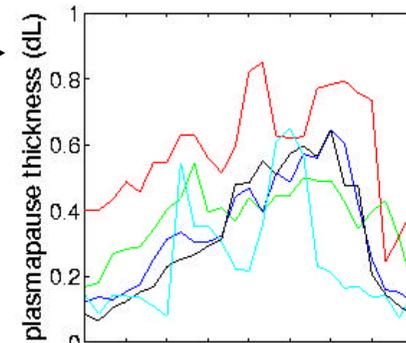
- strongly asymmetric with MLT at all K_p
- midnight ($k=5$) vs. noon ($k=2.5$)
- decreases with K_p , except in the bulges

Statistical analysis of Polar EFI data

- ? ~10,000 plasmopause crossings
- ? model fitting
- ? plasmopause location and thickness
 - K_p dependence
 - MLT dependence
- ? plasmasphere & trough density decline
 - K_p dependence
 - MLT dependence
- ? averages of the characteristics behave consistently, even though data points are strongly scattered (not shown)

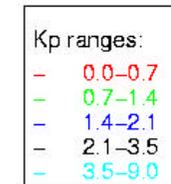
Plasmapause thickness

- large at 12-21 MLT
- largest in the bulge region
- bulge moves toward noon with rising Kp
- large PP anomaly around 9 MLT



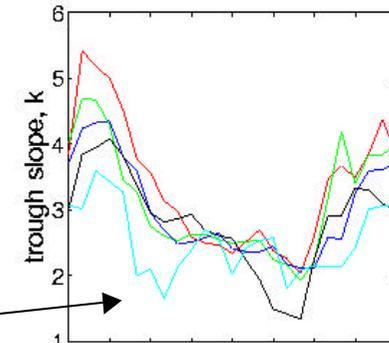
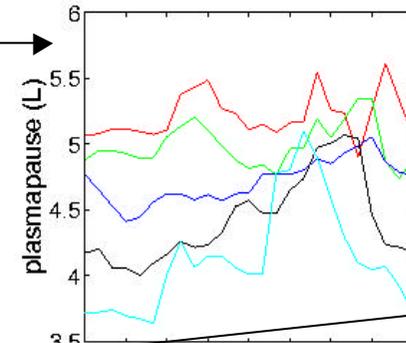
Polar EFI experiment

April 1, 1996 – December 31, 1999
(average of 3-hr Kp is used)



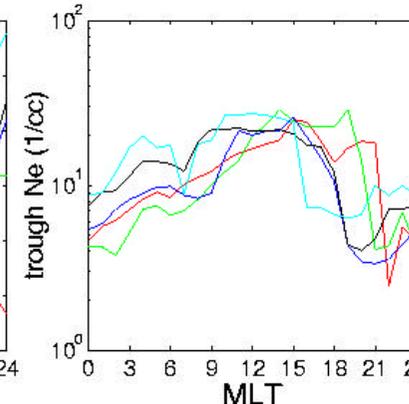
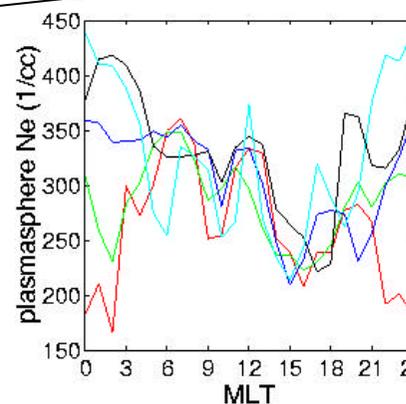
Plasmapause location

- symmetric for very low Kp
- morningside (7-10 MLT) bulge (?)
- PP moves earthward with increasing Kp
- evening bulge moves toward noon



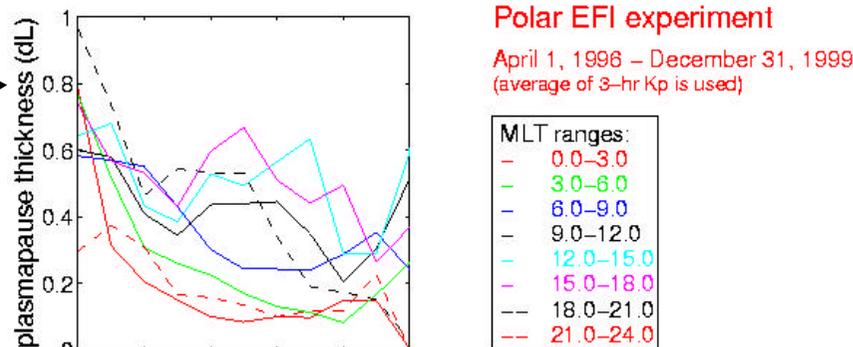
Trough slope k

- strongly asymmetric with MLT for all Kp
- large k (depends on Kp) at 21-6 MLT
- small k (independent of Kp) at 9-18 MLT



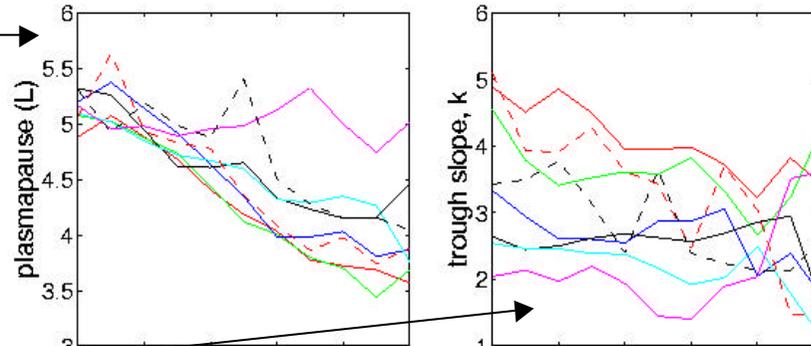
Plasmapause thickness

- steep decline with increasing K_p for $K_p = 0-2$
- PP very thin at 21-03 MLT for high K_p
- PP at 12-18 MLT varies least with K_p



Plasmapause location

- moves earthward linearly with K_p
- evening bulge (15-18 MLT) distance unchanged
- noon vs midnight asymmetry for increasing K_p
- dawn-dusk asymmetry for increasing K_p



Trough slope k

- midnight ($k=5$) vs. noon ($k=2.5$)
- generally decreases with K_p
- increases with high K_p at 15-18 MLT
- constant with K_p at 9-12 MLT

