The Plasmasphere Boundary Layer

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Ongoing questions about:

1. The processes involved in the formation of new boundary layers following quiet periods

2. The evolution of boundary layers in the aftermath of PBL formation

3. Variation in a boundary layer with distance along the geomagnetic field lines and with time
THE HOT/COLD PLASMA INTERFACE
Sub-Auroral Ion Drifts (SAID)

Anderson et al., 2001
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Density structure in the plasmapause profile

CRRES, orbit 140

Ne (el/cc)
PARTICLE PRECIPITATION IN THE PBL
Fig. 3.5. A 30-s segment of simultaneous recordings of (top) the X ray count rate for $E > 30$ keV, (middle) the integrated VLF amplitude from 0.6 to 5 kHz, and (bottom) the VLF spectrum from 0 to 5 kHz recorded at Siple, Antarctica, on January 2, 1971. The dashed line in the top panel refers to the cosmic ray background level of 175 counts/s [from Rosenberg et al., 1971].
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VLF WAVE ACTIVITY, OGO 2 at ~1150 km

SAR ARC LOCATION
Density structure in the plasmapause profile

CRRES, orbit 140

Ne (el/cc)
Kp ~ 3

- Slightly elevated Kp causes “islands” of cold plasma
High Densities in the Magnetosheath

• Magnetosheath and outer magnetosphere have similar densities
• Cold plasma observed in L range of 8-12
Why has it taken us ~40 years to “discover” the PBL?
“……we have yet another fascinating boundary problem in plasma physics to solve. The understanding of the structure, stability and formation of the plasmapause involves……an understanding of the interaction between electromagnetic forces, inertial forces and gravity; furthermore, collective particle effects, such as pressure gradients, field-aligned currents and interaction with waves, all play an important role not only for the microscopic physics but also for the macroscopic particle transport phenomena.”