FINAL REPORT

Grant NAG8-134

SPACE PLASMA PHYSICS RESEARCH

July 1, 1989 - December 30, 1992

by

Richard H. Comfort

and

James L. Horwitz

Prepared for

National Aeronautics and Space Administration
George C. Marshall Space Flight center
Marshall Space Flight Center, Alabama 35812

Submitted by

The University of Alabama in Huntsville
College of Science and
Center for Space Plasma and Aeronomic Research
Huntsville, Alabama 35899

January, 1993

INTRODUCTION

During the course of this grant, we have worked on a variety of topics and have a number of significant accomplishments. These have been documented in publications and presented to the scientific community in a variety of forums. Since we have also submitted extended discussions in the progress reports, the discussion below is limited to a summary of significant accomplishments, followed by chronological listings of the publications and presentations which have resulted from research supported in part under this grant.

ANALYSIS TECHNIQUES AND SOFTWARE DEVELOPMENT

Empirical Model Data Base

We have participated extensively in the efforts to develop an empirical model of the plasmasphere from observations made by the Retarding Ion Mass Spectrometer (RIMS) on Dynamics Explorer 1 (DE1). As part of this effort the thin sheath formulation was completely reworked to incorporate two additional features. First, the energy dependence of the solid angle was included, using calibration data to provide values for the relevant parameters of the different ion species. Then the instrument response function was modeled and included. The first modification affects all ion species, while the latter has practical consequences only for the heavy ions with the smaller response range. Both features were developed analytically so that they were easily implemented in the current computer codes. This has had particular benefits for improving the accuracy of analysis of the heavy ion species.

In conjunction with the empirical model group, we have developed a complete set of procedures for using end head energy analysis in conjunction with radial head spin analysis to optimize and make consistent our analysis of all ion species for the time frame following the development of the anomaly in the radial head operation. Each step has been extensively tested and compared with radial head results for times when that head was at full operation. The procedures implemented are as accurate as we can make them.

Data Reduction for Archiving

Students working under this grant have completed the integration and conversion of data from telemetry tapes to the mission analysis files usable by scientists for data analysis. All data on hand have been processed and resulting files have been archived on optical disk. This was a major milestone for RIMS data analysis and for the archiving effort. This has resulted in a significant improvement in the capability for undertaking statistical studies which examine data from the entire RIMS data set.

SCIENTIFIC INVESTIGATIONS

Semikinetic Modeling of Low Energy Plasma in the Inner Terrestrial Magnetosphere and Ionosphere

During the course of this grant we have developed a new time dependent plasma modeling technique. It is referred to as a semikinetic model since the ions are described in a kinetic fashion using some of the standard particle-in- cell techniques, while the electrons are modeled by using ordinary transport equations. The first, and simplest version of this model was used to study the outflow of polar ionospheric plasma along open field lines [Ref. 3, 9, 20]. Later the polar outflow model was upgraded to include a field-aligned current and wave-particle interaction effects. With these improvements Brown et al. [Ref. 8] studied the effects of waves produced by the current-driven electrostatic ion cyclotron instability and was able to produce O^+ and H^+ conics in a self consistent fashion. The model has also been applied to the study of early time kinetic effects occurring during the refilling and re-establishment of the plasmasphere following a magnetic storm [Ref. 10,18]. The effects of Coulomb collisions on the refilling process were also studied [Ref. 17]. The semikinetic model, with Coulomb collisions incorporated, has been applied to the study of this transition region [Ref. 17] for H^+ ions outflowing through an O^+ background.

O^+ Outflows

We have utilized measurements of core(0-50 eV) and energetic ion composition, plasma waves, and auroral images from DE-1, and plasma ions and electrons from DE-2 to examine some of their properties in the context of the polar cap environment. It is found that two distinct populations of O^+ beams are observed: 'high-speed' (10-30 eV or higher streaming energies) and 'low-speed' (generally ≤ 10 eV streaming energies). The 'high-speed' polar beams show an 'auroral' connection, i.e., they are observed on or near field lines threading the dark polar cap and may be convected from the cleft ion fountain. The low-speed streams are generally much more stable in energy and flux, while the high-speed streams tend to be bursty. In general, the streams are convecting anti-sunward, with velocities of 5-14 km/s in the orbital plane. Plasma wave measurements generally indicated little auroral hiss in the polar cap for the cases examined; however, one case showed densities in the range 1-5 e/cm^3. Estimates of electrostatic potential drops above the DE-2 satellite have been made using the energy-angle spectrograms of DE-2/LAPI atmospheric photoelectron data. Potential drops often are in the 20-40 volt range. At other times the potential falls below the ~5 volt instrument threshold or there are insufficient photo-electron fluxes for estimation. There is a suggestion of a trend for the largest potential drops to be just poleward of the cleft and a decline of the magnitude of the drop in the anti-sunward direction. No obvious correlation between the potential estimates and 'nearby' O^+ streaming energies is seen.

We have also begun to address the statistical properties of outflowing O^+ through bulk parameter analysis of DE1/RIMS observations when DE1 was in the mid altitude polar cap magnetosphere. We have selected a technique which relies on analysis of the DE1 radial head RPA data near the magnetic field direction for obtaining the O^+ bulk parameters of density, temperature and flow velocity from these measurements. We have so far analyzed four passes and tested our technique with reasonably good assurance regarding the derived parameters. Initial results were presented at the San Francisco AGU meeting [Ref. 78].

Equatorial Plasma Trough

We are presently conducting a statistical study of the properties of the transition between the trapped and field-aligned ion fluxes in the equatorial region, using RIMS core ion data from DE1 orbits which nearly "skim" along the L=4.6 shell. In this very preliminary study, we have identified and considered statistical trends in four parameters for 44 latitudinal transition events. Indicated trends at this stage include the following:

1. Transition latitudes occur at latitudes below 14°, and about 20% of these occur very close to the equator at $\Lambda \leq 2°$.
2. A broad range of equatorial ion anisotropies are seen, but the typical values would be consistent with bi-Maxwellian temperature ratios of $T_\perp/T_\parallel$ of about 2.
3. The latitudinal scales for the edges of the trapped ion populations display a rather strong peak in the 2-4° range.
4. It appears that there might be two distinct general classes of events based on penetration ratio, broadly for $P \leq 0.5$, indicating relatively strong decrease of flux beyond the transition region toward the equator, and $P \geq 0.5$, indicating lesser inhibition of the incoming flux.
5. There is a clear trend for the penetration ratios to decrease with higher equatorial trapped ion anisotropy. This may be interpreted in terms of larger equatorial anisotropies being associated with larger positive electric potential peaks, leading to greater repulsion and flux diminishment of incoming field-aligned ion streams from reaching the equator, hence the decrease of the penetration ratio.

Plasma Wave Ray-Tracing Studies

With support from this grant we have made extensive modifications to an existing plasma wave raytracing code developed by S. D. Shawhan and J. L. Green. We replaced the dipole magnetic field with the Mead-Fairfield model. We also replaced the diffusive equilibrium plasma distribution model with empirical models developed by D. L. Gallagher and A. Persoon, and added He^+ and O^+ in a rudimentary plasma composition model. A number of diagnostics were added, with particular emphasis on assessing the validity of the WKB approximation.

The model has been used to examine Pc3 waves and Pc1,2 waves launched at the dayside equatorial magnetopause. Results have shown that the inclusion of O^+ and He^+ in the plasma composition has a critical effect on the propagation of compressional waves for these ULF frequencies. Pc3 results have been submitted for publication [Ref. 24]

MEETINGS

In addition to presenting results at many different meetings, we also participated in convening them and contributing extensively to them. Among these were: The Second Huntsville Workshop on Magnetosphere/Ionosphere Models, held at UAH on October 11-13, 1989 [Ref. 9-12; Ref 25-29]; The Workshop on Plasmasphere Refilling, held at UAH on October 15-16, 1990 [Ref. 15-18; Ref. 39-41]; and the 3rd Huntsville Workshop on Magnetosphere-Ionosphere Models: Sources, Transport, Energization, and Loss of Magnetospheric Plasmas, held at Lake Guntersville State Park, October 5-8, 1992 [Ref. 64-74].

PUBLICATIONS

Papers Published (in chronological sequence)

1. Samir, U., R. H. Comfort, N. Singh, K. S. Hwang, and N. H. Stone, Insight into theory/experiment comparisons of wake measurements in the plasmasphere, *Planet. Space Sci., 37*, 873, 1989.
2. Newberry, I. T., R. H. Comfort, P. G. Richards, and C. R. Chappell, Thermal He^+ in the plasmasphere: comparison of observations with numerical calculations, *J. Geophys. Res., 94*, 15265, 1989.
3. Wilson, G. R., C. W. Ho, J. L. Horwitz, N. Singh, and T. E. Moore, A new kinetic model for time-dependent polar plasma outflow: initial results, *Geophys. Res. Lett., 17*, 263, 1990.
4. Horwitz, J. L., R. H. Comfort, and C. R. Chappell, A statistical characterization of plasmasphere structure and boundary locations, *J. Geophys. Res., 95*, 7937, 1990.
5. Horwitz, J. L., R. H. Comfort, P. G. Richards, M. O. Chandler, C. R. Chappell, P. Anderson, W. B. Hanson, and L. H. Brace, Plasmasphere-ionosphere coupling II: Ion composition measurements at plasmaspheric and ionospheric altitudes and comparison with modeling results, *J. Geophys. Res., 95*, 7949, 1990.
6. Saflekos, N. A., J. L. Burch, M. Sugiura, D. A. Gurnett, and J. L. Horwitz, Observations of reconnected flux tubes within the midlatitude cusp, *J. Geophys. Res., 95*, 8037, 1990.
7. Wilson, G. R., The plasma environment, charge state and currents of Saturn's C and D rings, *J. Geophys. Res., 96*, 9689, 1991.

8. Brown, D. G., J. L. Horwitz, G. R. Wilson, and D. L. Gallagher, 'Self-consistent' production of ion conics on return current region auroral field lines: A time-dependent, semi-kinetic model, *Geophys. Res. Lett.*, *18*, 1841, 1991.
9. Ho, C. W., J. L. Horwitz, and G. R. Wilson, Effects of sudden impulse in electron temperature on the polar wind: a time-dependent, semi-kinetic model, *AGU Monograph #62 Modeling Magnetospheric Plasma Processes*, p. 105, 1991.
10. Lin, J., J. L. Horwitz, G. R. Wilson, and C. W. Ho, An early-stage refilling model based on a kinetic approach with trapping due to ion heating and pitch-angle scattering, *AGU Monograph #62 Modeling Magnetospheric Plasma Processes*, p. 151, 1991.
11. Pollock, C. J., C. R. Chappell, J. L. Horwitz, and J. D. Winningham, Two-spacecraft observations of field-aligned electrostatic potential drops on polar cap field lines, *AGU Monograph #62 Modeling Magnetospheric Plasma Processes*, p. 111, 1991.
12. Craven, P. D., R. H. Comfort, D. L. Gallagher, R. West, Preliminary Empirical Model of Plasmaspheric Ion Temperatures from DE-1/RIMS, *AGU Monograph #62 Modeling Magnetospheric Plasma Processes*, p. 173, 1991.
13. Horwitz, J. L., T. E. Moore, B. L. Giles, G. R. Wilson, C. W. Ho, J. Lin and K. R. Swinney, Kinetic features of core plasmas in the magnetosphere A new generation of observations and simulations, *J. Geomag. Geol.*, *43*, 275, 1991.
14. Comfort, R. H., and M. O. Chandler, Semi-empirical analytical model for the spin modulation of RPA fluxes, *J. Spacecraft Rock.*, *27*, 577, 1991.
15. Horwitz, J. L., and N. Singh, Forward (to JGR special issue on plasmasphere refilling), *J. Geophys. Res.*, *97*, 1047, 1992.
16. Singh, N., and J. L. Horwitz, Plasmasphere refilling: Recent observations and modeling, *J. Geophys. Res.*, *97*, 1049, 1992.
17. Wilson, G. R., J. L. Horwitz, and J. Lin, A semikinetic model for early stage plasmasphere refilling, 1: Effects of Coulomb collisions, *J. Geophys. Res.*, *97*, 1109, 1992.
18. Lin, J., J. L. Horwitz, G. R. Wilson, C. W. Ho, and D. G. Brown, A semikinetic model for early stage plasmasphere refilling, 2: Effects of wave-particle interactions, *J. Geophys. Res.*, *97*, 1121, 1992.
19. Horwitz, J. L., C. J. Pollock, T. E. Moore, W. K. Peterson, J. L. Burch, J. D. Winningham, J. D. Craven, L. A. Frank, and A. Persoon, The polar cap environment of outflowing O^+, *J. Geophys. Res.*, *97*, 8361, 1992.
20. Ho, C. W., J. L. Horwitz, N. Singh, G. R. Wilson, and T. E. Moore, Effects of magnetospheric electrons on polar plasma outflow: A semikinetic model, *J. Geophys. Res.*, *97*, 8425, 1992.
21. Wilson, G. R., Semikinetic modeling of the outflow of ionospheric plasma through the topside collisional to collisionless transition region, *J. Geophys. Res.*, *97*, 10551, 1992.
22. Ho, C. W., J. L. Horwitz, N. Singh, and G. R. Wilson, Comparison of generalized transport and semikinetic model: prediction for evolution of a density enhancement in the polar wind, *Geoplasma Workshop Proceedings*, in press, 1992.
23. Ho, C. W., J. L. Horwitz, N. Singh, and G. R. Wilson, Plasma expansion in evolution of density perturbations in the polar wind: comparison of semikinetic and transport models, submitted to *J. Geophys. Res.*, 1992.

24. Zhang, X., R. H. Comfort, Z. E. Musielak, T. E. Moore, D. L. Gallagher, and J. L. Green, Propagation characteristics of Pc3 compressional waves generated at the dayside magnetopause, submitted to *J. Geophys. Res.*, 1992.

Papers Presented to Scientific Meetings

25. Ho, C. W., J. L. Horwitz, and G. R. Wilson, A time-dependent kinetic model of polar plasma outflow: initial results, presented to the Second Huntsville Workshop on Magnetosphere/Ionosphere Plasma Models, Huntsville, AL, October 11-13, 1989.
26. Lin, J., J. L. Horwitz, and K.-S. Hwang, Toward a kinetic model of the early-stage refilling of the plasmasphere: effect of turbulent heating and pitch-angle scattering, presented to the Second Huntsville Workshop on Magnetosphere/Ionosphere Plasma Models, Huntsville, AL, October 11-13, 1989.
27. Pollock, C. J., C. R. Chappell, J. L. Horwitz, and J. D. Winningham, Occurrence and effects of field-aligned electrostatic potential drops above the ionospheric polar caps, presented to the Second Huntsville Workshop on Magnetosphere/Ionosphere Plasma Models, Huntsville, AL, October 11-13, 1989.
28. Horwitz, J. L., R. H. Comfort, and C. R. Chappell, A Statistical Characterization of Plasmasphere density Structure and Boundary Locations, presented to the Second Huntsville Workshop on Magnetosphere/Ionosphere Plasma Models, Huntsville, AL, October 11-13, 1989.
29. Craven, P. D., R. H. Comfort, D. L. Gallagher, R. West, Preliminary Empirical Model of Plasmaspheric Ion Temperatures from DE-1/ RIMS, presented to the Second Huntsville Workshop on Magnetosphere/Ionosphere Plasma Models, Huntsville, AL, October 11-13, 1989.
30. Lin, J., J. L. Horwitz, and G. R. Wilson, An early-stage refilling model based on a "kinetic" approach with trapping due to turbulent ion heating, EOS, 70, 1297; presented to the Fall Meeting of the American Geophysical Union, San Francisco, CA, December 4-8, 1989.
31. Ho, C. W., J. L. Horwitz, and G. R. Wilson, A new time-dependent one-dimensional kinetic polar plasma outflow model, EOS, 70, 1291; presented to the Fall Meeting of the American Geophysical Union, San Francisco, CA, December 4-8, 1989.
32. Horwitz, J. L., R. H. Comfort, P. G. Richards, M. O. Chandler, C. R. Chappell, P. Anderson, W. B. Hanson, and L. H. Brace, Plasmasphere-ionosphere coupling II: ion composition measurements at plasmaspheric and ionospheric altitudes and comparison with modeling results, EOS, 70, 1297; presented to the Fall Meeting of the American Geophysical Union, San Francisco, CA, December 4-8, 1989.
33. Comfort, R. H., P. G. Richards, J. L. Horwitz, P. C. Craven, M. O. Chandler, and C. R. Chappell, Ion characteristics of thin plasmasphere boundary layers, presented to the 1990 Yosemite Meeting on Transition Regions in Solar System Plasmas, Yosemite National Park, CA, February 6-9, 1990.
34. Comfort, R. H., P. G. Richards, M. O. Chandler, P. D. Craven, C. R. Chappell, J. U. Kozyra, Ion characteristics of thin plasmasphere boundary layers: observations vs. theory, *EOS, 71*, 615, 1990; presented to the Spring Meeting of the American Geophysical Union, Baltimore, MD, May 29 - June 1, 1990.

35. Singh, N., C. W. Ho, J. L. Horwitz, and G. R. Wilson, Evolution of density perturbations in kinetic and hydrodynamic models of polar plasma outflow, *EOS, 71*, 599, 1990; presented to the Spring Meeting of the American Geophysical Union, Baltimore, MD, May 29 - June 1, 1990.

36. Ho, C. W., J. L. Horwitz, G. R. Wilson, N. Singh, and T. E. Moore, Magnetospheric electron effects on polar plasma outflow, *EOS, 71*, 599, 1990; presented to the Spring Meeting of the American Geophysical Union, Baltimore, MD, May 29 - June 1, 1990.

37. Wilson, G. R. The Saturnian ring-ionosphere plasma environment, presented at Magnetospheres of the Outer Planets, Fred Scarf Memorial Symposium, Annapolis, MD, August 20-24, 1990.

38. Wilson, G. R., and D. L. Gallagher, Electrostatic oscillations in thin, dense dust clouds, 4th Workshop on Dusty Plasmas, Iowa City, IA, September 11-13, 1990.

39. Horwitz, J. L., Toward a 'quasi-empirical' scenario for plasmasphere refilling from recent thermal ion measurements, presented to the Workshop on Plasmasphere Refilling, Huntsville, AL, October 15-16, 1990.

40. Lin, J., J. L. Horwitz, G. R. Wilson, and C. W. Ho, A model for early-stage plasmasphere refilling based on a kinetic approach with wave-particle interactions, presented to the Workshop on Plasmasphere Refilling, Huntsville, AL, October 15-16, 1990.

41. Comfort, R. H., P. G. Richards, P. D. Craven, D. L. Gallagher, and C. R. Chappell, Early-stage refilling plasma characteristics from observations of thin plasmasphere boundary layers, presented to the Workshop on Plasmasphere Refilling, Huntsville, AL, October 15-16, 1990.

42. Horwitz, J. L., C. J. Pollock, T. E. Moore, W. K, Peterson, J. L. Burch, J. D. Winningham, J. D. Craven, L. A. Frank, and A. Persoon, On outflowing O^+ beams in the polar cap regions, *EOS, 71*, 1493, 1990; presented to the Fall Meeting of the American Geophysical Union, San Francisco, CA, December 3-7, 1990.

43. Brown, D. G., J. L. Horwitz, G. R. Wilson, and D. L. Gallagher, Effects of currents on polar plasma outflow: A time-dependent, semi-kinetic description, *EOS, 71*, 1494, 1990; presented to the Fall Meeting of the American Geophysical Union, San Francisco, CA, December 3-7, 1990.

44. Brown, D. G., G. R. Wilson, J. L. Horwitz, and D. L. Gallagher, A 'self-consistent' kinetic model of plasma heating and transport on auroral field lines, *EOS, 72*, 252; presented to the Spring Meeting of the American Geophysical Union, Baltimore, MD, May 28-31, 1991.

45. Wilson, G. R., J. L. Horwitz, J. Lin, The effects of Coulomb self collisions on the refilling of a plasmaspheric flux tube: A kinetic perspective, *EOS, 72*, 252; presented to the Spring Meeting of the American Geophysical Union, Baltimore, MD, May 28-31, 1991.

46. Comfort, R. H., J. L. Horwitz, P. D. Craven, and C. R. Chappell, Characteristic refilling rates in the plasmatrough from observations by DE-1/RIMS, *EOS, 72*, 234; presented to the Spring Meeting of the American Geophysical Union, Baltimore, MD, May 28-31, 1991.

47. Zhang, X., R. H. Comfort, Z. Musielak, T. E. Moore, D. L. Gallagher, J. L. Green, Ray-tracing of ULF waves generated at the magnetopause, *EOS, 72*, 254; presented to the Spring Meeting of the American Geophysical Union, Baltimore, MD, May 28-31, 1991.

48. Craven, P. D., R. H. Comfort, and P. G. Richards, A comparison of models and observations of plasmaspheric N^+, *EOS, 72*, 252; presented to the Spring Meeting of the American Geophysical Union, Baltimore, MD, May 28-31, 1991.

49. Comfort, R. H., P. D. Craven, D. L. Gallagher, C. R. Chappell, and R. L. West, Survey of thermal O+ temperatures observed in and near the plasmasphere by DE-1/RIMS, presented to the XX General Assembly of the International Union of Geodesy and Geophysics/ International Association of Geomagnetism and Aeronomy, Vienna, Austria, August 11-24, 1991.
50. Gallagher, D. L., P. D. Craven, and R. H. Comfort, A composite empirical model of magnetospheric plasma, presented to the XX General Assembly of the International Union of Geodesy and Geophysics/ International Association of Geomagnetism and Aeronomy, Vienna, Austria, August 11-24, 1991.
51. Wilson, G. R., Semikinetic modeling of the topside ionosphere- magnetosphere transition region, *EOS, 72*, 401, 1991; presented to the Fall Meeting of the American Geophysical Union, San Francisco, CA, December 9-13, 1991.
52. Singh, N., G. R. Wilson, and J. L. Horwitz, Comparison between hydrodynamic and semi-kinetic models for plasmaspheric refilling, *EOS, 72*, 401, 1991; presented to the Fall Meeting of the American Geophysical Union, San Francisco, CA, December 9-13, 1991.
53. Grebowsky, J. M., P. D. Craven, C. S. Jenson, P. G. Richards, and R. H. Comfort, Comparison of topside F region field aligned plasma flows within and outside the plasmasphere, *EOS, 72*, 401, 1991; presented to the Fall Meeting of the American Geophysical Union, San Francisco, CA, December 9-13, 1991.
54. Giles B. L., C. R. Chappell, T. E. Moore, and R. H. Comfort, Low-energy plasma outflow in the auroral zone, polar cap, and cusp, *EOS*, *73*, 258, 1992; presented to the Spring Meeting of the American Geophysical Union, Montreal, Canada, May 12-16, 1992.
55. Kozyra, J. U., V. Jordanova, R. H. Comfort, D. C. Hamilton, D. M. Klumpar, W. K. Peterson, and D. W. Slater, The role of the composition and energy characteristics of the ring current in modulating SAR arc intensities, *EOS*, *73*, 258, 1992; presented to the Spring Meeting of the American Geophysical Union, Montreal, Canada, May 12-16, 1992.
56. Horwitz, J. L., G. R. Wilson, J. Lin, D. G. Brown, and C. W. Ho, Plasma transport in the ionosphere-magnetosphere system using semikinetic models, presented at 18th Rarefied Gas Dynamics Symposium in Vancouver, Canada, July, 1992.
57. Horwitz, J. L., G. R. Wilson, and N. Singh, Plasmasphere refilling: A starting point for understanding magnetosphere-ionosphere coupling, presented to the Workshop on "Controversial Issues and New Frontier Research in Geoplasmas", Cambridge, Mass, August 1992.
58. Ho, C. W., J. L. Horwitz, N. Singh, and G. R. Wilson, Comparison of time-dependent semikinetic and hydrodynamic polar wind models: Initial polar wind expansion, density cavities and density enhancements, presented at Workshop on "Controversial Issues and New Frontier Research in Geoplasmas", Cambridge, Mass, August 1992.
59. Lin, J. , J. L. Horwitz, G. R. Wilson, and D. G. Brown, Early stage plasmasphere refilling: effects of spatial and temporal variations in ion and electron heating and ionospheric inflow, presented at Workshop on "Controversial Issues and New Frontier Research in Geoplasmas", Cambridge, Mass, August 1992.
60. Wilson, G. R. J. L. Horwitz, and J. Lin, Semikinetic modeling of plasma flow on outer plasmaspheric field lines, presented to the 29th COSPAR Meeting, Washington, DC, August 28-September 5, 1992.

61. Wilson, G. R., The electrostatic charging of ring dust clouds, presented to the 29th COSPAR Meeting, Washington, DC, August 28-September 5, 1992.
62. Zhang, X., R. H. Comfort, Z. Musielak, T. E. Moore, D. L. Gallagher, and J. L. Green, Propagation characteristics of Pc3 compressional waves generated at the dayside magnetopause, to be presented to the Chapman Conference on Solar Wind Sources of Magnetospheric ULF Waves, Williamsburg, VA, September 14-18, 1992.
63. Boardsen, S. A., and Comfort, R. H., Effects of hot plasmas and heavy ions on ULF wave propagation in the dayside magnetosphere, to be presented to the Chapman Conference on Solar Wind Sources of Magnetospheric ULF Waves, Williamsburg, VA, September 14-18, 1992.
64. Comfort, R. H., P. G. Richards, T. W. Garner, and C. R. Chappell, Field-aligned temperature and density structure in the plasmasphere: implications for parallel particle and energy transport, presented to the 3rd Huntsville Workshop on Magnetosphere-Ionosphere Plasma Models: Sources, Transport, Energization, and Loss of Magnetospheric Plasmas, Guntersville, AL, October 5-8, 1992.
65. Wilson, G. R., J. L. Horwitz, C. W. Ho, D. G. Brown, R. W. Schunk, and A. R. Barakat, Recent theoretical progress in the study of the outflow of core plasma from the high latitude ionosphere, presented to the 3rd Huntsville Workshop on Magnetosphere-Ionosphere Plasma Models: Sources, Transport, Energization, and Loss of Magnetospheric Plasmas, Guntersville, AL, October 5-8, 1992.
66. Craven, P. D. C. R. Chappell, R. H. Comfort, P. G. Richards, J. Grebowsky, Comparison of a physical plasmaspheric model (FLIP) with measured ionospheric/plasmaspheric plasma composition and temperature, presented to the 3rd Huntsville Workshop on Magnetosphere-Ionosphere Plasma Models: Sources, Transport, Energization, and Loss of Magnetospheric Plasmas, Guntersville, AL, October 5-8, 1992.
67. Garner, T. W., P. G. Richards, R. H. Comfort, and M. E. Hagan, Winter electron temperature anomaly over Millstone Hill: signature of plasmaspheric processes, presented to the 3rd Huntsville Workshop on Magnetosphere-Ionosphere Plasma Models: Sources, Transport, Energization, and Loss of Magnetospheric Plasmas, Guntersville, AL, October 5-8, 1992.
68. Ho, C. Wing, J. L. Horwitz, N. Singh, and G. R. Wilson, Comparison of semikinetic and hydrodynamic models in the study of time-dependent phenomena in the polar wind, presented to the 3rd Huntsville Workshop on Magnetosphere-Ionosphere Plasma Models: Sources, Transport, Energization, and Loss of Magnetospheric Plasmas, Guntersville, AL, October 5-8, 1992.
69. Wilson, G. R., The outflow of O+ through the topside transition region, presented to the 3rd Huntsville Workshop on Magnetosphere-Ionosphere Plasma Models: Sources, Transport, Energization, and Loss of Magnetospheric Plasmas, Guntersville, AL, October 5-8, 1992.
70. Wilson, G. R., Instrumentation for magnetospheric imaging, presented to the 3rd Huntsville Workshop on Magnetosphere-Ionosphere Plasma Models: Sources, Transport, Energization, and Loss of Magnetospheric Plasmas, Guntersville, AL, October 5-8, 1992.
71. Lin, J., J. L. Horwitz, D. G. Brown, and G. R. Wilson, Hemispheric "decoupling in plasmasphere refilling by equatorial ion and electron heating, presented to the 3rd Huntsville Workshop on Magnetosphere-Ionosphere Plasma Models: Sources, Transport, Energization, and Loss of Magnetospheric Plasmas, Guntersville, AL, October 5-8, 1992.

72. Brown, D. G., G. R. Wilson, and J. L. Horwitz, Synergism of magnetospheric particle anisotropies and wave heating in auroral ion beam formation and the "pressure cooker": a dynamic semikinetic model, presented to the 3rd Huntsville Workshop on Magnetosphere-Ionosphere Plasma Models: Sources, Transport, Energization, and Loss of Magnetospheric Plasmas, Guntersville, AL, October 5-8, 1992.
73. Frey, M. A., C. E. Rasmussen, J. L. Horwitz, and R. W. Spiro, Detached regions or plasmaspheric streamers?, presented to the 3rd Huntsville Workshop on Magnetosphere-Ionosphere Plasma Models: Sources, Transport, Energization, and Loss of Magnetospheric Plasmas, Guntersville, AL, October 5-8, 1992.
74. Giles B. L., C. R. Chappell, T. E. Moore, and R. H. Comfort, IMF influence on low-energy plasma outflow in the auroral zone, polar cap, and cusp, presented to the 3rd Huntsville Workshop on Magnetosphere-Ionosphere Plasma Models: Sources, Transport, Energization, and Loss of Magnetospheric Plasmas, Guntersville, AL, October 5-8, 1992.
75. Kozyra, J. U., L. H. Brace, A. M. Persoon, R. H. Comfort, and J. R. Sharber, Particle and wave observations within large-scale ducts in the outer plasmasphere, *EOS, 73,*480, 1992; presented to the Fall Meeting of the American Geophysical Union, San Francisco, CA, December 7-11,1992.
76. Neergaard, L., J. L. Horwitz, and R. H. Comfort, Plasmasphere-ionosphere coupling: ion heat fluxes and correlations among ion temperatures, composition and field-aligned flows from DE-1/2, *EOS, 73,*482, 1992; presented to the Fall Meeting of the American Geophysical Union, San Francisco, CA, December 7-11,1992.
77. Horwitz, J. L., J. Lin, D.G. Brown, and G. R. Wilson, Core plasma evolution at L = 4-7: Hemispheric "decoupling" by equatorial ion and electron heating, *EOS, 73,*481, 1992; presented to the Fall Meeting of the American Geophysical Union, San Francisco, CA, December 7-11,1992.
78. Ho, C. W., J. L. Horwitz, M. Loranc, and M. O. Chandler, Statistical survey of O^+ bulk parameters in the midlatitude polar cap magnetosphere, *EOS, 73,*481, 1992; presented to the Fall Meeting of the American Geophysical Union, San Francisco, CA, December 7-11,1992.
79. Lin, J., J. L. Horwitz, R. C. Olsen, and B. L. Giles, Properties of the latitudinal transition from field-aligned to trapped core ions in the equatorial inner magnetosphere, *EOS, 73,*481, 1992; presented to the Fall Meeting of the American Geophysical Union, San Francisco, CA, December 7-11,1992.
80. Frey, M. A., C. E. Rasmussen, J. L. Horwitz, R. W. Spiro, Detached regions or plasmaspheric streamers?, *EOS, 73,*481, 1992; presented to the Fall Meeting of the American Geophysical Union, San Francisco, CA, December 7-11,1992.
81. Wilson, G. R., N. Singh, and J. L. Horwitz, Comparison of hydrodynamic and semikinetic models for plasma flow along closed field lines, *EOS, 73,*482, 1992; presented to the Fall Meeting of the American Geophysical Union, San Francisco, CA, December 7-11,1992.
82. Brown, D. G., G. R. Wilson, and J. L. Horwitz, Mesoscale auroral plasma transport (MAPT): effects of magnetospheric populations and wave heating in a time-dependent semikinetic model, *EOS, 73,*474, 1992; presented to the Fall Meeting of the American Geophysical Union, San Francisco, CA, December 7-11,1992.