FINAL REPORT

"Kinetic Space Weather: Toward a Global Hybrid Model of the Polar Ionosphere-Lower Magnetosphere Plasma Transport"

NASA Grant: NAGW-4500

Period of Performance: March 1, 1995 to February 28, 1996

Principal Investigator: James L. Horwitz
Department of Physics/Center for Space Plasma and Aeronomic Research
The University of Alabama in Huntsville
Huntsville, Alabama

During the indicated period of performance, we had a number of publications concerned with kinetic polar ionosphere-lower magnetosphere plasma transport. For the IUGG 1991-4 Quadrennial Report, we reviewed aspects of U. S. accomplishments concerned with polar plasma transport, among other issues[Horwitz, 1995]. In another review, we examined the computer simulations of multiple-scale processes in space plasmas, including polar plasma outflow and transport[Horwitz and Zalesak, 1996]. We also examined specifically multiscale processes in ionospheric outflows in Horwitz[1996].

In Brown et al.[1995a] we developed a Generalized Semi-Kinetic(GSK) model for the topside-lower magnetosphere which explored the synergistic action of wave heating and electric potentials in the formation of auroral ion conics, in particular the "pressure cooker" mechanism.

In Brown et al.[1995b] and Ho et al.[1995] we extended the GSK model all the way down to 120 km and applied this code to illustrate the response of the ionosphere-magnetosphere to soft-electron precipitation and convection-driven frictional ion heating, respectively. Later, the convection-driven heating work was extended to a paper for the *Journal of Geophysical Research.*

In addition to the above full published papers, we also presented the first developments of the coupled fluid-semikinetic model for polar plasma transport during this period. In Su et al.[1995, 1996], results from a steady-state treatment were presented, with the second presentation being concerned with the effects of photo-electrons on the polar wind, and the first garnering an outstanding student paper award from the American Geophysical Union. In Estep et al.[1996], we presented the first results from a time-dependent version of this coupled fluid-semikinetic model.

References:

Brown, D. G., J. L. Horwitz, and G. R. Wilson, Synergistic effects of hot plasma-driven potentials and wave-driven ion heating on auroral ionospheric plasma transport, *J. Geophys. Res.*, **100**, 17499, 1995.

Brown, D. G., P. G. Richards, J. L. Horwitz and G. R. Wilson, Semikinetic simulation of effects of ionization by precipitating auroral electrons on ionospheric plasma transport, in *Cross-Scale Coupling in Space Plasmas*, ed. by J. L. Horwitz, N. Singh and J. L. Burch, AGU Monograph #93, Washington, D. C., p. 97, 1995.

Estep, G.M., Y.-J. Su, J. L. Horwitz, G. R. Wilson, P. G. Richards, and D. G. Brown, A time-dependent coupled fluid-semikinetic model for ionosphere-magnetosphere plasma transport: Initial results, Eos, **77,** 1996.

Ho, C. W., J. L. Horwitz and G. R. Wilson, High-latitude outflow of centrifugally-accelerated ions through the collisional/collisionlesss transition region, in *Cross-Scale Coupling in Space Plasmas*, ed. by J. L. Horwitz, N. Singh and J. L. Burch, AGU Monograph #93, Washington, D. C., p. 105, 1995.

Horwitz, J. L., The ionosphere's wild ride in outer space: IUGG 1991-1994 Quadrennial Report, Rev. Geophys., 33, 703, 1995.

Horwitz, J. L., Multiscale processes in ionospheric outflows, in *Physics of Space Plasmas*, ed. by T. Chang, Scientific Publishers, Inc., Cambridge, Mass, #14, p. 227, 1996.

Horwitz, J. L., and S. Zalesak, Computer simulation of multiple-scale processes in space plasmas: 1993-5 progress, *Reviews of Radio Science*, p. 677, 1996.

Su, Y-J., J. L. Horwitz, G. R. Wilson, P. G. Richards, and D. G. Brown, A coupled fluid-semikinetic treatment for ionospheric plasma outflow: First results, Eos, **76,** 1996.

Su, Y-J., J. L. Horwitz, G. R. Wilson, P. G. Richards, and D. G. Brown, A coupled fluid-semikinetic model for photoelectron effects on the polar wind: Initial results, Eos, **77,** 1996.