Simulations of ion flow and momentum transfer in the Venus environment. S. A. Ledvina[1] and S. H. Brecht[2], [1]Space Sciences Lab, University of California, Berkeley, CA 94720, Ledvina@berkeley.edu, [2]Bay Area Research Corp. Orinda CA 94563, sbrecht@pacbell.net.

Introduction: The solar wind interaction with Venus produces a particularly unique feature. *Lundin et al.,* [2011] using observations from Venus Express (VEX) found the existence of a large-scale vortex-like ion flow pattern in the Venus plasma tail. The flow pattern is characterized by a dominating anti-sunward flow, also a lateral flow component of solar wind (H^+) and ionospheric (O^+) ions. The lateral flow component is directed opposite to the Venus orbital motion. The combined anti-sunward and lateral H^+ and O^+ flow wraps over the planetary atmosphere, from the terminator into the nightside. The net lateral flow near Venus is in the direction of the Venus atmospheric super-rotation. Further down in the Venus plasma tail the flow display a circular motion around the central tail axis. This large-scale vortex ion flow pattern has not been observed at other planets or in any simulation of Venus interacting with the solar wind. *Lundin et al.,* [2011] speculated that the observed vortex features are driven by the orbital motion of Venus transverse to the solar wind.

Furthermore *Lundin et al.,* [2011] postulated that the general agreement in direction between the nightside ion flow over the Northern hemisphere, and the retrograde motion of the Venus atmosphere, implies a cause-effect relation between the ionospheric O^+ flow and the atmospheric neutral flow. Thus leading them to the question: Is the super-rotating upper atmosphere at Venus a consequence of solar wind forcing? Is the ion flow capable of accelerating, and maintaining, a super-rotating upper atmosphere at Venus?

In this presentation the hypothesis of *Lundin et al.,* that the orbital motion of Venus transverse to the solar wind flow drives the ion tail vortex and potentially the super-rotation up the upper atmosphere is tested. We perform hybrid (kinetic ion, fluid electron) simulations of the Venus solar wind interaction using the HALFSHEL code. The simulations include models for the ionospheric chemistry, ion-neutral collisions, Hall and Pederson conductivities. The model atmosphere (densities and dynamics) used in the simulations are taken from the VTGCM code. The orbital motion of the planet is included in the simulations by moving the planet each time step. The Venusian ion tail is examined to check for the ion vortex. Furthermore, we examine the magnitude and location of the energy and momentum deposited into the neutral atmosphere by the solar wind and pickup ions to examine the postulate that ion flow is capable of accelerating and maintaining the super-rotation in the upper atmosphere of Venus.

References:

[1] Lundin, R., et al., (2011), Ion flow and momentum transfer in the Venus plasma environment, *Icarus,215,* 751-758.