Geophysical Research Abstracts, Vol. 9, 09903, 2007
SRef-ID: 1607-7962/gra/EGU2007-A-09903

Solar wind interaction with Venus at solar minimum: Venus Express magnetic field observations

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The launch of Venus Express provides a new opportunity to study the solar wind interaction with Venus. Although a wealth of knowledge about the interaction of Venus and the solar wind has been obtained from earlier missions, notably the long lasting PVO mission, Venus Express will greatly improve our view of the Venus plasma environment due to many unique characteristics of the mission such as the improved capability of the onboard instrumentation, the unique orbital trajectory and the solar minimum observations at a low altitude compared with PVO. It is the purpose of this paper to illustrate some of the new science obtained by the Venus Express. We find that the bow shock stands off from the planet a smaller distance than at solar maximum. On the dayside, the magnetic field piles up to form a magnetic barrier in the inner magnetosheath. This magnetic barrier, an induce magnetosphere on the dayside, acts as an obstacle to the solar wind in analog to the Earth's magnetosphere. The magnetic barrier is bounded by the ionopause at its lower boundary and a "magnetopause" at its upper boundary. Both ionopause and magnetopause extend to nightside. The magnetopause on the nightside separates the magnetosheath and magnetotail which is formed by the anchored, draped magnetic fields. In contrast to its unmagnetized state at solar maximum, the ionosphere appears to be completely magnetized and its upper boundary, the ionopause, significantly lowered. The magnetic draping configuration on the dayside becomes reverse draping on the night, forming a near toroidal magnetic field at low altitude. Furthermore, proton cyclotron waves are found in the solar wind upstream from Venus, indicating a direct interaction of the solar wind with the hydrogen exosphere, distinctly different than that observed at solar maximum.