Effects of plasma mixing processes on the solar wind interaction with non-magnetized planets

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The solar wind interaction with the ionosphere of non-magnetized planets is numerically simulated in the framework of 3-D magnetohydrodynamics (MHD) with a two-component plasma. The formations of the bow shock and the magnetic barrier are seen in the dayside region. Due to the magnetic tension, partial penetration of the IMF occurs from the magnetic barrier to the terminator ionosphere. The penetrated magnetic field emerges in the ionohole on the nightside. This nonideal MHD process characterized by the penetration of flowing magnetized plasma into non-magnetized plasma plays a principal role in the mixing interaction between the solar wind and the planetary ionosphere.

The solar wind interaction with the ionosphere of non-magnetized planets is numerically simulated in the framework of 3-D magnetohydrodynamics (MHD) with a two-component plasma. In cases 1 and 2, solar extreme ultraviolet (EUV) flux values is set so the peak ionospheric plasma pressure is below and above the incident solar wind dynamic pressure. While the formations of the bow shock and the magnetic barrier in the upstream region are seen in both cases, a clear formation of the ionopause is seen only in case 2. In case 1, the interplanetary magnetic field (IMF) penetrates from the magnetosheath to the dayside ionosphere so as to adjust the ionospheric total pressure. Penetrating IMF affects the vertical motion of the ionospheric plasma. However, formation process of the ionotail is little affected by the penetrating IMF. In both cases 1 and 2, partial penetration of the IMF occurs from the magnetic barrier to the terminator ionosphere. The penetrated magnetic field emerges in the ionohole on the nightside. This nonideal MHD process characterized by the penetration of flowing magnetized plasma into non-magnetized plasma plays a principal role in the mixing interaction between the solar wind and the planetary ionosphere.