Finite Larmor radius effect on the magnetic barrier formation at non-magnetized planets

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We investigate formation mechanisms of the magnetic barrier, the region of enhanced magnetic field and very low plasma density just outside the obstacle (in the case of the earth, the magnetopause, and in the cases of Venus and Mars, the ionopause), using a two-dimensional global hybrid model of the solar wind interaction with an unmagnetized planetary ionosphere. It is commonly believed that the magnetic barrier is formed through a plasma pressure depletion produced by the plasma squeezing process out along the draping interplanetary field line, and it has been confirmed via a number of global MHD simulations and observations since Zwan and Wolf [1976] have proposed the process. However, our global hybrid model reveals that the magnetic field enhancement (without significant density depletion) at the barrier region of unmagnetized planets can develop even in the absence of the squeezing process if ion kinetics is taken into consideration. We discuss generation mechanism of the magnetic field enhancement in the kinetic model, and further discuss its possible impact on the barrier formation at Venus and Mars. Because the barrier thickness produced through the squeezing process is a function of the Alfven Mach number of the incident solar wind flow, it may be possible that the finite Larmor radius effect play a significant role in the field enhancement under a certain parameter regime.