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MHD simulations of the cold ion escape from the ionospheres of Mars and Venus

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Ionospheric flow channels and escape of cold ions from the ionospheres of Mars and Venus are investigated using a comprehensive magnetohydrodynamic (MHD) model of the solar wind interaction with the ionospheres of Mars and Venus. The model successfully describes the structures, dynamics, and energetics of both the solar wind and the planetary ionosphere regions. The model shows a complex 3-D flow pattern of the ionospheric plasma, forming large-scale four vortex structures on the nightside and escape channels through the magnetotail region. We also compare our numerical results with recent observations of the Kelvin-Helmoltz wave-like signatures obtained by the magnetometer onboard Venus Express. We show the importance of the viscous process in forming a complex flow pattern in the ionosphere and subsequent escape channels.

Keywords: Solar wind interaction, Mars, Venus