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Responses of Venus Ionosphere and Induced Magnetosphere to Solar Wind Pressure Variations

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Often regarded as the Earth's 'sister planet', Venus has similar size and mass as Earth. But it is also remarkably different from Earth in many respects. Even though we have some basic knowledge of the solar wind interaction with Venus based on spacecraft observations, little is known about how the interaction and the resulting plasma escape rates vary in response to solar wind variations due to the lack of coordinated observations of both upstream solar wind conditions and simultaneous plasma properties in the Venus ionosphere. Furthermore, recent observations suggest that plasma escape rates are significantly enhanced during stormy space weather in response to solar wind pressure pulses (Edberg et al., 2011). Thus it is important to understand the plasma interaction under varying solar wind conditions. In this study, we use a sophisticated multi-species MHD model that has been recently developed for Venus (Ma et al., 2013) to characterize the responses of the ionosphere and the induced magnetosphere of Venus to a typical variation of the solar wind: dynamic pressure change. We will examine the response of the ionosphere and the induced magnetosphere to both pressure enhancements and decreases. We will quantify the total plasma escape-rate change in response to such variations and to identify the underlying driver for changes in escape rate. We will also quantify the time scale of the Venus ionosphere and induced magnetosphere in responding to the pressure change of the external solar wind driver.