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Space Weather Effects at Venus Inferred from PVO Observations

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The passage of many interplanetary coronal mass ejections (ICMEs) by Venus during the Pioneer Venus Orbiter mission was detected by the magnetometer and plasma analyzer in the surrounding interplanetary medium. They are especially prevalent around the solar maximum years, occurring every few weeks during the mission period 1979-81 These interplanetary signatures included a leading interplanetary shock with dynamic pressure and magnetic field enhancements, followed by up to ˜2 days of extraordinarily large (˜20-40 nT) interplanetary magnetic fields. These conditions alter the Venus-solar wind interaction. The ionosphere exhibits its most extreme levels of magnetization down to the periapsis altitude of ˜150 km on both the dayside and the nightside. The so-called "disappearing nightside ionospheres" occur at these times, with interesting implications for ionospheric escape. During disappearing ionosphere episodes, most of the ionospheric ion transport by day-to-night pressure gradients is shut down, presumably by the imposition of a low solar wind pressure balance boundary and penetrated interplanetary fields. If we assume that the ionospheric ions are still produced in the upper atmosphere at the solar maximum rate, but instead escape into the solar wind at these times, we find ICME events can make a dominant contribution to the annual ion escape around solar maximum. This scenario has interesting implications for the early history of Venus. When the evolving Sun was more active, the conditions described above may have been typical. The effects of ICMEs on atmospheric escape related to the solar wind interaction remain to be determined by ASPERA on Venus Express, especially if the mission operates into the next solar maximum.