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Venus lacks an intrinsic magnetic filed, as a result, the incoming solar wind interacts directly with its atmosphere, creating an induced magnetosphere. Venus is believed to have once held a significant amount of water, which has since then disappeared from the planet as evidence by the increased, compared to Earth's, Deuterium-Hydrogen ratio measured by Pioneer Venus (Donahue et al. 1982). Its disappearance is mainly contributed to the interaction of the solar wind with the planet's induced magnetosphere. This interaction is the primary cause of atmospheric escape for elements heavier than Hydrogen, such as Oxygen (Futaana et al. 2017). Measurements from Venus Express have shown that the majority of the escape is taking place at the magnetotail, with the ration of Hydrogen to Oxygen escape being approximately equal to two during solar minimum and equal to one during solar maximum (Persson et al. 2018), indicating the escape of water from the nightside. This effect can bring rise to the question: what happens to the atmospheric loss under extreme solar wind conditions, such as under the influence of Interplanetary Coronal Mass Ejections (ICMEs)? Understanding those processes can give us valuable information on the evolution of the planet. Previous works have provided answers by investigating the impact of ICMEs on the Venusian atmospheric escape compared to nominal conditions with observations (Luhmann et al. 2007, McEnulty et al. 2010, Edberg et al. 2011, Collinson et al. 2015) and simulations (Luhmann et al. 2008, Dimmock et al. 2017) to name a few. In this study, we contribute to this subject by using observations taken from Venus Express and simulations to explore the influence of different ICME parameters on the escape.

The simulation used is a global hybrid model, called LatHyS, first developed for Mars (Modolo et al. 2017) and adapted for Venus (Aizawa et al. 2022), that has the advantage of having a self consistently calculated ionosphere. Magnetic field and particle data taken from Venus Express upstream of the bowshock are used as reference for the initial conditions of the simulations. Two ICME events are selected. The first impacted Venus on the 5th of November 2011 and created the highest observed magnetic obstacle at the planet. Upstream of the bowshock it had a temperature of 200 eV and a velocity of 900 km/s. The second event occurred on the 27th of October 2013 and had similar plasma and magnetic field parameters to the first one, but had significantly different temperature of 35 eV and velocity of 600 km/s. Idealized models of the events are simulated and compared. In order to discuss the parameter dependence, for each comparison the simulation inputs of the two events are forced to be the same, imposing either temperature or velocity to be identical, and leaving the studied variable as the only difference. We find an increase of the dayside Oxygen escape for the event with the higher velocity, but a decrease on the nightside outgoing ion flux. Since both of the selected events can be considered as fast solar wind, to better investigate the dependency of the velocity we perform an additional simulation with a much lower solar wind speed

of 300 km/s. To study further the effect of the ICME parameters, in a more model driven approach, the second selected event is kept as a reference and additional simulations are performed to examine variables such as the magnetic field strength and cone angle. Finally, the results are compared with statistical data of the mean solar wind conditions on Venus and their corresponding calculated atmospheric escape.

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