



Comparing the plasma environments of Venus, Mars and Titan

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The Pioneer Venus Orbiter (PVO), the Mars Express (MEX) and the Cassini spacecraft have performed measurements of the Venus, Mars and Titan plasma environments, respectively, for approximately a full solar cycle in each case. We use data taken by instruments capable of measuring thermal plasma densities (OETP, MARSIS, RPWS/LP, respectively) carried by these spacecraft to perform a comparative study of the global plasma environments of these three celestial bodies. The main ionization source of each upper atmosphere is photoionization, while other, secondary, factors control the structure of each plasma environment. The bodies have in common that their respective ionospheres are strongly controlled by the solar zenith angle in the sense that the plasma density drops with raising solar zenith angle. Their ionospheres are also controlled by the phase of the solar cycle. However, there are significant differences between the three ionospheres. For instance, the structure of Venus upper atmosphere is strongly affected by the solar wind dynamic pressure, like the other bodies too, but at Venus this can compress the plasma environment and control if the ionosphere is magnetized or unmagnetized. Mars' plasma environment is affected by its strong crustal magnetic fields and it has been shown that the crustal fields affect both the electron density above as well as the location of global plasma boundaries (magnetic pile-up boundary and bow shock) surrounding the planet. Titan's plasma environment is controlled by a complex organic chemistry in the neutral atmosphere and ionosphere but is also affected by the phase of Titan's orbit around Saturn and the dynamics of Saturn's magnetosphere.