



Observations of the nightside ionosphere of Mars by the Mars Express Radio Science Experiment MaRS

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Due to a lack of relevant observations, the vertical structure of the nightside ionosphere of Mars and its dependence on solar zenith angle are currently poorly determined. The relative importance of two key sources of nightside plasma, electron precipitation and transport of dayside plasma, is also poorly known. We address these points by examining 37 electron density profiles, a large number in this context, that were acquired from the ionosphere of Mars at solar zenith angles of 101 degrees to 123 degrees by the Mars Express Radio Science Experiment MaRS between 18 August and 1 October 2005. We obtain the following results. (1) Trends in peak electron density and altitude with solar zenith angle are consistent with the transport of dayside plasma being an important plasma source up to 115 degrees, but not higher. (2) Peak altitudes of around 150 km at higher solar zenith angles are consistent with models of plasma production by electron precipitation. (3) Peak altitudes found during solar energetic particle events are significantly lower, 90 km, again consistent with appropriate models. These results show what the dominant sources of nightside plasma are, and the data reported here present challenges for models of the nightside ionosphere, including their representations of plasma sources. We also observe that total electron content is highly correlated with peak electron density, which provides a framework for better interpreting measurements of either property and deserves a theoretical explanation.