EPSC Abstracts
Vol. 13, EPSC-DPS2019-592-1, 2019
EPSC-DPS Joint Meeting 2019

EPSC
EPSC-DPS Joint Meeting 2019
15–20 September 2019 | Geneva, Switzerland

Influence of the solar wind dynamic pressure on the ion precipitation: MAVEN observations and simulation results.

Martinez A. [1], Leblanc F. [1], Modolo R.[2], Chaufray J.Y.[2], Witasse O.[3] and MAVEN team

[1]LATMOS/IPSL, Sorbonne Université, CNRS, Paris, France, [2]LATMOS/IPSL, UVSQ Université Paris-Saclay, CNRS, Guyancourt, France [3] ESA/ESTEC, The Netherlands (antoine.martinez@latmos.ipsl.fr)

Abstract

In this work, we compare simulation of the precipitating flux for different solar wind dynamic pressure with MAVEN observations. In particular, we focus on the fluxes of precipitating ion towards Mars' atmosphere as seen by MAVEN/SWIA (cs product), an energy and angular ion spectrometer [1]. We also use LatHyS, which is a 3D multispecies parallelized hybrid model that describes the formation of Mars electromagnetic environment induced by its interaction with the solar wind [2].

1. Introduction

Although atmospheric sputtering is a minor component of atmospheric escape today, it is thought to have been much more important four billion years ago [3]. Heavy ion precipitation is the primary driver of atmospheric sputtering. At the present epoch, the efficiency of Mars' atmospheric sputtering by precipitating heavy ions to induce atmospheric escape is expected to be small compared to other mechanisms of atmospheric erosion. However, since the main driver of sputtering is ion precipitation, it is crucial to constrain the dependence of the precipitating ion flux on present solar wind conditions, before any extrapolation to past solar conditions. By comparing simulation results and MAVEN observations, we here investigate the mechanisms controlling the precipitation when the solar wind dynamic pressure change.

We will present how the precipitating ion flux, measured by MAVEN/SWIA, is influenced by the solar wind dynamic pressure and will analyze these observations by comparison with simulation results.

2. Observations and simulations results

We define two periods of different solar wind dynamic pressure from the set of MAVEN observations of the precipitating flux and simulate Mars' interaction with the solar wind for the average values of the solar parameters (Extreme Ultraviolet irradiance, Interplanetary magnetic field, solar wind density, solar wind speed...) for both periods. We then reconstruct map of the precipitating heavy ion flux at 250km in altitude and the simulated precipitating flux along each MAVEN trajectory used in our analysis.

3. Summary

Comparing MAVEN observations with models improves our understanding of the parameters that control the precipitating ion flux. By defining two periods, characterized by different solar wind dynamic pressure and modelling them, we present the comparison between models and observations.

Acknowledgements

AM acknowledges the support of DIM ACAV and ESA/ESTEC. This work was also supported by CNES "Système Solaire" program and by the Programme National de Planétologie and Programme National Soleil-Terre. This work is also part of HELIOSARES Project supported by the ANR (ANR-09-BLAN-0223), ANR MARMITE (ANR-13-BS05-0012-02) and ANR TEMPETE (ANR-17-CE31-0016).

References

[1] Leblanc F., R. Modolo and al. (2015), Geophys. Res. Lett, 42, 9135-9141, doi : 10.1002/2015GL066170.

[2] Modolo, R., et al. (2016), J. Geophys. Res. Space Physics, 121, 6378–6399, doi: 10.1002/2015JA022324.

[3] Luhmann, J.G., Johnson, R.E., Zhang, M.H.G., (1992), Geophys. Res. Lett., 19, 21, 2151-2154.