



**HAL**  
open science

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

Antoine Martinez, Ronan Modolo, François Leblanc, Jean-Yves Chaufray,  
Olivier Witasse

## ► To cite this version:

Antoine Martinez, Ronan Modolo, François Leblanc, Jean-Yves Chaufray, Olivier Witasse. Influence of the solar wind dynamic pressure on the ion precipitation: MAVEN observations and simulation results. Europlanet Science Congress 2020, Sep 2020, Virtual Meeting, Unknown Region. pp.EPSC2020-262, 2020, 10.5194/epsc2020-262 . insu-04418754

**HAL Id: insu-04418754**

**<https://insu.hal.science/insu-04418754>**

Submitted on 26 Jan 2024

**HAL** is a multi-disciplinary open access archive for the deposit and dissemination of scientific research documents, whether they are published or not. The documents may come from teaching and research institutions in France or abroad, or from public or private research centers.

L'archive ouverte pluridisciplinaire **HAL**, est destinée au dépôt et à la diffusion de documents scientifiques de niveau recherche, publiés ou non, émanant des établissements d'enseignement et de recherche français ou étrangers, des laboratoires publics ou privés.

# Europlanet Science Congress 2020

Virtual meeting

21 September – 9 October 2020

[Home](#) > EPSC2020-262

EPSC Abstracts

Vol.14, EPSC2020-262, 2020, updated on 08 Oct 2020

<https://doi.org/10.5194/epsc2020-262>

Europlanet Science Congress 2020

© Author(s) 2020. This work is distributed under the Creative Commons Attribution 4.0 License.



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

**Antoine Martinez** et al.

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 sets 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 sets. 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 sets, characterized by different solar wind dynamic pressure and modelling them, we present the comparison between models and observations.

### Acknowledgements

This work was supported by the DIM ACAV and the ESA/ESTEC faculty. 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). Spacecraft data used in this paper are archived and available in the Planetary Data System Archive (<https://pds.nasa.gov/>). Numerical simulation results used in this article can be found in the simulation database (<http://impex.latmos.ipsl.fr>).

### 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:10.1029/2015JA021324.

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

**How to cite:** Martinez, A., Modolo, R., Leblanc, F., Chaufray, J.-Y., and Witasse, O.: Influence of the solar wind dynamic pressure on the ion precipitation: MAVEN observations and simulation results., Europlanet Science Congress 2020, online, 21 September–9 Oct 2020, EPSC2020-262, <https://doi.org/10.5194/epsc2020-262>, 2020



## Contact

[Imprint](#)

[Contact](#)



[Data protection](#)

© 2019 Copernicus GmbH

Header image © Europlanet Society