



HAL
open science

Recovery Timescales of the Dayside Martian Magnetosphere to Interplanetary Magnetic Field Variability

N. Romanelli, Gina Dibraccio, Ronan Modolo, François Leblanc, Jared R. Espley, Jacob R. Gruesbeck, Jack Connerney, Jasper Halekas, J. Mcfadden, Bruce Jakosky

► **To cite this version:**

N. Romanelli, Gina Dibraccio, Ronan Modolo, François Leblanc, Jared R. Espley, et al.. Recovery Timescales of the Dayside Martian Magnetosphere to Interplanetary Magnetic Field Variability. EPSC-DPS Joint Meeting 2019, Sep 2019, Geneva, Switzerland. pp.EPSC-DPS2019-281. insu-04449758

HAL Id: insu-04449758

<https://insu.hal.science/insu-04449758>

Submitted on 9 Feb 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.

Recovery Timescales of the Dayside Martian Magnetosphere to Interplanetary Magnetic Field Variability

N. Romanelli (1,2), G. DiBraccio (2), R. Modolo (3), F. Leblanc (3), J. Espley (2), J. Gruesbeck (2), J. Connerney (2), J. Halekas (4), J. McFadden (5), B. Jakosky (6)

(1) CRESST II/University of Maryland Baltimore County, Greenbelt, Maryland, USA. (2) Solar System Exploration Division, NASA Goddard Space Flight Center, Greenbelt, Maryland, USA (norberto.romanelli@nasa.gov). (3) Laboratoire Atmosphere, Milieux et Observations Spatiales (LATMOS), IPSL, CNRS, UVSQ, UPMC, Paris, France. (4) Department of Physics and Astronomy, University of Iowa, Iowa City, Iowa, USA (5) Space Sciences Laboratory, University of California, Berkeley, California, USA. (6) Laboratory for Atmospheric and Space Physics, University of Colorado, Boulder, Colorado, USA.

Abstract

In this work we revisit an event observed by Mars Atmosphere and Volatile Evolution Mission (MAVEN) [1] in the solar wind (SW) on 23 December 2014 where the IMF rotates around the Mars-Sun axis during 6 minutes. Based on a time-dependent LATMOS Hybrid Simulation (LatHyS) [2, 3, 4] run taking into account MAVEN observations [5, 6, 7], we have determined ratios between the angular velocity associated with the recovery of the dayside magnetic field morphology in the magnetosheath and magnetic pile-up region and the associated IMF rotation observed by MAVEN upstream from the Martian bow shock. Such ratios provide recovery timescales of the dayside Martian magnetosphere normalized by the IMF variability timescale. In particular, we find that the recovery timescales of the Martian magnetosphere (up to the $X_{MSO} = -1 R_M$ plane) range between 5 s and 8 min for an IMF rotation that lasts 50 s, depending on the considered region. We also find that recovery timescales of the O^+ plume to the IMF rotation varies between 40 s and 120 s, and take greater values for further downstream distances. Such temporal range is on the order of the local O^+ gyrofrequency in the Martian magnetosheath, showing the kinetic nature of the O^+ plume recovery process.

model, *J. Geophys. Res. Space Physics*, 121, 6378-6399, doi:10.1002/2015JA022324.

- [3] Modolo, R., et al. (2017), The LatHyS database for planetary plasma environment investigations: Overview and a case study of data/model comparisons, *Planetary and Space Science*, <http://dx.doi.org/10.1016/j.pss.2017.02.015>.
- [4] Romanelli, N., Modolo, R., Leblanc, F., Chaufray, J.-Y., Hess, S., Brain, D., et al. (2018). Effects of the crustal magnetic fields and changes in the IMF orientation on the magnetosphere of Mars: MAVEN observations and LatHyS results. *Journal of Geophysical Research: Space Physics*, 123, 5315-5333, <https://doi.org/10.1029/2017JA025155>.
- [5] Connerney, J. E. P., J. Espley, P. Lawton, S. Murphy, J. Odom, R. Oliverson, and D. Sheppard (2015), The MAVEN magnetic field investigation, *Space Sci. Rev.*, 195, 1735, doi:10.1007/s11214-015-0169-4.
- [6] Halekas, J. S., E. R. Taylor, G. Dalton, G. Johnson, D. W. Curtis, J. P. McFadden, D. L. Mitchell, R. P. Lin, and B. M. Jakosky (2015), The solar wind ion analyzer for MAVEN, *Space. Sci. Rev.*, doi:10.1007/s11214-013-0029-z.
- [7] McFadden, J., et al. (2015), The MAVEN Suprathermal and thermal Ion Composition (STATIC) instrument, *Space Sci. Rev.*, 195, 199-256, doi:10.1007/s11214-015-0175-6.

References

- [1] Jakosky, B. M., et al. (2015), The Mars Atmosphere and Volatile Evolution (MAVEN) mission, *Space Sci. Rev.*, 195(1-4), 3-48, doi:10.1007/s11214-015-0139-x.
- [2] Modolo, R., et al. (2016), Mars-solar wind interaction: LatHyS, an improved parallel 3-D multispecies hybrid