Enhanced water loss during the Mars Year 34 C storm

Conference or Workshop Item

How to cite:
Holmes, James; Lewis, Stephen; Patel, Manish; Chaffin, Michael; Cangi, Eryn; Deighan, Justin; Schneider, Nicholas; Aoki, Shohei; Fedorova, Anna; Kass, David and Vandaele, Ann Carine (2021). Enhanced water loss during the Mars Year 34 C storm. In: EGU General Assembly 2021: 19–30 April 2021, 19-30 Apr 2021, Online.

For guidance on citations see FAQs.

© 2021 James Holmes; 2021 Stephen Lewis; 2021 Manish Patel; 2021 Michael Chaffin; 2021 Eryn Cangi; 2021 Justin Deighan; 2021 Nicholas Schneider; 2021 Shohei Aoki; 2021 Anna Fedorova; 2021 David Kass; 2021 Ann Carine Vandaele

Version: Version of Record

Link(s) to article on publisher’s website:
http://dx.doi.org/doi:10.5194/egusphere-egu21-14926
http://doi.org/10.5194/egusphere-egu21-14926

Copyright and Moral Rights for the articles on this site are retained by the individual authors and/or other copyright owners. For more information on Open Research Online’s data policy on reuse of materials please consult the policies page.

oro.open.ac.uk
Enhanced water loss during the Mars Year 34 C storm

James Holmes¹, Stephen Lewis¹, Manish Patel¹,², Michael Chaffin³, Eryn Cangi³, Justin Deighan³, Nicholas Schneider³, Shohei Aoki⁴, Anna Fedorova⁵, David Kass⁶, and Ann Carine Vandaele⁴
¹School of Physical Sciences, The Open University, Milton Keynes, UK
²Space Science and Technology Department, Science and Technology Facilities Council, Rutherford Appleton Laboratory, Harwell Campus, Didcot, UK
³LASP, University of Colorado, USA
⁴Royal Belgian Institute for Space Aeronomy, Belgium
⁵Space Research Institute of the Russian Academy of Sciences (IKI RAS), Russia
⁶Jet Propulsion Laboratory, USA

We investigate the evolving water vapour and hydrogen distribution in the martian atmosphere and their associated effect on hydrogen escape during the Mars Year (MY) 34 C storm (a late winter regional dust storm that occurs every Mars year). Improved calculation of the integrated loss of water throughout Mars' history (that is currently not well constrained) is possible through tracking the water loss through time from global simulations constrained by available observations. Through constraining water loss we can provide better insight into planetary evolution.

The Open University modelling group global circulation model is combined with retrievals from the ExoMars Trace Gas Orbiter (temperature and water vapour profiles from the Atmospheric Chemistry Suite and water vapour profiles from the Nadir and Occultation for Mars Discovery instrument) and the Mars Climate Sounder (temperature profiles and dust column) on the Mars Reconnaissance Orbiter. This multi-spacecraft assimilation provides the best possible replication of the evolving lower atmosphere.

The unusually intense dusty conditions during the MY 34 C storm led to increased amounts of water vapour and hydrogen above 80 km compared to a more typical C storm, which had an important impact on the amount of water escaping Mars' atmosphere. Modelled hydrogen escape rates during the MY 34 C storm peaked at around $1.4 \times 10^9 \text{ cm}^{-2} \text{s}^{-1}$, three times the escape rate calculated in the MY 30 C storm scenario and equivalent to those found during previous global-scale dust storms. The weak MY 30 C storm and strong MY 34 C storm can be seen as a bracketing pair of events and therefore the calculated escape rates represent the interannual variability expected during C storm events.

Our results indicate water loss during the C storm event each year is highly variable, and must be considered when calculating the integrated loss of water through Mars' history.