Mesospheric water ice clouds in Mars Year 34-35 as identified in ExoMars UVIS occultation opacities

Conference or Workshop Item

MESOSPHERIC WATER ICE CLOUDS IN MARS YEAR 34-35 AS IDENTIFIED IN EXOMARS UVIS OCCULTATION OPACITIES. P. M. Streeter[1] (paul.streeter@open.ac.uk), G. Sellers[1], M. J. Wolff[2], J. P. Mason[1], M. R. Patel[1,3], S. R. Lewis[1], J. A. Holmes[1], F. Daerden[4], I. R. Thomas[4], B. Ristic[4], Y. Willame[4], C. Depiesse[4], A. C. Vandaele[4], G. Bellucci[5], J. J. López-Moreno[6]. [1]School of Physical Sciences, The Open University, Walton Hall, Milton Keynes MK7 6AA, U.K., [2]Space Science Institute, Boulder, Colorado, U.S.A., [3]Space Science and Technology Department, Science and Technology Facilities Council, Rutherford Appleton Laboratory, Harwell Campus, Didcot, Oxfordshire OX11 0QX, U.K., [4]Royal Belgian Institute for Space Aeronomy (IASB-BIRA), Brussels, Belgium, [5]Instituto de Astrofisica e Planetologia Spaziali (IAPS/INAF), Rome, Italy, [6]Instituto de Astrofísica de Andalucía (IAA), Consejo Superior de Investigaciones Científicas (CSIC), Granada, Spain.

Introduction: Suspended atmospheric aerosols are key components of the martian atmosphere, and their vertical distribution has long been a subject of investigation with orbital observations and modelling. The aerosols found in Mars' atmosphere are mineral dust, water ice, and CO_2 ice, and each have distinct spatiotemporal distributions and radiative effects.

Of particular interest for this study is the vertical distribution of atmospheric aerosols. In recent years, dust has been observed to have a more complex vertical distribution structure than previously thought, with the detection of detached dust layers [1] and large plume-like structures during Global Dust Storms (GDS) [2].

Water ice distribution is tied to the seasonal behaviour of its associated cloud formations, with seasonally recurring features including the aphelion cloud belt (ACB) [3] and polar hood clouds [4] at tropospheric altitudes, as well as higher altitude mesospheric (>40 km) clouds during Mars' perihelion season [5] as well as during GDS [6,7].

Mars' low atmospheric temperatures also enable the formation of CO_2 ice clouds, which have been detected at mesospheric altitudes over the tropics/subtropics and generally during the colder aphelion season [5,8]. These are thought to be more ephemeral than their water ice counterparts, with lifetimes as low as minutes [9]. More persistent and optically thicker CO2 ice clouds have been detected at tropospheric altitudes in the polar night [10].

The Ultraviolet and Visible (UVIS) Spectrometer [11], part of the Nadir and Occultation for MArs Discovery (NOMAD) spectrometer suite aboard the ExoMars Trace Gas Orbiter (TGO) [12], has now observed the martian atmospheric limb via solar occultations for over 1.5 martian years. This period covers the 2018/Mars Year (MY) 34 GDS and regional dust storm, as well as the entirety of the more typical MY 35. As such, UVIS solar occultation data provides a great opportunity to examine Mars' vertical aerosol structure.

Results: We present a new UVIS occultation opacity profile dataset, openly available for use by the community. We also discuss particular features of interest in the dataset, and interpret these features by reference to previous published work and by comparison with the MGCM. In particular, we focus on notable mesospheric water ice cloud phenomena observed in both MY 34 and MY 35. We describe the spatiotemporal distribution of these features, and the link between specific water ice features and strong atmospheric dust activity from global and regional storms. The MGCM temperature and aerosol opacity fields provide valuable points of comparison with the UVIS dataset, for the purposes of both explanation and validation of the MGCM's existing parametrizations. The UVIS dataset offers opportunities for further research into the vertical aerosol structure of the martian atmosphere, and improvement of how this is represented in numerical models.

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