EPSC Abstracts
Vol. 16, EPSC2022-640, 2022
https://doi.org/10.5194/epsc2022-640
Europlanet Science Congress 2022

Attempting to use dust analogue from lab to study Martian atmosphere

zachary flimon[1,2], justin erwin[1], Ann Carine vandaele[1], lori Neary[1], arianna piccialli[1], loic trompet[1], yannick willame[1], filip Vanhellemont[1], sophie bauduin[2], Michael wolff[4], olga Munoz[3], julia Martikainen[3], Juan Carlos Gomez Martin[3], and Fernando Moreno[3]
[1]Institut d'aéronomie spatiale de Belgique, Belgium (zachary.flimon@aeronomie.be)
[2]Université libre de Bruxelles (ULB), Spectroscopy, Quantum Chemistry and Atmospheric Remote Sensing (SQUARES), Brussels, Belgium
[3]Instituto de Astrofìsica de Andalucía, Consejo Superior de Investigaciones Científicas (CSIC), Granada, Spain
[4]Space Science Institute, Boulder Colorado, USA

Attempting to use dust analogue from lab to study Martian atmosphere

- **Flimon[1], J. Erwin[1], A.C. Vandaele[1], L. Neary[1], A. Piccialli[1], L. Trompet[1],Y. Willame[1], F. Vanhellemont, S. Bauduin[2], M.Wolff[4], Olga Munoz[3], Julia Martikainen[3], Juan Carlos Gomez Martin[3], Fernando Moreno[3]**

[1] Royal Belgian Institute for Space Aeronomy, BIRA-IASB

[2] Université libre de Bruxelles (ULB), Spectroscopy, Quantum Chemistry and Atmospheric Remote Sensing (SQUARES), Brussels, Belgium

[3] Instituto de Astrofìsica de Andalucía, Consejo Superior de Investigaciones Científicas (CSIC), Granada, Spain

[4]Space Science Institute, Boulder Colorado, USA

Introduction:

Aerosols are present in the atmosphere of Mars and have a major effect on it. They are mainly composed of dust, water ice and CO_2 ice. Dust is confined to lower altitudes during the aphelion season and can reach higher altitudes during the perihelion, especially during dust storms that frequently arise on Mars. These storms can sometimes grow up to cover the entire planet and are then called global dust storms. They have important consequences on the atmosphere as dust will heat the atmosphere and change its composition. The dust can go higher in altitude and bring, for example, water vapor to places where we do not see it outside the dust storm.

Previous studies worked on dust climatology but the composition is still not well constrained. To understand the mechanisms behind the dust lifting and the impact of dust in the mesosphere, it is important to have a good understanding of the Martian dust. Knowing the size of the grain, the vertical profile, or the composition are key elements to understanding its radiative property.

The goal of the RoadMap (ROle and impAct of Dust and clouds in the Martian AtmosPhere) project is to use Martian dust analogues, measure their radiative and optical properties and compare them to space measurements of the Martian atmosphere. The space measurements considered here are made by the NOMAD instrument.

The NOMAD ("Nadir and Occultation for MArs Discovery") spectrometer suite onboard the ExoMars Trace Gas Orbiter (TGO) is composed of three spectrometers. In this work, we will use the UVIS channel in occultation mode.

Method:

The extinction efficiency, Q_{ext} is computed using a Mie code (Bohren, et al., 1998) considering a log-normal size distribution and refractive indeces for Martian dust from (Wolff et al., 2009) and the new values obtained within the RoadMap project.

To compute the extinction due to aerosols from the transmittances of UVIS, we first use the ASIMUT code (Vandaele, et al., 2006.) to make a fit of the ozone abundance. The ozone absorption (as well as the Rayleigh extinction) is then subtracted from the original transmittances. In the result should remain only the contribution due to the aerosol extinction. Local extinctions are then computed from these reduced transmittances using a simple onion peeling methodology.

Preliminary results:

We made comparisons of the extinction cross section from Wolff and RoadMap refractive indices. The first results obtained are a net difference in value between the two dataset. Wolff values are higher by several order of magnitude. More work will be done to understand this and show the agreement or disagreement between both datasets with real data.

Acknowledgements:

The NOMAD experiment is led by the Royal Belgian Institute for Space Aeronomy (IASB-BIRA), assisted by Co-PI teams from Spain (IAA-CSIC), Italy (INAF-IAPS), and the United Kingdom (Open University). This project acknowledges funding by the Belgian Science Policy Office (BELSPO), with the financial and contractual coordination by the ESA Prodex Office (PEA 4000103401, 4000121493), by Spanish Ministry of Science and Innovation (MCIU) and by European funds under grants PGC2018-101836-B-I00 and ESP2017-87143-R (MINECO/FEDER), as well as by UK Space Agency through grants ST/V002295/1, ST/V005332/1 and ST/S00145X/1 and Italian Space Agency through grant 2018-2-HH.0. This work was supported by the Belgian Fonds de la Recherche Scientifique – FNRS under grant number 30442502 (ET_HOME). The IAA/CSIC team acknowledges financial support from the State Agency for Research of the Spanish MCIU through the 'Center of Excellence Severo Ochoa' award for the Instituto de Astrofísica de Andalucía (SEV-2017-0709). US investigators were supported by the National Aeronautics and Space Administration. Canadian investigators were supported by the Canadian Space Agency. The ROADMAP project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 101004052.

References:

Bohren, Craig F. and Donald R. Huffman,Absorption and scattering of light by small particles, New York : Wiley, 1998, 530 p., ISBN 0-471-29340-7, ISBN 978-0-471-29340-8 (second edition)

Vandaele, A.C., Kruglanski, M., Mazière, M.D., n.d. MODELING AND RETRIEVAL OF ATMOSPHERIC SPECTRA USING ASIMUT 6.

Wilquet, V., Drummond, R., Mahieux, A., Robert, S., Vandaele, A.C., Bertaux, J.-L., 2012. Optical extinction due to aerosols in the upper haze of Venus: Four years of SOIR/VEX observations from 2006 to 2010. Icarus 217, 875–881. https://doi.org/10.1016/j.icarus.2011.11.002

Wolff, M.J., Smith, M.D., Clancy, R.T., Arvidson, R., Seelos, F., Murchie, S., Savijärvi, H., 2009. Wavelength dependence of dust aerosol single scattering albedo as observed by the Compact Reconnaissance Imaging Spectrometer. J. Geophys. Res. 114, E00D04. https://doi.org/10.1029/2009JE003350