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RoadMap to understand the role of dust in the atmosphere of Mars

Ann Carine Vandaele[1], Jon Merrison[2], Gerhard Wurm[3], Olga Munoz[4], Teresa Jardiel[5], Hannakaisa Lindqvist[6], Mike Wolff[7], Lori Neary[1], Yannick Willame[1], Arianna Piccialli[1], Loïc Trompet[1], Zachary Flimon[1], Andebo Abesha[2], Tim Becker[3], Julia Martikainen[4], Juan Carlos Gomez-Martin[4], and Marco Peiteado[5]

[1]Royal Belgian Inst. for Space Aeronomy, Planetary Aeronomy, Bruxelles, Belgium (a-c.vandaele@aeronomie.be)
[2]Aarhus Universitet, Denmark
[3]Universität Duisburg Essen, Germany
[4]Instituto de Astrofisica de Andalucia, Spain
[5]Instituto de Ceramica y Vidrio, Spain
[6]Finnish Meteorological Institute, Finland
[7]Space Science Institute, USA

The atmosphere of Mars is driven by different cycles – seasonal cycles of temperature, dust, ice, water vapour, CO2, etc. – which are coupled through transport: dust is blown from the surface by winds, carried aloft where it absorbs solar radiation and heats the atmosphere, impacting temperature, composition and winds. Formation of water ice crystals scavenges dust back from the surface. Water, being involved in the creation processes of clouds, is one of the most important species in the atmosphere. It controls the stability of the atmosphere, dominates its chemistry, and has a radiative impact through the formation of clouds.

Dust is present everywhere on Mars, yet its abundance, physical properties, size distribution as well as impact on the composition, structure and dynamics of the atmosphere has today only barely been addressed and understood. However, knowledge of the characteristics of aerosols (such as dust, ices, clouds and haze) is crucial for the interpretation of the IR and UV spectra because they absorb in these spectral regions, and their absorption signature overlaps the absorption features of other species (such as O3 in the UV), and they regulate the travelling path of light in the atmosphere through absorption and (multiple) scattering. Their impact is difficult to accurately estimate because their spectral characteristics are not known with enough accuracy.

The goal of the ROADMAP project (ROle and impAct of Dust and clouds in the Martian AtmosPhere) is to better characterize the Martian dust and clouds in terms of size, shape and loading within the atmosphere, but also to provide laboratory reference data which will be used to improve our knowledge on the genesis, transport and impact of dust and clouds on the Martian atmosphere.

The team behind the RoadMap project brings together the laboratory community, scientists involved in space missions and numerical modellers to promote synergies through their different perspectives and experiences: laboratory scientists understand the reference data and know-how to extract the most value from their experiments; mission scientists know the intricacies and potential of the instruments and the details of their calibration; numerical modellers know what data, information and parameters are most pertinent to their simulations and how best to interpret the results.

We will describe the methodology behind the project and show how we intend to improve space exploration (observation and modelling of the atmosphere) using new laboratory results (dust resuspension induced by saltation, scattering properties, etc).

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