



HAL
open science

Global 3D modelling of Martian CO₂ clouds

Christophe Mathé, Anni Määttänen, Joachim Audouard, Constantino Listowski, Ehouarn Millour, Francois, Forget, Aymeric Spiga, Déborah Bardet, Lucas Teinturier, Lola Falletti, et al.

► **To cite this version:**

Christophe Mathé, Anni Määttänen, Joachim Audouard, Constantino Listowski, Ehouarn Millour, et al.. Global 3D modelling of Martian CO₂ clouds. European Planetary Science Congress. EPSC 2021, Sep 2021, Virtual Meeting, France. 10.5194/epsc2021-324 . insu-03319697

HAL Id: insu-03319697

<https://hal-insu.archives-ouvertes.fr/insu-03319697>

Submitted on 12 Aug 2021

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.



Distributed under a Creative Commons Attribution| 4.0 International License



Global 3D modelling of Martian CO₂ clouds

Christophe Mathé¹, Anni Määttänen¹, Joachim Audouard^{1,2}, Constantino Listowski^{1,3}, Ehouarn Millour⁴, François Forget⁴, Aymeric Spiga⁴, Déborah Bardet⁴, Lucas Teinturier¹, Lola Falletti¹, Margaux Vals⁶, Francisco González-Galindo⁵, and Franck Montmessin⁶

¹LATMOS/IPSL, Sorbonne Université, UVSQ Paris-Saclay, CNRS, Paris, France (christophe.mathe@latmos.ipsl.fr)

²Currently at : WPO, Paris, France

³DAM-Ile de France (DIF), Bruyères-le-Châtel, France

⁴LMD/IPSL, Sorbonne Université, CNRS, Paris, France

⁵Instituto de Astrofísica de Andalucía, CSIC, Granada, Spain

⁶LATMOS/IPSL, UVSQ Université Paris-Saclay, Sorbonne Université, CNRS, Guyancourt, France

In the Martian atmosphere, carbon dioxide (CO₂) clouds have been revealed by numerous instruments around Mars from the beginning of the XXI century. These observed clouds can be distinguished by two kinds involving different formation processes: those formed during the winter in polar regions located in the troposphere, and those formed during the Martian year at low- and mid-northern latitudes located in the mesosphere (Määttänen et al., 2013). Microphysical processes of formation of these clouds are still not fully understood. However, modeling studies revealed processes necessary for their formation: the requirement of waves that perturb the atmosphere leading to a temperature below the condensation of CO₂ (transient planetary waves for tropospheric clouds (Kuroda et al., 2012), thermal tides (Gonzalez-Galindo et al., 2011) and gravity waves for mesospheric clouds (Spiga et al., 2012)). In the last decade, a state-of-the-art microphysical column (1D) model for CO₂ clouds in a Martian atmosphere was developed at Laboratoire Atmosphères, Observations Spatiales (LATMOS) (Listowski et al., 2013, 2014). We use our full microphysical model of CO₂ clouds formation to investigate the occurrence of these CO₂ clouds by coupling it with the Global Climate Model (GCM) of the Laboratoire de Météorologie Dynamique (LMD) (Forget et al., 1999). Last modeling results on Martian CO₂ clouds properties and their impacts on the atmosphere will be presented and be compared to observational data.