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The Mars Climate Database (version 6)

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1. Introduction

The Mars Climate Database (MCD) is a database of meteorological fields derived from General Circulation Model (GCM) numerical simulations of the Martian atmosphere and validated using available observational data. The MCD includes complementary post-processing schemes such as high spatial resolution interpolation of environmental data and means of reconstructing the variability thereof.

The GCM that is used to create the MCD data is developed at Laboratoire de Météorologie Dynamique du CNRS (Paris, France) [1-3] in collaboration with LATMOS (Paris, France), the Open University (UK), the Oxford University (UK) and the Instituto de Astrofisica de Andalucia (Spain) with support from the European Space Agency (ESA) and the Centre National d'Etudes Spatiales (CNES).

The latest version of the MCD, version 5.3, was released in July 2017, and at the time of writing of this abstract we are working on MCDv6.0, which we plan to release in the fall of 2019. This new version will benefit from all the recent developments and improvements [4-5] in the GCM's physics package.

The MCD is freely distributed and intended to be useful and used in the framework of engineering applications as well as in the context of scientific studies which require accurate knowledge of the state of the Martian atmosphere. Over the years, various versions of the MCD have been released and handed to more than 400 teams around the world.

Current applications include entry descent and landing (EDL) studies for future missions (e.g. Exo-Mars 2020), investigations of some specific Martian issues (via coupling of the MCD with homemade codes), analysis of observations (Earth-based as well as with various instruments onboard Mars Express, Mars Reconnaissance Orbiter, Trace Gas Orbiter),...

The MCD is freely available upon request (contact millour@lmd.jussieu.fr or forget@lmd.jussieu.fr); a simplified convenient web interface for quick browsing at MCD outputs is available on http://www-mars.lmd.jussieu.fr

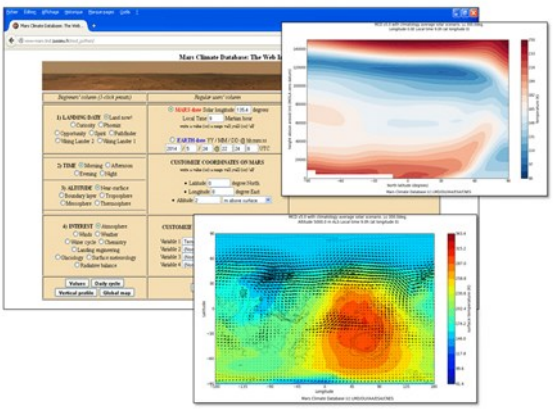

Figure 1: Illustrative example of the online Mars Climate Database web interface and its plotting capabilities.

2. MCD setup and contents

The MCD provides mean values and statistics of the main meteorological variables (atmospheric temperature, density, pressure and winds) as well as atmospheric composition (including dust and water vapor and ice content), as the GCM from which the datasets are obtained includes water cycle [6,7], chemistry [8], and ionosphere [9,10] models. The database extends up to and including the thermosphere [11,12] (~350km). Since the influence of Extreme Ultra Violet (EUV) input from the sun is significant in the latter, 3 EUV scenarios (solar minimum, average and maximum inputs) account for the impact of the various states of the solar cycle.

As the main driver of the Martian climate is the dust loading of the atmosphere, the MCD provides climatologies over a series of synthetic **dust scenarios** : **standard year** (a.k.a. **climatology**) , **cold** (i.e: low dust), **warm** (i.e: dusty atmosphere) and **dust storm**, These are derived from home-made, instrument-derived (TES, THEMIS, MCS, MERs), dust climatology of the last 10 Martian years [13]. In addition, we also provide additional "add-on" scenarios which focus on individual Martian Years (from MY 24 to MY 34) for users more interested in more specific climatologies than the MCD baseline scenarios.

In practice the MCD provides users with:

- Mean values and statistics of main meteorological variables (atmospheric temperature, density, pressure and winds), as well as surface pressure and temperature, CO_2 ice cover, thermal and solar radiative fluxes, dust column opacity and mixing ratio, [H_20] vapour and ice concentrations, along with concentrations of many species: [CO], [O_2], [O], [N_2], [Ar], [H_2], [O_3], [H] ..., as well as electrons mixing ratios. Column densities of these species are also given.

- Dust mass mixing ratio, along with estimated dust effective radius and dust deposition rate on the surface are provided.

- Physical processes in the Planetary Boundary Layer (PBL) [14], such as PBL height, minimum and maximum vertical convective winds in the PBL, surface wind stress and sensible heat flux.

- A high resolution mode which combines high resolution (32 pixel/degree) MOLA topography records and Viking Lander 1 pressure records with raw lower resolution GCM results to yield, within the restriction of the procedure, high resolution values of atmospheric variables.

- The possibility to reconstruct realistic conditions by combining the provided climatology with additional large scale (derived from Empirical Orthogonal Functions extracted from the GCM runs) and small scale perturbations (gravity waves).

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