Mars Dust Storm Sequence Dataset (MDSSD)

The MDSSD dataset was originally documented and analyzed in Wang et al. [2023] to investigate the characteristics and annual cycle of Martian dust storms. This is an updated version from the original dataset. The updates include error fixes and new data.

The *.tar.gz files are compressed archive files (using the “tar” and “gzip” software tools) for selected subphase periods of the "P", "B", "G", "D", "F", "J", and “K” phases of the data collection from the Mars Reconnaissance Orbiter (MRO) Mars Color Imager (MARCI) Mars Daily Global Maps (MDGMs) that are released on Harvard Dataverse (https://doi.org/10.7910/DVN/U3766S). To obtain individual data folders for different mission subphases, the individual compressed archive files must be unpacked, e.g., using “tar -zxvf <filename>”.

Data for "P","B","G","D", and "F01-F04" periods are modified from the MDAD v1.0 (https://doi.org/10.7910/DVN/F8R2JX). Other data are collected from scratch. The MDSSD was created to focus on the days with dust storm sequences, but some dust storm instances that are not part of a sequence are also included. For each day within MDSSD, all dust storm instances were recorded whether or not a dust storm instance belongs to a dust storm sequence. Most (but not all) of the days in MDSSD have dust storm sequences.

The files in each data folder are in IDL (Interactive Data Language) SAVE binary files with the ".sav" extension. The individual MDSSD file names include the name of the MDGM from which they were derived. For example, "B02_day01_roi.sav" contains the results from the MDGM named "B02day01".

A mdssd.tab file is provided with the MDSSD dataset. It is an ASCII table that summarizes all the data contained in MDSSD, including MDGM name, Mars year, solar longitude Ls, storm ID, sequence ID, centroid longitude, centroid latitude, area, and confidence level. The confidence level is a subjective measure of the quality of the storm identification and is represented by a number between 1 and 4. A confidence level of 1 indicates low confidence, and a confidence level of 4 indicates high confidence. Note, the IDs used to label dust storm instances and sequences within this dataset should not be assumed to have any direct correspondence with the IDs that were used in MDAD. When an ID is present in both MDSSD and MDAD, it may or may not refer to the same thing. Thus, any storm or sequence IDs that are common to both datasets are best treated as coincidental.

Below is an example of how to display a single dust storm instance in a sample MDSSD data file using the IDL software.

```
%idl
(1)IDL> restore, 'B02_day01_roi.sav'
(2)IDL> mask = bytarr(3600,1801)
(3)IDL> roix=results.obj01.roix
(4)IDL> roiy=results.obj01.roiy
(5)IDL> mask[roix,roiy]=255
(6)IDL> tv,congrid(mask,900,450)
(7)IDL> exit
```

Line (1) above will load a data structure from the file into memory called "results". Once this is done, executing the following commands will list more information.
IDL> help, results
will list the dust storm instance data objects identified for this MDGM, and they will be listed as OBJ01, OBJ02, OBJ03, etc. There is no specific meaning to the order in which the objects are numbered; typically, it merely reflects the arbitrary order in which the data collector identified dust storm instances within the MDGM.

Furthermore, executing
IDL help, results.obj01
will list the individual fields that describe that dust storm instance contained in the data object "OBJ01", which include:
ROIX: 0-based column index of dust storm area.
ROIY: 0-based line index of dust storm area.
STORM_ID: An arbitrary, but unique, text label that differentiates this individual dust storm from others. Dust storm instances on multiple MDGMs that are the same individual dust storm will have the same STORM_ID. See the reference for further details.
SEQUENCE_ID: An arbitrary, but unique, text label that indicates what dust storm sequence of which the dust storm instance is a member. If blank (an empty string) then the dust storm instance is not a member of a dust storm sequence. Please see reference for further details.
CONFLEV: The confidence level of the identification of the dust storm instance. Values are 1,2,3, or 4 in order of increasing confidence.
NAME: The name of the MDGM from which the dust storm instance was identified.
The ROIX and ROIY values are defined with respect to the 0.1 degree longitude x 0.1 degree latitude (3600 columns x 1801 lines) MDGMs released on Harvard Dataverse at https://doi.org/10.7910/DVN/U3766S. Note, the (0,0) pixel in the MDGM refers to -90N, -180E.

Lines (2)-(5) create a binary mask array with the same dimension as the MDGM used (3600x1801) and highlight the pixels that correspond to results.obj01.

Line (6) reduces the mask array's dimension from 3600x1801 to 900x450 and displays the resized array in a pop-up window on the screen. The (0,0) pixel is at the lower left corner of the window.

To facilitate usage, a python program (mdssd.py) along with its readme file (mdssd_python_readme.pdf) are also provided.

Reference
Wang, H., Saidel, M., Richardson, M.I., Toigo, A.D., Battalio, J.M., Martian dust storm distributions and annual cycle from Mars Daily Global Map observations, Icarus, 2022 in revision.

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and the paper listed in the reference. Please direct any feedback to hwang@cfa.harvard.edu.