The martian dust chronicle: Eight years of reconstructed climatology from spacecraft observations

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The Martian Dust Chronicle: Eight Years of Reconstructed Climatology from Spacecraft Observations

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We have reconstructed the climatology of airborne dust from Martian years (MY) 24 to 31 using multiple datasets of retrieved or estimated column optical depth. The datasets are based on observations of the Martian atmosphere from March 1999 to July 2013 by different orbiting instruments: the Thermal Emission Spectrometer (TES) on board Mars Global Surveyor, the Thermal Emission Imaging System (THEMIS) on board Mars Odyssey, and the Mars Climate Sounder (MCS) on board Mars Reconnaissance Orbiter (MRO). The procedure we have adopted consists in gridding the available retrievals of column dust optical depth (CDOD) from TES and THEMIS nadir observations, as well as the estimates of this quantity from MCS limb observations. Our gridding method calculates weighted averages on a regular but likely incomplete spatial grid, using an iterative procedure with weights in space, time, and retrieval uncertainty. The derived product consists of daily synoptic gridded maps of CDOD at a resolution of 6 degree longitude x 3 degree latitude for MY 24-26, and 6 degree longitude x 5 degree latitude for MY 27-31.

We have statistically analyzed the gridded maps to present an overview of the dust climatology on Mars over eight years, specifically in relation to its intraseasonal and interannual variability.

Finally, we have produced complete daily maps of CDOD by spatially interpolating the available incomplete gridded maps using a kriging method. These complete maps are used as dust scenarios in the Mars Climate Database (MCD) version 5, and should be useful for many other applications.

The maps for the eight available Martian years are publicly available and distributed with open access, under Creative Commons Attribution-ShareAlike 3.0 Unported License. The current version and future updates can be downloaded from the MCD website at the Laboratoire de Meteorologie Dynamique: http://www-mars.lmd.jussieu.fr/mars/dust_climatology/