ADDING NEW, SMALLER DUNE FIELDS TO THE MARS GLOBAL DIGITITAL DUNE DATABASE INVENTORY. L. K. Fenton, SETI Institute, Mountain View, CA, USA (lfenton@seti.org).

Introduction: The Mars Global Digital Dune Database (MGD[3]) archives the location and several morphological, mineralogical, and thermophysical characteristics of large dark dunes (LDD) on Mars ([1-4]). Initial results [5-7] confirmed Viking-era studies indicating that most of the dune fields are located in circum-polar dune fields, Valles Marineris, and isolated depressions (mainly craters) in the mid- to high-southern latitudes. The studies further demonstrated that the locations of intracrater dunes, when compared to wind directions simulated by the NASA Ames general circulation model [8], are generally found on the downwind sides of craters. A recent installment of the MGD[3] demonstrates that most dunes are rich in feldspar, pyroxene, and high-silica phases, with minor amounts of olivine and possibly sulfate minerals [9].

Since the MGD[3] was first compiled, Mars has been imaged more completely and at higher resolution, revealing that numerous (mostly small) dune fields were not identified in the original survey. The work presented here includes a global inspection of CTX images, first using individual images and then, when it became available, the CTX global mosaic [10]. Newly found dune fields more than double the number found in the MGD[3], supplementing the original database's utility as a planetary science community resource. The shapefile and list in CSV format can be found at: https://www.dropbox.com/sh/0vhnkhmhw8qzix5/AAC5meToxgSGImYHYxhaid4Na?dl=0

Method: Images spanning the martian globe were inspected, and dune fields were outlined in a shapefile, using Java Mission-planning and Analysis for Remote Sensing GIS (JMARS) [11]. For each polygonal dune field shape, a Dune_ID was assigned following the format of [1]. JMARS analysis was used to calculate polygon areas, and, using a map lookup tool, the mean elevations from a MOLA elevation map [12]. Much of the work was conducted for stress relief, with full employment of music playlists and favorite podcasts.

Results: This work identified 2052 new dune fields; including the MGD[3], the total number of identified dune fields on Mars is now 3231. The area spanned by the new dune fields is 52,032 km^2; including the MGD[3] the total LDD coverage on Mars is 1.025×10^6 km^2 (or 0.56×10^6 km^2, accounting for low dune field density in the north polar sand seas [2]). This work thus increases the known dune field coverage of Mars by only 5-10%, so that the total areal coverage of the martian surface by LDDs remains low (~0.7%). **Table 1** lists some of the dune fields with more extreme characteristics.

Figure 1 shows the distribution of dune fields by area and number. The dunes in this work substantially increase the number of identified dune fields <~20 km^2.

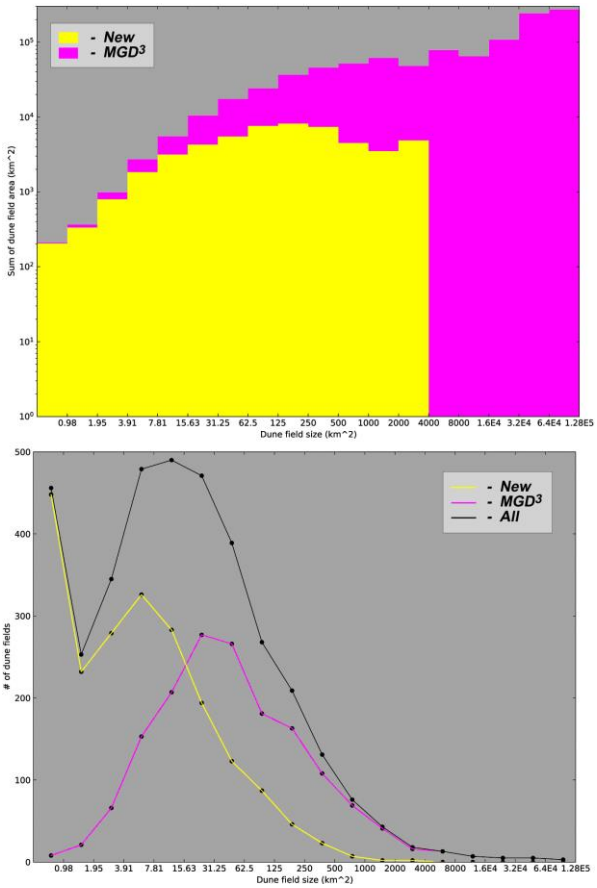

Figure 1. Histograms of dune fields on Mars by area (top) and number (bottom). The new dune fields are numerous but small.

Figure 2 shows a hypsogram of Mars elevations and dune field locations; dunes are preferentially located in, but do not fill, low-lying basins. **Figure 3** shows the global distribution of dune fields on Mars.

Summary: Many small, previously unmapped dune fields on Mars have been identified, and their locations, elevation, and area have been made available as a resource to the Mars community.

References: [1] Hayward et al. (2007a) USGS Open-File Rept. 2007-1158. [2] Hayward et al. (2010) USGS Open-File Rept. 2010-1170. [3] Hayward et al. (2012) USGS Open-File Rept. 2012-1259. [4] Gullikson et al. (2018) USGS Open-File Rept. 2018-1164. [5] Hayward et al. (2007b) *JGR 112*, E1107, doi:10.1029/2007JE002943. [6] Hayward et al. (2011) *Earth Surf. Process Landf. 36*, doi:10.1002/esp.2219. [7]

Hayward et al. (2014) *Icarus 230*, doi:10.1016/j.icarus.2013.04.11. [8] Haberle et al. (1999) *JGR 104*, doi:10.1029/1998JE900040. [9] Fenton et al. (2019) *Icarus, 330*, doi:10.1016/j.icarus.2019.04.025. [10] Dickson et al. (2018) *LPSC XLIX*, Abst. #2083. [11] Christensen et al. (2009) *AGU Fall Mtg.*, Abst. IN22A-06. [12] Smith et al. (2003) NASA PDS MGS-M-MOLA-5-MEGDR-L3-V1.0.

Table 1. Some of the most extreme dune fields on Mars.

Characteristic	Dune_ID	Elevation	Area	Region
Highest elevation	1602-802	2726 m	0.79 km^2	Planum Australe
Lowest elevation	0624-327	-7866 m	0.79 km^2	Hellas Planitia
Smallest DF	3058+493	-4199 m	0.02 km^2	Tempe Terra
Largest DF	2100+805	-4566 m	125,969 km^2	Eastern Olympia Undae
Largest DF not in MGD[3]	2785-517	-1065 m	2669 km^2	Lowell crater
Farthest north	1792+855	-4310 m	83.89 km^2	Olympia Cavi
Farthest south	2703-814	2127 m	2.16 km^2	Cavi Angusti

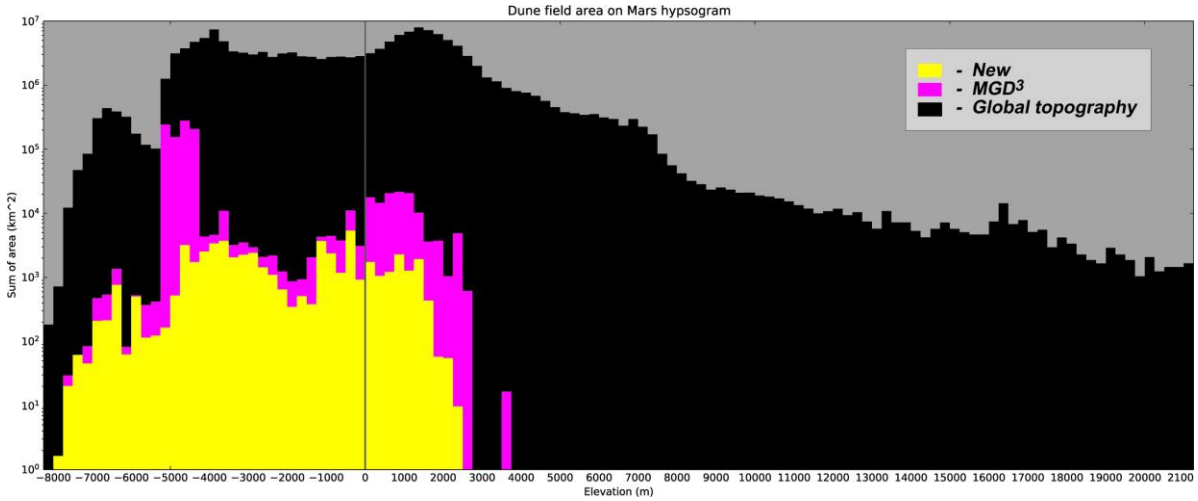

Figure 2. A hypsogram of Mars with areal coverage of dune fields. Note dune field concentrations at ~-5000 m (North Polar Sand Seas and Valles Marineris) and at ~1000 m (Southern Highlands).

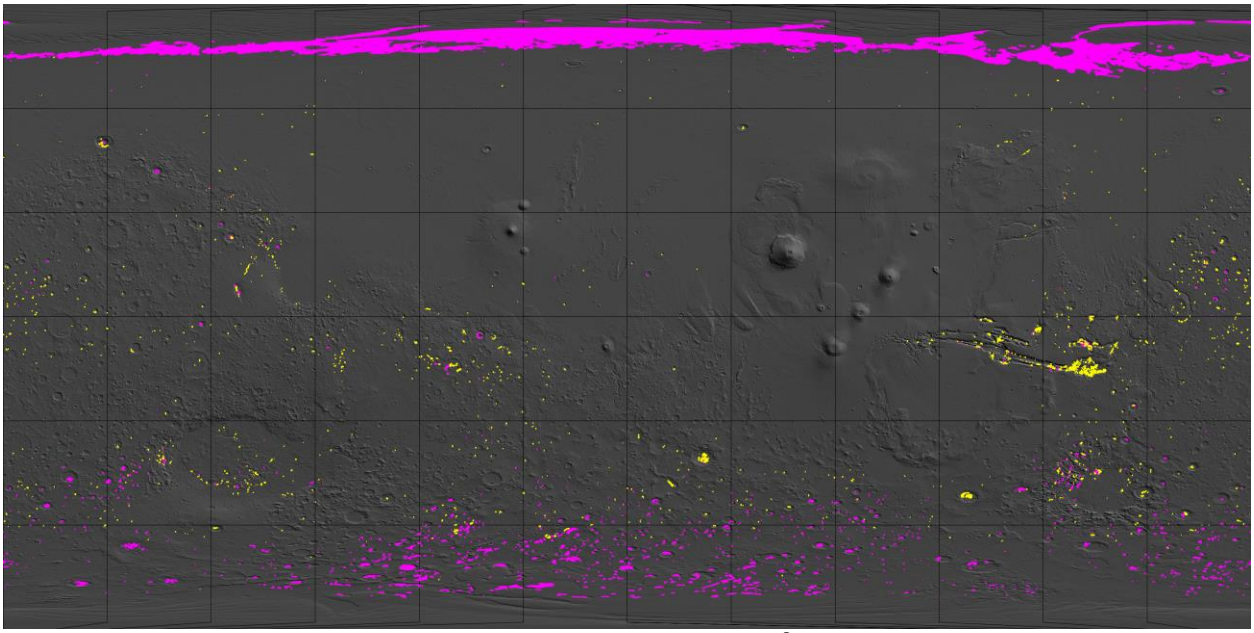

Figure 3. Global distribution of dune fields, including those in the original MGD[3] (magenta) and those identified in this work (yellow). Many small dune fields do not appear at this scale.