FUTURE MARS EXPLORATION: THE PRESENT IS THE KEY TO THE PAST. C. M. Dundas[1], S. Byrne[2], M. Chojnacki[2], I. J. Daubar[3], C. J. Hansen[4], A. S. McEwen[2], L. Ojha[5], G. Portyankina[6]. [1]USGS (cdundas@usgs.gov), [2]University of Arizona, [3]JPL/Caltech, [4]PSI, [5]Johns Hopkins University, [6]University of Colorado.

Introduction: Observations of changes on the surface of Mars have multiplied in recent years. These changes are the key to understanding current processes, a necessary step before extrapolating back through geologic time. Here we provide a summary of known surface activity, requirements for future measurements, and connections to MEPAG goals.

Current Surface Changes: Observations of surface changes date to early telescopic and orbital observations of albedo variations [1-2] and Viking Lander observations [3]. Global changes continue to be monitored [e.g., 4] and higher-resolution observations have revealed many other forms of surface activity. The walls of CO_2 ice pits on the south polar cap retreat several meters annually [5]. Hundreds of new impact craters have been observed [6-7]. New deposits occur in gullies [6], and slope streaks form in dusty regions [8]. Recurring Slope Lineae (RSL) are a widespread, distinct surface process [9]. Avalanches and blockfalls occur on steep north polar units [10]. Additional slope changes include equatorial slumps [11] and shifting high-latitude boulders [12]. Araneiform features are forming in the southern hemisphere [13], driven by seasonal CO_2 defrosting [14]. Dune movement occurs planet-wide [15], primarily in the polar erg where CO_2-frost and wind processes combine [16]. Dust devil tracks regularly shift the surface albedo on short timescales [17]. Landed studies of surface changes have primarily observed eolian processes and traces of seasonal frost [3, 18-20].

Relation to MEPAG Goals: The MEPAG Goals Document [21] includes few direct references to active processes. However, Investigation IV.B.3.1 calls for change detection surveys, and several goals require an understanding of current processes, particularly Goal III.A (Determine the geologic record…and interpret the processes that have created that record) and its sub-objectives, and for interpreting landforms for Goal II (Understand the processes and history of climate). This understanding is critical to determine how surface processes have varied in the past and whether others should be invoked. Although detections of change are now abundant, we are only beginning to understand the driving processes, some of which have no Earth analog. For instance, active sand movement on Mars has led to a new understanding of the initiation of saltation [22]. Major changes in gullies associated with CO_2 frost have raised the possibility that they form without liquid water [23], while the processes driving RSL remain enigmatic [24]. Changes in the south polar residual cap are evident but the sign of the mass balance is not certain and may be zero [25]. Active processes also expose fresh subsurface material for investigation [26].

Future Exploration: Information needed to study active processes includes 1) improved monitoring of changes of all types to expand the change record and capture currently undetected subtle or rare events, 2) volume measurements (fluxes), 3) seasonal and geographic distribution, 4) better temporal resolution (e.g., do RSL grow gradually or in steps?) and 5) the local environmental conditions triggering activity. Orbital and landed data are both relevant for all of these, but 1–3 are best accomplished with a large sampling observed from orbit, requiring HiRISE-class or better imaging and topography [27]. Some environmental data can be determined from orbit, but 4–5 (and the detailed workings of processes) are best studied *in situ*. Detailed studies of new deposits would also help interpret older materials planet-wide. Different types of change require different measurements, particularly in possible Special Regions (e.g., gullies, RSL) where landed investigations may be needed to confirm or rule out liquid water.

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