SUBSURFACE WATER ICE MAPPING (SWIM) ON MARS IN SUPPORT OF IN SITU RESOURCE UTILIZATION. N.E. Putzig,[1] G.A. Morgan,[1] Z.M. Bain,[1] D.M.H. Baker,[2] A.M. Bramson,[3] S.W. Courville,[1] C.M. Dundas,[4] R.H. Hoover,[5] S. Nerozzi,[3] A. Pathare,[1] M.R. Perry,[1] E.I. Petersen,[3] H.G. Sizemore,[1] B.A. Campbell,[6] M. Mastrogiuseppe,[7] M.T. Mellon,[8] I.B. Smith.[1,9] [1]Planetary Science Institute, [2]NASA Goddard Space Flight Center, [3]University of Arizona, [4]U.S. Geological Survey, [5]Southwest Research Institute, [6]Smithsonian Institution, [7]Sapienza University of Rome, [8]Cornell University, [9]York University. Contact: nathaniel@putzig.com.

Summary: As part of a NASA effort to assess in situ resources for future human missions to Mars, the SWIM Team is performing multi-dataset mapping to characterize the distribution of buried water ice from 60ºS to 60ºN. Deriving a single measure for the presence of accessible ice (upper few meters) from a diverse range of remote sensing techniques with unique resolutions and caveats is a challenging problem. To enable data synthesis we present a methodology based on "ice consistency" mapping. In 2019, we produced ice consistency maps for much of the northern hemisphere [1,2]. In 2020, we are extending our mapping to include the southern hemisphere at elevations < +1 km (Fig. 1). Our maps are being made available on the SWIM Project website (https://swim.psi.edu), and we intend to complete our extended mapping in the summer of 2020.

Consistency Mapping: The SWIM Project uses multiple techniques: neutron-detected hydrogen (MONS), thermal behavior (TES, THEMIS, and MCS), multiscale geomorphology (HiRISE, CTX, HRSC and MOLA), and surface and subsurface radar echoes (SHARAD). With methods attuned to each dataset, we assign values scaled between +1 (dataset fully consistent with ice) and -1 (dataset consistent with the absence of ice). We use the SWIM Equation [1,2] to calculate multi-dataset ice consistency (Fig. 1). The highest ice-consistency values occur poleward of ~40ºN, in Arcadia Planitia where widespread ground ice was inferred previously [3] and in Deuteronilus Mensae where extensive debris-covered glaciers have been identified [4]. Positive values (blue) extend southward to ~20ºN. Equatorward of 28ºN, mostly negative (red) values occur, arguing for ice-free conditions in these regions.

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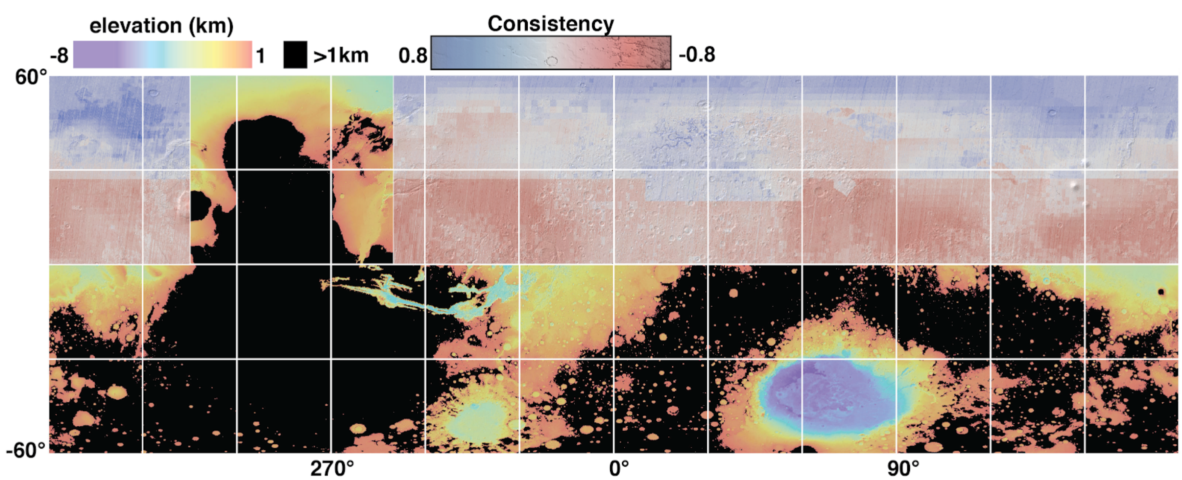

Figure 1. SWIM project study area, showing the results of the 2019 northern hemisphere water-ice consistency mapping (blue-red color bar). We are currently mapping the remaining regions, shown here in elevation (rainbow color bar). Elevations above +1 km (black) are excluded from the ongoing efforts. Hillshade and topography derived from MOLA data.