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Topography Data on Mars: Optimizing its Collection and Application Using Laser Scanning.

Mark Bulmer (1) and David Finnegan (2)

(1) Geophysical Flow Observatory, JCET, University of Maryland Baltimore County, Baltimore, MD 21250 (mbulmer@umbc.edu), (2) Engineer Research and Development Center, Cold Regions Research and Engineering Laboratory, Hanover, New Hampshire (david.finnegan@usace.army.mil)

Sites on Mars with rocky geomorphic features interpreted to be lava flows, avalanches, talus cones, rock glaciers, glacial moraines and fluvial outwash channels are the focus of interest for this project. For each site, image and topography datasets have been compiled that include Viking Orbiter, Mars Orbiter Laser Altimeter (MOLA), Mars Orbital Camera (MOC), Thermal Emission Imaging System (THEMIS), HRSC and most recently MRO CTX and HiRISE. To correctly interpret geomorphic and geologic features and their underlying processes the limitations of the imaging sensors used at Mars and any derived data products have had to be understood. From studies conducted at our terrestrial analog sites it has become clear that obtaining topographic data at the appropriate resolution is essential to provide the boundary conditions to quantify processes such as lava flows, landslides and fluvial activity on Mars.

Airborne Laser Altimeter derived topography at $\sim$1-2 m/pixel has been obtained for six sites (Martinez, Chaos Jumbles, Amboy, Mission Creek, Buckhorn Playa, and Mojave River). These data were obtained using NASA's Research Grade Airborne Topographic Mapper IV (ATM-IV) waveform laser altimeter. As a result of these data acquisitions, we have come to understand that each dataset is unique due to variations in aircraft speed and altitude which affects the size of the laser footprint on the surface of interest, incident angle and the number of return pulsed within it. Working with the NASA pilots, we have been able to test a variety of flight strategies in an attempt to determine the optimal flight profile for the surface of interest.

High-resolution topography has also been acquired at Amboy, Mission Creek, Buckhorn Playa, and Mojave River using a tripod/vehicle mounted LMS-Z420i scanning laser. The technical specifications of the instrument enables repeatable topographic accuracies to 5 mm. Considerable knowledge has been gained at each of our sites as to most suitable position to scan from on the surface, at what height, and how many shot points will be required to generate a representative sampling.