**THERMOPHYSICAL PROPERTIES OF PROPOSED GLACIAL FEATURES ON MARS.** Jennifer L. Piatek, [1]Central Connecticut State University, Department of Physics and Earth Science (piatekjel@ccsu.edu)

**Introduction:** A number of geomorphologic features formed by flow of near subsurface ice have previously been identified on Mars. Included in these features are lobate masses extending from massif slopes that are considered to be analagous to terrestrial rock glaciers or ice-lubricated debris flows [1-9]. A subset of these features (identified by [8]) have been shown to exhibit variations in surface thermophysical properties that can be identified in nighttime thermal infrared images [9,10], specifically those from the Thermal Emission Imaging System (THEMIS) instrument [11]. In order to expand on this previous work, additional flow features are examined to determine if similar thermophysical variations are observed.

**Background:** The presence of near-surface ground ice on Mars has been long suggested based on observed geomorphologic features. This conclusion is consistent with recent observations of subsurface hydrogen made by the Gamma Ray Spectrometer and associated High Energy Neutron Detector aboard Mars Odyssey [12-14], which are interpreted as indications of concentrations of subsurface water ice. Surface features that are consistent with a layer of near subsurface ice include rampart craters, thermokarst features, chaotic terrain, patterned ground, pingos, lineated valley fill, and concentric crater fill (see review by [15]). Recent high resolution images from the High Resolution Stereo Camera have suggested further evidence for glaciation on Mars [16-20].

A group of geomorphic features referred to as lobate debris aprons are included in this evidence for subsurface or surface ice flow. These features are masses of debris that extend from topographic highs (massifs or crater rims) to form distinctive lobate masses with sharply defined steep margins [1,2,8,17,20-22]. Increasing resolution of imaging datasets has allowed for better comparison of Martian features with terrestrial analogs, and the higher resolution results appear consistent with the rock glacier hypothesis.

Analysis of THEMIS nighttime images of 54 debris aprons near Reull Vallis [9,10] has shown that there are thermophysical variations visible on the surface of these features that appear to be related to their mode of emplacement. In general, these debris aprons have a lower thermal inertia than the background surface (values consistent with a particle size of fine sand, assuming a basaltic composition), with the highest thermal inertias on massif slopes. All the aprons examined showed thermophysical variations on their surfaces, typically in the form of lineations parallel to the downslope direction. These lineations were of both higher and lower thermal inertias than the surrounding apron material.

**Image Analysis:** THEMIS nighttime infrared images were identified for the defined study area using JMars [23]. Initial image processing is undertaken via the THMPROC web page interface [24], using the undrift/dewobble, rectify, deplaid, and unrectify options. These processing steps should calibrate the images and remove a significant portion of systematic instrument-induced variations. Brightness temperatures are derived from image radiance values using the normalized emissivity method [25,26].

Variations in thermophysical properties can identified qualitatively based solely on variations in brightness temperature. For more quantitative results, these temperatures are used along with image parameters such as time of day and solar longitude, to predict a value of thermal inertia. This study uses a set of lookup tables generated from the model of [27] to determine these values. The thermal inertia of a surface is related to the thermal properties of that material (i.e. composition) as well as the physical state (particle size, packing, and induration). Variations in these material parameters should reveal information about the formation of surface features.

**Preliminary Results:** Initial examinations of debris flows and lineated valley fill (e.g. [28,29]) suggest that the thermophysical variations observed by [9,10] are not observed on other similar features. A comparison of THEMIS images for debris flows near the Hellas Montes [28] and Promethei Terra [10] are shown in Figure 1. The surface of the feature in Figure 1a shows little variation in surface brightness temperature, while these variations are quite striking in Figure 1b. The thermophysical variations present in Figure 1b are consistent with surface textures present in the HIRISE image shown in Figure 2. These features suggest downslope flow of material, forming ridges and furrows similar to those seen on terrestrial rock glaciers. Similar flow features have been noted in MOC images of the feature in Figure 1a [28], but distinct thermophysical variations are not observed in the THEMIS image.

**Conclusions:** The initial comparison of thermophysical expressions of potential ice flow features on Mars suggests that similar features in different geographic locations may have different geologic histories. These results may be due to differences in dust cover or scale, or may suggest different formation mechanisms for debris aprons and ice-flow features (possibly related to differences in climate during the time of formation). Additional comparisons and quantitative analyses will be done to relate surface morphology with thermophysical appearance and identify the reasons for differences between similar features.

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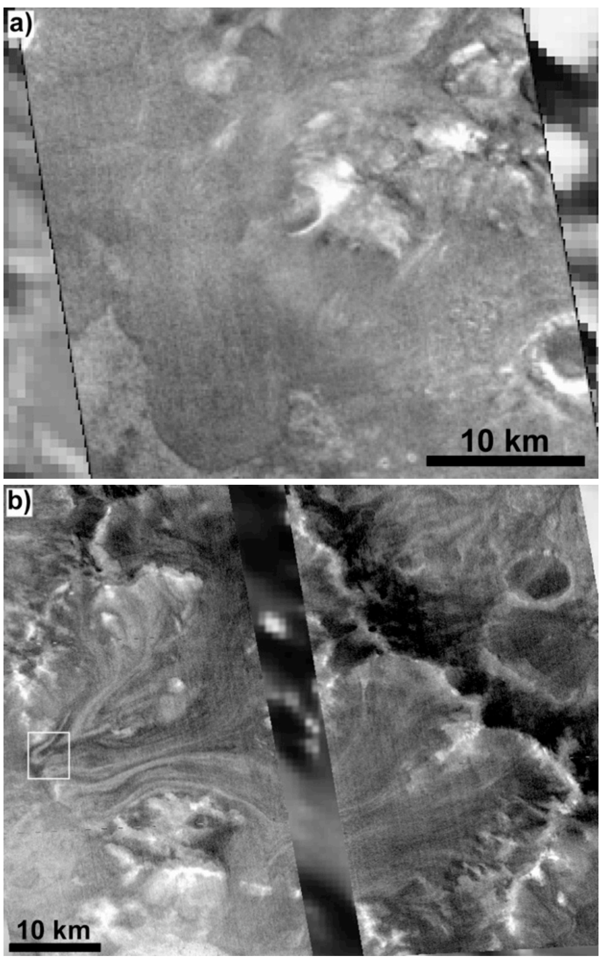


**Figure 1**. THEMIS nighttime IR images (overlain on MOLA by JMars) of debris aprons a) near Hellas Montes and b) in Promethei Terra. Darker colors indicate lower brightness temperatures. The white box in b) indicates the location of the image in Figure 2.

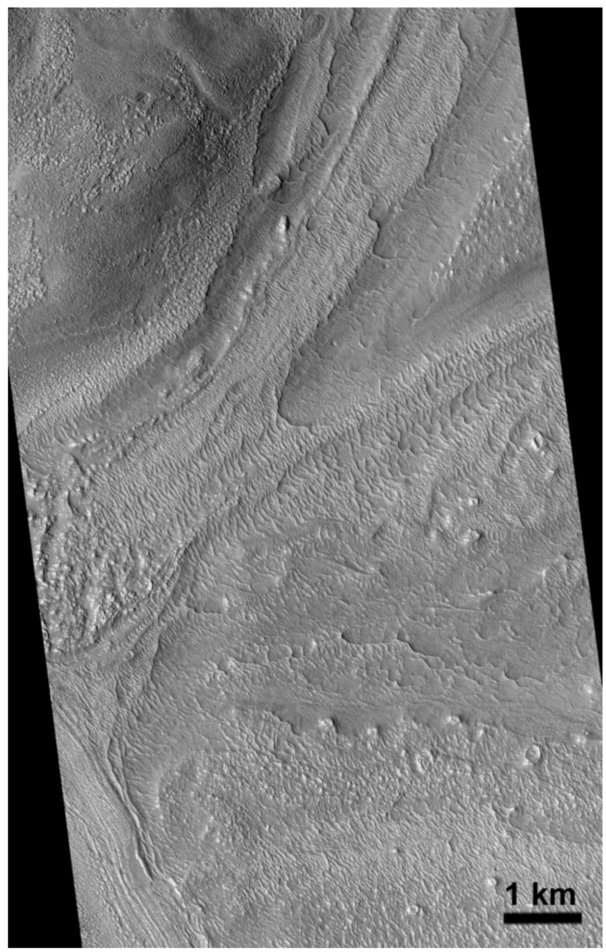


**Figure 2:** The toe of the debris apron in Figure 1a, in a portion of HIRISE image PSP-004285-1375. The morphologies observed in this image correlate with the thermophysical variations noted in THEMIS images.