PRELIMINARY ANALYSIS OF SURFACE TEMPERATURE IN THE DEPRESSION AT THE LOWER NW FLANK OF HECATES THOLUS VOLCANO, MARS . J.D. Centeno[1] and M.A. de Pablo[2,3,1], [1]Departamento de Geodinámica. Universidad Complutense de Madrid. 28040 Madrid (juande@geo.ucm.es). Spain. [2]Departamento de Geología. Universidad de Alcalá. 28871 Madrid, Spain. (miguelangel.depablo@uah.es). [3]International Research School of Planetary Sciences. Università d'Annunzio. 65124 Pescara, Italy.

Introduction: NW flank of Hecates Tholus (31.6ºN, 150ºE), at the Elysium volcanic rise (Fig. 1), shows different features marking the existence of a possible glacier covered by a thin layer of dust and aeolian sediments, as proposed by different authors [1][2][3][4][5][6][7][8], by the analysis of satellite images. The geomorphological features seems to reveal the existence of surface morphologies similar to moraines, crevasses, cirques, etc. [6][7][8], but the present surface does not show any evidence of ice nowadays. So, Could be ice underneath the surficial dust and materials? If so, are those features evidence of ice-cored glacier or rocky glaciers? In order to study this topic and try to solve this questions, we tested the use of THEMIS-derived Brightness Temperature Record (BTR) data in order to analyze surface temperature. Here we present the result of the preliminary test of two of those images in order to test this technique with this application.

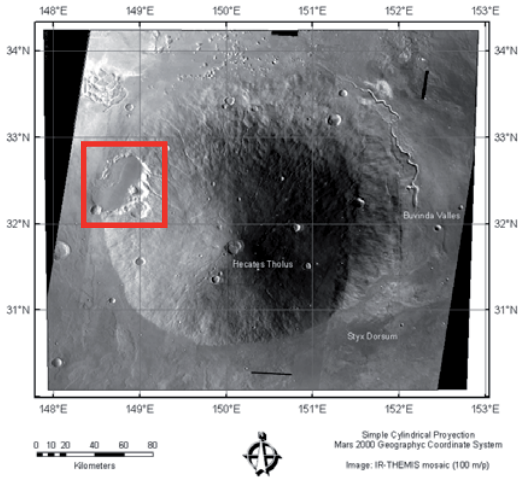

Fig. 1: Location map of the study area (red box) in the NW flank of Hecates Tholus volcano.

Data and Methods: The analyzed data are infrared (IR) images (about 100 meters/pixel) acquired by THEMIS instrument on board Mars Odyssey spacecraft. We derived Brightness Temperature from band number 9, thanks to the use of THMPROC on-line tool (THEMIS Processing Web Interface from Arizona State University –ASU) [9]. From all the available data, we selected those covering the study area (Table 1), using, for testing purposes, two images acquired in winter and during the night in order to reduce the effect of solar insolation and high thermal inertia of the materials. After to process those images we introduce them into a GIS (Figure 2) to analyze them together with HRSC-derived Digital Elevation Model (DEM), through different temperature and altitude profiles (Figure 2).

Type	Image	Date	Solar longi-tude	Min. Temp.	Max. Temp.
Night	I05394011	3-Mar-2003	146.216	158.518	188.373
	I05731008	31-Mar-2003	160.583	89.846	160.924
	I06480019	1-Jun-2003	195.067	140.907	178.731
	I06842009	30-Jun-2003	212.963	149.714	180.225
	I06867006	2-Jul-2003	214.223	157.835	191.032
	I07204010	30-Jul-2003	231.475	150.825	178.18
	I07591013	**31-Aug-2003**	**251.64**	**154.644**	**174.627**
	I07616010	2-Sep-2003	252.943	166.736	191.578
	I09925004	**10-Mar-2004**	**2.446**	**152.25**	**184.18**
	I14817023	17-Apr-2005	194.705	95.532	170.439
	I14842018	19-Apr-2005	195.916	90.171	167.64
	I16689007	18-Sep-2005	290.491	160.764	178.109
	I23740011	22-Apr-2007	223.646	159.739	195.823
	I31813030	14-Feb-2009	209.965	151.803	184.235
Day	I02404005	30-Jun-2002	34.53	220.07	251.703
	I02429005	2-Jul-2002	35.464	215.753	252.217
	I04289002	2-Dec-2002	103.059	210.281	252.162
	I08034021	6-Oct-2003	274.696	184.129	229.299
	I09644004	16-Feb-2004	350.787	209.676	238.581
	I16695015	19-Sep-2005	290.808	163.485	195.118
	I17319013	9-Nov-2005	321.059	185.27	222.349
	I17344019	11-Nov-2005	322.221	182.559	227.577
	I17631022	5-Dec-2005	335.272	196.194	230.84
	I17943008	30-Dec-2005	348.868	201.332	232.009
	I18567014	20-Feb-2006	14.393	201.071	233.366
	I18879012	17-Mar-2006	26.467	208.706	239.91
	I19503018	8-May-2006	49.662	221.209	236.232
	I20726008	16-Aug-2006	93.827	196.559	237.726
	I28538002	21-May-2008	74.612	188.945	231.571

Table 1: Available THEMIS-IR images (on May 2010) fo the study area classified by time period (nighttime and daytime), showing the date and solar longitude when they were acquired. Minimum and maximum brightness temperatures are of the whole image.

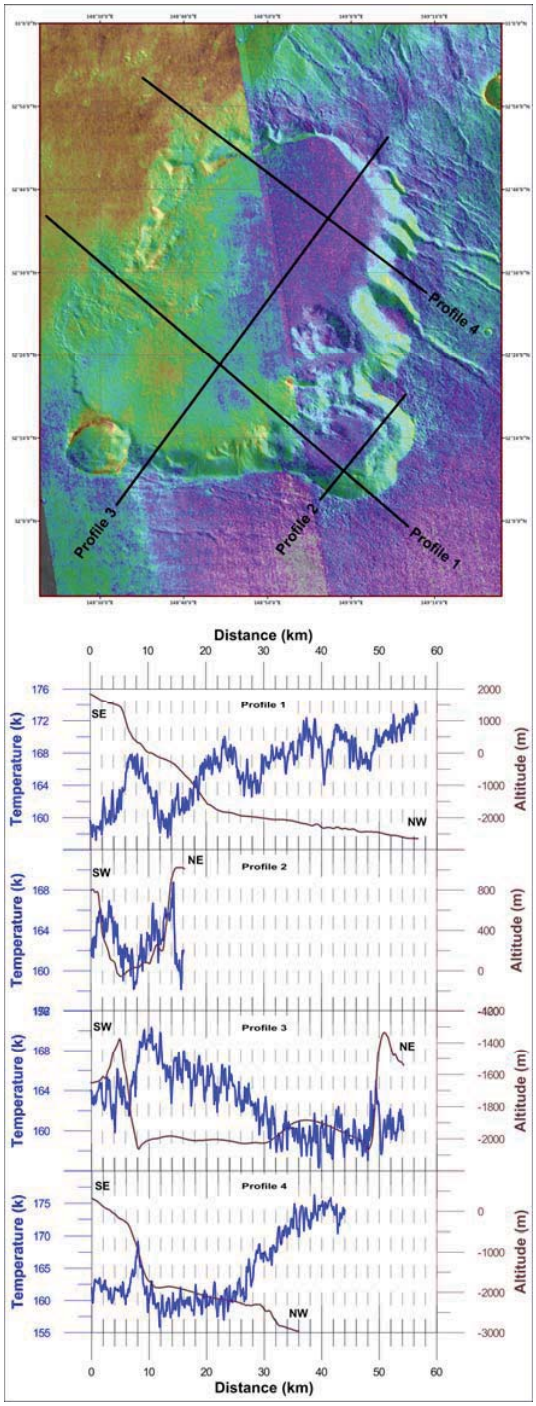

Fig. 2: Map of surface temperature (above) from THEMIS-derived BTR data showing four topographic (brown line) and thermal profiles (blue lines) (below). A detailed analysis could help to deduce areas with lower possible buried ice existence.

Results: There is not a unique image covering al the study area, then, some differences in temperature are expected (Figure 2) due to the images having been acquired at different day, year, time, etc. However, assuming this constraint, temperature map shows clear differences on surface temperature mainly depending of (1) the surficial materials (due to their different thermal inertial), and (2) the different isolations depending of the surface aspect. However the profiles done in the area (Figure 2), reveals that the resolution could be enough to observe differences in spite the slope or surficial materials are apparently the same. Profile 1 shows a clear drop on temperature in the medium altitude platform, but also in the floor of the main depression at the base of the scarps. Surface temperature tends to increase when altitude decrease, but this tendency is not clear in de NW-oriented slopes. Profile 4 shows a similar pattern, although the area with lower temperatures, at the floor of the main depression, is larger. In both cases, the lower temperature is about 160 ºK.

Profiles 2 and 3 show higher temperatures on the slopes than on the floor of the depression, where they also shows an interesting pattern, with lower temperatures linked to small mounds and topographic terraces. This effect is more visible on the NE and it is relevant that the possible glacial features are concentrated. In those cases, lower temperatures are about 160 ºK. All the main slopes of the scarps show increase on the temperature, possible due to the presence of rocky materials (lava flows of the volcano), or to insolation.

Conclusions: The preliminary analysis of surface temperature derived from THEMIS-IR data provided interesting results since it is possible to observe the lowest surface temperature at areas with glacial and periglacial features [8] on HiRISE, MOC and CTX images. So, this technique could be important to solve the previous questions, but new and more detailed studies should be conducted in order to corroborate our observations.

References: [1] Head and Marchant, (2003) *Geology* 31, 641–644. [2] Shean et al., (2005) *JGR*, doi:10.1029/2004.[3] Milkovich et al., (2006) *Icarus*, 181, 388-407. [4] Shean et al., (2007) *JGR*, doi: 2006JE002761. [5] Hauber et al., (2005) *Nature*, 434. 356-361. [6] de Pablo and Centeno (2011) *LPSC, 42.* Abstract #1030. [7] Centeno and de Pablo (2011). *LPSC, 42.* Abstract #1031. [8] de Pablo and Centeno (2012) LPSC, 43. Abstract (This issue). [9] http://thmproc.mars.asu.edu/