DAILY TEMPERATURE FLUCTUATION ON MARS AT APHELION. A. Kuti[1], A. Kereszturi[2,3]. [1]Eotvos Lorand University of Sciences Department of Astronomy, H-1518 Budapest, Pf. 32., Hungary, [2]Collegium Budapest Institute for Advanced Study, [3]Hungarian Astronomical Association, e-mail:adrienn.kuti@index.hu).

Introduction: The daily and annual temperature changes of the Martian surface are influenced both by the occurrence/distribution of surface frost, and thermal inertia, as well as atmospheric clouds, fogs and dust [1]. The up to-date published works focus on the daily temperature changes in order to estimate the surface thermal inertia [2]. Here we present some preliminary results from our analysis on the zonal and global characteristics of temperature fluctuations, which are dominated by seasonal processes and not by local or regional surface thermal inertia values.

Working methods: Temperature and pressure data were derived from Mars Global Surveyor (MGS) Thermal Emission Spectrometer (TES) measurements [3, 4], using "vanilla" software. Our search has been restricted only to surface observations. We have chosen three regions that cover areas of 300-330˚E, 195-225˚E, 75-105˚E longitude by 90˚S-90˚N latitude. The data examined were retrieved for solar longitudes of 90-95˚ (around northern summer solstice). Daytime and night-time data were taken around 2 pm and 2 am, local true solar time. We have retrieved daily temperature values that were averaged in 5 degree latitude bands. To produce temperature curves with trends to analyze, daily values for each 5 degree wide latitudinal band were averaged again.

Discussion: We have used the retrieved and latitudinally averaged daily temperature data to analyze correlation between days.

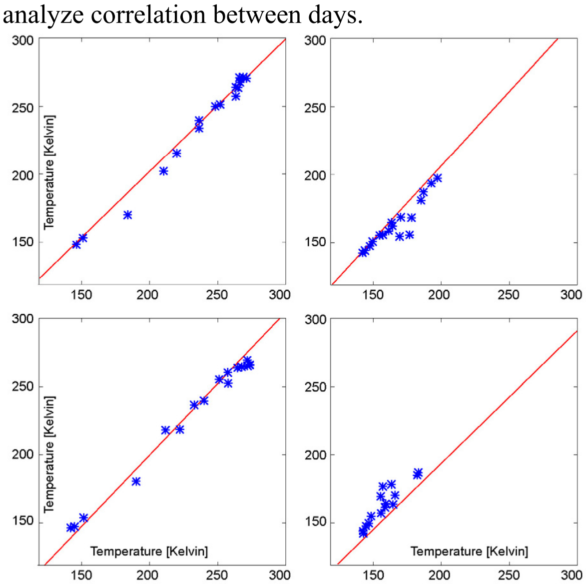

Figure 1. Temperature regression curves for pairs of days in the same year (top), two subsequent years (bottom), for daytime (left) and night-time (right)

Day and night regression curves (Fig. 1.) were produced for pairs of days around Ls=90˚, where blue crosses mark the temperature values, and the red line is the regression line. We have also correlated days from the same and from two different years (MY25 and MY26). A short table with some of the results is shown below. The correlation between daytime temperatures is stronger than between night-time values. The possible reason may be in connection with the aphelion cloud belt mentioned below.

Region	Orbit number	Daytime	Night-time	MY
300-330E	9747,9748+18142,18143	0.9949		25/26
300-330E	18188,18187+18129,18130	0.9938		26
300-330E	9691,9692+18086,18085		0.9868	25/26
300-330E	18086,18085+18111		0.9313	26
195-225E	18026+18038,18039	0.9992		26
195-225E	9744+18038,18039	0.9939		25/26
195-225E	9712,9713+18145,18146		0.6914	25/26
195-225E	9700,9701+9712,9713		0.8331	25/26
75-105E	9740+18097	0.9979		25/26
75-105E	9702+9715	0.9987		25
75-105E	9746+18053		0.9899	25/26
75-105E	9696+9721		0.9425	25

Table. Correlations between daytime and night-time temperatures around Ls=90˚. The values are for the three sites (Region field) between two subsequent days in the same year (MY 25 or 26) and between two days in different years (MY 25/26)

Results: Figure 2. shows daytime and night-time temperatures, averaged for 5 degree wide latitude bins at three different sites. Southward of 65˚S there is no solar insolation, although daytime temperature starts meridionally rising only around 55˚S, and from there on the two curves strongly diverge. Getting closer to the equator, daytime temperatures show a steady increase followed by a decrease from 35˚N to the northern polar region. The meridional maximum value of the averaged daytime temperatures vary between 271-274 K, and located a little bit farther to the north than the location of the maximal solar culmination. Analyzing the meridional night-time temperatures, a 40-60 degree wide peak can be observed that differs from the trend of the curves at the three sites, with the maximum at the latitude of 15˚S, rising above the general night-time trend with about 20 K. In the 75-105˚E region that difference is particularly high (~30

K) compared to the other two regions. As seen in Figure 2., our peak extends from 55˚S to 15-35˚N, thereafter the curves follow the trends again. Analyzing this night-time peak, we examined the following three possible reasons:

Random fluctuation can be one reason for the origin of the nighttime peak. But because of the resembling trend at all three sites we found this to be improbable.

Thermal inertia distribution may also cause the observed peaks. Based on a simple analysis of published TI map with JMARS [5] there is no such tendency that could realize the night-time peak.

Aphelion cloud belt was also taken account as a possible effect to rise our nighttime peak. The tropical aphelion cloud belt originates probably through condensation of water vapor raised by the ascending branch of Hadley circulation, and is characteristic of the Martian atmosphere during the northern spring/summer [6, 7, 8]. There are warmer than average night-time regions on Mars at aphelion, in close correlation with the aphelion tropical cloud belt [9]. Based on this it seems to be possible that our night-time peak is caused by the infrared reflection effect of the clouds. Although the published distribution of the aphelion cloud belt peaks further north, between roughly 0˚ and 20˚N, our peak is situated south of the equator.

Conclusion: The acquired meridional temperature distribution reflects global and zonal phenomenon. The correlation between temperature values from different years indicates annual phenomenon. As a result, with this method global characteristics of the surface temperature change can be analyzed beside the effects of surface thermal inertia. The reason for the worse correlation between night-time than daytime temperatures may be the changing heat insulator effects of night-time clouds. Our analysis revealed a zonal peak in the night-time temperature, that may be connected to the nigh-time clouds, even though the peak's location differs from the published night-time cloud distribution.

References: [1] Basu S. J. et al. (2006) JGR, 111, E09004, doi:10.1029/2005JE002660. [2] Mellon M. T. (1999) *5th Mars Conf.* #6131 [3] Christensen P.R. et al. (2001) JGR. 106, 23823-23872. [4] Bandfield J.L. and Smith M.D. (2003) *Icarus 161*, 47-65. [5] Gorelick N. S. et al. (2003) *LPS XXXIV* #2057. [6] Clancy R. T. et al. (1996) *Icarus, 122*, 36–62. [7] Clancy R.T. (1999) *5th Mars Conf.*, #6023. [8] Rodin A.V and Wilson R.J (1999) *5th Mars Conf.* #6235. [9] Wilson R. J. at al. (2007), *GRL, 34,* L02710, doi: 10.1029/ 2006GL027976.

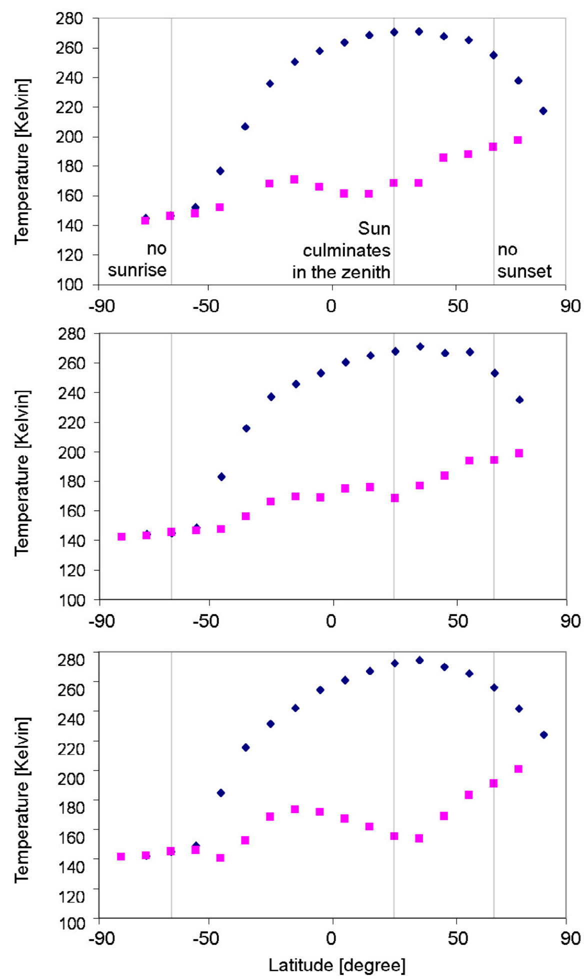

Figure 2. Averaged daytime (blue dots) and night-time (pink dots) temperature values for the examined three regions (300-330˚E (top), 195-225˚E (middle), 75-105˚E (bottom) longitude). At the time of the observations (around Ls=90) the Sun never rises below 65˚S, never sets above 65˚N and culminates in the zenith at 25˚N