MARS: COMPARATIVE ANALYSIS OF TERMOSCAN AND VIKING-IRTM DATA.

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Abstract The comparative analysis of the Termoscan and Viking-IRTM data received for the same region of Mars at similar geometry of the instruments operation was made up. The results of the analysis were used for correction of the albedo and the thermal inertia values created from the high resolution Termoscan observations data.

The regional thermal inertias maps of Mars, compiled from the Termoskan data with high resolution 1.8x1.8km [1] represents essential supplement to the Viking global map of thermal inertias [2] with resolution 30x30km. On the base of those regional maps the remarkable tendency to increasing of the thermal inertia values on the floors of old valleys, chasmata and into craters with the spots of dark albedo material was founded previously [1].

Because the Termoscan fixed to the spacecraft board and was pointed in the anti solar direction constantly during operation, all observations were received at zero phase angle and only during daytime [3]. As result, the Termoscan images of the visual channel are characterized by the remarkable opposition brightening, which usually is most visible at zero phase angle. Due to the effect, calculated from the Termoscan data, the normal albedo values are higher in relation to the Viking albedo created from IRTM data for the same region at phase angles more than 6⊕. On the example of the Termoscan session 26.03.89 it can be seen that the difference between the mean albedo of the imaged region (0.31) and the Viking mean albedo (0.23) is equal to 34%. As a consequence the absolute values of the thermal inertia calculated from the Termoscan observations are noticeably lower in relation to the thermal inertias from Viking-IRTM data for the same region of Mars. At that, the mean albedo difference is reach 46%. Since the atmospheric opacities during the Termoscan operation were sufficiently low and are founded in the range 0.2-0.3 [4] considerable influence of the atmospheric dust to albedo values it is seems unlikely.

To correct the albedo derived from the Termoscan data the comparative analysis of the Termoscan visual channel observation with the Viking-IRTM data at similar geometry of observations (for the same region) was made. The analysis was realized on the example of the region in Aeolis area, imaged during Termoscan session 26.03.89 and limited by the coordinates 8-20⊕S; 184-233⊕W. Such old valles as Ma'adim and Al-Qahira, and also Apollinaris Patera are in the region. For more convenience of comparison, the Termoscan albedo and thermal inertia data were reduced to the resolution of the Viking albedo map (1⊕x1⊕) [5] and thermal inertias map (1/2⊕ x1/2⊕) [2] respectively. From the Viking-IRTM data all the observations of the region received at phase angles ⊟ 5⊕ were selected Following to the analysis the Viking-IRTM observations at low phase angles have demonstrated similar rise of the mean albedo value in the studded region (0.29) as in the case of the Termoscan albedo (0.31). As result the Viking thermal inertias were decreased to 18% with mean value 5.24. Small difference between mean albedo values of both instruments may be caused by small phase angle difference (about several degrees), existed in their observation geometry. So both experiments with the time operations difference about 12 years have demonstrated very similar average optical properties of the surface material in the studded region. Detected difference (0.08) between the mean values of the Termoscan and the Viking albedo has been used as correction parameter. Each albedo value created from the Termoscan data was reduced on the value 0.08 and then the thermal inertias were estimated again.

On the fig.1. are shown the frequency distributions of the Termoscan thermal inertias, estimated before and after the albedo correction. After correction the mean values of the Termoskan thermal inertia became equal to 5.61 (in unit 10^{-3} cal. $cm^{-2}.s^{-1/2}.K^{-1}$) which is in good consent to the mean value 6.2, created from the Viking-IRTM data. The example of the regional map of high resolution thermal inertias,.compiled after albedo correction , is shown on fig.2. No one places with bedrock on the surface were observed at the resolution of the map. It is notable that the thermal signatures of the crater's streaks on the map are seen up to the limit of the Termoscan data resolution. Difference of the mechanisms associated with the deposition, removal of atmospheric dust and surface transportation of sand-like material are as more likely reason of the thermal inertias differences observed very clearly on the map.

REFERENCES: [1]-Kuzmin R.O. et al.,1991, Abstr.of 14 Soviet-American microsymp.,pp 47-48;; [2]-Christensen P.R.,1986, Icarus,v68,pp 217-238; [3]-Selivanov A.S. et al.,1989,Nature,v341,n6243,pp 593-595; [4]-Combes M. et al.,1991, Planet.Space Sci.,39,pp 187-197; [5]-Pleskot L.K. and Miner E.D.,1981, Icarus,v45,pp179-201.

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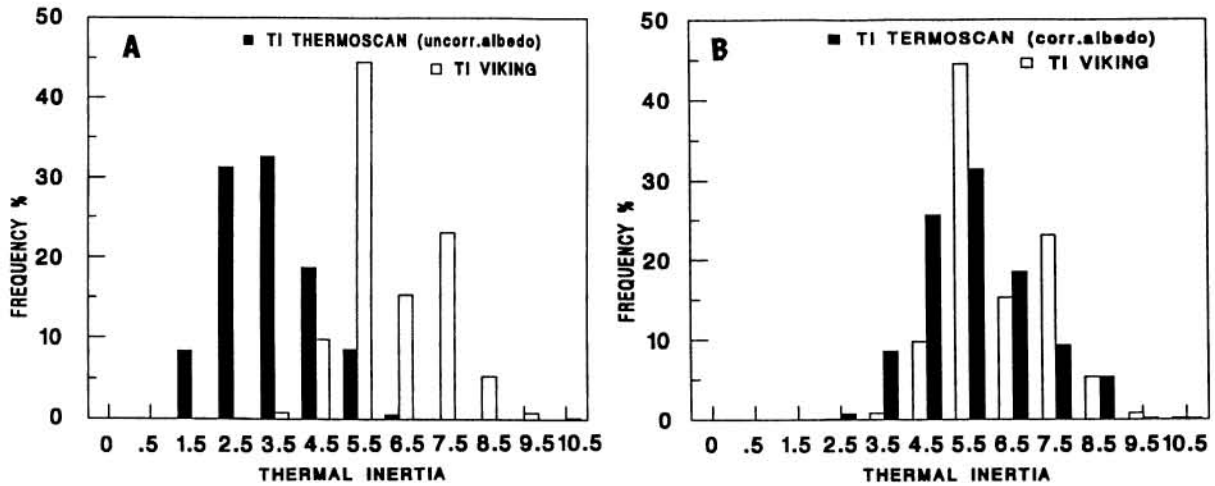

Figure 1. Frequency distribution comparison of uncorrected (a) and corrected (b) Termoscan thermal inertias (created from the data of the session 26.03.89) with Viking thermal inertias for Aeolis region.

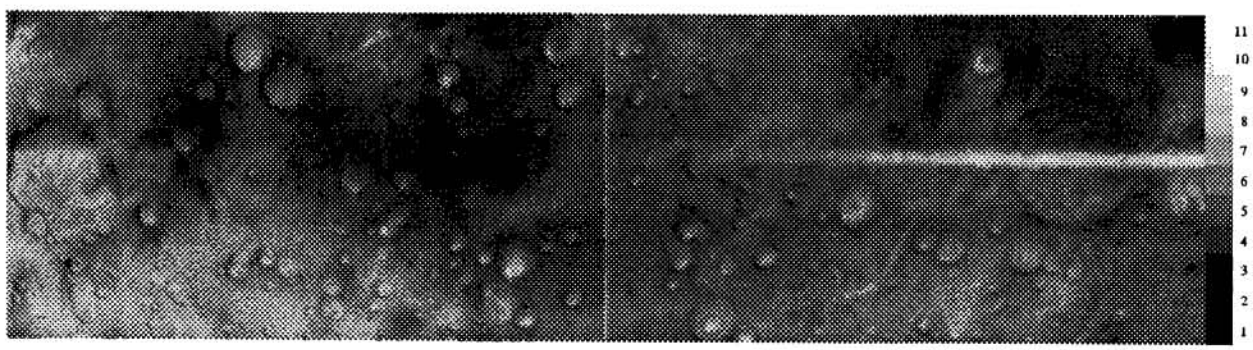

Figure 2. The high resolution thermal inertias map of Aeolis region, compiled from Termoscan data after albedo correction. The bright horizontal streak on the map is the effect of Phobos shadow.

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