

A study of surface temperature variations observed by LRO Diviner Radiometer data

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Studies of the surface temperature variations of the lunar surface have gained a lot of importance in the past decades. Previously measured temperatures on the lunar surface have revealed a large variation between daytime and nighttime surface temperatures (~ 400 K at the lunar equator during the daytime and ~ 140 K at nighttime)^{[1][2]}. Such large fluctuations make the lunar surface an interesting case for detailed study. More importantly, in view of the several manned missions that are scheduled to touch-down on the lunar surface in the coming decades, the role of the surface as well as the sub-surface in terms of temperature needs to be properly understood^{[3][4]}. In this work, we have attempted to study the surface temperature (T_S) variations of a location centered at $\sim 0.04^\circ$ N and $\sim 58.96^\circ$ E on the lunar surface around the lunar equatorial region using data obtained from Diviner radiometer present onboard Lunar Reconnaissance Orbiter (LRO). Diviner channel 5 data (centered at $8.55 \mu\text{m}$) used in this work was in RDR format which provided T_B (calibrated brightness temperature). In order to derive T_S , T_B of each point was divided by emissivity (ϵ)^[5]. According to the Diviner DP-SIS, the minimum detectable temperature for channel 5 is ~ 150 K^[6]. Therefore, all $T_B < 150$ K were removed before estimating T_S . Surface temperatures obtained were then overlaid on an LRO-WAC mosaic in order to get contextual information of the surface. The maps generated (Fig.

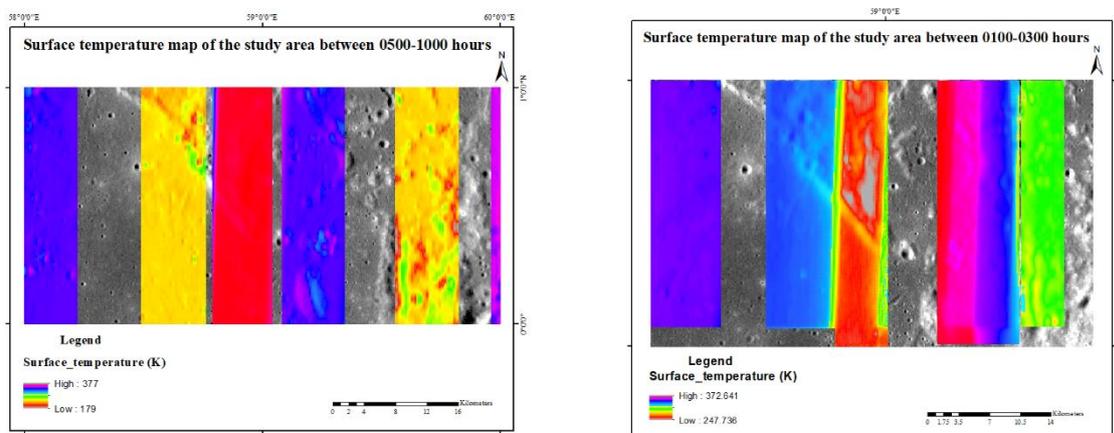


Fig. 1 Surface temperature maps of the study area generated between a) 0500 to 1000 hours and b) 0100 to 0300 hours

1) represent variation of T_S between two different times of the lunar day, i.e., Fig. 1a depicts T_S between 0500-1000 hours while Fig. 1b depicts T_S between 0100-0300 hours in local time. It is apparent from Fig.1 where a difference can be easily observed between the two maps. In fact, a linear surface feature can be visually identified in Fig. 1b, which indicates a possible correlation between surface temperature and the actual surface appearance. Surprisingly, the same feature is not easily distinguishable from Fig. 1a, thereby raising a few important questions regarding surface topography and solar latitude, which needs to be investigated further.

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