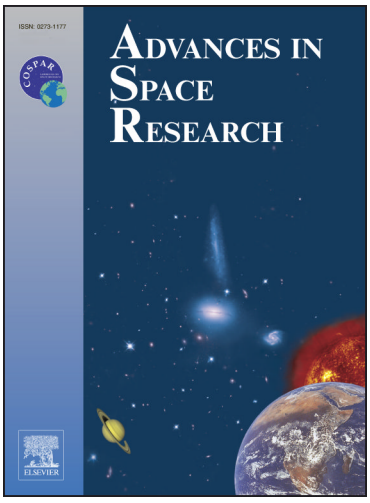

Effects of solar radiation, terrestrial radiation and lunar interior heat flow on surface temperature at the nearside of the Moon: Based on numerical calculation and data analysis

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Effects of solar radiation, terrestrial radiation and lunar interior heat flow on surface temperature at the nearside of the Moon: Based on numerical calculation and data analysis

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Abstract: Surface temperature at the nearside of the Moon ($T_{s,n}$) embraces an abundance of valuable information to be explored, and its measurement contributes to studying Earth's energy budget. On a basis of a one-dimensional unsteady heat-transfer model, this paper ran a quantitative calculation that how much the $T_{s,n}$ varies with the changes of different heat sources, including solar radiation, terrestrial radiation, and lunar interior heat flow. The results reveal that solar radiation always has the most important influence on $T_{s,n}$ not only during lunar daytime (by means of radiation balance) but also during lunar nighttime (by means of lunar regolith heat conduction). Besides, the effect of terrestrial radiation is also unavoidable, and measuring the variation of lunar nighttime low temperature is exactly helpful in observing Earth outgoing radiation. Accordingly, it is pratical to establish a Moon-base observatory on the Moon. For verification, the Apollo 15 mission temperature data was used and analysized as well. Moreover, other 9 typical lunar areas were selected and the simulation was run one after another in these areas after proper model amendation. It is shown that the polar regions on the Moon are the best areas for establishing Moon-base observatory.

Key words: Lunar surface temperature; Solar radiation; Terrestrial radiation; Lunar interior heat flow; the Moon

1. Introduction[1]

On a basis of well-developed space detection techniques, the profound mysteries in outer space have attracted scientists' attention to a higher degree. As the closest-to-Earth planet, the Moon conceals much valuable information inside, thus it is of critical importance to explore the Moon for a better understanding. Among the various Moon-related exploration objects, lunar surface temperature is always a focus.

Limited in its own synchronous rotation, the Moon always hides its farside away from Earth and faces Earth merely with its nearside (Huang, 2008). At the nearside of the Moon, lunar surface temperature is determined by various heat sources collectively, consisting of solar radiation, terrestrial radiation, and lunar interior heat flow (Woolf et al., 2002; Goode and Dziembowski, 2003; Ouyang, 2005; Huang, 2008). Because the terrestrial radiation may be detected on the Moon, the amount of the research concerned about Moon-based Earth observation is increasing gradually.

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