

Deriving Historical TSI Variations from Lunar Borehole Profiles

Guoyong Wen [wen@climate.gsfc.nasa.gov], Goddard Earth Sciences and Technology Center (GEST) and NASA/Goddard Space Flight Center, Baltimore, Maryland; and Robert F. Cahalan, NASA/Goddard Space Flight Center, Greenbelt, Maryland.

To understand the radiation budget and heat flow of the Moon, a coevolved natural satellite of the Earth, it is important to understanding the climate of the Sun-Earth-Moon system. In this study the outgoing longwave radiation is derived from temperature measurements from Apollo 15 and 17 Heat Flow Experiments (HFEs). The distance between the Sun and the Moon, and the solar zenith angle from an ephemeris code by Myles Standish at JPL are used to compute the incident solar radiation at the Apollo sites. A similar procedure is applied to obtain terrestrial radiation at the Apollo sites. With both outgoing and incoming radiation available, we can easily examine the radiation budgets. From the Apollo 15 and 17 HFEs, the surface temperature experiences dramatic changes from ~100 K during lunar night to ~380 K at daytime. The sub-surface temperature at a depth about 50 cm below the surface is not sensitive to daily changes of solar input. The sub-surface in the regolith layer temperature is a good indicator of the lunar climate. We will also discuss the response of lunar climate to changes of total solar irradiance in centennial time scale, and how to use regolith temperature profile to reconstruct the total solar irradiance (TSI) back to Galileo's time.