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CALIBRATION OF MULTI-CHANNEL MILLIMETER-WAVE RADIOMETERS OF GEOSYNCHRONOUS FY-4M USING BRIGHTNESS TEMPERATURE OF THE LUNAR SURFACE AT MILLIMETER CHANNELS DERIVED FROM LRO IR AND CHANG'E MICROWAVE DATA

Abstract

One of Chinese meteorological satellites, Feng Yun-4M (FY-4M), as one of new generation of geosynchronous series satellites, is planning to upload multi-channel millimeter-wave radiometers, e.g. from 50 GHz to 430 GHz. Due to long period stability and no atmospheric interference etc., brightness temperature (TB) of the Lunar surface can be seen as a good candidate for thermal calibration of FY-4M radiometers. In this paper, the physical temperature profile of lunar regolith media is first derived by resolving one-dimensional heat transfer equation with validation of the measurements of the Diviner Lunar Radiometer Experiment onboard the Lunar Reconnaissance Orbiter (LRO). Then, the loss tangent is fitted and validated using the TiO2 abundances, which is derived from Clementine five-bands multispectral data and Chinese Chang'e-2 (CE-2) 37GHz TB data. Multi-channel TB of a lunar surface region along the Moon equator at certain lunar time (noon and midnight) are numerically derived for all FY-4M channels. TB of lunar equator center area (0N,0E) are presented with variation of the lunar local time. These results can be well applied to calibration of FY-4M. with a sustainable error in the range of 1.8K (425 GHz) to 3.8K (89 GHz).