

EGU22-1276

<https://doi.org/10.5194/egusphere-egu22-1276>

EGU General Assembly 2022

© Author(s) 2022. This work is distributed under the Creative Commons Attribution 4.0 License.



Observation of a Total Eclipse of the Moon at 183 GHz

Martin Burgdorf¹, Niutao Liu², Stefan A. Buehler¹, and Yaqiu Jin²

¹Universität Hamburg, Meteorologisches Institut, Centrum für Erdsystemforschung und Nachhaltigkeit, Hamburg, Germany (martin.burgdorf@uni-hamburg.de)

²Key Laboratory of Information Science of Electromagnetic Waves, Fudan University, Shanghai, China

The observation of an eclipse of the Moon at millimetre wavelengths makes it possible to investigate the electrical and thermal properties of the lunar surface to a depth of 10 cm without being influenced by deeper layers. Such measurements are usually carried out with radio telescopes on Earth. When microwave instruments on weather satellites use observations of deep space for their calibration, however, the whole lunar disk appears sometimes in their field of view as well. We identified such an event with the Advanced Microwave Sounding Unit-B on NOAA-15 that coincided with a total lunar eclipse. From this unique vantage point in a polar orbit around the Earth we could measure, once per orbit, the lunar radiance at 183 GHz - a frequency, where the atmosphere is not transparent.

We found a maximum temperature drop during the eclipse of 47 ± 9 K at 183 GHz, corresponding to $16.6\pm 2.1\%$ of the flux density of full Moon, and of 17.3 ± 6 K, corresponding to $6.4\pm 2.1\%$ of the flux density of full Moon, for the window channel at 89 GHz. The evolution in time of the global flux agrees well with the predictions from a new radiative transfer model simulating the global brightness temperatures. Our measurements are consistent with results reported in the past, except for two, which we consider erroneous. The temperature changes are similar everywhere on the lunar disc. The good agreement between the observations from a weather satellite and theoretical predictions demonstrates that the Moon is very useful as flux reference and for checking the reliability of climate data records from Earth observation.