

Spectral radiance simulations of the Earth's disk observed from the Moon by LETO

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The Lunar Earth Temperature Observatory (LETO), which consists of a Fourier transform spectroradiometer (LETO-FTS) and an imager (LETO-IMG) and it is planned to be deployed in the Italian Earth-Moon-Mars (EMM) lunar infrastructure to monitor the global far- and mid- infrared (FIR/MIR) spectral radiance coming from the whole Earth's disk. To mimic the LETO's measurement, a comprehensive software was developed at the CNR-National Institute of Optics. This is composed of an Earth-Moon orbital simulator and a radiative transfer algorithm to simulate the spectral radiance of the Earth's portion viewed from the Moon as a function of time and position of the lunar site. The orbital simulator is able to provide at a given time the Earth's portion observed by LETO, which can be subdivided in pixels to calculate the total radiative contribution. The second algorithm is able to simulate the spectral radiances emitted from each pixel by using the sigma-FORUM fast radiative transfer model to obtain the total integrated emitted radiance. Hourly simulations of the whole spectral radiance of the visible portion of the Earth's disk are obtained for a specific day, for a lunar site located on the prime meridian at a latitude of -70° . Lunar orography can be considered. The time variability of the signal over specific spectral bands, between 100 and 1600 cm^{-1} , is used to study the correlations with the variability of geophysical parameters, such as the global outgoing longwave radiation, the average global temperature, the water vapour amount, etc., with the goal of building a long-term dataset to monitor climate variables.