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Retrieval of atmospheric parameters and radiative properties using Far-Infrared remote sensing measurements

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The far-infrared (FIR) spectral region, covering wavelengths between 15 μm (667 cm^{-1}) and about 1 μm (10,000 cm^{-1}) plays a critical role in the climate system. A good knowledge of the radiation processes in this spectral region is of high interest for observations and understanding of heating and cooling rates, and global energy balance. Even though approximately 50% of terrestrial radiation occurs in the FIR and despite the critical FIR contribution to the Earth's energy balance, this spectral region has been only studied by a few number of instruments. Also the full FIR spectral region has not ever been directly observed from space.

High spectral resolution observations in this region can help to enlighten its role for the global energy budget and atmospheric radiation processes. Among others, the reasons for this lack of measurements are: (i) the decreasing intensity of the radiation towards longer wavelengths; and, then (ii) the high sensitivity and cooling of the detectors requirements. These requirements are now overcome and future space missions will have the capability to measure the full FIR and then open fully one-half of the Earth's spectrum, and accordingly improve our ability to model and assess climate processes.

The aim of the study is to assess the use of FIR remote sensing instruments for retrievals of atmospheric parameters and radiative properties such as heating and cooling rates. Case studies with simulated spectra, together with ground based measurements in the FIR at Dome C over the Antarctic Plateau at 3,230 m a.s.l. (above sea level) in clear-sky conditions, which been observed almost continuously since 2012, are used to assess the potential of remote sensing instruments in the far-infrared region. Appropriate selection of spectral channels to directly measure the far-infrared spectra as needed for future space missions and recommended.