Geophysical Research Abstracts
Vol. 20, EGU2018-14587-2, 2018
EGU General Assembly 2018

Remote sensing of cirrus clouds properties by means of far infrared spectral measurements

Gianluca Di Natale (1), Luca Palchetti (2), Giovanni Bianchini (2), and Tiziano Maestri (3)

(1) Institute of Applied Physics, CNR, Sesto Fiorentino, Firenze, Italy (g.dinatale@ifac.cnr.it), (2) National Institute of Optics, CNR, Sesto Fiorentino, Firenze, Italy (luca.palchetti@ino.cnr..it), (3) Department of Physics and Astronomy, University of Bologna, Bologna, Italy (tiziano.maestri@unibo.it)

Cirrus clouds play a key role in the Earth's radiation budget but there is a large uncertainty about their infrared radiative impact due to the high variability in the size/shape distribution of ice particles. Their radiative effect is very strong in the atmospheric window between 820–960 cm^{-1} (8–12 μm) but the contribution in the far infrared (FIR) of the spectrum, below 667 cm^{-1} (> 15 μm), is also very important. In fact about 50% of the entire thermal flux is emitted in the FIR spectral range and here the sensitivity to the ice particle properties, such as crystal habits, is very large. Despite this, only few measurements exist in the FIR that could be used to improve the characterisation of cirrus radiative effect.
The present work describes remote sensing data concerning high latitudes ice clouds and the derivation of their optical and micro-physical properties, such as the crystals effective diameter, the ice water path and optical depth. Measurements are performed by means of a Fourier transform spectroradiometer, named Radiation Explorer Far Infrared – Prototype for Applications and Development (REFIR-PAD), operating in the FIR spectral region. This instrument has been successfully used during many field campaigns and it is currently installed at Concordia base at Dome-C (Antarctica, 3230 m a.s.l.), where has been operating continuously in ground-based zenith-looking observation geometry since 2012. This campaign has allowed to collect a wide database of the downwelling spectral radiance, also in presence of cirrus clouds, together with other supporting measurements, such as lidar and thermodynamic vertical profiles, for independent characterisation of the atmospheric state.
The retrieval of the cirrus clouds parameters has been performed by two independent methodologies: the physical Radiative Transfer – Retrieval (RT-RET) and the Simultaneous Atmospheric and Clouds Retrieval (SACR) code which is based on optimal estimation. This last code, developed for this purpose, allows to perform the retrieval of the atmospheric variables, such as the vertical profiles of water vapour and temperature, and the cirrus clouds properties by using the single scattering coefficients of different ice crystal habits, provided by specific databases.
The analysis of the cirrus clouds properties, performed by using the ground-based measurements of REFIR-PAD, will be of support to the Far-infrared-Outgoing-Radiation Understanding and Monitoring (FORUM) mission, recently selected by ESA as candidate for the EE-9 missions. FORUM will perform for the first time the spectral measurement of the FIR outgoing radiation and, by flying in tandem with IASI-NG which measures the mid-IR component, will open up a new window for understanding and quantifying the radiative processes involving water vapour, clouds and other greenhouse gases.