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PROBING PLANETARY ATMOSPHERES WITH POLARIZED INELASTIC SCATTERING SENSED BY SPACEBORNE PLATFORMS

Abstract

The quantification of rotational Raman scattering (RRS) in planetary atmospheres and the in-filling of gaseous absorbing lines, such as the oxygen A-band (758 - 772 nm), by inelastically scattered photons is investigated with the vector radiative transfer model SCIATRAN. For various viewing geometries, instrumental specifications and geophysical scenarios, we show that changes in total upwelling radiance, RRS and light polarization help in the retrieval of dust-like aerosol and ice cloud properties. This can be already demonstrated for simulated measurements of the upcoming ESA Sentinel-4 geostationary mission onboard the Meteosat Third Generation Sounder (MTG-S) satellite, whose launch is scheduled for 2020. Sentinel-4's payload is the imaging spectrometer Ultra-violet/Visible/Near-Infrared (UVN) that covers the oxygen A-band at a nominal spectral resolution of 0.12 nm and monitors Europe with hourly time sampling. Additionally, we show a proof of concept of a new spaceborne mission aiming at the analysis of the spectral signature of Raman scattering (the so-called Raman ghosts). The feasibility of the presented method in detecting ice-nuclei of biological origin in exoplanetary atmospheres is discussed.