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Cloud sensitivity studies for stratospheric and lower mesospheric ozone profile retrievals from limb scattered solar radiance

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The cloudy atmosphere plays an important role in reflection, absorption and transmission of solar radiation affecting trace gas retrievals. Here we examine the sensitivity of stratospheric ozone retrievals from limb-scattered radiance to clouds using the SCIATRAN radiative transfer model. SCIATRAN is based on a radiative transfer model using the discrete ordinate method. Assuming an aerosol-free atmosphere, Mie phase functions for cloud particles and a constant ground albedo of A=0.3, we compute the percent relative error of ozone profile retrievals in a cloudy atmosphere with respect to a cloud-free scenario.

To access altitudes from the stratosphere up to lower mesosphere, we combine Chappuis and Hartley ozone absorption bands. We find significant cloud sensitivity to the limb ozone retrivals in the Chappuis bands at the lower stratosphere range. The relative error of the ozone retrieval profile decreases gradually upward and becomes insensitive to cloud above 40 km range. The main parameters that contribute most to the relative error are cloud optical thickness (τ), clouds level, solar zenith angle (SZA) and azimuth angle (ASM). Other variables such as cloud effective radius r_e and cloud thermodynamic state have a small influence on the error, less than 1% at altitudes above the cloud.