



Determination of aerosol properties from MAX-DOAS observations of the Ring effect

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The retrieval of aerosol properties from Multi-Axis-DOAS measurements has become a widely used tool during the last years. From such observations, additional information on aerosols can be retrieved from the analysis of the Ring effect (the filling-in of Fraunhofer lines due to rotational Raman scattering). Here, the first quantitative comparison of MAX-DOAS observations of the Ring effect with model simulations is presented. It is performed for a large variety of viewing geometries (solar zenith angles: 45° to 90°, elevation angles: 3°, 6°, 10°, 18°, 90°; three different azimuth angles), which allows a comprehensive test of our capabilities to measure and simulate the Ring effect. In addition to the Ring effect, also the observed O₄ absorptions and radiances are compared with model simulations. In general good agreement is found for all retrieved quantities. Various sensitivity studies are carried out to investigate the influence of different aerosol properties on the Ring effect (and the O₄ absorption and radiance) under various measurement conditions. It is found that, like for the O₄ absorptions, aerosol optical depth has typically the strongest influence on the Ring effect. But also other properties (e.g. the single scattering albedo and the asymmetry parameter) can have a substantial impact. In specific cases, the observation of the Ring effect can provide complementary information to that retrieved from the O₄ observations.