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Exploitation of the UV Aerosol Index scattering angle dependence: Properties of Siberian smoke plumes

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The UV Aerosol Index (UVAI) is a simple measure of aerosols from satellite that is particularly sensitive to elevated layers of absorbing particles. It has been determined from a range of instruments including TOMS, GOME-2, and OMI, for almost four decades and will be continued in the upcoming Sentinel missions S5-precursor, S4, and S5.
Despite its apparent simplicity, the interpretation of UVAI is not straightforward, as it depends on aerosol abundance, absorption, and altitude in a non-linear way. In addition, UVAI depends on the geometry of the measurement (viewing angle, solar zenith and relative azimuth angles), particularly if viewing angles exceed 45 degrees, as is the case for OMI and TROPOMI (on S5-precursor). The dependence on scattering angle complicates the interpretation and further processing (e.g., averaging) of UVAI. In certain favorable cases, however, independent information on aerosol altitude and absorption may become available.
We present a detailed study of the scatter angle dependence using SCIATRAN radiative transfer calculations. The model results were compared to observations of an extensive Siberian smoke plume, of which parts reached 10-12 km altitude. Due to its large extent and the high latitude, OMI observed the complete plume in five consecutive orbits under a wide range of scattering angles. This allowed us to deduce aerosol characteristics (absorption and layer height) that were compared with collocated CALIOP lidar measurements.