



Observations of the ozone and nitrogen dioxide profiles in TROICA train expeditions Moscow-Khabarovsk-Moscow

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For investigation of the vast area of Northern Eurasia a mobile scientific facility based in a railway carriage was developed. It was equipped with spectrometers for remote sensing of ozone and nitrogen dioxide in the atmosphere for the TROICA-4 and TROICA-8 expeditions, which were carried out from February 18 to March 5, 1998 and from March 19 to April 1, 2004, accordingly. Measurements of the gases were performed during train movement along a way from Moscow to Khabarovsk and back. During TROICA-4, measurements of radiance scattered in the zenith were performed. During TROICA-8, the zenith-sky measurements were supplemented by observations along nine slant directions to characterize better gas tropospheric distribution. A twilight DOAS method was applied for retrieval of nitrogen dioxide profiles basing on spectral measurements at visual wavelength (434-451 nm). A novel DOAS-type retrieval algorithm, which is applicable to UV observations with strong absorption (by ozone), was developed. The new UV retrieval algorithm completely takes into account multiple scattering of sunlight. The linearized radiative transfer model MCC++ was used in radiance calculations. Differ to the NO₂ retrieval, taking into account multiple scattering and albedo is significant for ozone retrieval. Numerical experiments show that using of derivatives calculated in approximation of single scattering leads to overestimation of the total ozone content (TOC) by 15%. The calculation for albedo equal to 0 instead of 1 gives overestimation of the TOC by 5%. The new algorithm was applied for determination of ozone profile and total content using UV spectrum (310-335 nm). The ozone and nitrogen dioxide contents are obtained and shortly validated against available alternative data.