

Assumption of the spherically homogeneous atmosphere in the problem of the satellite IR remote sensing of the mesosphere using limb geometry

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Limb infrared medium- and high-resolution spectra in the CO₂ 15 μm and O₃ 9.6 μm bands have been calculated for tangent altitudes 40-90 km accounting for horizontal gradients of atmospheric parameters and also under the assumption of the spherically homogeneous atmosphere (SHA). In the 15 μm region for tangent altitude 60 km, the errors, stipulated by the SHA assumption, are about 1.5%. In the 9.6 μm region for tangent altitude 70 km and optical path crossing the terminator, the errors reach 10-14%. The absolute values of the errors, caused by the SHA assumption, have been compared to the errors of spectral measurements by modern satellite instruments. In the center of the 15 μm band, the obtained error values exceed the detector noise of the CRISTA instrument, but are considerably lower than the total measurement error value. In the center of the 9.6 μm band for medium spectral resolution, the errors, caused by the SHA assumption, constitute about 0.005 mW/(m² sr cm⁻¹) which is comparable to the total error of the CRISTA spectral measurements. For high spectral resolution calculations in the 9.6 μm region, the errors reach 0.025 mW/(m² sr cm⁻¹) in the line centers. This value is one order of magnitude less than the detector noise of the MIPAS instrument.