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Preliminary study of the limb scattered radiance for a scene with variation of the atmospheric profiles along the line of sight

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The inversion of satellite-based observations of limb scattered sunlight for the retrieval of atmospheric species requires an efficient and accurate modeling of the measurement. In addition, an accurate model is also applied to other research and application fields, such as pointing/attitude retrievals based on measurements with the Rayleigh scattering altitude sensor and precise simulation of atmospheric background radiance and so on. There aren't any models embedding three-dimensional variations in the real atmospheric profiles except Monte-Carlo models. In the present paper, a preliminary study is presented to examine the Ultraviolet limb scattered radiance for a scene with variation of the atmospheric profiles along the line of sight (LOS) based on a single-scattering-approximation radiative transfer (RT) model developed by the authors. In the simulation experiments atmospheric profiles with relatively course vertical and horizontal resolution from ENVISAT-MIPAS product are applied to the model. Preliminary results show that there are 2%∼4% variations in the radiance due to a scene with three dimensional inhomogeneous atmospheric profiles along the LOS compared to that with spherically-layered homogeneous atmospheric distributions.
The work is a preliminary study to quantitatively examine variations in the radiance due to a scene with three dimensional inhomogeneous atmospheric profiles along the LOS compared to that with spherical-layered symmetrical atmospheric distributions, since the MIPAS data have course spatial resolution vertically (3 km - 8 km) and horizontally (2.5°in latitude and 5.0°in longitude) and limited height coverage (21km∼60 km). In addition, the multiple scattering that plays a significant role in the longer ultraviolet and visible wavelengths and the inhomogeneity of aerosols are both ignored in the present research.
The study will be extended to shorter ultraviolet wavelengths, which are suited for ozone retrievals in the mesosphere, sensor altitude examination and so on. And for further exploring the contribution due to the 3D inhomogeneity of atmospheric conditions to limb scattering radiance, the inhomogeneity of aerosols and multi-scattering should be both taken into account in the future.

Keywords: Three dimensional radiative transfer model; Ultraviolet/visible limb scattered radiance; Single scattering approximation