Geophysical Research Abstracts
Vol. 12, EGU2010-14489, 2010
EGU General Assembly 2010

Concept of a Fast and Simple Atmospheric Radiative Transfer Model for Aerosol Retrieval

Felix Seidel (1) and Alexander A. Kokhanovsky (2)

(1) Remote Sensing Laboratories, University of Zurich, Zurich, Switzerland (felix.seidel@geo.uzh.ch), (2) Institute of Environmental Physics, University of Bremen, Bremen, Germany (alexk@iup.physik.uni-bremen.de)

Radiative transfer modelling (RTM) is an indispensable tool for a number of applications, including astrophysics, climate studies and quantitative remote sensing. It simulates the attenuation of light through a translucent medium. Here, we look at the scattering and absorption of solar light on its way to the Earth's surface and back to space or back into a remote sensing instrument. RTM is regularly used in the framework of the so-called atmospheric correction to find properties of the surface. Further, RTM can be inverted to retrieve features of the atmosphere, such as the aerosol optical depth (AOD), for instance. Present-day RTM, such as 6S, MODTRAN, SHARM, RT3, SCIATRAN or RTMOM have errors of only a few percent, however they are rather slow and often not easy to use.

We present here a concept for a fast and simple RTM model in the visible spectral range. It is using a blend of different existing RTM approaches with a special emphasis on fast approximative analytical equations and parametrizations. This concept may be helpful for efficient retrieval algorithms, which do not have to rely on the classic look-up-tables (LUT) approach. For example, it can be used to retrieve AOD without complex inversion procedures including multiple iterations. Naturally, there is always a trade-off between speed and modelling accuracy. The code can be run therefore in two different modes. The regular mode provides a reasonable ratio between speed and accuracy, while the optional mode is very fast but less accurate. The normal mode approximates the diffuse scattered light by calculating the first (single scattering) and second order of scattering according to the classical method of successive orders of scattering. The very fast mode calculates only the single scattering approximation, which does not need any slow numerical integration procedure, and uses a simple correction factor to account for multiple scattering. This factor is a parametrization of MODTRAN results, which provide a typical ratio between single and multiple scattered light.

A comparison of the presented RTM concept to the widely accepted 6S RTM reveals errors of up to 10% in standard mode. This is acceptable for certain applications. The very fast mode may lead to errors of up to 30%, but it is still able to reproduce qualitatively the results of 6S.

An experimental implementation of this RTM concept is written in the common IDL language. It is therefore very flexible and straightforward to be implemented into custom retrieval algorithms of the remote sensing community. The code might also be used to add an atmosphere on top of an existing vegetation-canopy or water RTM. Due to the ease of use of the RTM code and the comprehensibility of the internal equations, the concept might be useful for educational purposes as well. The very fast mode could be of interest for a real-time applications, such as an in-flight instrument performance check for airborne optical sensors.

In the future, the concept can be extended to account for scattering according to Mie theory, polarization and gaseous absorption. It is expected that this would reduce the model error to 5% or less.