Abstract

Tropospheric sulfur dioxide detected by radiance measurements of back-scattered sunlight from the atmosphere and/or reflected by the surface is examined. The satellite instrument Global Ozone Monitoring Experiment (GOME) is used to perform this task. GOME's high spectral resolution enables use of the Differential Optical Absorption Spectroscopy (DOAS) algorithm to derive SO_2 column densities from radiance measurements.
A trajectory model, the Hybrid Single-Particle Lagrangian Integrated Trajectory (HYSPLIT) is used in this work to compute simple air parcel trajectories and dispersion patterns for pollutants. From these calculations, altitude and movement of the plumes are determined. SO_2 values recorded with GOME are compared with Total Ozone Mapping Spectroscopy (TOMS) SO_2 values. Significant deviations were found between the two instruments.
An important aim of this thesis is to improve the analysis algorithm. This is achieved by performing a sensitivity analysis of important parameters Analysis parameters such as wavelength window, sun spectra and absorption cross-sections for different gases are of paramount importance when using the DOAS algorithm. Sensitivity studies show how much influence these parameters have on the final results (column SO_2 values).
By exploiting the GOME data, it is also possible to determine cloud fraction. By comparing cloud fraction and SO_2 values, it is shown that there is a positive correlation between them. Possible explanations for this effect are given.
To convert from slant to vertical column densities, an Air Mass Factor (AMF) must be applied. Geometric calculations of AMF have been compared to AMF calculations from a radiative transfer model. At high solar zenith angles (>60°) they strongly deviate from each other.
When the DOAS algorithm has been applied to the radiance measurements and conversion from slant to vertical columns has been accounted for, plots that indicate the presence of SO_2 can be made. In this work, observations of volcanic eruptions from Italy, Iceland, Congo, Ecuador, and Mexico as well as anthropogenic industrial emission from China, the USA, and Bulgaria are studied. The enhanced SO_2 from anthropogenic sources is concluded to have its origin from the combustion of sulfur rich lignite from coal-fired power plants.