SENSITIVITY OF AIR MASS FACTORS TO ATMOSPHERIC PROFILES OF FORMALDEHYDE

O. Engelsen (1), F. Flatøy (1), A. Kylling (1)
(1) Norwegian Institute for Air Research (NILU)
ola.engelsen@nilu.no/Fax:+47-77750376

Formaldehyde is a good tracer of pollution from fossil fuel combustion and biomass burning. Retrieval of vertical columns of optically thin trace gases such as formaldehyde from satellite or surface based instruments usually involves two steps: 1) Slant columns are obtained by fitting modelled spectra to observed absorption spectra, e.g. by the DOAS algorithm. 2) Air mass factors (AMFs) are computed by radiative transfer models to convert slant column measurements of trace gases into total vertical columns. The AMFs are defined as the ratio of the slant columns to the vertical columns. Because of scattering in the atmosphere, the AMFs depends on the vertical distribution of the trace gases of interest, as well as the vertical profiles of scattering constituents in the atmosphere.

In this paper we explore the sensitivity of AMFs with respect to various atmospheric profiles.

Using a regional atmospheric chemical transport model (CTM) we can simulate realistic profiles at arbitrary locations and study the impact of the vertical profiles of trace gases on air mass factors. For example, we have simulated daily vertical profiles of formaldehyde for the Italian city of Milan throughout the full year of 1999. We found that air mass factors can vary between 1.3 and 1.9 at UV wavelengths (336nm) at low solar elevations (3 degrees) for a surface based zenith-sky looking spectrometer. The corresponding range for a nadir-looking satellite instrument is 0.3 to 0.9. The vertical column retrieval can be greatly enhanced by use of CTM results.