Geophysical Research Abstracts,
Vol. 11, EGU2009-6972, 2009
EGU General Assembly 2009

Providing Space-Based Constraints on the Chemical Composition of Aerosols

J.P. Veefkind (1), B. Veihelmann (1), K.F. Boersma (1), T. Kurosu (2), and P.F. Levelt (1)

(1) Royal Netherlands Meteorological Institute, KNMI, De Bilt, Netherlands (veefkind@knmi.nl), (2) Harvard-Smithsonian Center for Astrophysics, Cambridge, MA, USA

Human activities around the globe cause the emission of gases such as SO_2, NO_x and VOCs. In the atmosphere, these gases are transformed to secondary fine mode aerosol particles. Understanding sources of anthropogenic aerosols and their precursor gases is relevant for climate change as well as for air quality. To predict how the aerosol load responds on changing emissions, knowledge of the chemical composition of aerosol particles is necessary.

Over the last decade, accurate satellite data on aerosol optical thickness (AOT) and tropospheric columns of NO_2, SO_2 and formaldehyde (HCHO) have become available. In this contribution we use AOT from MODIS on the NASA EOS Aqua satellite and NO_2, SO_2 and HCHO data from OMI on the NASA EOS Aura satellite, which are both part of the A-Train satellite constellation. Whereas the trace gas tropospheric columns are a direct measure of the concentration, the AOT is an optical parameter, which is not directly linked to the physical and chemical properties of the aerosol particles. To establish the link between the AOT and its precursor gases, we have investigated the spatial correlation of AOT and the trace gas columns in multi-year averages for different regions and seasons.

The results show that in regions where the aerosol is dominated by anthropogenic sources, there is a strong spatial correlation between AOT and tropospheric NO_2. HCHO columns correlated with AOT for biomass burning regions and industrial regions in Asia. Also strong correlation is observed between AOT and HCHO over the Southeast of the USA in the summer season, which can be attributed to aerosols from biogenic sources.

We show that the corresponding slope between the AOT and NO_2 varies strongly between source regions and contains information on the chemical composition of the aerosol particles. For example, we find that the AOT-NO_2 slope is comparable between Northwestern Europe and the US East coast, but deviates from the slope over Eastern Europe. This difference in slope can be explained by difference in the sulfate to nitrate ratio of the aerosol particles.