Seminar on Physics and Chemistry
of the Atmosphere
26.01.2018, WiSe 2017-2018, IUP Bremen

Investigation of NO_2 vertical distribution from satellite measurements
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Detection of outflow from the African continent

Lisa Behrens
(IUP)

Abstract

The talk is divided into two independent parts. The first part is about a novel NO_2 DOAS retrieval in the ultraviolet (UV) spectral range for satellite observations from the Global Ozone Monitoring Instrument 2 on board EUMETSAT's MetOp-A (GOME-2A) satellite. The results from the new UV NO_2 retrieval will be compared to an established NO_2 retrieval in the visible (vis) spectral range from the same instrument and infer (albeit limited) information about the NO_2 vertical profile shape in the troposphere. Radiative transfer calculations for satellite geometries show that the sensitivity close to the ground is higher in the vis than in the UV spectral range. Consequently, NO_2 slant column densities (SCDs) in the vis are usually higher than in the UV, when the NO_2 is close to the surface. Therefore, these differences in NO_2 SCDs between the two spectral ranges contain information on the vertical distribution of NO_2 in the troposphere.

6 regions are investigated in more detail, representative of both anthropogenic and biomass burning NO_2 pollution. Anthropogenic air pollution is mostly located in the boundary layer close to the surface, which is reflected by the large differences between UV and vis SCDs of 60%. Biomass burning NO_2 in contrast is often uplifted in elevated layers, above the boundary layer. While not enabling a full retrieval of the vertical NO_2 profile shape in the troposphere, the results can help to constrain the vertical profile of NO_2 in the lower troposphere and, when analyzed together with simulated NO_2 fields, can help interpret the model output.

The second part of the presentation is about enhanced levels of formaldehyde (HCHO) and glyoxal (CHOCHO) over the Atlantic Ocean, which are regularly identified in trace gas global maps retrieved from satellite measurements. To validate the spatial distribution of the apparent continental outflow, ship-based measurements were performed during the DFG project COPMAR (Continental outflow of pollutants towards the marine troposphere). A multi-axis differential optical absorption spectrometer (MAX-DOAS) was installed on board the research vessel Maria S. Merian. This cruise was conducted in October 2016 and went from Ponta Delgada (Azores) to Cape Town (South Africa). The observed spatial gradients of HCHO and CHOCHO along the cruise track have a similar spatial distribution. Especially, on one day enhanced values were observed in an elevated layer, which is expected from

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satellite measurements and as model simulations. Furthermore in the measurement, the well-known diurnal cycle and the latitudinal dependency of stratospheric NO_2 could be observed.