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Systematic aerosol characterization by combining GOME-2 UV Aerosol Indices with trace gas concentrations

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The task of determining aerosol type using passive remote sensing instruments is a daunting one. First, because the variety in aerosol (optical) properties is very large; and second, because the effect of aerosols on the detected top-of-atmosphere reflectance spectrum is smooth and mostly featureless. In addition, spectrometers like GOME-2 have a coarse spatial resolution, which makes aerosol characterization even more difficult due to interferences with clouds.

On account of these problems, we do not attempt to derive aerosol properties from single measurements: instead, we combine time series of UV Aerosol Index and trace gas concentrations to derive the dominating aerosol type for each season. Aside from the Index values and trace gas concentrations themselves, the correlation between UV Aerosol Indices (which are indicative of aerosol absorption) with NO_2, HCHO, and CHOCHO columns – or absence of it – provides clues to the (main) source of the aerosols in the investigated region and time range. For example: a high correlation of HCHO and Absorbing Aerosol Index points to aerosols from biomass burning, highly correlated CHOCHO, HCHO, and SCattering Index indicate biogenic secondary organic aerosols, and coinciding high NO_2 concentrations with high SCattering Index values are associated with industrial and urban aerosols.

We here present case studies for several regions to demonstrate the suitability of our approach. Then, we introduce a method to systematically derive the dominating aerosol type on a global scale on time scales varying from monthly to yearly.