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Colours of air pollutants: Spectral responses of ambient aerosols

The spectral responses of ambient particulate matter (PM) are in the middle of gradually increased scientific interest in environment science nowadays. On a global scale, the ambient aerosol as a driver of global warming are in major concern, while on a regional scale, the scientific attention is dominantly focussing on the atmospheric PM as an air pollutant particularly in terms of its regulation. Aerosol can absorb and scatter the incoming radiation affecting the radiative balance of the atmosphere (direct effect) and can also act as cloud condensation nuclei (CCN) modifying the spectral responses and also the residential time of clouds (indirect effect). According to the latest scientific assessment the carbonaceous particulate matter (CPM) which is a negligible subsection of total particulate matter (TPM) in mass concentration is the second most important human emission. Only the CO2 greenhouse gas has larger climatic effect than that of CPM. Despite of its importance the spectral responses of CPM are described poorly in the literature. That can be attributed to several reasons. Starting from the missing data of the recently discovered CPM constituents such as HULIS (humic like substances) aerosol, via the lack of proper instrumentation for accurate and precise determination of absorption, ending with the deficient knowledge of the effect of ambient factors on the absorption spectra. Moreover, many studies have demonstrated experimentally that the absorption spectra of CPM can be used as a real time measurable chemical selective parameter opening up novel possibilities in source apportionment and also in regulation term. In this course, we learn about the basic principle of light-aerosol interaction especially focussing on the absorption phenomenon of light absorption by carbonaceous nano-fractal aggregates emitted by combustion processes. We describe the analytical and methodology difficulties associated to the spectral responses measurement of CPM, introduce novel methodologies into the generation and also into the precise and accurate characterisation of CPM developed at University of Szeged recently. Finally, we describe some practical applications of the presented methodologies for real time source apportionment and for toxic alerting.