15 year long-term trend of OC and EC in PM at Melpitz site in Germany using an inter-comparison of thermographic and thermo-optical data

Gerald Spindler, Anke Rödger, Laurent Poulain, Hartmut Herrmann

Leibniz Institute for Tropospheric Research (TROPOS), Permoserstrasse 15,
D-04318 Leipzig (Germany)

Organic (OC) and elemental carbon (EC), sum total carbon (TC),were quantified on daily quartz-fibre filters (HV samples PM10, PM2.5 and PM1, DIGITEL DHA-80) at the TROPOS site in Melpitz (German lowlands in Central Europe, 12°56'E, 51°32'N, 86 m a.s.l.) Melpitz represents the regional background in Central Europe (Spindler et al. 2012 and 2013) and highest EC concentrations were found during air-masse transport from East especially in winter (van Pinxteren et al. 2016). The concentrations in 2013 for OC und EC were 3.12 and 2.08 μgm^{-3}. The quantified amount of OC or EC depends from the method and temperature protocol used. From 2003-2014 a thermographic method (TGVDI) following VDI2465 (Part 2) was realized. Because this method doesn't exceed 650°C, also impactor samples on aluminum foils can be analyzed. Charring processes cannot be accounted here (Spindler et al 2012). Therefore 2012 a thermo-optical method (TO) using the Lab OC-EC Aerosol Analyzer (Sunset Laboratory Inc.) together with the temperature protocol EUSAAR2 (Cavalli et. al 2009) was introduced. Charring correction is done by Transmittance (TOTEUSAAR2). In European networks, EMEP[1)], ACTRIS and ACTRIS2[2)] this method is the preferred technique. Both methods were used for three years (2012-14) in parallel. For the transformation of TOTEUSAAR2-results from 2015 to 2018 back to quasi TGVDI-results linear conversion equations for OC, EC and TC were derived from daily measurements (Equation 1).

$$[OC; EC; TC]_{TGVDI} = m \times [OC; EC; TC]_{TOTEUSAAR2} + n \qquad (1)$$

Because there was no dependence from the particle size but from the season, conversion equations were calculated for the twelve months of the year over all three sizes as a three year mean (inter-comparison). For OC the factors m for February and May are in the range of 0.794 and 0.601 respectively. Using this factors continuous falling long-term trends (2003-2018) for OC ($-0.036\ \mu gm^{-3}a^{-1}$) and EC ($-0.073\ \mu gm^{-3}a^{-1}$) could be reconstructed quasi without inhomogeneity. A recalculation of OC and EC detected by different thermographic and thermo-optical analyzing methods is impossible mostly, because it strongly depends from the place of measurement, the meteorological conditions and the chemical character of carbonaceous aerosol detected.

Cavalli et al. (2010) Atmos. Meas. Tech., **3**. 79-89.
Spindler et al. (2012) J. Atmos. Chem. 69, 127-157.
Spindler et al (2013) J. Atmos. Chem. **70**, 165-195.
Van Pinxteren et al. (2016) Faraday Discuss. **189**, 291-315.

1) Co-operative Programme for Monitoring and Evaluation of the Long-Range Transmission of Air Pollutants in Europe

2) Aerosols, Clouds, and Trace gases Research InfraStructure network