Cite abstract as Author(s) (2017), Title, European Aerosol Conference 2017, Zurich, Abstract T205N452

Characterization of the aging process of smoke observed over Austria using organic carbon mixing ratio

C. Talianu[1,2]

[1]*Institute of Meteorology, University of Natural Resources and Life Sciences, Vienna, Austria,*
[2]*National Institute or R&D for Optoelectronics, Magurele, Romania*

Keywords: smoke, organic carbon, aerosol aging, lidar ratio.
Presenting author email: camelia.talianu@boku.ac.at

The smoke from anthropogenic and natural sources is considered to be a mixture of sulphates, black carbon (BC) and organic carbon (OC), see Solomon et al (2006). It is produced in two ways: emitted directly as particles into atmosphere (primary aerosols), or created in the atmosphere after chemical or physical transformations of precursor gases (secondary aerosols). Most of the smoke is in the optically active accumulation mode.

In this paper, a method to characterize the smoke aging process based on mixing ratio is presented. For this study we used MACCIII reanalysis data at 700 hPa level, related to OC, BC and Sulphate, for March – May 2014, for Vienna, Austria as reference site. Seven cases of smoke were identified, using a back-trajectories analysis based on Flexpart aerosol dispersion model, see Stohl et al (2005). The cases selected for this study are shown in Table 1.

Table 1. Cases of smoke over Vienna in Spring 2014.

Date	Hour	Source
22 March	00:00 UTC	Austria
2 April	12:00 UTC	North America
4 April	18:00 UTC	North America
8 April	18:00 UTC	Austria
14 April	12:00 UTC	North West Europe
29 April	18:00 UTC	South East Europe
7 May	06:00 UTC	North America

The microphysical properties for smoke compound calculated at 0 % relative humidity, are shown in Table 2.

Table 2. Microphysical properties for BC hydrophilic (BC1), BC hydrophobic (BC2), OC hydrophilic (OC1), OC hydrophobic (OC2), Sulphate (SU).

Spc	Sigma	Density [μg/m3]	Radius [μm]	Reference
BC1	1.7	1.5	0.0118	Solomon et al (2006)
BC2	2.0	1.5	0.03	Solomon et al (2006)
OC1	2.0	1.7	0.06	Solomon et al (2006)
OC2	2.0	1.7	0.1	Solomon et al (2006)
SU	2.03	1.7	0.069	Koepke et al (1997)

The smoke aerosol is considered to have a small depolarization (less than 5%). The optical properties for smoke were calculated using T-Matrix method for two wavelengths: 350 nm and 550 nm. The aging process was determined using two methods: ratio of OC mixing ratio to BC mixing ratio (OC/BC), respectively ratio of OC mixing ratio to total mixing ratio (OC/T). In order to estimate the aerosol ages, the result was compared with the ratio (RLR) of lidar ratio at 550 nm to lidar ratio at 350 nm, see Nicolae et al (2013). RLR < 1 means fresh smoke and RLR >= 1 means aged smoke. The age of smoke is proportional to the growth of the RLR.

Results

Figure 1 shows the comparison between RLR derived from optical parameters and the mixing ratios for each case analysed.

We obtained a good correlation between RLR and both methods. The results shows that the age of aerosols increases with increasing content of OC.

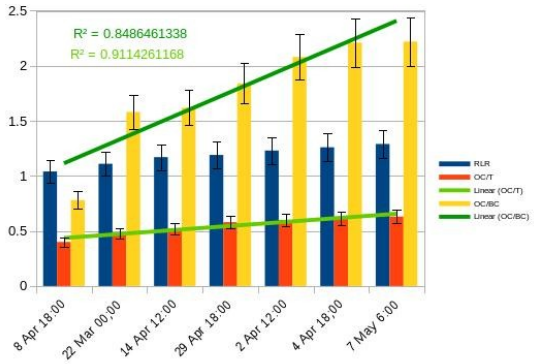

Figure 1. Comparison between RLR and OC/T and OC/BC.

This work is supported by Austrian Science Fund (FWF): project number M 2031 Meitner-Programm.

Solomon, F., Giorgi, F., and Liousse, C. (2006) *Tellus*, **58B**, 51–72

Stohl, A., Forster, C., Frank, A., Seibert, P., and Wotawa, G. (2005) *Atmos. Chem. Phys.*, **5**, 2461-2474

Koepke, P., M. Hess, I. Schult, and E.P. Shettle (*1997*), *Report* No. **243**, Max-Planck-Institut für Meteorologie, Hamburg

Nicolae, D., Nemuc, A., Müller, D., Talianu, C., Vasilescu, J., Belegante L., and Kolgotin, A. (2013), *J. Geophys. Res*., **118**, 2956–2965