Long-term observations of carbonaceous aerosols and related gaseous emissions near a crude-oil plant in South Italy

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Keywords: Carbonaceous aerosol, organic emissions, time series
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A two-year dataset of almost continuous Black Carbon (BC) content measurements by a Magee AE31 7-wavelenghts aethalometer (370 to 950 nm) near a crude oil pre-treatment plant in South Italy (Agri Valley, 40.33°N, 15.92° E, 582 m a.s.l) has been analyzed. Since 1996 an intense crude-oil extraction together with a pre-treatment activity has been carried out at the site with continuous and controlled combustion processes and smoke emissions.

A suitably implemented algorithm has been applied to the aethalometer data in order to analyse absorption coefficient spectral dependence and to reduce the error in UVPM detection (Esposito *et al.*, 2012). BC and UVPM data have been compared to some organic compounds concentrations (Benzene, Toluene, Methane, Non-Methane Hydrocarbons) routinely measured at the same site and for the same period by ARPAB (Basilicata region environmental protection agency).

Recurrent trends have been searched for on a wide temporal scale (two-years diurnal cycles/ seasonal pattern, summer and winter) by applying the statistical Lomb-Scargle periodogram technique to the entire data-set. This is a powerful technique to be applied for frequency analysis of not equally-spaced data to obtain reconstructed spectra on both seasonal and annual basis (Hocke *et al*., 2009). These spectra can be considered as representative of background emissions to be compared with much intense emissions taking place in shorter periods (few days to few weeks) during the year (Pavese *et al*., 2012).
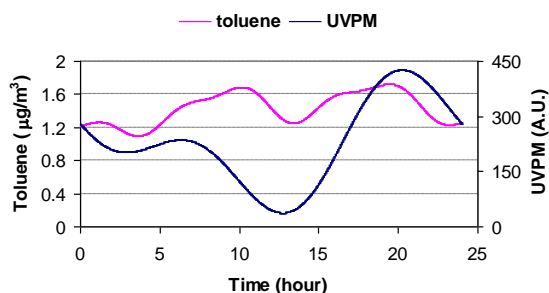

Figure 1: Reconstructed spectra of toluene and UVPM "typical day" as obtained by Lomb-Scargle periodogram for the two-year database.

As an example, reconstructed spectra of toluene and UVPM "typical day" from two-years concentrations data are shown in Figure 1. The differences observed can suggest different dynamics in aerosol formation and/or in adsorption processes onto atmospheric particles.

On the contrary, considering an episode of intense emissions (March, 8th- 19th 2011), UVPM and toluene time behaviours show similar patterns, as reported in Figure 2, highlighting the necessity to study emissions on different time-scales.
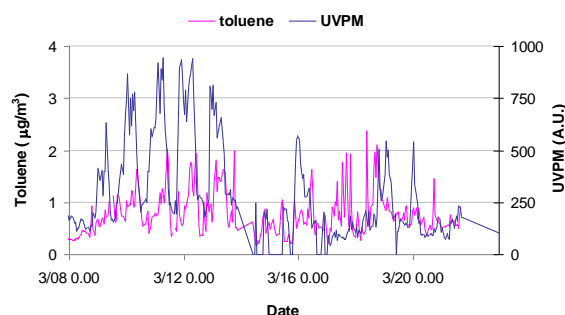

Figure 2: Temporal variation of toluene concentrations and UVPM hourly mean values for the period march 8th - 19th 2011.

To complete this study, an analysis of meteo-climatic parameters such as solar radiation, wind intensity and prevalent direction, has been carried out to verify if and when these parameters contribute to a major/minor agreement among combustion products time patterns.

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