Long-term atmospheric measurements of Benzene and Toluene in Athens during wintertime: Indications of financial crisis influence on traffic and biomass burning emissions

B. Psiloglou[1], E. Liakakou[1], A. Paliatsos[2] and N. Mihalopoulos[1,3]

[1]IERSD, National Observatory of Athens, Palaia Penteli, GR-15236 Athens, Greece
[2]Electronic Computer Systems Engineering Dept, Tech. and Education Institute of Piraeus, Athens, Greece
[3]ECPL, Department of Chemistry, University of Crete, GR-71003 Heraklion, Crete, Greece
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Presenting author email: bill@meteo.noa.gr

Benzene and toluene are constituents of gasoline and are emitted into the atmosphere by car exhausts. In addition biomass burning can also lead to additional emissions of these aromatic compounds (Novakov & Corrigan, 1996). Since 2009, Greece experienced a severe financial crisis leading to a significant decrease in traffic emissions and industrial activity by almost 30-50% (Vrekoussis et al., 2013). In addition since winter 2013, smog events were observed in the greater Athens area as an immediate result of the economical crisis due to increase of heating oil price which enhanced the use of wood as burning material.

During wintertime (October to December) in 2009, 2014 and 2015 a Differential Optical Absorption Spectroscopy (DOAS) system was continually operated in the Athenian suburb of Aegaleo, at the Technological Educational Institute of Piraeus (TEIP) facilities. This system, unique in the greater Athens area, monitors basic air pollutants (O_3, NO_2, SO_2), as well as benzene and toluene (BT). Additionally in winter 2014 and 2015 campaign measurements at Thissio (historical centre of Athens), including CO and BC incorporating a MAAP Thermo and Magee Scientific seven wavelengths aethalometers, were also available. The comparison of O_3, NO_2, BT and BC concentrations during these two periods (2009 vs. 2014-2015) can provide useful information on the influence of traffic and biomass burning on the air quality of the urban environment.

The mean diurnal variation of both benzene and toluene, for 2009 and 2014-2015 respectively, is depicted in Figure 1. Measurements conducted during October 2014 and May 2015 (not shown) were considered as wood burning free periods. The dominant peak during the morning hours related to traffic is clearly visible for both benzene and toluene. However benzene and toluene levels are significantly reduced in 2014-2015 compared to 2009 by almost 50% in line with NO_2 decrease (fig. 1). Apart the concentration levels a complete different pattern was observed for BT in the afternoon/night hours in November and December (fig. 1). Traffic peak significantly decreased in 2014-2015 compared to 2009 and replaced by another peak delayed (by almost 2 hours) compared to 2009 and significantly correlated to BC (fig. 2) and CO (not shown) and assigned to biomass burning. A clear night peak (20-4h next day) was observed for BT, CO and BC during the colder winter months (November, December) when intense biomass burning activity was observed.

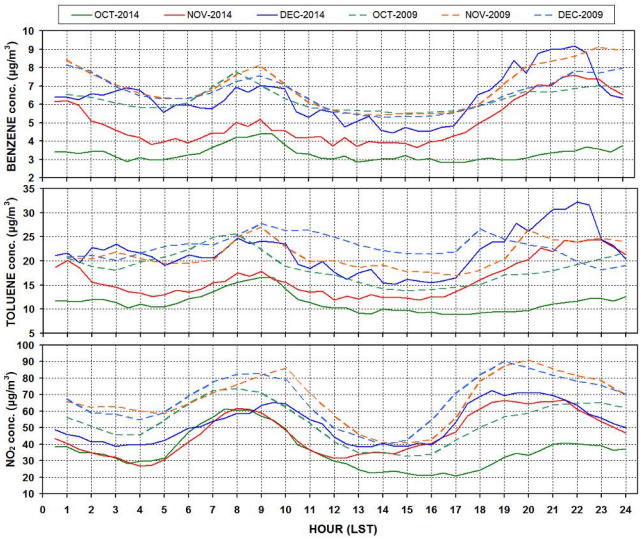

Figure 1. Mean diurnal variation of Benzene, Toluene and NO_2 concentrations, for October-December period, at TEIP site, during the years 2009, 2014-2015.

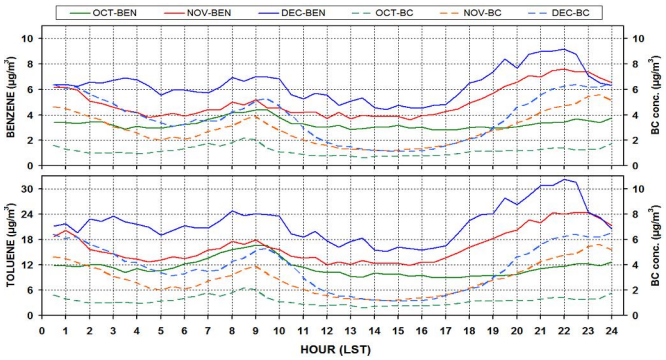

Figure 2. Mean diurnal variation of Benzene, Toluene and BC concentrations, for October-December period, at TEIP site in Athens, during the period 2014-2015.

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