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Black carbon measurements during winter 2013-2014 in Athens and intercomparison between different techniques

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Black carbon (BC) is a particulate pollutant species emitted from the combustion of fuels, biomass burning for agricultural purposes and forest fires, with the first two anthropogenic sources being the major contributors to the atmospheric burden of BC. The presence of BC is important due to its direct and indirect physicochemical effects and its use as a tracer of burning and subsequent transport processes.

Black carbon measurements took place during winter 2013 –2014 in the frame of a pollution monitoring experiment conducted at the urban site of Thissio, Athens (city center) at the premises of the National Observatory of Athens. The economic crisis in Greece and the resulting turn of Athens inhabitants to wood burning for domestic heating, has led to increased daily concentrations of BC in the range of 2-6 μg m^{-3}, peaking at night time (15-20 μg m^{-3}). Three different optical methods were used for the determination of BC. A Particle Soot Absorption Photometer (PSAP; Radiance Research) commercial instrument was used to monitor the light absorption coefficient (σ_{ap}) at 565 nm of ambient aerosols, with 1 minute resolution. During parts of the campaign, a portable Aethalometer (AE-42; Magee Scientific) was also used to provide measurement of the aerosol BC content at 7 wavelengths over 5 minutes intervals. Exploiting the measurements at different wavelengths is was feasible to separate wood burning BC from BC related to fossil fuel. Two Multi Angle Absorption Photometers (MAAP; Thermo) were also operated as reference. Finally, aerosol samples were collected on 12-hour basis using a sequential dichotomous sampler for the sampling of $PM_{2.5}$, $PM_{2.5-10}$and PM_{10} fractions of aerosols on quartz filters, and the filters were analyzed for elemental carbon (EC) by a thermal – optical transmission technique.

The main objective of the study is the intercomparison of the different BC monitoring techniques under a large range of ambient concentrations achieved due to the special circumstance occurring in Athens with the rapid increase of BC emission due to wood burning. In parallel, the BC measurements are used for the estimation of the contribution of wood burning in fireplaces and wood-stoves in ambient PM levels, compared to other known sources of local pollution (e.g. traffic, central heating).