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Two year-long continuous monitoring of PM_1 aerosol chemical composition at the Cyprus Atmospheric Observatory. Source apportionment of the Organic content and geographic origins.

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Particulate matter with diameter smaller than $1\mu m(PM_1)$ induces direct and indirect effects on local and regional pollution, global climate and health. As of the beginning of 2015, the chemical composition of submicron aerosols, is continuously being monitored at the newly established Cyprus Atmospheric Observatory (CAO, http://www.cyi.ac.cy/index.php/cao.html), a national facility of the ACTRIS Research Infrastructure operated by The Cyprus Institute. Cyprus, an island located in the Eastern Mediterranean Middle East region and influenced by diverse air masses throughout the year, is ideal for monitoring photochemically aged aerosols and gaseous pollutants of both natural and anthropogenic origin. Furthermore this is a unique dataset for this area in such proximity to the Middle East, a poorly documented area in terms of atmospheric aerosol observations.

An Aerodyne Quadrupole Aerosol Chemical Speciation Monitor (Q-ACSM) is currently deployed at the CAO premises (35.04N – 33.06E) situated at the rural area of Agia Marina Xyliatou on the foothill of mount Troodos at an elevation of 532m above sea level (asl). The ACSM delivers chemical composition of the major non-refractory aerosol (PM_1) chemical constituents (organics, sulfate, nitrate, ammonium, chloride) with an effective (close to 100%) collection efficiency for particles in the diameter range of 65-700 nm at a 30 minute temporal resolution. Black Carbon (BC) was also monitored using both Magee Scientific AE-31 and AE-33 aethalometers. Quality control of the PM chemical dataset was conducted by comparison with chemical analysis performed on collocated 24-h filter samples (PM_1) and comparison with 1-h $PM_{2.5}$ derived from a Thermo Scientific TEOM (1400a) Monitor. Positive Matrix Factorization (PMF) was conducted and different organic aerosol factors were distinguished using the Igor based SoFi toolkit utilizing the ME-2 multilinear engine. Air mass origin was investigated for each measurement day using the Lagrangian dispersion model FLEXPART in backward mode.

Analysis of the PMF on the organic mass spectra, based on good agreement with external standard mass spectra, led to the selection of a solution with three factors, an HOA (Hydrocarbon-like Organic Aerosol) factor with relatively low overall contribution (9%), a typical Low Volatility (LV-OOA) factor contributing 54%, and a factor attributed to Semi-Volatile organics (SV-OOA), contributing 37%. The FLEXPART model analysis, led to eight main regions of influence, namely Europe, West Turkey, Anatolia, Middle East, North Africa, Marine, Local and Mixed. Organic content exhibits maximum values when air masses originate from the wider northern sector (West Turkey and Anatolia) and the Middle East. Less aged organic content was identified for air masses originating from the immediate neighboring regions (West Turkey, Anatolia, Middle East and North Africa) while fresh organics peaked when air masses originated from the Middle East, coinciding with elevated BC concentrations, suggesting strong anthropogenic sources for this sector.

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