



Aerosol chemical composition at NEO (Eastern Mediterranean) during the ARGON 2012 summer campaign

NAVARINO
ENVIRONMENTAL
OBSERVATORY

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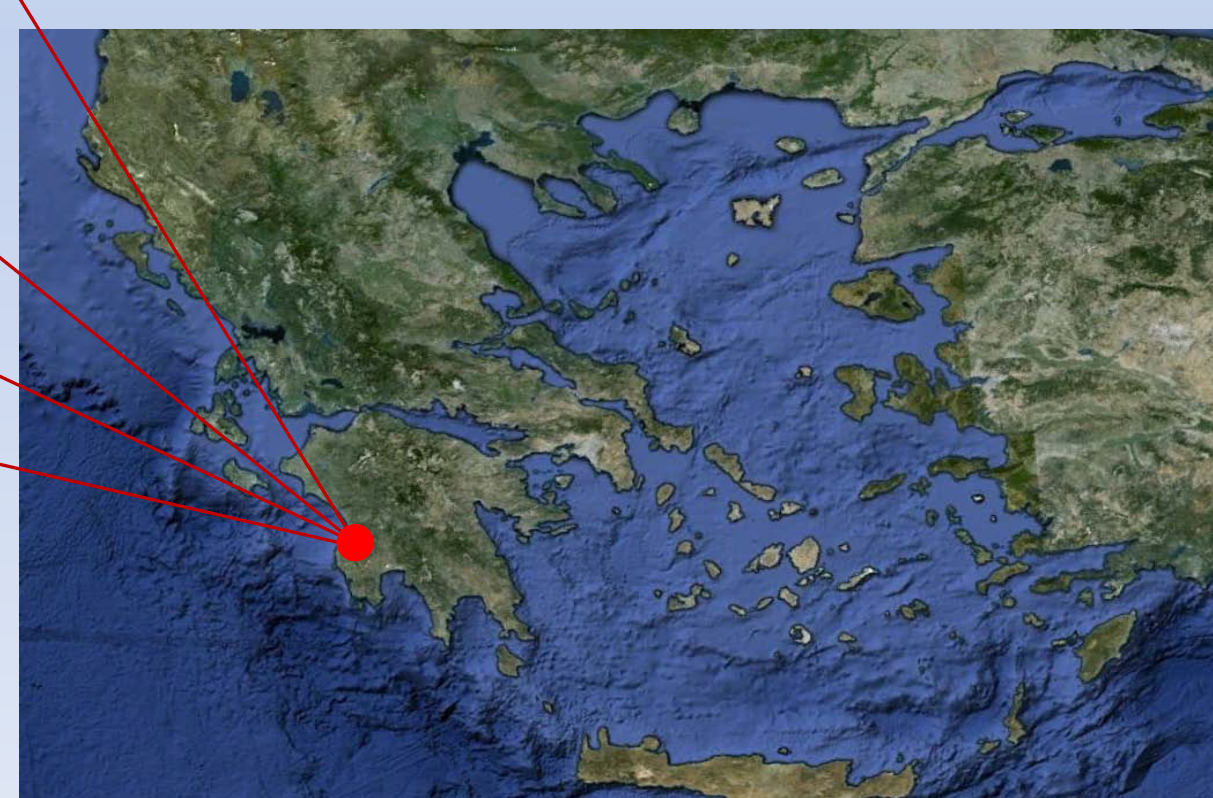
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The NEO station



The Navarino Environmental Observatory (NEO) is a collaboration between the Stockholm University, the Academy of Athens and a private company (TEMES S.A.) dedicated to research and education on the climate and environment of the Mediterranean region. The Observatory is situated in SW Greece and operates an aerosol station for monitoring of main aerosol physical, optical and chemical properties, as well as a radiometric station, since 2011 (www.navarinoneo.gr)



The ARGON campaign

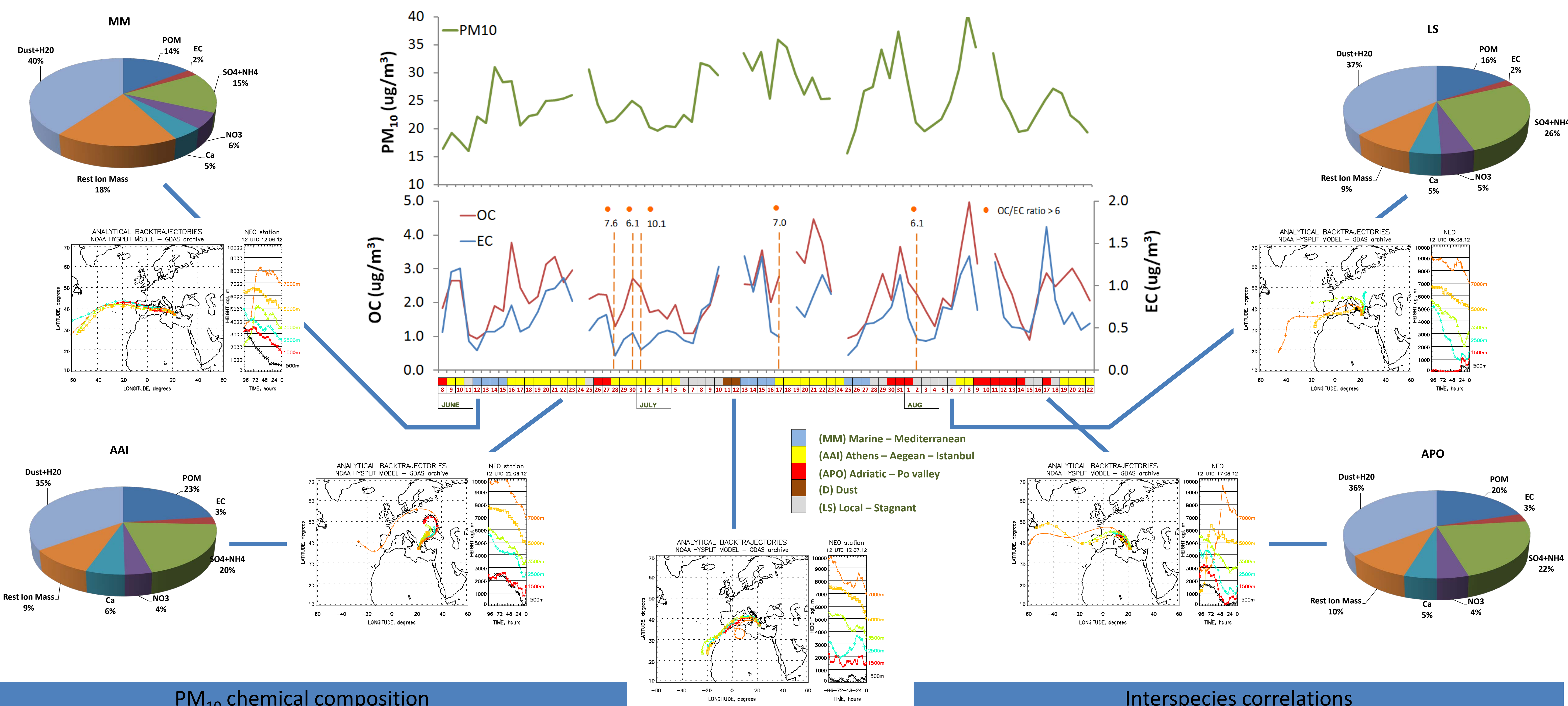
ARGON (Aerosol and Trace Gases Observational Campaign at NEO)

In an attempt to identify and discriminate local sources from medium to long range transport during summer time, the ARGON campaign was organized. The main campaign took place during the period 7 June – 12 July 2012 at NEO, while sampling for chemical composition analyses was extended to 22 Aug 2012. During the main period and in parallel to the routine measurements of the station, additional instrumentation was operated for the monitoring of NO_x (NO and NO₂), CO and PM₁₀, for the first time in the area. A PM₁₀ sampler was used for the collection of 24h atmospheric samples on quartz filters for further in vitro chemical analyses. Finally, a mobile LIDAR system was deployed for the scanning of the vertical profile of aerosol in the atmosphere during the period of measurements.

Chemical Analyses

The sampling at NEO station (37°00'N, 21°6'E, 50 m a.s.l.) was conducted using a Derenda PNS 16T sampler. A total of 71 samples of the PM₁₀ fraction of particulate matter were collected on a 24hour basis, using quartz fiber filters. The filters were weighed prior and posterior to sampling, in order to estimate the masses of collected aerosol. Chemical analyses were conducted on all acquired samples for the definition of chemical composition of the PM₁₀ fraction. The concentration of Organic and Elemental carbon was calculated using the Thermal-Optical Transmission (TOT) technique on a Sunset Laboratory OC/EC Analyzer while the content in Water Soluble Organic Carbon was defined by a Shimadzu Total Organic Carbon Analyzer. The samples were also analyzed by Ionic Chromatography for the main water soluble ions. More specifically, the concentration of anions (Cl⁻, NO₃⁻, SO₄²⁻, PO₄³⁻, C₂O₄²⁻) was determined using a Dionex AS4A-SC column whereas, for the definition of cations (NH₄⁺, K⁺, Na⁺, Mg²⁺, Ca²⁺) a Dionex CS12-SC column was applied.

RESULTS - DISCUSSION



PM₁₀ chemical composition

	PM10 ugr/m3	OC ugr/m3	EC ugr/m3	WSOC
avg	25	2.34	0.68	1.18
stdev	5	0.86	0.33	0.53
min	16	0.89	0.17	0.13
max	40	4.97	1.70	2.92

	Na	NH4	K	Mg	Ca
avg	1.23	0.45	0.17	0.14	1.29
stdev	0.78	0.30	0.15	0.13	0.66
min	0.20	0.00	0.01	0.00	0.14
max	4.54	1.38	0.96	0.66	3.55

	Cl	NO3	HPO4	SO4	Ox
avg	0.59	1.15	0.11	4.92	0.51
stdev	0.89	0.57	0.05	1.44	0.18
min	0.00	0.00	0.00	2.40	0.20
max	4.94	2.54	0.27	8.47	1.01

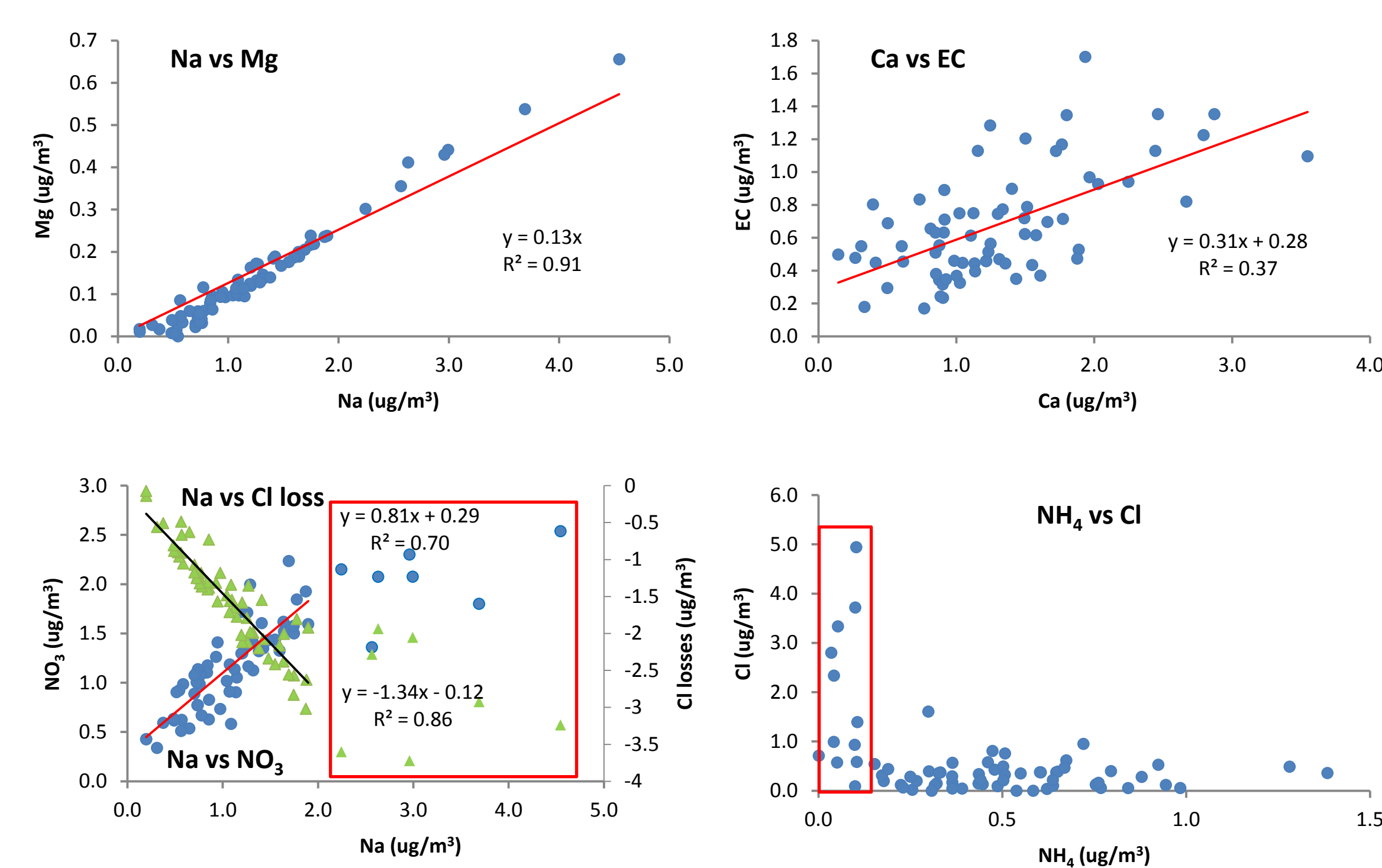
PM₁₀ concentration varies from 16 to 40 ugr/m³ with an average value of 25 ugr/m³, which is typical for regional background (RB) in the Mediterranean Basin, taking also into account the west-east trend (Querol et al., 2009).

EC is 2-3 times higher than the Mediterranean RB (0.2-0.4 ugr/m³) while OC falls in the typical range of values. For the same period OC and EC values at the closest ACTRIS site (Finokalia) were 1.8 and 0.3 ugr/m³, respectively, indicating the impact of local fires in Peloponnese on ambient AQ.

Sulphate levels measured at NEO fall close to the usual range reported for Eastern Mediterranean (5-6 ug/m³), which are among the highest in Europe.

Nitrate levels are considerably lower than the what is usually observed over the Mediterranean (1.7-1.9 ug/m³) (e.g. Koulouri et al., 2008)

Interspecies correlations



Na vs Mg: the mass ratio of 0.13 is close to that reported for seawater (0.12, Bardouki et al., 2003) indicating that both are exclusively of marine origin and thus Na can be used as an index of marine aerosol

Ca vs EC: Ca higher values are observed for air masses from continental Greece (mostly dry) and the correlation between Ca and EC indicates the parallel enrichment with EC from combustion processes

Na vs NO₃: For higher Na concentrations (>2 ug/m³, marine aerosol) a plateau is formed between Na and NO₃. This is indicative of heterogeneous reactions on sea salt between NaCl and HNO₃ which leads to Cl losses

NH₄ vs Cl: Heterogeneous reactions under the influence of marine air masses are probably the reason behind NH₄ losses

References

Bardouki et al., Atmos. Environ., 37, 195-208, 2003
Koulouri et al., Atmos. Environ., 42, 6542-6550, 2008
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