PM_{10} AND $PM_{2.5}$ COMPOSITION OVER THE CENTRAL BLACK SEA: MASS CLOSURE AND ORIGIN OF EXCEEDANCES

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AIM OF STUDY:

This long-term study aims at determining PM_{10} and $PM_{2.5}$ levels, the origin and aerosol chemical composition of their exceedances in the Central Black Sea and also exploring the temporal variability and the probable sources of water-soluble ions

SİTE DESCRİPTİON AND SAMPLE COLLECTİON :

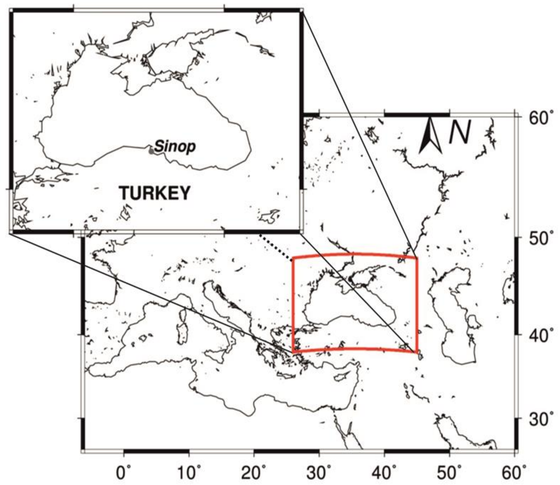

Fig. 1. Location of sampling site at the Central Black Sea region, Sinop.

• a rural site located on the coastline of the Central Black, Sinop (42.04° N, 35.04° E) , Turkey (Figure 1).

•Aerosol sampling campaign was commenced in April 2009 and ended in February 2010 , with a temporal resolution of 24 hours

•Dichotomous stacked filter unit low-volume sampler was used. The sampler operates at a flow rate of 16 litres per min. The aerosol samplings were collected in separate “coarse” (2.5-10 μm EAD) and fine (<2.5 μm EAD) size fractions on two sequential 47 mm diameter polycarbonate filters (299 samples).

•The concentrations of water-soluble anions and cations measured by ion chromatography instrument

•The Thermal-Optical Trasmission (TOT) technique was applied to determine the concentrations of OC and EC

CONCLUSION:

- The mass concentrations of PM_{10} and $PM_{2.5}$ were found to be 23.2±16.7 and 9.8±6.9 μg m^{-3}, respectively. Approximately 60 % of the PM10 was associated with coarse mode, suggesting the predominance of the primary aerosol such sea-salt and crustal material
- The sea-salt originated Cl^-, Na^+ and Mg^{2+} illustrated their higher concentrations and variability during winter months (December, January, and February) because of unsettled weather conditions in winter season.
- The Cl^-/Na^+ ratio was lower than that reported for seawater (1.79), suggesting Cl^- depletion particularly in summer. Chlorine depletion was chiefly attributed to reaction between alkaline sea-salt particles and nitrate.
- Crustal material and sea salt were found to be accounted for majority of the PM_{10}, with contributions of 34 and 13 %, respectively. The IM, POM and EC contributions explained 13, 20 and 3 % of the PM_{10} mass, correspondingly.
- The mass closure for fine mode demonstrated that IM, POM and EC dominated the $PM_{2.5}$ (~ 74 %) mass, explaining 22, 46 and 6 % of the observed mass. The crustal material and sea salt elucidated 12 and 8 % of the fine mode, respectively.
- The majority of the PM10 and PM2.5 concentrations (≥95 %) were found to be less than 50 μg m^{-3} and 25 μg m^{-3} limit values established by European Commission

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RESULTS

- % 60 of PM is in coarse mode whereas remain part (% 40) is in fine mode.
- Affected by primarly aerosols
- sea-salt originated species (Cl^-, Na^+ and Mg^{2+}) and calcium were mainly found to be associated with the coarse fraction
- ammonium and sulfate were primarily dominated by fine aerosol particle

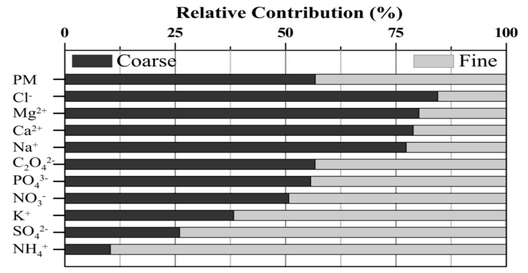

Figure 2. Relative contributions of PM and aerosol species in the fine and coarse modes.

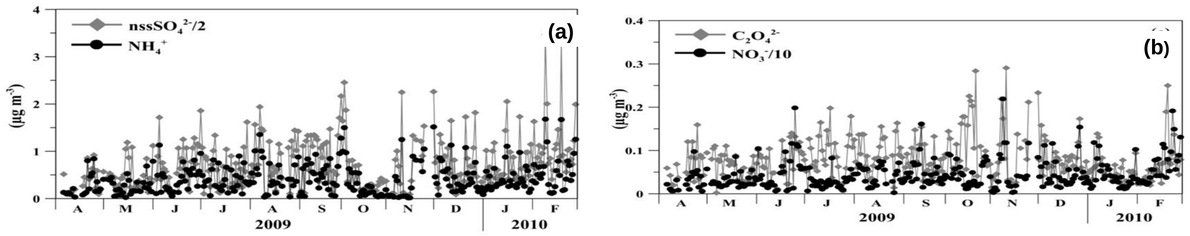

Figure 3. Daily variability in the concentrations of aerosol species at Sinop site between April 2009 and February 2010. $nssSO_4^{2-}$ and NH_4^+ (a), $C_2O_4^{2-}$ and NO_3^- (b)

- Water-soluble species $nssSO_4^{2-}$, NO_3^-,$C_2O_4^{2-}$ and NH_4^+ values were found higher during summer than that observed in spring.
- From September to mid November, their concentrations were found to be diminished gradually
- In spite of low photochemistry and efficient precipitation scavenging, higher concentrations of these species were also obvious in winter months.

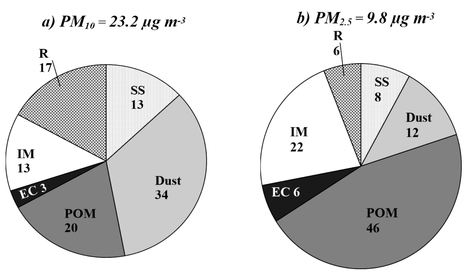

Figure 4. Mass closure for PM_{10} (a) and $PM_{2.5}$ (b).

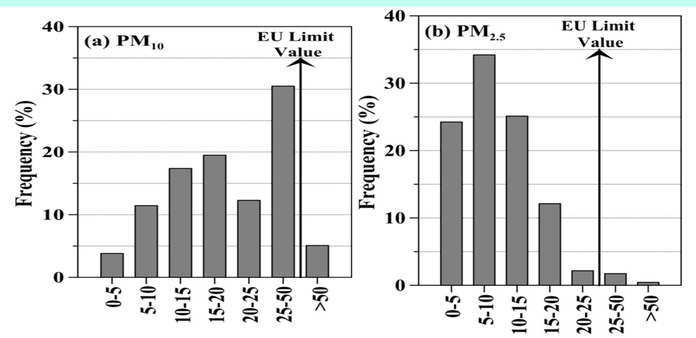

Fig. 5 Histogram for PM_{10} (a) and $PM_{2.5}$ (b) along with corresponding exceeded days and EU limit values

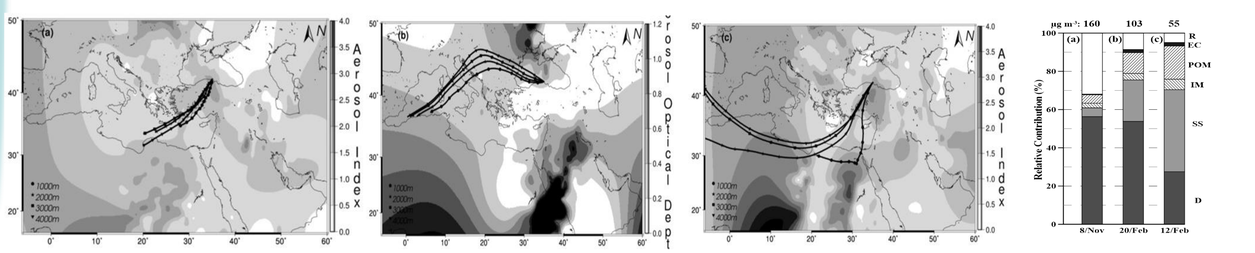

Figure 6. Three days back trajectories demonstrating the transport of air masses to the sampling site and OMI Absorbing Aerosol Index (or Aerosol Optical Depth). 8th of November 2009 (a), 20th of February 2010 (b) and 12th of February 2010 (c) .