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Factors controlling the solubility of trace metals in atmospheric aerosols over the Eastern Mediterranean

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Atmospheric input of aerosols is recognized, as an important source of nutrients, for the oceans. The chemical interactions between aerosols and varying composition of air masses lead to different coating of their surfaces with sulfate, nitrate and organic compounds, increasing their solubility and their role as a carrier of nutrients and pollutants in ecosystems. Recent works have highlighted that atmospheric inputs of nutrients and trace metals can considerably influence the marine ecosystem functioning at semi-enclosed or enclosed water bodies such as the eastern Mediterranean.

The current work aims to determine the sources and the factors controlling the variability of nutrients in the eastern Mediterranean. Special focus has been given on trace elements solubility, considered either as key nutrients for phytoplankton growth such as iron (Fe), phosphorus (P) or inhibitors such as copper (Cu). This has been accomplished by analyzing size segregated aerosol samples collected at the background site of Finokalia in Crete for an entire year.

Phosphorus concentrations indicate important increases in air masses influenced both by anthropogenic activities in the northeast European countries and by dust outbreaks. The last is confirmed by the correlation observed between total P and dust concentrations and by the air mass backward trajectories computed by running the NOAA Hysplit Model (Hybrid Single – Particle Langrangian Integrated Trajectory (http://www.arl.noaa.gov/ready/hysplit4.html). Overall 73% of total P has been found to be associated with anthropogenic sources.

The solubility of P and Fe has been found to be closely related to the acidity (pH) and dust amount in aerosols. The aerosol pH was predicted using thermodynamic modeling (ISORROPIA-II), meteorological observations (RH, T), and gas/particle observations. More specifically P and Fe solubility appears to be inversely related to the crustal elements levels, while it increases in acidic environment. The significance of our findings for the eastern Mediterranean Sea is thoroughly discussed.

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