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Source apportionment of atmospheric P over East Mediterranean using the Positive Matrix Factorization (PMF) model

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The PMF receptor model was applied to a combined dataset using specific markers such as phospholipids and sugars together with other metals (e.g. Al, Pb, V) and ions (e.g. K^+, Ca^{2+}, SO_4^{2-}, NO_3^-) as tracers of main aerosol sources in order to characterize the sources of P in atmospheric particles. The samples were collected from East Mediterranean; an oligotrophic region, strongly P-limited, with atmospheric nutrients deposition affecting its primary productivity. The results revealed that dominant sources of P compounds are the dust (43%) and the bioaerosols (34%). The coexistence of these sources in the spring period increased the organic P up to 53% of total P with more than a half to originate from bioaerosols. Dust is the major source of inorganic P forms with almost equal contribution to the phosphate ions and to the condensed P forms (e.g pyrophosphate or phosphorous minerals).

Based on the results of source apportionment analysis and the atmospheric concentration of P species, the maximum annual deposition scaled to the East Mediterranean surface was 21.5 Gg P with almost equal deposition of org-P and phosphate ions. The soluble P content from dust aerosols is the similar magnitude of potential bioavailable organic P emitted from bioaerosols (~4 Gg P y^{-1}), especially during the stratification period, when surface water is mostly nutrient starved. Anthropogenic pollution contributes slightly higher to organic P comparing with phosphate ions, while the latter is produced mainly secondary. Biomass burning emissions in the area are associated mainly with the more soluble P.