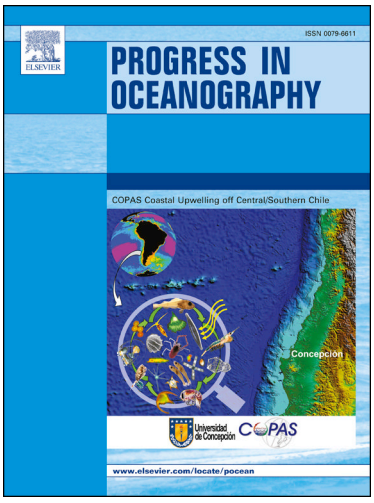

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Sugars in atmospheric aerosols over the Eastern Mediterranean

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Abstract

Aerosol samples (PM_{10}) were collected at Finokalia monitoring station in a remote area of Crete in the Eastern Mediterranean over a two-year period. They were analyzed for total organic carbon (OC), water-soluble organic carbon (WSOC), and the molecular distribution of sugars. WSOC comprised 45% of OC while the contribution of sugars to the OC and WSOC content in the PM_{10} particles averaged 3±2% (n=218) and 11±6% (n=132), respectively. The total concentration of sugars ranged between 6 and 334 ng m^{-3} with the two most abundant sugars over the two-year period being glucose and levoglucosan, contributing about 25% each to the total carbohydrate pool. Primary saccharides (glucose, fructose, and sucrose) peaked at the beginning of spring (21, 17, and 15 ng m^{-3}, respectively), indicating significant contributions of bioaerosols to the total organic aerosol mass. On the other hand, higher concentrations of anhydrosugars (biomass burning tracers levoglucosan, mannosan, galactosan) were recorded in winter (19, 1.4, and 0.2 ng m^{-3} respectively) than in summer (9.1, 1.1, and 0.5 ng m^{-3} respectively). Levoglucosan was the dominant monosaccharide in winter (37% of total sugars) while the low concentration measured in summer (19% of total sugars) was probably due to the enhanced photochemical oxidation by hydroxyl (·OH) radicals which impact anhydrosugars. Based on levoglucosan observations, biomass burning was estimated to contribute up to 13% to the annual average OC measured at Finokalia. Annual OC, WSOC, and carbohydrate dry deposition fluxes for the two-year sampling period were estimated at 414, 175, and 9 mg C m^{-2} y^{-1}, respectively. Glucose and levoglucosan accounted for 34% and 2% of the total sugar fluxes. According to our estimations, atmospheric OC and WSOC inputs account for 0.70% and 0.71%, respectively of the carbon in the annual primary production in the Cretan Sea. Considering the entire Mediterranean, dry deposition of OC can provide at least 3 times more C than riverine inputs of Rhone. Carbohydrate dry deposition flux represents a small fraction of total carbon flux up to 0.04% of the C used for the primary production