

Early Observations of Aerosols from the Hawaii Aerosol Time-Series

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Aerosol trace elements deposited to the marine environment, especially those sourced from windborne continental dust and industrial pollution, affect marine cycles in numerous, complex ways (e.g., Duce et al., 1991; Baker et al., 2021). Measuring aerosol fluxes to the open surface ocean is challenging, in part due to the vastness of the global ocean and the episodic nature of aerosol deposition. Here we present the first year of results from the Hawaii Aerosol Time-Series, a two-year time-series designed to address these challenges based on Oahu in the central North Pacific Ocean. A high-volume total suspended particle aerosol sampler, currently installed at Makai Research Pier on the eastern side of Oahu, collects weekly-integrated bulk aerosol samples during onshore wind conditions. The sampler holds 12 acid-washed, 47 mm Whatman-41 filters mounted in a PVC manifold; three filters are reserved for total elemental digestion (including Al, Co, Cu, Fe, Mn, Ni, Pb, Th, Ti, and Zn via ICP-MS) and three for analysis of the cosmogenic-sourced radionuclide ⁷Be. Following aerosol deposition into the surface ocean, ⁷Be is soluble, not subject to significant particle scavenging, and with a half-life of 53.2 days is an effective tracer of seasonal aerosol deposition fluxes (Kadko et al., 2019). Seasonal ⁷Be water column profiles are collected at nearby station ALOHA in coordination with the Hawaii Ocean Time-Series. We employed the ⁷Be tracer method to estimate surface deposition rates in conjunction with bulk aerosol concentrations from the total digestions of aerosol filters to draw meaningful conclusions about the impacts of aerosols on surface ocean chemistry and marine ecosystems. Total digestions of aerosols collected over 2022 and the beginning of 2023 represent the seasonal variation of both the peak and low deposition seasons and flux, and this pattern is observed in the ⁷Be water-column profiles. Molar ratios of trace elements in the digested aerosol samples are also compared to crustal values to calculate the enrichment factor of each respective element to help assess aerosol provenance and pollution impacts.