WASHOUT RATIOS OF NITRATE, NON-SEA-SALT SULFATE AND SEA-SALT ON VIRGINIA KEY, FLORIDA AND ON AMERICAN SAMOA

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Abstract—On Virginia Key, Miami, Florida, 257 rainwater samples were collected on a event basis from May 1982 to April 1983. At the same site, 171 aerosol samples were collected throughout 1984. All of these samples were analyzed for nitrate, non-sea-salt (NSS) sulfate and sodium to assess the temporal variations in the concentrations and to determine the washout ratios of each of the constituents. The annual volume-weighted mean concentrations in rainwater are: nitrate—0.51 μg ml⁻¹, NSS sulfate—0.74 μg ml⁻¹, Na—1.95 μg ml⁻¹. Only sodium exhibited a significant seasonal cycle; its concentrations were markedly higher during the winter. In aerosols, the mean concentrations are: nitrate—1.5 μg m⁻²; NSS sulfate—2.5 μg m⁻²; Na—3.7 μg m⁻². Nitrate and NSS sulfate exhibit consistent seasonal cycles with concentrations being significantly higher during the winter and spring. We estimate that wet deposition accounts for the majority of the total fluxes of each constituent: 89% for nitrate, 95% for NSS sulfate, and 67% for Na. Annual washout ratios at Virginia Key are similar for nitrate and NSS sulfate, 30 and 290, respectively. That for Na is about a factor of two higher, 550. Comparable long-term ratios were calculated for American Samoa based on aerosol data from the SEAREX program and rainwater data from the National Atmospheric Deposition Program. 270 for nitrate, 420 for NSS sulfate, and 520 for Na. The comparability of the Virginia Key and Samoa results suggest that these ratios may be applicable over a wide area of the world ocean. Estimates from nonconcurrent data for the washout rates at Bermuda were factors of two to four higher. Regression equations for washout ratio vs event rainfall (log W = log a + b log R) at Virginia Key were essentially the same for all three constituents with 'a' ranging from 1.10 to 1.30 and 'b' ranging from −0.26 to −0.29. The coefficients for American Samoa were markedly different: 'a' ranged from 2.90 to 3.60 and 'b' ranged from −0.51 to −0.50.

Key word index: Aerosols, precipitation, Florida, American Samoa, sulfate, nitrate, sea-salt, washout ratios.