SCCWRP #570

Dry atmospheric deposition rates of metals along a coastal transect in southern California

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Abstract

While recent studies indicate atmospheric deposition is a significant source of metals to the Santa Monica Bay and coastal river systems of the Los Angeles area, the spatial extent of the atmospheric source along the entire southern California coast has not been measured in 30 years. This study provides measurements of dry atmospheric deposition of chromium, copper, lead, nickel and zinc at eight sites located along the coast between Santa Barbara and San Diego, and compares these data to historic measurements from the 1970s. Median dry deposition fluxes across sites ranged between 0.23 and 3.6 (chromium), 0.21 and 5.4 (nickel), 0.52 and 14 (lead), 0.89 and 29 (copper), and 4.8 and 160 (zinc) $\mu g\ m^{-2}\ day^{-1}$. Differences in metal dry deposition rates observed between sites were dominated by proximity to urban areas and/or other nearby sources, with the highest metal fluxes observed near the Los Angeles Harbor (LAH) and San Diego Bay (SDB) sites. Compared with data from the 1970s, lead fluxes were typically one to two orders of magnitude lower in the present study (2006), indicating atmospheric sources of this metal have decreased over the past three decades in southern California. Chromium fluxes were also lower in 2006 compared with the 1970s, although to a lesser extent than for lead. In contrast, copper and zinc fluxes were typically within the same order of magnitude between the two time periods, with some higher measurements observed in 2006 compared with the 1970s at the LAH and SDB sites. This result indicates atmospheric sources of copper and zinc have not decreased over the past three decades in southern California, and have increased near our harbor/urban sites. Differences in sampling conditions (e.g., Santa Ana winds) and measurement techniques may also explain, in part, the differences observed in metal flux rates for these time periods. However, these limitations were most important for those metals with the smallest difference in flux rates measured in the 1970s vs. 2006 (e.g., chromium).