ATMOSPHERIC NUTRIENT DEPOSITION IN HAWAI'I:

METHODS, RATES AND SOURCES

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Abstract

The atmospheric deposition of N and base cations in fog, precipitation, and dry deposition was measured over 5-7 years at the Hawaii Volcanoes National Park, Hawaii. Precipitation deposition was measured for 1.5 years at the Kokee State Park/ Na Pali Kona Forest Reserve, Kauai.

Fog interception on Hawaii was 158 +61/-32, 148 +69/-36, 251 +85/-51, 251 +91/-51, 243 +96/-59, and 181 +56/-38 cm per year for the years 1995 to 2000 respectively. This represents an average of 46% of the total water input and 83% of precipitation. An analysis of the lowest uncertainty that could realistically be achieved using our water balance method yielded a minimum uncertainty of +16% and – 14% for annual fog interception values and +54% and –53% for individual fog events. At the Thurston Lava Tube site, fog interception was by far the largest deposition pathway for K^+, Mg^{+2}, Ca^{+2}, and N. Sea salt contributes the majority of cations, while local biomass burning on Hawaii and Asian dust are significant sources for some years. Fog N deposition at Thurston averaged 20 kg N ha^{-1} yr^{-1}. Organic N was on average 16% and 12% of the N in rain and fog.

Several methods were used to determine whether volcanically produced N significantly impacted the Thurston site. Back trajectory analysis showed that air can blow from the volcano to our sampling site when there is an interruption in the northeasterly trade winds. Collected fog during one such episode had measurable NO_2^-, indicating very high atmospheric concentration of atmospheric NO_2. NH_4^+

concentrations were higher for fog events with back trajectories that indicated volcanic influence than for those without, indicating that the volcano is also a reduced N source. Enough fog events were sampled from 1998 to 2000 to statistically show higher concentrations of NO_3^-, NH_4^+ and organic N in events with volcanic influence versus those without. Lower deposition of NO_3^- in precipitation on Kauai also argues that volcanic N is significant at Thurston.