MEASUREMENTS OF CLOUD WATER AND DRY DEPOSITION AT KĪLAUEA, HAWAI'I

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ABSTRACT

The goals of this study were to more accurately quantify cloud water (CW) interception amounts and CW nutrient concentrations with special emphasis on nitrogen species. Additionally, dry deposition of nitrogen dioxide was investigated to determine if it makes a substantial contribution to the atmospheric nitrogen input.

With an automated collector over 500 cloud water samples were collected over a 14-month period at a montane wet forest site in Hawai'i Volcanoes National Park. Mean nitrogen concentration were found to be 0.53 mgL^{-1}, lower than in previous studies at this site (Heath 2001). Surprisingly, it was found that NH_4^+ contributed as much N to these samples as NO_3^-, indicating that the volcano provides equal amounts of reduced and oxidized N.

Cloud water interception was estimated with the use of the canopy water balance method. Throughfall (TF), one of the parameters used in this method, was measured with a set of 6 roving collectors and compared to measurements made with 2 stationary collectors. Roving collector TF catch was 30% higher than stationary collector catch and indicated extremely high spatial variability. A regression of roving to stationary collector data was applied to fog event measurements and both the original TF data (TFstat) and the derived roving collector TF (TFrov) data were used in cloud water interception estimates. Use of TFrov increased estimates of CW interception by a factor of 2.6. Mean annual CW interception based on TFrov was found to be 739 mm. Mean annual nitrogen deposition via CW was estimated at 3.9 $kgha^{-1}$, lower than in previous studies (Heath 2001) due to both lower mean N concentrations and lower interception estimates. Uncertainty in the

CW interception estimates and, thus, deposition estimates is still high and factors contributing to these uncertainties are discussed.

Atmospheric nitrogen input via NO_2 dry deposition was investigated with the use of passive sampling devices (PSD) across 6 sites in Hawaii Volcanoes National Park. Ambient NO_2 concentrations were found to be elevated compared with background levels over the open Pacific, but still very low (means of 0-1.3 ppbv). Annual deposition flux estimates, calculated using several published values for NO_2 deposition velocities, ranged between 0.03 and 0.6 $kgha^{-1}$. Uncertainty in these values is very high, as many samples were near the detection limit, but this preliminary study still indicates that NO_2 dry deposition amounts are comparable to input of N via wet deposition of N and dry deposition of nitric acid and is dwarfed by input via CW. The PSD were found to be inadequate for accurate NO_2 measurements but useful for measurements of SO_2, which was collected as ancillary data.