



Trends of precipitation and streamwater chemistry at a subtropical forested catchment, northeastern Taiwan

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Abstract

The assessment of long-term input-output budgets has been widely used to examine the impacts of acidic deposition on temperate forest ecosystems, but rarely in subtropical forest ecosystem. In this study, we used weekly bulk precipitation and streamwater chemistry data collected between 1994 and 2013 in a small catchment in northeastern Taiwan. The long-term volume-weighted mean pH of precipitation and streamwater were 4.64 and 6.79 respectively which indicated that the stream was capable of neutralizing common acidic deposition. Precipitation revealed a significant decline trend in Ca^{2+} , NH_4^+ , and NO_3^- concentration and fluxes in the summer possibly due to decreases of local emissions in Taiwan. But the persistent high levels of NO_3^- and SO_4^{2-} during winter period over the past 20 years could a potential threat to forest ecosystems in the region. Although the concentrations and fluxes of all elements in streamwater showed high inter-annual variation, there were no significant trends. The long-term nutrient budget indicates net loss for Na^+ , Mg^{2+} , Ca^{2+} , NO_3^- and SO_4^{2-} , net retention for NH_4^+ and Cl^- and near balance for K^+ . The significant trend of net export of NO_3^- during the study period calls for further investigation to clarify if nitrogen saturation is occurring due to the high acid deposition or if other factors such as typhoon disturbance are driving its dynamics. From the comparisons between seasonal and annual budgets, it is clear that hydrological flux instead of biological activities dominated the biogeochemical processes and this is very different from the biotic control of biogeochemistry in temperate forest ecosystem (e.g. Hubbard Brook Experimental Forest). Our results also have important implications on the effects of climate change on biogeochemical cycles.

Keywords: acid deposition, nutrient budget, biogeochemistry, forest ecosystem, subtropical mountainous island.