



Estimating the terrestrial N processes in subtropical mountainous forestry catchment through INCA-N: A case study in FuShan catchment, Taiwan

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The riverine DIN is a crucial indicator for eutrophication in river network. The riverine DIN export in Taiwan is featured by the extremely high yield, $\sim 3800 \text{ kg-N km}^{-2}\text{yr}^{-1}$, nearly 20-fold than the global average, showing the interesting terrestrial N process yet rarely documented. In this study we collected the DIN samples in rainwater, soil water, and stream water in a mountainous forest watershed, FuShan experimental forest watershed 1 (WS1) which is a natural broadleaf forest without human activities. Based on the intensive observations, we applied the INCA-N to simulate the riverine DIN response and thus estimate the terrestrial N processes in a global synthesis. The result showed that both discharge and DIN yield were simulated well with the average Nash-Sutcliffe efficiency coefficient of 0.83 and 0.76, respectively. Among all N processes, N uptake, mineralization, nitrification, denitrification, and immobilization are significantly positive correlated with soil moisture ($R^2 > 0.99$), which indicates that soil moisture greatly influences N cycle processes. The average rate of mineralization and nitrification in wet years are consistent with documented values, whereas the rates in dry years are lower than the observations. Despite the high nitrification rate, the secondary forest may uptake abundant N indicating the plant uptake, which responds for removing considerable nitrate, is a controlling factor in forest ecosystem. Our simulated denitrification rate falls between the documented rates of temperate forest and agricultural area, and that may be affected by the high N-deposition in Taiwan. Simulated in-stream denitrification rate is less than 10% of the rate in soil, and is a little lower than that in temperate forest. This preliminary simulation provides an insightful guide to establish the monitoring programme and improve the understanding of N cycle in subtropical.