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Characteristic of riverine dissolved inorganic nitrogen export in subtropic high-standing island, Taiwan

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Extreme increase of anthropogenic nitrogen (e.g. fertilizer and excretion) has altered the nitrogen cycling and terrestrial ecosystems. Taiwan located between eastern Asia and Oceania is the hotspot of global riverine DIN (dissolved inorganic nitrogen, including NH_4, NO_3, and NO_2) export, but rarely documented comprehensively. Totally 50 catchments, covering 2/3 of this island, with different anthropogenic activities are involved in this study. The monthly sampling for NH_4 and seasonal sampling for NO_3 and NO_2 supplemented with daily discharge are used to estimate the riverine DIN export. Meanwhile, the landscape characteristics, land-use, and population density are also used to discriminate the characteristics of riverine DIN export.

Results showed that the observed riverine DIN concentration and yield vary from 17.7-603.5 μM and 575.0-15588.9 kg-N km^{-2} yr^{-1} corresponding to the increase of anthropogenic activities. The arithmetic mean of DIN concentration and yield are 126.7μM and 3594.7 kg-N km^{-2} yr^{-1}, respectively. The unexpected high yields can attribute to abundant precipitation, heavy fertilizer application, and high population. For concentration variation, no significant variation can be found in the pristine and agriculture-dominated catchments, whereas the strong dilution effect in the wet season is characterized in the intensively-disturbed catchments. Although there are some seasonal variations in concentration, the yields in wet season are almost doubled than that in dry season indicating the strong control of streamflow. For speciation, NH_4 is the dominant species in intensively-disturbed catchment, but NO_3 dominates the DIN composition for the pristine and agriculture-dominated catchments. Our result can provide a strong basis for supplementary estimation for regional to global study and DIN export control which is the aim of the Kampala Declaration on global nitrogen management.

Keywords: dissolved inorganic nitrogen, anthropogenic nitrogen, Taiwan.