# Nitrogen and phosphorus dynamics in the mainstem of the Fuji River estimated by *in situ* spiralling metric measurements

*Yuuta Ikeda[1], Tomoya Iwata[1]

1. University of Yamanashi

Excess land-derived nitrogen and phosphorus often stimulate the primary production of downstream ecosystems such as lakes and coastal waters, thereby causing the eutrophication problems therein. Therefore, elucidating the role of river networks in processing the fluvial nutrients supplied from terrestrial ecosystems has become an important prerequisite for the ecosystem management of downstream ecosystems. Nitrogen and phosphorus dynamics in lotic ecosystems have long been described uniquely by three major variables of spiralling metrics (areal uptake rate, $U$; uptake velocity, $v_f$; uptake length, $S_w$). Areal uptake rate ($U$) represents the net uptake rates of nutrient atoms by benthic compartments, while uptake velocity ($v_f$) and uptake length ($S_w$), respectively, refer to nutrient uptake efficiency relative to concentration and the longitudinal travel distance of a dissolved nutrient atom before removal from the water column. However, until recently, there are only a few studies that have undertaken to measure the spiralling metrics in large rivers at the downstream end of the river networks, especially in large rivers of mountainous watersheds with high relief, as are watersheds in Japan. The objective of the present study is to evaluate the roles of large rivers in fluvial nutrient transports by estimating the nutrient spiraling metrics ($U$, $v_f$, $S_w$) in the mainstem of a sixth-order river (discharge = 37–53 $m^3 s^{-1}$) in a Japanese high-relief watershed.

The field study was conducted during May and December 2015 in the mainstem and tributaries of the Fuji River system in central Japan. We monitored the longitudinal changes of inorganic nitrogen (ammonium, nitrite, and nitrate) and phosphorus (phosphate) concentrations by directly tracking a specific parcel of water and by continuously collecting the samples from the parcel along the river course. Assuming that nutrient removal reactions in river channels obey first-order kinetics, we estimated nutrient spiralling metrics from the longitudinal change of the natural logarithm of nutrient concentrations with distance downstream. In this presentation, we will show the pattern and dynamics of nitrogen and phosphorus in the Fuji River by using the estimated nutrient spiralling metrics. The results emphasize the seasonal dynamics of nutrient uptake and the importance of substrate limitation and nitrification in phosphorus and nitrogen uptake in the river system. Based on these findings, we discuss the functional roles of large river ecosystems in longitudinal nutrient transports from terrestrial to coastal ecosystems.

Keywords: nitrogen, phosphorus, river, spiral metrics

 