Supplement of Biogeosciences, 11, 5307–5321, 2014
http://www.biogeosciences.net/11/5307/2014/
doi:10.5194/bg-11-5307-2014-supplement

Biogeosciences
Open Access

Supplement of

Speciation and dynamics of dissolved inorganic nitrogen export in the Danshui River, Taiwan

T.-Y. Lee et al.

Correspondence to: J.-C. Huang (riverhuang@ntu.edu.tw)

Supplementary

Flux is defined as the movement of mass over time through a defined cross-sectional area, and can be derived by the product of measured concentrations and discharge. It will not be a problem if continuous measured concentration and discharge is available. However, the measured concentration is often discrete. Therefore, flux estimators are often used to overcome the situation, but uncertainties will inevitably arise due to sampling frequency, hydrological behaviors, and hydrologic response. Four method-derived fluxes at each site were averaged and normalized by drainage area to derive flux and yield, respectively, to reduce the uncertainties.

The linear interpolation (LI) method interpolates the unsampled daily DIN concentrations by two adjacent measured DIN concentrations, as shown in Equation 1. The main merit of this method is to supplement the discrete DIN concentration to pair with the consecutive discharge records (Moatar and Meybeck, 2005).

$$FLUX = m\sum_{j=1}^{T} C_j^{\text{int}} \times Q_j \quad \text{(Equation 1)}$$

Where FLUX is annual DIN load (kg/yr); C_j^{int} is the DIN concentration on j[th] day linearly interpolated between two measured samples (μM); Q_j is the monitored daily discharge (m^3/sec); *m* is the conversion factor to convert the calculated values into a specific unit (kg/yr). T stands for the number of days of the studied period, which is a year for this study.

Another method, global mean (GM) method, is to multiply the average concentration of all samples by the total discharge within the study period, as shown in Equation 2 (Birgand et al., 2010).

$$FLUX = m\frac{\sum_{i=1}^{n} C_i}{n} \times Q_t \quad \text{(Equation 2)}$$

Where C_i is the DIN concentration of the water sample (μM); Q_t is the annual total discharge (m^3/yr); and *n* is the number of DIN samples in a year. This method does not yet take the hydrological responses into account, which could be applied to the remote area where runoff is not available but could be roughly estimated by annual rainfall.

The flow weighted (FW) method which weighs the sampled concentration by discharge for considering the hydrological responses, is also widely used as shown in Equation 3. Annual DIN flux equals the annual discharge volume multiplied by the flow-weighted DIN concentration (Ferguson, 1987).

$$FLUX = m\frac{\sum_{i=1}^{n}(C_i Q_i)}{\sum_{i=1}^{n} Q_i} \times Q_t \qquad \text{(Equation 3)}$$

Where Q_i (m^3/sec) is the corresponding discharge on the discrete sampling day.

The rating curve (RC) method has been widely used in small mountainous rivers with highly fluctuating hydrodynamic range (Kao and Liu, 2000; Kao et al., 2004; Hung et al., 2012b; Lee at al., 2013). A straight line is first fitted to the logarithms of observed DIN and discharge to get *a* and *b* (Equation 4). Then the continuous daily discharge could be substituted into the equation to estimate daily DIN flux.

$$FLUX = m\sum_{j=1}^{T}(Q_j C_j) = m\sum_{j=1}^{T}[Q_j(aQ_j^b)] = m\sum_{j=1}^{T} aQ_j^{b+1} \qquad \text{(Equation 4)}$$

Where Q_j (m^3/s) is the daily water discharge; C_j (μM) is an estimated DIN concentration on the j^{th} day. Yield denotes the flux divided by the watershed area.