EVALUATION AND DEVELOPMENT OF A RIVER NUTRIENT LOAD CALCULATOR

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Accurate estimates of river nutrient loads are required for better management of water quality at a catchment level. In most catchments, there are continuous measurements of river flow but only infrequent measurements of water quality parameters. Thus, a number of methods have been developed to estimate the annual river loads using various temporal resolutions of river flow and nutrient concentrations.

We assessed the uncertainty in estimated annual river-nutrient loads as a function of sampling frequency and load estimation methods for the Manawatu River catchment. The true river loads of "soluble inorganic nitrogen (SIN), total nitrogen (TN) and dissolved reactive phosphorus (DRP)" were calculated using the daily measurements of both river flow and nutrients concentrations at the Manawatu Teachers College monitoring site for the 2010/2011 year. We considered three sampling frequencies (weekly, fortnightly and monthly). For each sampling frequency, river nutrient load was estimated using four load estimation algorithms (Global mean "GM", Ratio estimator "RE", Flow-stratified "FS", and Flow-weighted "FW"). The resulting estimated annual nutrient loads for all sampling frequencies and load estimation algorithms were compared to the true loads and the bias (a measure of the accuracy) and the root mean square error (RMSE; a measure of both the accuracy and the precision) were calculated.

Our results showed that the bias decreased, for all load-estimation algorithms except the GM, from weekly to fortnightly sampling frequency. However, the bias increased from fortnightly to monthly sampling frequency. On the other hand, the root-mean square error (RMSE) was found to have an inverse relationship with the sampling frequency, as it increased from weekly to monthly for all load estimation algorithms, except the GM. The GM was found to underestimate the river annual load for all water quality parameters used in the study regardless of sampling frequency. The FW and RE gave the same results for all water-quality parameters. In general, FW and RE were found to perform better than the FS. However, the FS performed better than FW and RE only for SIN at fortnightly sampling frequency. From these results we recommend the use of either FW and/or RE to estimate annual river nutrient loads in the study area.

Editor's Note: A manuscript has not yet been submitted for this presentation.