HIGH RESOLUTION MONITORING OF NITRATE IN AGRICULTURAL CATCHMENTS – A CASE STUDY ON THE MANAWATU RIVER, NEW ZEALAND

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High resolution monitoring (≤15 mins) of nitrate-N concentration in streams and rivers in New Zealand agricultural catchments would improve our understanding of nitrate-N dynamics and increase the accuracy of our nitrate-N load calculations. However currently, the use of these sensors is rare. Most of the nitrate sensors available on the market are manufactured in Europe and are designed to measure higher nitrate-N concentrations than are typical of New Zealand freshwater conditions. For this reason, it is important to thoroughly assess the precision and bias of nitrate sensors in order to make informed decisions about their use under New Zealand conditions. In 2016, a NITRATAX (Hach Lange GmbH, Germany) UV/VIS sensor was loaned by Ulster University and deployed in the Manawatu river (catchment area: 3,914km²) for a period of one year. The NITRATAX sensor provided accurate and precise nitrate-N measurements over the entire range of nitrate-N concentrations, with concentrations ranging from 0.00 to 1.29 mg/L. The NITRATAX values, however, were slightly negatively biased in comparison to the standard laboratory analysis method, and a comprehensive calibration was used to apply a correction factor to the data.

High resolution monitoring allowed a detailed examination of the annual fluctuation of nitrate-N concentrations in the Manawatu River, revealing trends that have rarely been studied at a catchment scale in New Zealand, and improved the quantification accuracy of the nitrate-N loads in the study river. There was a 14% difference between the annual nitrate-N load measured using the NITRATAX sensor data and monthly grab samples analysed in a laboratory (using the flow-weighted method), with higher annual nitrate-N load measured using the NITRATAX (1926 vs 1674 t/yr). The data analysis confirmed that the monthly grab sampling missed some of the highest flow events, resulting in an underestimation of annual nitrate-N loads in the Manawatu River.

This study confirmed that the NITRATAX high-resolution sensor is a promising, novel tool to allow detailed measurement of nitrate-N concentrations and loads in the Manawatu River, provided that extensive calibration and adjustment is undertaken. On this basis, this sensor is recommended for further testing and evaluation, as a new tool to improve our understanding of nitrate-N loss processes from New Zealand catchments and to improve the accuracy of our nitrate-N load calculations.

Editor's Note: An extended manuscript has not been submitted for this presentation.