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Factors controlling stream water nitrate and phosphor loads during precipitation events

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Pollution of surface waters in densely populated areas with intensive land use is a serious threat to their ecological, industrial and recreational utilization. European and national manure policies and several regional and local pilot projects aim at reducing pollution loads to surface waters. For the evaluation of measures, water authorities and environmental research institutes are putting a lot of effort into monitoring surface water quality. Fro regional surface water quality monitoring, the measurement locations are usually situated in the downstream part of the catchment to represent a larger area. The monitoring frequency is usually low (e.g. monthly), due to the high costs for sampling and analysis. As a consequence, human induced trends in nutrient loads and concentrations in these monitoring data are often concealed by the large variability of surface water quality caused by meteorological variations. Because natural surface water quality variability is poorly understood, large uncertainties occur in the estimates of (trends in) nutrient loads or average concentrations.

This study aims at uncertainty reduction in the estimates of mean concentrations and loads of N and P from regional monitoring data. For this purpose, we related continuous N and P records of stream water to variations in precipitation, discharge, groundwater level and tube drain discharge. A specially designed multi scale experimental setup was installed in an agricultural lowland catchment in The Netherlands. At the catchment outlet, continuous measurements of water quality and discharge were performed from July 2007-January 2009. At an experimental field within the catchment continuous measurements of precipitation, groundwater levels and tube drain discharges were collected. 20 significant rainfall events with a variety of antecedent conditions, durations and intensities were selected for analysis. Singular and multiple regression analysis was used to identify relations between the continuous N and P records and characteristics of the dynamics of discharge, precipitation, groundwater level and tube drain discharge. From this study, we conclude that generally available and easy to measure explanatory data (such as continuous records of discharge, precipitation and groundwater level) can reduce uncertainty in estimations of N and P loads and mean concentrations. However, for capturing the observed short load pulses of P, continuous or discharge proportional sampling is needed.