
Applying on-line monitoring for quantification of diffuse load

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The load calculations of nutrients and suspended solids transported by streams and rivers are usually based on single water samples, models or discharge/concentration rating curves. Water quality changes are very rapid especially in small watercourses. Therefore, sporadic sampling is inadequate for determination of quality variation, resulting in significant errors in load calculations. New monitoring techniques that can measure high suspended solids and nutrient concentrations at frequent intervals are therefore needed.

High resolution water quality data collected by automatic sensors (YSI 600 and SCAN Spectrolyser) were used to determine the suspended solids (SS), phosphorus (P) and nitrogen (N) load from agricultural, clayey catchments of different size in the region of Lepsämäenjoki River in southern Finland. Automated monitoring stations measured turbidity, nitrate nitrogen ($\text{NO}_3\text{-N}$ concentration, electric conductivity, water temperature and water level in every 5 to 60 minutes. Data from the sensors were collected with the data loggers. Loggers were equipped with transmitters using GSM mobile phone network to automatically send the data measured into the server. Continuous turbidity data was calibrated to total phosphorus (TP), particulate phosphorus (PP) and SS concentrations by using regression analysis. Data from the nitrate sensor was calibrated to ($\text{NO}_3\text{-N}$) and total nitrogen (TN) concentrations on the basis of laboratory analyses. The discharge was measured indirectly on the basis of stage-discharge relation for each measurement location or with measuring weir. Results of load calculations based on single samples and on-line water quality data were compared to estimate the advantage of the continuous monitoring.

With high resolution on-line data collected from agricultural watersheds it is possible to reliably estimate the total load and to detect even the minor changes in water quality. It is, for instance, possible to investigate the influences of certain agricultural practices applied in the catchment. The method has been used successfully for example to investigate the effects of gypsum amendment on P fluxes and erosion in a small agricultural catchment in southern Finland.