Geophysical Research Abstracts
Vol. 21, EGU2019-13652, 2019
EGU General Assembly 2019

Utilizing high-frequency, automated monitoring to determine nutrient sources, fates and impacts on microbiology in the River Thames catchment, UK.

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Generating high-frequency water quality data using the latest automated monitoring technologies can provide unique insights into river pollution sources and dynamics. The relationships between hourly total reactive phosphorus (TRP) and nitrate concentration signals and flow were studied in a tributary of the River Thames, UK. A combination of hysteresis and load apportionment modelling was used to infer changes in nutrient source and dynamics through both the annual cycle and each individual storm event. TRP concentrations exhibited strong dilution patterns with increasing flow, and predominantly clockwise hysteresis through storm events, indicating that TRP inputs were dominated by inputs from sewage treatment works (STW) for the majority of the year. Agricultural diffuse TRP inputs were only dominant during storms in the May of each year, probably relating to manure application to land at this time. The nitrate concentration–flow relationship produced a series of dilution curves, indicating major inputs from groundwater and to a lesser extent STW. Significant diffuse agricultural nitrate inputs with anticlockwise hysteresis trajectories were observed during the first major storms of the winter period. A second five-year monitoring programme of the River Thames, combining physical and chemical observations and hourly chlorophyll concentrations were used to identify flow, temperature, light and nutrient conditions required to facilitate algal growth. This enabled a greater understanding of the multiple-stressor controls on the timing and magnitude of phytoplankton blooms. This study indicated that for nutrient enriched rivers such as the Thames, manipulating residence time (through removing impoundments) and light/temperature (by increasing riparian tree shading) may offer more realistic solutions than reducing phosphorus concentrations for controlling excessive phytoplankton biomass. The application of the latest biogeochemical monitoring instruments is leading to a step-change in our understanding of catchment processes.