The impact of temporary data uncertainty on SWAT calibration results

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Reasons to Commence Research
- Increasing problem of eutrophication, which causes many social problems and necessitates the specification of the size of nutrient loads discharged into water bodies, including seas.
- The basis of such analysis is usually the monitor measurement results carried out in each country.
- Moreover, these measurements are used in models in the calibration, validation and verification processes of the water quality data.

Macromodel DNS module - SWAT is used to analyze the water quality in a catchment. It allows simulating the nutrient loads at the selected control point as daily-mean, monthly-mean and annual-mean data. Currently the DNS/SWAT calibration process is conducted as a comparison of simulation results; in this case daily values, and instantaneous measurement. This may cause errors due to the daily variation of nutrients concentrations.

Methodology
The article analyzes the representativeness of a single measurement during the day in relation to the daily variation of nutrient loads concentrations in the river profile of a pilot river. For this purpose, three cycles of field study were made. They were compatible with plants in the growing stage season. Measurements were carried out on the Rega River in the West Pomeranian voivodship of Poland, water gauge profile - Trzebiatów. Rega is a river that drains into the Baltic Sea. The Trzebiatów control point city is located on the 14.86 km of the river. Measurement cycles were carried out in June 2012 (growing season) - I cycle, November 2012 (after the end of the growing season) - II cycle and March 2013 (before the start of the growing season, during spring thaw) – III cycle.

The analysis gave interesting results. There was a significant change observed in the size of nutrients concentration during the day (up to 31% for total nitrogen and to 91% for total phosphorus). This trend is maintained regardless of the stage of plant growth. After combining variability of measurement with uncertainty of measurement, the uncertainty range of the benchmark for modeling is widened.

The variability of nutrient concentrations is irrespective of actual precipitation, that is, current changes in the amount of water on the profile. The daily variability results from a complex set of factors, which create a vast uncertainty of the water quality studies, which are based on a single daily measurement, more than on monthly measurements, which occurs in Polish conditions.

Survey cycle | Daily variation of measurements | Total nitrogen | Total phosphorus |
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cycle I | 31% | 44% |
cycle II | 10% | 93% |
cycle III | 9% | 91% |

Field of Research

Uncertainty of Measurement
According to State Environmental Monitoring (SEM), measurements of uncertainty are as indicated in the table. SEM uncertainty takes into account the uncertainty connected with mass chemical designation, samples volume, device errors etc.

Additionally, it is valuable to include uncertainty connected with daily variability of nutrients concentrations.