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Modeling annual diffuse phosphorus concentrations in Danish mini-catchments

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Intensive monitoring data from the Danish National Monitoring programme (NOVANA) from 24 smaller catchments (mean: 14 km²) was used in a two layer cross-validation to establish a model for the annual diffuse phosphorus (P) flow-weighted concentration in Danish streams. A total of 196 monitoring years with data from automatic sampling (ISCO) of water from the 24 streams were used as a training dataset. Data in the training dataset covers the period 1994-2002.

Moreover, another dataset consisting of 108 agricultural mini-catchments with discrete water samples covering the period 1990-2017 was used as a control in the eight different georegions of Denmark. A total of four different models was established three models based on the intensive dataset and one model based on the larger dataset with discrete water sampling.

The best model established included eight explanatory parameters and explained 53 % of the variation in the annual flow-weighted total P concentrations in the training dataset. A validation of the four different models established showed that the best model has to be bias-corrected in some of the georegions. The result of the validation shows that the models generally overestimate the total P concentrations. An overestimation of around 10-20% was to be expected as intensive automatic water sampling in streams has shown that the flow-weighted concentration of total P obtained from discrete sampling (monthly or fortnightly) is normally underestimated.

The validations of the three models based on intensive dataset showed an R-square between 0.08 and 0.12. The model based on the larger data with discrete samples had an R-square (0.29).