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Nutrient mitigation measures and climate change interaction: Comparison of the Selke (Germany) and Berze (Latvia) catchments

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There is an increasing concern about the deterioration of the stream water quality due to the growing anthropogenic pressures and the climate changes impacts. Hydrological water quality models have been proven to be an appropriate decision supporting tool to understand the processes functioning of the catchment and to test the effects of different nutrient mitigation measures and prediction of climate change impacts. This study is a part of the MIRACLE project, where the Hydrological Predictions for the Environment (HYPE) model was used to test the interactions between preventive nutrient mitigation measures suggested by stakeholders and climate changes effects in two different catchments. Two agricultural-dominant land use catchments ($\approx$ 50%), but distinct in terms of topography, soil type and climate conditions; the Selke (463 km2 in Germany) and Berze (872 km2 in Latvia) were used as implementation sites.

First, the HYPE model was successfully tested to mimic the baseline simulations (for the period 2005-2014) of discharge (Q), Nitrate-N (NO_3-N) and Total Phosphorus (TP), for both catchments. Multi-site and multi-objective calibration approach was considered. Then, effects of different stakeholders-designed nutrient mitigation measures were evaluated. Mitigation measures include both agricultural targeting measures, e.g., buffer strips, reduced tillage and optimized fertilizer application rates, as well as better controlled point-source inputs such as increased number of households connected to wastewater treatment plants and improved wastewater treatment efficiency. The scenarios analysed were delivered in close cooperation with cost-benefit assessments. For the Selke catchment, results revealed that 20% reduction of N fertilizer reduces the nitrogen loads by 6% compared to baseline conditions. For TP, however, 10 m of buffer strips implementation decreased the loads by about 10%. The largest TP loads reduction was observed only when join implementation (different individual measures were implemented simultaneously) was conducted (loads were reduced by 25% for the Selke case study).

Second, the interactions between climate change effects and mitigation measures will be discussed in the horizon of 2016-2045. Results showed that climate change will increase the TP loads due to the amplified storm events occurrence in the near future. Particularly, modelling results of how much the measures suggested by stakeholders in each case study compensate the climate changes effects will be presented and discussed.