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Modelling seasonal nutrient fluxes in large river basins: Rhine case study

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Nutrient discharge to coastal waters from rivers draining populated areas is often the direct cause of large algal blooms. Changing conditions in the drainage basin, like land use change, or climate induced hydrograph change, can alter current riverine N and P fluxes and further increase the pressure on coastal water quality. Several large scale models have been employed to quantify riverine nutrient fluxes on a yearly to decadal timescale. In addition to variation in inter-annual nutrient emissions, however, there is considerable seasonal variation in nutrient transfer through river basins. A new model, RiNUX, has been developed to adequately simulating present and future river nutrient loads and capturing the intra-annual variation at the basin scale using globally available distributed datasets. This model is applied to investigate the effect of seasonal variation on nutrient export in order to provide a more accurate estimate of future nutrient loading in response to global change. The model shows that groundwater and point sources are the largest suppliers of N measured at the river outlet. Also, lower nutrient loads observed in summer, can be largely attributed to seasonal variation in within-stream retention. Preliminary results show a fit of r^2=0.69 between measured and modelled monthly TN load over the period 1990-2000 and a Nash-Sutcliffe efficiency of 0.67. The largest prediction errors occur in estimating high TN loads.