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Linking seasonal nutrient load fluctuations to hydrological regimes by explicitly modelling water flow components

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Nutrient loads in rivers are the product of their emissions and the retention from its source to the measuring point. The relative importance of the active pathways is variable in time. At high water a larger part is derived from surface flow, while at low water (baseflow conditions) groundwater flow dominates. This may affect the relative loads of the nutrient species transported, as they differ in mobility. Groundwater flow transports more soluble nutrient species, whereas surface flow is the main source for particulate-bound nutrients to the river. With the use of a hydrological model the water flow in the Rhine catchment is divided into four components: snowmelt, surface flow, shallow groundwater flow and deep groundwater flow. Long-term (1978-2003) in-stream measurements of nutrient loads (N and P) are averaged to monthly means and linked to the water flow components derived from the model. We attempt to relate seasonal variations in nutrient speciation and transport in the River Rhine - targeting on the dissolved fractions of nitrogen (NO3, NH4, DIN) and phosphorus (PO4) and their total amounts (TN, TP) - to variation in the dominant flow components in these seasons. River stations with different upstream areas are compared for their seasonal water flow distribution and nutrient speciation, as well as N:P ratios.