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Sources and transformation of nutrient emissions in medium and large European river systems - results and problems

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Within different studies the point and diffuse emissions of nutrients were estimated into large European river systems (Axios, Daugava, Danube, Elbe, Odra, Po, Rhine and Vistula) by application of the model MONERIS. The model allows beside the regional distributed estimation of the nutrient load from the rivers to the coastal zone the differentiation between point source discharges and 6 different diffuse pathways of nutrient emissions into the river systems as well as the separation of the total emissions and loads into the share of the main drivers (waste water management and agriculture). The results give an overview covering 21 % of the total basins of the European seas where 34 % of the European population is living.

The investigated river systems differ regarding the socio-economic situation, population density and natural conditions (precipitation, flow, soil, river network, lakes). Beside these differences the following conclusions were derived from the comparison of the model results:

- With exception of Rhine and Elbe the present state of the waste water treatment in the investigated river systems was far from the fulfilling of the EU waste water guideline.
- The point source is the dominant source for the total P emissions into all river systems with exception of the Elbe. For all river catchments the second largest source of P in the rivers are the agricultural emissions mainly due to erosion and surface runoff.
- European river catchments with the use of P free detergents have a substantial higher efficiency of P-elimination in WWTPs as catchments without P free detergents.
- Diffuse nutrient inputs into the river systems are much more dependent on the intensities of land uses (especially in agriculture) than on the land use categories itself.
- Extreme reductions of the land use intensities (e.g. nitrogen surplus in agriculture) were identified in the earlier 1990‘s in all of the Eastern European countries due to the changes of the socio-economic condition. In contrast the reduction of these intensities is small in Western European countries.
- The regional distribution of the agricultural intensities in Europe leads in combination with the regional differences of flow conditions to extreme gradients of the nitrogen loads within the river systems and from the rivers into the coastal zone.
- Differences of the flow conditions between different time periods mask often the changes of the nutrient emissions. Consequently, the nutrient load (especially of nitrogen) can be increasing during periods with decreasing emissions into the river systems.
- An urgent need for the forthcoming of the analysis on nutrient emissions into European river catchments is the establishment of an harmonized database reaches from unified digital maps over the access to statistical data on waste water management, population and agriculture for the lowest possible administrative level to measured data for meteorological parameters, the discharges and concentrations in the rivers.